U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1437
Supplement 60

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 60

Regarding License Renewal of Comanche Peak Nuclear Power Plant

Draft Report for Comment

Office of Nuclear Material Safety and Safeguards

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United States Nuclear Regulatory Commission
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Supplement 60

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Regarding License Renewal of Comanche Peak Nuclear Power Plant

Draft Report for Comment

Manuscript Completed: October 2023
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Office of Nuclear Material Safety and Safeguards

Proposed Action	Issuance of renewed facility operating licenses NPF-87 and NPF-89 for Comanche Peak Nuclear Power Plant, Units 1 and 2, in Somervell County, Texas
Type of Statement	Draft Supplemental Environmental Impact Statement
Agency Contact	Tam Tran U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Material Safety and Safeguards Mail Stop T-4B72 Washington, DC 20555-0001 Email: tam.tran@nrc.gov

Comments:

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COVER SHEET

Responsible Agency: U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. There are no cooperating agencies involved in the preparation of this document.

Title: Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 60, Regarding Comanche Peak Nuclear Power Plant, Units 1 and 2, Draft Report (NUREG–1437). Comanche Peak Nuclear Power Plant is located in Somervell County, Texas.

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) prepared this supplemental environmental impact statement (SEIS) in response to Vistra Operations Company, LLC and Luminant's application to renew the operating license for Comanche Peak Nuclear Power Plant (Comanche Peak), Units 1 and 2 for an additional 20 years. Luminant is a subsidiary of Vistra Operations Company, LLC. This SEIS evaluates the environmental impacts of the proposed action and alternatives to the proposed action. Alternatives considered include: (1) New Nuclear (Small Modular Reactors), (2) Natural Gas-fired Combined-Cycle, (3) Combination Solar Photovoltaic, Onshore Wind, and New Nuclear, and (4) no renewal of the operating licenses (the no-action alternative). The NRC staff's preliminary recommendation is that the adverse environmental impacts of license renewal (LR) for Comanche Peak are not so great that preserving the option of LR for energy-planning decisionmakers would be unreasonable. The NRC staff based its recommendation on the following factors:

- the analysis and findings in NUREG–1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
- the environmental report submitted by the applicant
- the NRC staff's consultation with Federal, State, Tribal, and local agencies
- independent environmental review
- the consideration of public comments

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EXECUTIVE SUMMARY

Background

By letter dated October 3, 2022, Vistra Operations Company, LLC and Luminant (the applicant) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to issue a renewed operating license for Comanche Peak Nuclear Power Plant (Comanche Peak), Units 1 and 2 for an additional 20-year period.

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 51.20(b)(2) (TN250), the 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, in connection with the renewal of an operating license, the NRC shall prepare an EIS, which is a supplement to the Commission's NUREG–1437, *Generic Environmental Impact Statement (LR GEIS) for License Renewal of Nuclear Plants* (NRC 2013-TN2654).

Upon acceptance of the applicant's application, the NRC staff began the environmental review process described in 10 CFR Part 51-TN250, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," by publishing a notice of intent to prepare a supplemental environmental impact statement (SEIS) and to conduct scoping for Comanche Peak. To prepare this SEIS, the NRC staff performed the following:

- conducted two public scoping meetings: a webinar on January 17, 2023, and an in-person meeting on February 23, 2023, in Glen Rose, Texas
- conducted a severe accident mitigation alternatives audit on February 13, 2023, and an environmental audit at Comanche Peak on February 21, 2023, to review the applicant's environmental report (ER) and compared it to the NRC's LR GEIS
- consulted with Federal, State, Tribal, and local agencies
- conducted a review of the issues following the guidance set forth in NUREG-1555, Supplement 1, Revision 1, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Supplement 1: Operating License Renewal*, Final Report
- considered public comments received during the scoping process

Proposed Action

The proposed Federal action (i.e., renewal of the Comanche Peak operating licenses) was initiated by Vistra Operations submitting their license renewal application. The current Comanche Peak Units 1 and 2 operating licenses (NPF-87 and NPF-89) are set to expire on February 8, 2030, and February 2, 2033, respectively. The NRC's Federal action is to determine whether to renew the Comanche Peak operating licenses for an additional 20 years. The regulation at 10 CFR Part 2-TN6204, "Effect of Timely Renewal Application," states that if a licensee of a nuclear power plant files an application to renew an operating license at least 5 years before the expiration date of that license, the existing license will not be deemed to have expired until the NRC staff completes safety and environmental reviews of the application, and the NRC makes a final decision about whether to issue a renewed license for the additional 20 years.

Purpose and Need for Action

The purpose and need for the proposed action (renewal of the Comanche Peak operating licenses) is to provide an option that allows for power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by energy-planning decisionmakers, such as State regulators, utility owners, and Federal agencies (other than the NRC). This definition of purpose and need reflects the NRC's recognition that, absent findings in the safety review required by the Atomic Energy Act of 1954 (TN663), as amended, or in the National Environmental Policy Act of 1969 (TN661) environmental analysis that would lead the NRC to reject a license renewal application, the NRC has no role in the energy-planning decisions of utility officials and State regulators as to whether a particular nuclear power plant should continue to operate.

Environmental Impacts of License Renewal

- This SEIS evaluates the potential environmental impacts of the proposed action. The environmental impacts of the proposed action are designated as SMALL, MODERATE, or LARGE. As established in the LR GEIS, Category 1 issues are those that meet all the following criteria:
- The environmental impacts associated with the issue are 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.
- A single significance level has been assigned to the impacts except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal.
- 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.
    - **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.

For Category 1 issues, no additional site-specific analysis is required in this SEIS unless new and significant information is identified. Site-specific issues (Category 2) are those that do not meet one or more of the criteria for Category 1 issues; therefore, an additional site-specific review for the non-generic issues is required, and the results are documented in this SEIS. Chapter 3 of this SEIS presents the process for identifying new and significant information.

Neither the applicant nor the NRC identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the LR GEIS. This conclusion is supported by the NRC staff's review of the applicant's ER and other documentation relevant to the applicant's activities, the public scoping process, and the findings from the site audits conducted by the NRC staff. Therefore, the NRC staff relied upon the conclusions of the LR GEIS for all Category 1 issues applicable to Comanche Peak.

Table ES-1 summarizes the Category 2 issues relevant to Comanche Peak and the NRC staff's findings related to those issues. If the NRC staff determined that there were no Category 2 issues applicable for a particular resource area, the findings in the LR GEIS, as documented in Appendix B to Subpart A of 10 CFR Part 51, are incorporated for that resource area.

Table ES-1 Summary of NRC Conclusions Relating to Site-Specific Impacts of License Renewal at Comanche Peak

Resource Area	Relevant Category 2 Issues	Impacts
Groundwater Resources	Radionuclides released to groundwater	SMALL
Terrestrial Resources	Effects on terrestrial resources (non-cooling system impacts)	SMALL
Aquatic Resources	Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	SMALL
	Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	SMALL
Special Status Species and Habitats	Threatened, endangered, and protected species, critical habitat, and essential fish habitat	May affect, but is not likely to adversely affect the golden-cheeked warbler, tricolored bat, or monarch butterfly
Historic and Cultural Resources	Historic and cultural resources	Would not adversely affect known historic properties
Human Health	Microbiological hazards to the public	SMALL
	Chronic effects of electromagnetic fields	UNCERTAIN
	Electric shock hazards	SMALL
	Design-basis accidents	SMALL
	Severe accidents	See SEIS Appendix F
Environmental Justice	Minority and low-income populations	No disproportionate and adverse human health and environmental effects on minority and low-income populations No disproportionate and adverse human health effects in special pathway receptor populations in the region because of subsistence consumption of water, local food, fish, and wildlife
Cumulative Impacts	Cumulative Impacts	See SEIS Chapter 3.16

Severe Accident Mitigation Alternatives

The applicant submitted an assessment of severe accident mitigation design alternatives (SAMDAs) as part of its operation license application for Comanche Peak, Unit 1 in 1990 and

Unit 2 in 1993 (see Appendix F). Because the NRC staff has previously considered SAMDAs (or severe accident mitigation alternatives [SAMAs]) in the Final Environmental Statement (FES) for Comanche Peak (NRC 1989-TN7822), the applicant is not required to perform another SAMA analysis for its license renewal application (10 CFR 51.53(c)(3)(ii)(L)). Nevertheless, the applicant's ER must contain any new and significant information of which the applicant is aware (10 CFR 51.53(c)(3)(iv)).

The NRC staff discusses new information pertaining to SAMAs in Appendix F, "Environmental Impacts of Postulated Accidents," in this SEIS. The NRC staff did not find any substantial changes in the proposed action as previously evaluated in the FES that are relevant to environmental concerns or any significant new circumstances or information relevant to environmental concerns and bearing on the licensing of Comanche Peak Units 1 and 2. Based on the NRC staff's review and evaluation of the applicant's analysis regarding SAMAs and the staff's independent analyses, as documented in Appendix F, "Environmental Impacts of Postulated Accidents" to this SEIS, the staff finds that there is no new and significant information for Comanche Peak related to SAMAs.

Alternatives

As part of its environmental review, the NRC is required to consider alternatives to LR and evaluate the environmental impacts associated with each alternative. These alternatives can include other methods of power generation (replacement energy alternatives), as well as not renewing the Comanche Peak operating licenses (the no action alternative).

The NRC considered 16 alternatives to the proposed action and eliminated 13 from detailed study due to technical, resource availability, or commercial limitations that are likely to exist when the Comanche Peak operating licenses expire. Three replacement energy alternatives were determined to be commercially viable, and include:

- new nuclear (small modular reactor or SMR)
- natural gas-fired combined-cycle
- combination alternative of solar photovoltaic, onshore wind, and new nuclear (SMR)

These alternatives, along with the no-action alternative, were evaluated in detail in this SEIS. In addition, NRC staff also evaluated new and significant information that could alter the conclusions of the SAMDA analysis previously performed for the Comanche Peak, which authorized reactor operation.

Recommendation

The NRC staff's preliminary recommendation is that the adverse environmental impacts of Comanche Peak LR are not so great that preserving the LR option for energy-planning decisionmakers would be unreasonable. The NRC staff based its recommendation on the following:

- analysis and findings in NUREG–1437
- Vistra Operations' ER
- the NRC staff's consultation with Federal, State, Tribal, and local agencies
- independent environmental review
- the consideration of public comments

ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
^{14}C	carbon-14 (an isotope of carbon)
°F	degrees Fahrenheit
ac	acre(s)
ac-ft	acre-feet
AD	anno Domini—with respect to time period
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
APE	area of potential effect
AQCR	air quality control region
BC	before Christ—with respect to time period
BDTF	blowdown treatment facility
BEIR	Biological Effects of Ionizing Radiation
BMP	best management practice
BRA	Brazos River Authority
BTA	best technology available
BTU	British thermal unit
CAA	Clean Air Act
CCR	Comanche Creek Reservoir
CCWS	component cooling water system
CDF	core damage frequency
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
cfs	cubic feet per second
CH_4	methane
CLB	current licensing basis
cm	centimeter(s)
CO	carbon monoxide
CO_2	carbon dioxide
CO_2eq	carbon dioxide equivalent
CPNPP	Comanche Peak Nuclear Power Plant
CP PowerCo	Comanche Peak Power Company, LLC
CWA	Clean Water Act (Federal Water Pollution Control Act)
CWS	circulating or cooling water system

CZMA	Coastal Zone Management Act
dBA	A-weighted decibel(s)
DOE	U.S. Department of Energy
EA	environmental assessment
EFH	Essential Fish Habitat
EIS	environmental impact statement
EMF	electromagnetic field
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	environmental report
ERCOT	Electric Reliability Council of Texas
ESA	Endangered Species Act
FES	final environmental statement
fps	foot (feet) per second
FR	*Federal Register*
ft	foot (feet)
FT	federally threatened
ft^3	cubic foot (feet)
FWS	U.S. Fish and Wildlife Service
gal	gallon(s)
gal/kWh	gallons per kilowatt-hour
g Ceq/kWh	grams carbon equivalent per kilowatt-hour
GHG	greenhouse gas
GMRS	ground motion response spectrum
gpd	gallons per day
gpm	gallons per minute
gpma	average gallons per minute for the month
gpy	gallons per year
GW	gigawatt(s)
GWd/MTU	gigawatt-day(s) per metric ton of uranium
GWP	global warming potential
H_2O	water
ha	hectare(s)
Hz	hertz

IPaC	Information for Planning and Conservation
IPE	individual plant examination
IPEEE	individual plant examination of external events
ISFSI	independent spent fuel storage installation
kg	kilogram(s)
km	kilometer(s)
kV	kilovolt(s)
kWh	kilowatt-hour(s)
L/day	liter(s) per day
L/min	liter(s) per minute
L/sec	liter(s) per second
lb	pound(s)
Ldn	day-night 24-hour average (noise)
LERF	large early release frequency
lg	magnitude short period surface wave (earthquakes)
LLC	limited liability company
LLRF	large late release frequency
LOS	level of service
LLRW	low-level radioactive waste
LR	license renewal
LRA	license renewal application
LR GEIS	NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
Luminant	Luminant Generation Company, LLC
m	meter(s)
mA	milliampere(s)
mb	Short period body-wave magnitude (earthquakes)
MBTA	Migratory Bird Treaty Act
MDCT	mechanical draft cooling tower
MG	million gallons
mg/L	milligram per liter
MGD	millions of gallons per day
MGM	millions of gallons per month
MGY	millions of gallons per year
mi	mile(s)
ml	local magnitude (earthquakes)
MLD	million liters per day
mm	millimeter(s)

MM	modified Mercalli intensity (seismic intensity scale)
MMBtu	million British thermal units
mph	mile(s) per hour
mrem/yr	milli roentgen equivalent man per year
MSL	mean sea level
MW	megawatt(s)
MWD/MTU	megawatt day(s) per metric ton uranium
MWe	megawatt(s) electric
Mwr	magnitude regional (earthquakes)
MWt	megawatt(s) thermal
NA	not available/not applicable
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NGCC	natural gas-fired combined-cycle
NH_3	ammonia
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NUREG	U.S. Nuclear Regulatory Commission technical report designation
NWI	National Wetlands Inventory
O_3	ozone
ODCM	offsite dose calculation manual
OL	operating license
OSHA	Occupational Safety and Health Administration
Pb	lead
pc/h	passenger cars per hour
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PM	particulate matter

$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PM_{10}	particulate matter less than 10 micrometers in diameter
PNNL	Pacific Northwest National Laboratory
PRA	probabilistic risk assessment
PSDAR	post-shutdown decommissioning activities report
psi	pounds per square inch
PV	photovoltaic
PWR	pressurized water reactor
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
SAMA	severe accident mitigation alternative
SAMDA	severe accident mitigation design alternatives
SCP	Squaw Creek Park
SCWD	Somervell County Water District
SEIS	supplemental environmental impact statement
SER	safety evaluation report
SERF	small early release frequency
SF_6	sulfur hexafluoride
SMR	small modular reactor
SOARCA	State-of-the-Art Reactor Consequence Analysis
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
SPCC	spill prevention, control, and countermeasure
SSC	systems, structures, and components
SSI	safe shutdown impoundment
SSWS	station service water system
STC	source term category
SWPPP	stormwater pollution prevention plan
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
THC	Texas Historical Commission
TPDES	Texas Pollutant Discharge Elimination System
tpy	ton(s) per year
TPWD	Texas Parks and Wildlife Department
TWDB	Texas Water Development Board
UCB	upper-confidence bound

U.S.	United States
USACE	U.S. Army Corps of Engineers
US-APWR	U.S. Advanced Pressurized Water Reactor
USCB	U.S. Census Bureau
USGCRP	United States Global Change Research Program
USGS	U.S. Geological Survey
VOC	volatile organic compound
yr	year(s)
yd	yard(s)

1 INTRODUCTION

Under the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations, which are found in Title 10 of the *Code of Federal Regulations* (10 CFR Part 51-TN250), "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," and implement the National Environmental Policy Act (NEPA), issuance of a new nuclear power plant operating license requires the preparation of an environmental impact statement (EIS).

The Atomic Energy Act of 1954 (AEA) (TN663) specifies that licenses for commercial power reactors can be granted for up to 40 years. NRC regulations (10 CFR 54.31-TN4878) allow for an option to renew a license for up to an additional 20 years. The initial 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 entirely with 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 makes the decision to grant or deny license renewal based on whether the applicant has demonstrated that the environmental and safety requirements in the agency's regulations can be met during the period of extended operation.

1.1 Proposed Federal Action

Vistra Operations Company, LLC (Vistra, the applicant) initiated the proposed Federal action by submitting an application for license renewal of Comanche Peak Nuclear Power Plant (Comanche Peak), Units 1 and 2, for which the existing licenses (NPF-87 and NPF-89) expire on February 8, 2030, and February 2, 2033, respectively. Luminant is a subsidiary of Vistra. The NRC's proposed Federal action is the decision whether to renew the licenses for an additional 20 years.

1.2 Purpose and Need for the Proposed Federal 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 a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by other energy planning decisionmakers. This definition of purpose and need reflects the NRC's recognition that, unless there are findings in the safety review required by the AEA or findings in the NEPA environmental analysis that would lead the NRC to reject a license renewal application (LRA), 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 renewed license is issued, State regulatory agencies and the applicant will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the operating license is not renewed, then the facility must be shut down on or before the expiration dates of the current operating licenses.

1.3 Major Environmental Review Milestones

The applicant submitted an environmental report (ER) as part of its LRA (Luminant 2022-TN8655) on October 3, 2022. After reviewing the LRA and ER for sufficiency, the NRC staff published a *Federal Register* Notice of Acceptability and Opportunity for Hearing (87 FR 73798-TN8656) on December 1, 2022. On December 13, 2022, and February 22, 2023, the NRC published notices in the *Federal Register* (87 FR 76219-TN8657 and 88 FR 10940-TN8658) on the intent to conduct scoping, thereby beginning the scoping period that ended on March 13, 2023.

The NRC staff held two public scoping meetings: a webinar on January 17, 2023, and an in-person meeting on February 23, 2023, in Glen Rose, Texas (NRC 2023-TN8659). The comments received during the scoping process and NRC discussion are presented in their entirety in *Environmental Impact Statement Scoping Process, Summary Report, Comanche Peak Nuclear Power Plant, Units 1 and 2* (NRC 2023-TN8659), and in Appendix A of this supplemental environmental impact statement (SEIS).

For independent evaluation of information provided in the ER, the NRC staff conducted a site audit at Comanche Peak, Units 1 and 2, in February 2023. During the site audit, the NRC staff met with plant personnel, reviewed specific documentation, and toured the facility. Some NRC staff met with interested local Federal and State offices. A summary of that site audit and a list of attendees is contained in the *Comanche Peak Nuclear Power Plant, Units 1 and 2, Summary of the License Renewal Environmental Audit* (NRC 2023-TN8713).

Upon completion of the scoping process and site audit, the NRC staff compiled its findings in the draft SEIS (Figure 1-1). This document is made available for public comment for 45 days. During this time, the staff will host public meetings and collect public comments. Based on the information gathered, the NRC staff will amend the draft SEIS findings, as necessary, and publish the final SEIS for license renewal.

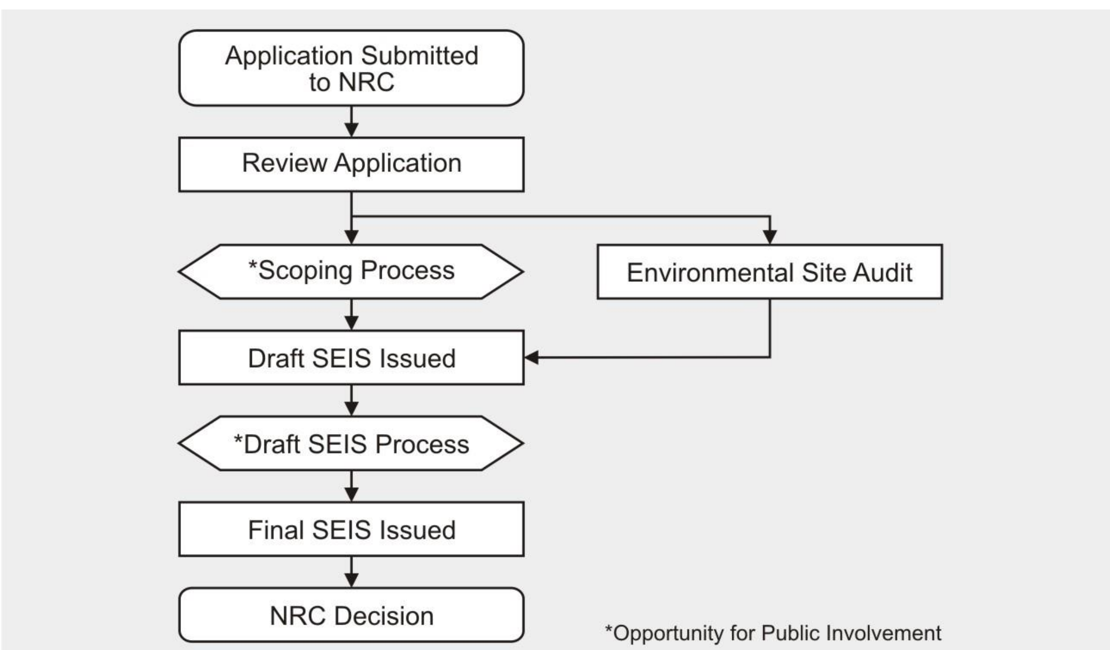


Figure 1-1 Environmental Review Process

The NRC has established a license renewal review process that can be completed in a reasonable period with clear requirements to assure safe plant operation for up to an additional 20 years of plant life. The NRC staff conducts the safety review simultaneously with the environmental review. The staff documents the findings of the safety review in a safety evaluation report (SER). The findings in the SEIS and the SER are both factors in the NRC's decision to either grant or deny the issuance of a renewed license. The SER and the SEIS schedules are listed at the project website: https://www.nrc.gov/reactors/operating/licensing/renewal/applications/comanche-peak.html.

1.4 Generic Environmental Impact Statement

The NRC staff performed a generic assessment of the environmental impacts associated with license renewal to improve the efficiency of its license renewal review. The *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (LR GEIS), NUREG-1437, Revision 1 (NRC 2013-TN2654) documented the results of the staff's systematic approach to evaluate the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. The staff analyzed in detail and arrived at generic findings for those environmental issues that could be resolved generically in the LR GEIS.

The LR GEIS establishes separate environmental impact issues for the NRC staff to independently evaluate. Of these issues, the NRC staff determined that some issues are generic to all plants (Category 1). Other issues do not lend themselves to generic consideration (Category 2 or uncategorized). The NRC staff evaluates these issues on a site-specific basis in a SEIS to the LR GEIS. Appendix B to Subpart A of 10 CFR Part 51 (10 CFR Part 51-TN250) provides a summary of the staff findings in the LR GEIS.

For each potential environmental issue in the LR GEIS, the NRC staff performs the following:

- describes the activity that affects the environment
- identifies the population or resource that is affected
- assesses the nature and magnitude of the impact on the affected population or resource
- characterizes the significance of the effect for both beneficial and adverse effects
- determines whether the results of the analysis apply to all plants
- considers whether additional mitigation measures would be warranted for impacts that would have the same significance level for all plants

The NRC's standard of significance for impacts was established using the Council on Environmental Quality former terminology for "significant" and in the LR GEIS. The NRC established three levels of significance for potential impacts—SMALL, MODERATE, and LARGE. The definitions are listed below.

> **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.

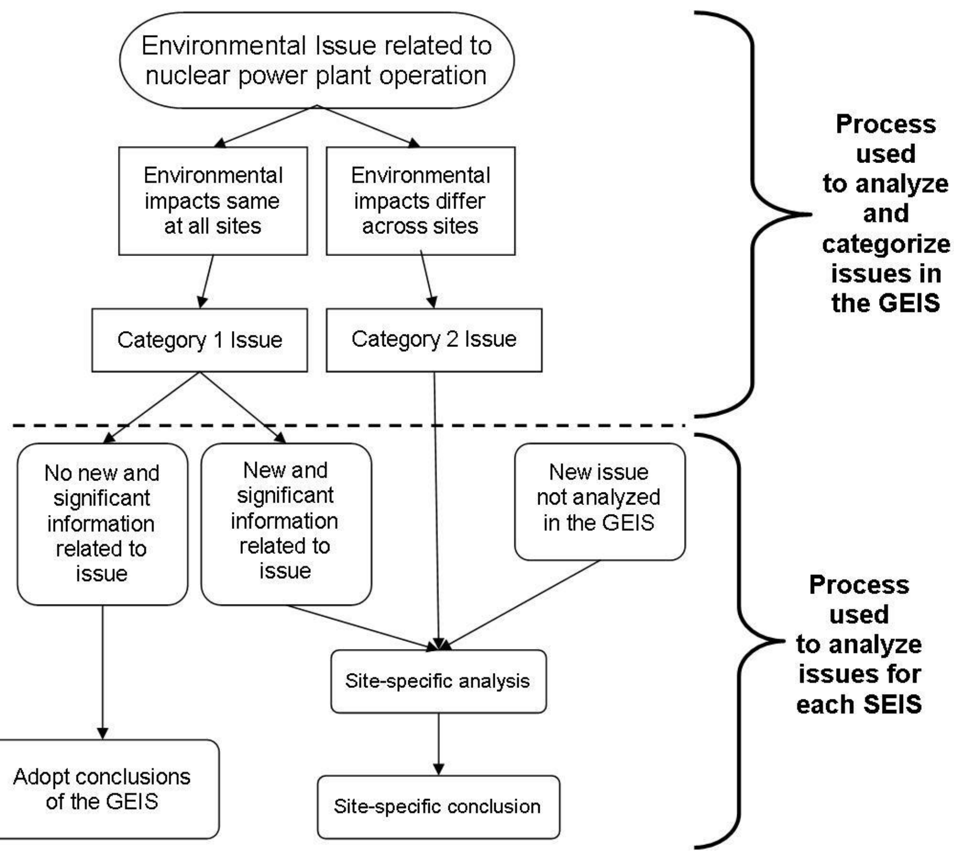
SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

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.

The LR GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted (Figure 1-2). Issues are assigned a Category 1 or a Category 2 designation. As set forth in the LR GEIS, Category 1 issues are those that meet the following criteria:

- The environmental impacts associated with the issue have been 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.
- 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).
- Mitigation of adverse impacts associated with the issue has been 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.



The LR GEIS evaluated 78 issues. Site-specific analysis is required for 17 of those 78 issues.

Figure 1-2 Environmental Issues Evaluated for License Renewal

For generic issues (Category 1), no additional site-specific analysis is required in the SEIS unless new and significant information is identified. The process for identifying new and significant information is presented in Chapter 3. Site-specific issues (Category 2) are those that do not meet one or more of the criteria of Category 1 issues; therefore, additional site-specific review for these issues is required. The results of that site-specific review are documented in the SEIS.

> **New information** can be identified from many sources, including the applicant, the NRC, other agencies, or public comments. If a new issue is revealed, it is first analyzed to determine whether it is within the scope of the license renewal environmental evaluation. If the new issue is not addressed in the LR GEIS, the NRC staff would determine the significance of the issue and document the analysis in the SEIS.

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

1.5 Supplemental Environmental Impact Statement

The SEIS presents an analysis that considers the environmental effects of the continued operation of Comanche Peak, Units 1 and 2, alternatives to license renewal, and mitigation measures for minimizing adverse environmental impacts. Chapter 2 includes analysis of reasonable alternatives. Chapter 3 contains analysis and comparison of the potential environmental impacts from alternatives while Chapter 4 presents the preliminary recommendation of the NRC on whether the environmental impacts of license renewal are so great that preserving the option of license renewal would be unreasonable. The final recommendation will be made after consideration of comments received on the draft SEIS during the public comment period.

For information gathering to prepare the SEIS for Comanche Peak, Units 1 and 2, the NRC staff carried out the following activities:

- reviewed the information provided in the applicant’s ER
- consulted with other Federal, State, and local agencies and Native American Tribes
- conducted an independent evaluation of the issues during the site audit
- considered the public comments received for the review (during the scoping process and, subsequently, on the draft SEIS)

1.6 Decision to Be Supported by the SEIS

The decision to be supported by the SEIS is whether to renew the operating licenses for Comanche Peak for an additional 20 years. The NRC decision standard is specified in 10 CFR 51.103 (TN250):

> In making a final decision on a license renewal action pursuant to Part 54 of this chapter, the Commission shall determine 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.

In the statement of consideration for 10 CFR Part 51 (TN250), the Commission further explained:

> Given the uncertainties involved and the lack of control that the NRC has in the choice of energy alternatives in the future, the Commission believes that it is reasonable to exercise its NEPA authority to reject license renewal applications only when it has determined that the impacts of license renewal sufficiently exceed the impacts of all or almost all of the alternatives that preserving the option of license renewal for future decision makers would be unreasonable.

The analyses of environmental impacts evaluated in this SEIS will provide the NRC's decisionmaker (in this case, the Commission) with important environmental information for use in the overall decision-making process. There are decisions that are made outside the regulatory scope of license renewal. These include decisions related to: (1) changes to plant cooling systems, (2) disposition of spent nuclear fuel, (3) emergency preparedness, (4) safeguards and security, (5) need for power, and (6) seismicity and flooding (NRC 2013-TN2654).

1.7 Cooperating Agencies

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

1.8 Consultations

The Endangered Species Act of 1973 (TN1010), as amended (ESA); the Magnuson–Stevens Fisheries Management Act of 1996, as amended and reauthorized (TN7841); and the National Historic Preservation Act of 1966 (TN4157) require that Federal agencies consult with applicable State and Federal agencies and groups prior to taking action that may affect endangered species, fisheries, or historic and archaeological resources, respectively. Appendix C includes copies of consultation documents.

1.9 Correspondence

Appendix D contains a chronological list of documents sent and received during the environmental review.

1.10 Status of Compliance

The applicant is responsible for complying with all NRC regulations and other applicable Federal, State, and local requirements. Appendix F of the LR GEIS describes some of the major applicable Federal statutes.

There are numerous permits and licenses issued by Federal, State, and local authorities for activities at Comanche Peak, Units 1 and 2. Appendix B of this SEIS contains further discussion about Comanche Peak status of compliance.

1.11 Related Federal and State Activities

The NRC reviewed the possibility that activities of other Federal agencies might impact the renewal of the operating license for Comanche Peak. There are no Federal projects that would make it necessary for another Federal agency to become a cooperating agency in the preparation of this SEIS. There are no known Native American lands (under Tribal nations) within 50 mi of Comanche Peak. Consistent with Section 3.16, “Cumulative Effects of the Proposed Action,” no Federal project was identified for which EISs would be prepared that might impact the renewal of the operating licenses for Comanche Peak.

The NRC is required under Section 102(2)(C) of NEPA (TN661) to consult with and obtain the comments from any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the EISs. For example, during the preparation the SEIS, the NRC consulted with the U.S. Fish and Wildlife Service and the office of Texas State Historic Preservation Officer. Appendix C contains a complete list of all key consultation correspondence.

2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

Although the NRC's decision-making authority in LR is limited to deciding whether to renew a nuclear power plant's operating license, the agency's implementation of the National Environmental Policy Act of 1969, as amended (NEPA; 42 U.S.C. 4321 et seq.; TN661), requires consideration of the environmental impacts of potential alternatives to renewing a plant's operating license. Although the ultimate decision about which alternative (or the proposed action) to carry out falls to operator, State, or other non-NRC Federal officials, comparing the impacts of renewing the operating license to the environmental impacts of alternatives allows the NRC to determine whether the environmental impacts of LR are so great that preserving the option of LR for energy-planning decisionmakers would be unreasonable (10 CFR 51.95(c)(4)) (TN250).

Energy-planning decisionmakers and owners of the nuclear power plant decide whether the nuclear plant will continue to operate, and economic and environmental considerations play important roles in making this decision. In general, the NRC's responsibility is to ensure the safe operation of nuclear power facilities, not to formulate energy policy or encourage or discourage the development of alternative power generation. The NRC does not engage in energy-planning decisions, and it makes no judgment about which energy alternatives evaluated would be the most likely alternative in any given case.

The remainder of this chapter provides (1) a description of the proposed action, renewal of the Comanche Peak Nuclear Power Plant (Comanche Peak), Units 1 and 2 licenses, (2) a description of alternatives to the proposed action (including the no-action alternative), and (3) alternatives to the proposed action that the NRC staff considered and eliminated from detailed study.

2.1 Description of Nuclear Power Plant Facility and Operation

This section describes the Comanche Peak, Units 1 and 2, operating systems, infrastructure, operations, and maintenance. The use of "Vistra" refers to the applicant, Vistra Operations Company LLC, that submitted the LRA. Luminant Generation Company LLC (Luminant) and Comanche Peak Nuclear Power Company (CP PowerCo) are affiliates and each are wholly-owned subsidiaries of Vistra. CP PowerCo is the owner of Comanche Peak Nuclear Power Plant. Comanche Creek Reservoir (CCR) refers to the former Squaw Creek Reservoir, which was renamed in January 2023. (DOI 2023-TN8684). A more detailed description of the Comanche Peak facility and operation is found in Vistra's ER, part of its LRA. (Luminant 2022-TN8655, Section 2.2).

2.1.1 External Appearance and Setting

The Comanche Peak occupies a site on a peninsula located on the southwestern bank of the CCR (Figure 2-1). The CCR is completely within the bounds of the Comanche Peak site (Figure 2-2) (Luminant 2022-TN8655). The Comanche Peak site and the 50-mile radius can be seen in Figure 2-3 (Luminant 2022-TN8655).

Squaw Creek Park (SCP) is located within the Comanche Peak site (Luminant 2023-TN8884). Vistra maintains the park and controls public access to the park and reservoir (Luminant 2022-TN8655, Section 2.2).

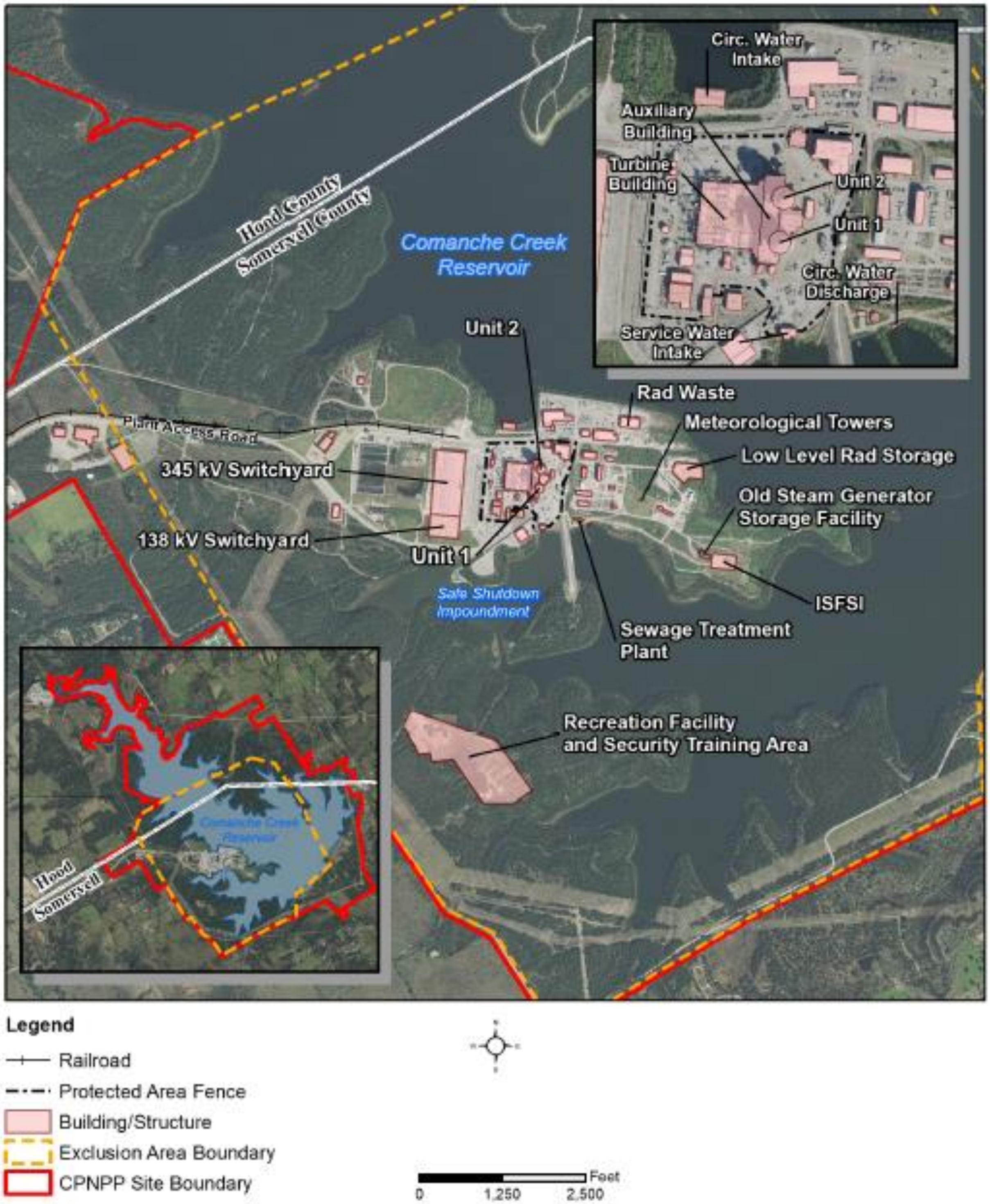


Figure 2-1 Comanche Peak Layout. Adapted from: Luminant 2022-TN8655

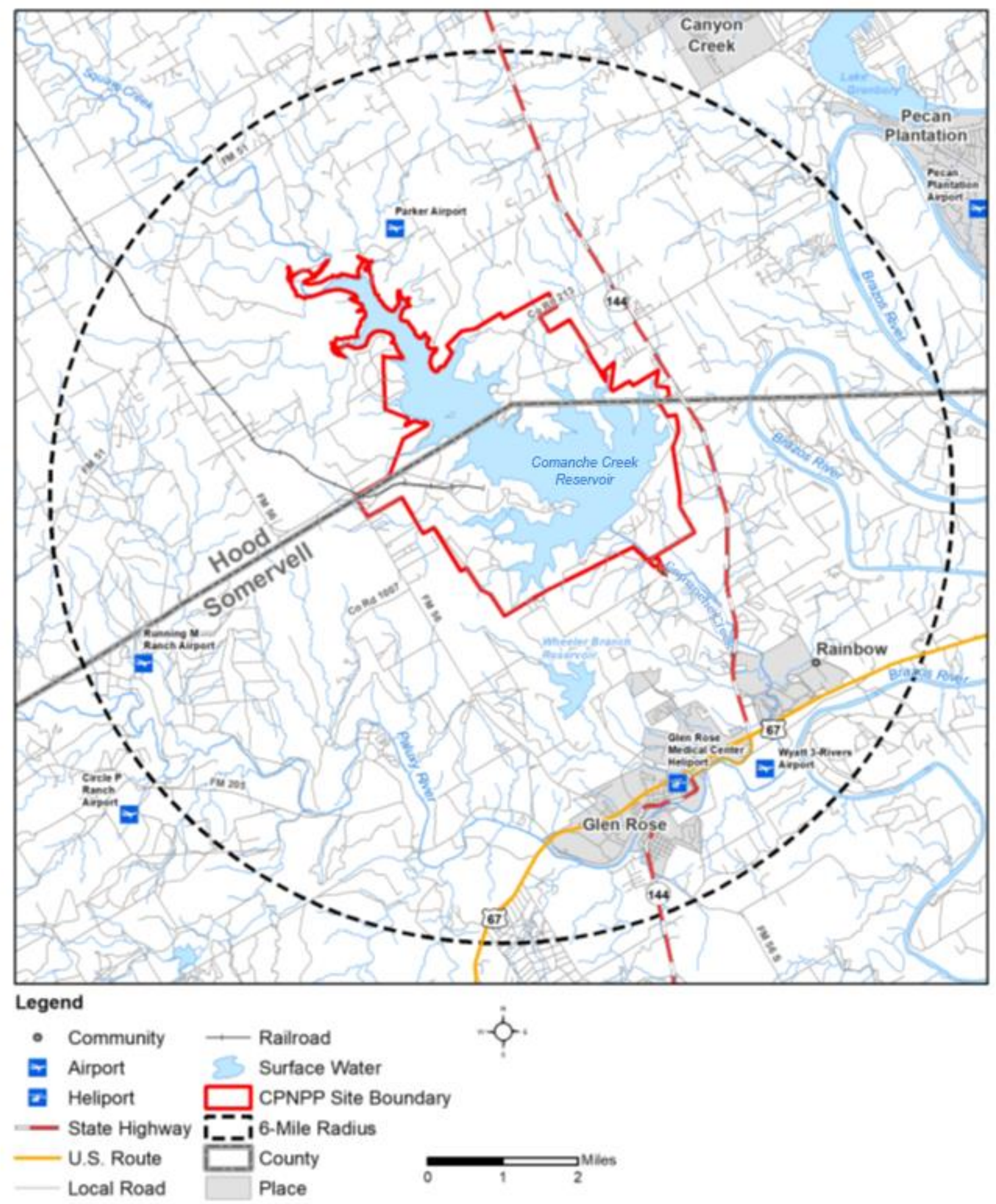


Figure 2-2 Comanche Peak 6 mi (10 km) Radius Map. Adapted from: Luminant 2022-TN8655

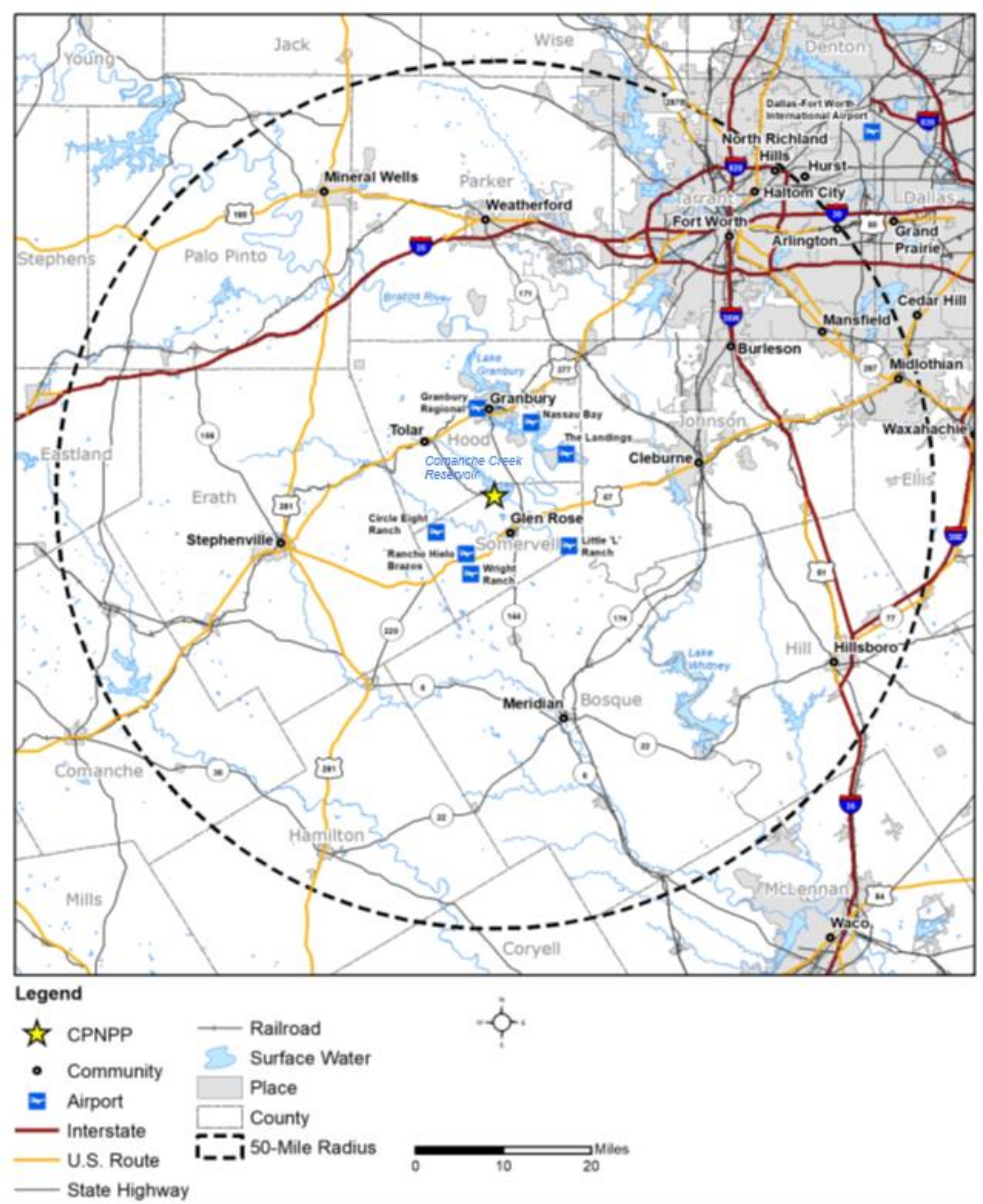


Figure 2-3 **Comanche Peak Site and 50-mi (80 km) Radius. Adapted from: Luminant 2022-TN8655**

2.1.2 Nuclear Reactor Systems

The Comanche Peak Unit 1 operating license was issued on April 17, 1990, and the Unit 2 operating license was issued on April 6, 1993. Each of the units consists of one pressurized water reactor (PWR), four steam generators, one steam turbine generator, a heat dissipation system, and associated auxiliary and engineered safeguards (Luminant 2022-TN8655, Section 2.2.1.1).

Units 1 and 2 were each licensed to generate net electrical output of 3,458 MWt (NRC 1990-TN9109). In 2007, Comanche Peak submitted an application to the NRC for a power uprate, which was approved in June 2008. The power uprate increased the power capacity to 3,612 MWt, an increase of 5.9 percent (Luminant 2022-TN8655, Section 2.2.1.1).

The high-pressure turbines at both units were replaced as part of the uprate. As described in Section 2.2.6 of the applicant's ER, the uprate had no impacts on radiological effluents. (Luminant 2022-TN8655).

2.1.3 Cooling and Auxiliary Water Systems

The Comanche Peak cooling system has two major components, the circulating water system and the station service water system (SSWS). The circulating water is withdrawn from the CCR through an eight-water pump intake structure. The water is pumped through the condensers and heat exchangers and then returned to CCR. A dam across an arm of the CCR establishes a separate water impoundment—the safe shutdown impoundment (SSI). The SSI is to provide cooling capability that can withstand postulated natural phenomena hazard (Luminant 2022-TN9107). When necessary, service water is withdrawn from the SSI through a structure containing four pumps (Luminant 2022-TN8655, Section 2.2.3).

The SSI provides cooling water for dissipating reactor heat and allows an orderly shutdown of the plant. The water level of the SSI is equalized with the CCR via a channel and provides cooling capacity in accordance with the requirements of NRC Regulatory Guide 1.27 (NRC 2015-TN5907), which is further described in Section 2.2.3 of the applicant's environmental report (Luminant 2022-TN8655, Section 2.2.3). The circulating water system supplies approximately 1,100,000 gpm of cooling water to Units 1 and 2 through an intake structure located north of the plant on the CCR. This flow is sufficient to remove the heat from the main condenser, the two auxiliary condensers, the turbine plant cooling water heat exchanger, the three-condenser exhausting vacuum pump heat exchangers, and five non-safety ventilation chillers. The heated water of the circulating water system is discharged to the CCR via a discharge tunnel southeast of the plant. The circulating water system is not required for emergency cooldown or for operation of the engineered safeguard systems or for shutdown cooling (Luminant 2022-TN8655, Section 2.2.3.1).

2.1.3.1 Cooling Water Intake and Discharge

Cooling water for normal plant operation is withdrawn from the CCR by eight circulating water pumps, each with 275,000 gpm capacity. The number of pumps needed for operation is adjusted seasonally; three pumps operate during cooler months and four pumps operate during mild or warmer months. The total heat removed amounts to approximately 8.8×10^9 Btu/hr. The circulating water system provides water at a temperature of 95 °F. The expected discharge temperature is an approximately 15 °F temperature rise above the inlet temperature. The SSWS is designed to operate with the water level at 770 ft—the lowest elevation of the CCR (Luminant 2022-TN8655, Section 2.2.3.1).

Cooling water is returned to the CCR via a tunnel discharging into a discharge structure located at a distance from the circulating water intake to ensure sufficient mixing and evaporative cooling. The discharge velocity is approximately 9.8 fps and promotes dissipation of the rejected heat by evaporation (Luminant 2022-TN8655, Section 2.2.3.1).

Water from the CCR flows to the circulating water pumps for both Units 1 and 2 through, steel trash racks and 12 traveling screens. Circulating water is withdrawn through a single screenhouse that has 12 intake bays; each bay measures 11 ft, 2 in. wide and has a vertical traveling water screen. A trash rack measuring 4 in. x ½ in. wide, with a 2 in. clear spacing is located along the upstream face of the rack. The twelve 10-ft wide traveling water screens are located downstream from the trash racks. The screens have ⅜ in. square mesh openings. The screens are on a 4-hour timed rotation schedule and are cleaned with a high-pressure front spray wash. The screens can also be set to rotate automatically based on differential pressures from high debris loading. The screens are set for continuous operation when water temperatures reach below 38 °F (Luminant 2022-TN8655, Section 2.2.3.1).

Two screen wash pumps in Unit 1 and two screen wash pumps in Unit 2 are located downstream of the traveling water screens. Each pump supplies about 1,200 gpm of water to the traveling water screens. Each screen well contains “stop logs” to allow dewatering of any individual screen well. The water from the wells flows to a suction pit. Four centrifugal circulating water pumps take suction from this pit.

The circulating water is “shock-treated” with sodium hypochlorite and sodium bromide to reduce organic fouling and biological growth. At periodic intervals, chlorine is also injected into the system to prevent the growth of algae and bacterial slime from accumulating on the surfaces of the circulating water tunnel and the condensers (NRC 1981-TN8799). The chlorine dosage is adjusted in accordance with the Texas Pollutant Discharge Elimination System (TPDES) permit that restricts the total residual chlorine concentration to a daily maximum of 0.2 mg/L and 880 lb/day. Effluent limitations for chlorine at Outfall 001 are a 0.2 mg/L daily average, with a daily maximum of 0.5 mg/L and 1,101 lb/day (Luminant 2022-TN8655, Section 2.2.3.1).

Cooling water is withdrawn from the SSI by four 17,000 gpm capacity service water pumps. These pumps are in a seismic Category I building. Cooling water is returned to the SSI through the service water discharge canal that is located at a sufficient distance from the intake structure to ensure water mixing and evaporative cooling (Luminant 2022-TN8655, Section 2.2.3.2).

The SSWS removes heat from the component cooling water system (CCWS) heat exchangers and from the emergency diesel generators. So that no single failure impairs the cooling of essential equipment, the CCWS with two flow loops and redundant pumps, heat exchangers, and piping, is normally required to be operating during all phases of plant operation after a loss-of-coolant accident. The SSWS supplies cooling water to the safety injection system, centrifugal charging pump lube oil coolers, and the containment spray pump bearing oil coolers. The SSWS also supplies cooling water to the plant cooling system during normal operation, shutdown, and during or after a postulated loss-of-coolant accident. In addition, the SSWS acts as a backup water supply for the auxiliary feedwater system if the content of condensate storage tank is depleted (Luminant 2022-TN8655, Section 2.2.3.2).

The SSWS has a separate system that injects sodium hypochlorite and sodium bromide into the water to control organic fouling, and phosphate, organic phosphate, and a copolymer to control corrosion and fouling of the carbon steel piping in the system (Luminant 2022-TN8655, Section 2.2.3.2).

The SSWS associated with each of the units is completely independent and redundant. Each unit has two fully independent trains, either of which can supply the required cooling water flow. The pumps and heat exchangers of each train can be aligned with the other train in the event of a component failure. Like the CCWS, the SSWS has two flow loops with redundant pumps, heat exchangers, and piping arrangements so that no single failure impairs the capability to cool essential equipment (Luminant 2022-TN8655, Section 2.2.3.2).

2.1.3.2 Thermal Effluent Dispersion

A 2007 thermal discharge study was performed regarding the impacts of the power uprate. The study identified a maximum discharge temperature increase from 109 °F to 111 °F, and an average discharge temperature increase from 95.3 °F to 96.6 °F at Outfall 001. Since Comanche Peak is currently permitted by the TPDES permit for discharge at a daily average temperature of 113 °F and a daily maximum temperature of 116 °F, the impacts associated with the power uprate thermal discharge are bounded according to the thermal discharge study performed for the TPDES permit (Luminant 2022-TN8655, Section 2.2.3.3).

2.1.3.3 Municipal Water Supply System

The Comanche Peak potable and sanitary water system is designed to provide water for toilets, sinks, showers, and drinking purposes in all permanent personnel areas; water for emergency eyewash and showers; water to fire protection hoses for various onsite buildings; and water to fill and to provide normal makeup for the fire water storage tanks. A small quantity (35,900 gal, less than 1 gpm, in 2020) of groundwater per year was historically used primarily for potable and sanitary purposes at the recreation training facility. Groundwater withdrawals are discussed in detail in Section 3.5. Backflow preventers are installed on potable water lines to protect the water supply from potential contamination, and are tested and certified annually (Luminant 2022-TN8655, Section 2.2.3.4).

To prevent radioactive contamination of the potable water supply, there is no interconnection with any source of radioactive materials. The system is also completely separated from the laundry and hot shower portion of the liquid waste processing system. Wastes produced by the potable and sanitary water system are treated in the domestic waste treatment facility (Luminant 2022-TN8655, Section 2.2.3.4).

Because the sanitary and potable water system is common to Comanche Peak Units 1 and 2, and is independent of their operation, a shutdown of either or both units does not affect the supply of potable water. However, in the case of contamination or shutdown of the system, potable water can be trucked to the site (Luminant 2022-TN8655, Section 2.2.3.4).

2.1.3.4 Fire Protection Water Supply System

The fire protection water supply system capacity was designed using National Fire Protection Association Standard 13 and NRC branch technical position Auxiliary Power Conversion Systems Branch 9.5-1 Appendix A, as guidance. The capacity of the system is based on supplying water to the largest fixed extinguishing system and the adjacent hose stations with the shortest portion of the fire protection yard-loop out of service (Luminant 2022-TN8655, Section 2.2.3.5).

Water is provided to the system by two dedicated 100 percent capacity, atmospheric fire water storage tanks, each with a nominal capacity of 524,500 gal. The SSI provides refill capability via a separate pump to refill each tank within 8 hours (Luminant 2022-TN8655, Section 2.2.3.5).

The station fire main system and all the associated supporting equipment are shared by the two Comanche Peak units (Luminant 2022-TN8655, Section 2.2.3.5).

2.1.4 Radioactive Waste Management Systems

Section E2.2.6 of Vistra's ER, submitted as part of its LRA, provides an expanded description of Comanche Peak's radioactive waste treatment systems (Luminant 2022-TN8655, Sections E2.2.6, and E-2-14 to E-2-20). The NRC staff incorporates this information here by reference.

The NRC licenses all nuclear plants with the expectation that they will release radioactive material to both the air and water during normal operations. However, NRC regulations require that gaseous and liquid radioactive releases from nuclear power plants meet radiation dose-based limits specified in 10 CFR Part 20-TN283, "Standards for Protection Against Radiation," and the as low as reasonably achievable (ALARA) criteria in 10 CFR Part 50-TN249, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents." In other words, the NRC places regulatory limits on the radiation dose that members of the public can receive from radioactive effluents of a nuclear power plant. For this reason, all nuclear power plants use radioactive waste management systems to control and monitor radioactive wastes.

Comanche Peak uses liquid, gaseous, and solid waste management systems to collect and process radioactive materials and waste produced as a byproduct of plant operations. Liquid waste disposal systems are used to collect, hold up, treat, monitor, dispose, and record the liquid effluent. The gaseous wastes disposal systems are used to collect, hold, if necessary, filter, monitor, and record the gaseous effluent. Solid wastes are stored, packaged, and shipped off-site. Solid waste is composed of reactor components, equipment, and tools that have been removed from service, contaminated protective clothing, paper, rags, and other trash generated from plant design and operations modifications and routine maintenance activities and non-fuel solid waste. Non-fuel solid waste consists of the treatment and separation of radionuclides from gases and liquids, in addition to contaminated materials from various reactor areas (Luminant 2022-TN8655, p. 2-19).

The liquid waste processing system for Comanche Peak is shared by Unit 1 and Unit 2, as is the gaseous waste processing system. The liquid waste processing system can process the waste produced by normal operation of the systems, as well as anticipated wastes related to operational occurrences involving liquid waste processing system equipment malfunction, excessive leakage in reactor coolant system equipment, and excessive leakage in auxiliary system equipment. The gaseous waste processing system design is based on continuous operation of the nuclear steam supply stream, assuming that fission products associated with 1 percent of the core power generation are available for leakage from the fuel into the coolant over the life of the plant. These radioactive waste management systems assure that the dose to members of the public from radioactive effluents is reduced to ALARA levels in accordance with NRC regulations (Luminant 2022-TN8655).

Vistra maintains a radiological environmental monitoring program (REMP) to assess the radiological impact, if any, to the public and the environment from radioactive effluents released during operations at Comanche Peak (Luminant 2022-TN8655). The REMP is discussed in Section 2.1.4.5 of this SEIS.

Vistra maintains an Offsite Dose Calculation Manual (ODCM) that contains the methods and parameters for calculating offsite doses resulting from liquid and gaseous radioactive effluents. These methods ensure that radioactive material discharges from Comanche Peak meet NRC and U.S. Environmental Protection Agency (EPA) regulatory dose standards. The ODCM also contains the requirements for the REMP.

2.1.4.1 Radioactive Liquid Waste Management

Vistra uses waste management systems to collect, analyze, and process radioactive liquids produced at Comanche Peak. These systems reduce radioactive liquids before they are released to the environment. The Comanche Peak liquid waste disposal system meets the design objectives of 10 CFR Part 50-TN249, Appendix I, and controls the processing, disposal, and release of radioactive liquid wastes.

The liquid waste processing system consists mainly of two subsystems designated as drain channel A and drain channel B. Drain channel A is connected to drain channel B and processed for release through the filter demineralizer system. A drain system inside the containment collects liquid in drains and from leaks. The drain system transfers that waste to an appropriate tank. The waste processing system is also capable of handling and storing spent demineralizer resins. Drain channel C is provided to collect and process waste effluents from onsite laundry, personnel decontamination showers and sinks, and surface decontamination. This liquid is pumped to one of the two 5,000 gal waste monitoring tanks. The wastewater is then sampled to determine whether the liquid is to be discharged or reprocessed through the filter demineralizer or the waste evaporator. Based on the results of the analysis, wastewater is continuously monitored and controlled and is either recycled through the boron recycle system or processed through the liquid waste processing system and released (Luminant 2022-TN8655, Section E2.2.6.1).

The liquid waste disposal system was designed to receive, process, and discharge potentially radioactive liquid waste. Holdup capacity is provided for retention of liquid effluents, particularly where unfavorable environmental conditions can be expected to require operational limitations upon the release of radioactive effluents to the environment. Radioactive fluids entering the waste disposal system are processed or collected in tanks until a determination of subsequent treatment can be made. The waste is sampled and analyzed to determine the quantity of radioactivity. Liquid wastes are processed as required and then released under controlled conditions.

Instrumentation and controls necessary for the operation of the liquid waste processing system are located on a control board in the auxiliary building. Any alarm on this control board is relayed to the main control board in the control room and monitored to ensure that the waste does not exceed the station release limits.

All liquid wastes are monitored prior to their release to ensure that they will not exceed the limits of 10 CFR Part 20-TN283. The radiation monitoring system monitors the effluent and closes the discharge valve if the amount of radioactive material in the effluent exceeds preset values. Vistra performs off-site dose calculations based on effluent samples obtained at this release point to ensure that the limits of 10 CFR Part 50-TN249, Appendix I are not exceeded. The ODCM prescribes the alarm/trip setpoints for the liquid effluent radiation monitors. Vistra's use of these radiological waste systems and the procedural requirements in the ODCM provides assurance that the dose from radiological liquid effluents at Comanche Peak complies with NRC and EPA regulatory dose standards. Vistra calculates dose estimates for members of the public using radiological liquid effluent release data.

Vistra's annual radioactive effluent release reports contain a detailed presentation of liquid effluents released from Comanche Peak and the resultant calculated doses (Luminant 2023-TN8660). These reports are publicly available on the NRC's website.

The NRC staff reviewed 5 years of radioactive effluent release data from 2018 through 2022 (Luminant 2019-TN8661, 2020-TN8662, 2021-TN8663, 2022-TN8664, 2023-TN8660). A 5-year period provides a data set that covers a broad range of activities that occur at a nuclear power plant, such as refueling outages, routine operation, and maintenance, which can affect the generation and emission of radioactive effluents into the environment. The NRC compared the data against NRC dose limits and looked for indications of adverse trends (i.e., increasing dose levels or increasing radioactivity levels).

The doses calculated for radioactive liquid effluents released from Comanche Peak during 2022 (Luminant 2023-TN8660) are summarized below.

Comanche Peak Unit 1 in 2022

- The total-body dose to an off-site member of the public from Comanche Peak Unit 1 radioactive effluents was 7.0×10^{-2} millirem (mrem) (7.0×10^{-4} millisievert [mSv]), which is well below the 3 mrem (0.03 mSv) dose criterion in Appendix I to 10 CFR Part 50-TN249.
- The maximum organ dose (gastrointestinal tract) to an off-site member of the public from Comanche Peak Unit 1 radioactive effluents was 7.0×10^{-2} mrem (7.0×10^{-4} mSv), which is well below the 10 mrem (0.1 mSv) dose criterion in Appendix I to 10 CFR Part 50-TN249.

Comanche Peak Unit 2 in 2022

- The total-body dose to an off-site member of the public from Comanche Peak Unit 2 radioactive effluents was 7.0×10^{-2} mrem (7.0×10^{-4} mSv), which is well below the 3 mrem (0.03 mSv) dose criterion in Appendix I to 10 CFR Part 50-TN249.
- The maximum organ dose (gastrointestinal tract) to an off-site member of the public from Comanche Peak Unit 2 radioactive effluents was 7.0×10^{-2} mrem (7.0×10^{-4} mSv), which is well below the 10 mrem (0.1 mSv) dose criterion in Appendix I to 10 CFR Part 50-TN249.

In the values cited above, the NRC staff divided Vistra's reported total-body and maximum organ liquid effluent doses for the entire facility evenly among Units 1 and 2. This was done to attribute the approximate dose contribution to each of the licensed nuclear units. The NRC staff's review of Vistra's radioactive liquid effluent control program shows that the applicant maintained radiation doses to members of the public within NRC and EPA radiation protection standards, as contained in Appendix I to 10 CFR Part 50-TN249, 10 CFR Part 20-TN283, and Title 40, "Protection of Environment," of the *Code of Federal Regulations* 40 CFR Part 190-TN739, "Environmental Radiation Protection Standards for Nuclear Power Operations." The NRC staff observed no adverse trends in the dose levels.

During the LR term, Vistra will continue to perform routine plant refueling and maintenance activities. Based on Vistra's past performance in operating a radioactive waste system at Comanche Peak that maintains ALARA doses from radioactive liquid effluents, the NRC staff expects that Vistra will maintain similar performance during the LR term.

2.1.4.2 Radioactive Gaseous Waste Management

Radioactive gaseous wastes develop from gases in liquid contained in tanks and piping at Comanche Peak. The gaseous wastes are monitored and released at an acceptable rate designated by the ODCM. The ODCM determines the effluent release rate to ensure that releases are within predetermined limits, which ensures compliance with dose limitations of licensee commitments. Comanche Peak Units 1 and 2 share a Gaseous Waste Disposal System, which maintains a non-oxidizing cover gas of nitrogen in tanks and equipment that may contain radioactive gas. These systems also provide for holdup gas decay, and they release the gases under controlled conditions.

Vistra calculates dose estimates for members of the public based on radioactive gaseous effluent release data and atmospheric transport models. Vistra's annual radioactive effluent release reports present in detail the radiological gaseous effluents released from Comanche Peak and the resultant calculated doses. As described in Section 2.1.4.1, "Radioactive Liquid Waste Management," of this SEIS, the NRC staff reviewed 5 years of radioactive effluent release data from the 2018 through 2022 reports (Luminant 2019-TN8661, 2020-TN8662, 2021-TN8663, 2022-TN8664, 2023-TN8660). The NRC staff compared the data against NRC dose limits and looked for indications of adverse trends (i.e., increasing dose levels) over the period.

The calculated doses from radioactive gaseous effluents released from Comanche Peak during 2022 (Luminant 2023-TN8660) are summarized below.

<u>Comanche Peak Unit 1 in 2022</u>

- The air dose due to noble gases with resulting gamma radiation in gaseous effluents was 1.81×10^{-4} millirad (mrad) (1.81×10^{-6} milligray), which is well below the 10 mrad (0.1 milligray) dose criterion in Appendix I to 10 CFR Part 50-TN249.
- The air dose from beta radiation in gaseous effluents was 6.6×10^{-5} mrad (6.6×10^{-7} milligray), which is well below the 20 mrad (0.2 milligray) dose criterion in Appendix I to 10 CFR Part 50-TN249.
- The critical organ dose (bone) to an off-site member of the public from radiation in gaseous effluents as a result of iodine-131, iodine-133, hydrogen-3, and particulates with greater than 8-day half-lives was 1.02×10^{-1} mrem (1.02×10^{-3} mSv), which is below the 15 mrem (0.15 mSv) dose criterion in Appendix I to 10 CFR Part 50-TN249.

<u>Comanche Peak Unit 2 in 2022</u>

- The air dose due to noble gases with resulting gamma radiation in gaseous effluents was 1.81×10^{-4} mrad (1.81×10^{-6} milligray), which is well below the 10 mrad (0.1 milligray) dose criterion in Appendix I to 10 CFR Part 50-TN249.
- The air dose from beta radiation in gaseous effluents was 6.6×10^{-5} mrad (6.6×10^{-7} milligray), which is well below the 20 mrad (0.2 milligray) dose criterion in Appendix I to 10 CFR Part 50-TN249.
- The critical organ dose (bone) to an off-site member of the public from radiation in gaseous effluents as a result of iodine-131, iodine-133, hydrogen-3, and particulates with greater than 8-day half-lives was 1.02×10^{-1} mrem (1.02×10^{-3} mSv), which is below the 15 mrem (0.15 mSv) dose criterion in Appendix I to 10 CFR Part 50-TN249.

In the values cited above, the NRC staff divided Vistra's reported air dose due to noble gases, air dose from beta radiation, and critical organ dose for the entire facility evenly among Units 1, and 2. This was done to attribute the approximate dose contribution to each of the licensed nuclear units. The NRC staff's review of Comanche Peak's radioactive gaseous effluent control program showed radiation doses to members of the public that were well below NRC and EPA radiation protection standards contained in Appendix I to 10 CFR Part 50-TN249, 10 CFR Part 20-TN283, and 40 CFR Part 190-TN739. The NRC staff observed no adverse trends in the dose levels over the 5 years reviewed.

During the LR term, Vistra will continue to perform routine plant refueling and maintenance activities. Based on Vistra's past performance in operating a radioactive waste system at Comanche Peak that maintains ALARA doses from radioactive gaseous effluents, the NRC staff expects that Comanche Peak will maintain similar performance during the LR term.

2.1.4.3 Radioactive Solid Waste Management

Comanche Peak's solid waste disposal system provides for packaging and/or solidification of radioactive waste that will subsequently be shipped off-site to an approved burial facility. These activities reduce the amount of waste shipped for off-site disposal. Solid radioactive wastes are logged, processed, packaged, and stored for subsequent shipment and off-site burial. Solid radioactive wastes and potentially radioactive wastes include reactor components, equipment and tools removed from service; chemical laboratory samples; spent resins; used filter cartridges; and radioactively contaminated hardware, as well as compacted wastes such as contaminated protective clothing, paper, rags, and other trash generated from plant design modifications and operations and routine maintenance activities. In addition, non-fuel solid wastes result from treating and separating radionuclides from gases and liquids and from removing containment material from various reactor areas.

2.1.4.4 Radioactive Waste Storage

At Comanche Peak, low-level radioactive waste (LLRW) is stored temporarily onsite at a low-level waste storage facility before being shipped off-site for processing or disposal at licensed LLRW treatment and disposal facilities. Energy*Solutions* is the processing and disposal facility Comanche Peak uses. LLRW is classified as Class A, Class B, or Class C (minor volumes are classified as greater than Class C). Class A includes both dry active waste and processed waste (e.g., dewatered resins). Classes B and C normally include a low percentage of the LLRW generated. Radioactive waste that is greater than Class C waste is the responsibility of the Federal government. Low-level mixed waste is managed and transported to either the Energy*Solutions* facility or Waste Control Specialist facility with which Vistra has contracts. As indicated in Vistra's ER and discussed with the NRC staff at the virtual audit, Comanche Peak has sufficient existing capability to store all generated LLRW onsite. No additional construction of onsite storage facilities would be necessary for LLRW storage during the period of extended operation.

Comanche Peak Units 1 and 2 each store spent fuel in a spent fuel pool and in an onsite independent spent fuel storage installation (ISFSI). The ISFSI safely stores spent fuel onsite in licensed and approved dry cask storage containers. Spent fuel is stored in the ISFSI under a separate license. The possible need to expand the size of the ISFSI would depend on the U.S. Department of Energy's (DOE's) future performance of its obligation to accept spent nuclear fuel or the availability of other interim storage options. During the audit discussion Vistra personnel clarified that it would need to expand the ISFSI by 2030 if off-site storage options do not become available in sufficient time. This timeline would potentially require Vistra to act before the current facility operating licenses expire in February 2030 (Unit 1) and February 2033 (Unit 2). If the ISFSI expansion were needed, enough land area would be expected to be available for expansion within the site boundary of the existing facility. The staff understands that Vistra is allowed under a 10 CFR Part 72-TN4884general license as part of the units' 10 CFR Part 50-TN249 licenses to expand the ISFSI as necessary (see 10 CFR 72.210; TN4884). Vistra confirms that they will ensure that there will be adequate spent fuel storage to safely accommodate spent fuel onsite for the current license term and during the proposed LR term through expansion of the ISFSI if off-site storage options do not become available in sufficient time (Luminant 2023-TN8665). Currently, Comanche Peak has not proposed the installation of additional spent fuel storage pads in the current ISFSI area to support LR. If future changed circumstances require the installation of additional spent fuel storage pads, then this would be subject to a separate NEPA review. Therefore, the staff does not consider expansion of the ISFSI in this SEIS. The NRC staff notes, however, that the impacts of onsite storage of spent nuclear fuel during the period of extended operation is a Category 1 issue and has been determined to be SMALL, as stated in 10 CFR Part 51-TN250, Appendix B, Table B-1; see also NUREG-2157, *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel* (NRC 2014-TN4117).

2.1.4.5 Radiological Environmental Monitoring Program

Vistra maintains a REMP to assess the radiological impact, if any, on the public and the environment from Comanche Peak operations. The REMP measures the aquatic, terrestrial, and atmospheric environment for ambient radiation and radioactivity. Monitoring is conducted for the following: direct radiation, air, precipitation, well water, river water, surface water, milk, food products and vegetation (such as edible broad leaf vegetation), fish, silt, and shoreline sediment. The REMP also measures background radiation (i.e., cosmic sources, global fallout, and naturally occurring radioactive material, including radon).

In addition to maintaining the REMP, Vistra established a Comanche Peak onsite groundwater protection initiative program in accordance with Nuclear Energy Institute (NEI) 07-07, "Industry Groundwater Protection Initiative" (NEI 2007-TN1913). This program monitors the onsite plant environment to detect leaks from plant systems and pipes containing radioactive liquid. Section 3.5.2.3, "Groundwater Quality," of this SEIS contains information about Comanche Peak's groundwater protection initiative program. Since monitoring installation began in 2008, the groundwater monitoring network at Comanche Peak has expanded and now consists of 12 onsite monitoring wells (Luminant 2022-TN8655). As part of the REMP, Vistra conducts analyses of selected wells for the presence of gamma emitters, tritium, and difficult-to-detect radionuclides in groundwater on a quarterly, semi-annual, or annual basis.

Section 3.5.2.3 of this SEIS describes the results from groundwater sampling. During the 2022 sampling activities, a total of 20 groundwater samples were collected from the five different monitoring locations. No radionuclides were detected in any of the samples. In addition, no gamma or difficult-to-detect radionuclides, other than naturally occurring radionuclides, were identified in well samples from 2016–2020 (Luminant 2022-TN8655).

Section 3.5.2.3, "Groundwater Quality," of this SEIS also contains a more complete description of the groundwater protection program and a historical description of tritium and other radionuclides monitoring in groundwater at the site.

The NRC staff reviewed 5 years of annual radiological environmental monitoring data from 2018 through 2022 (Luminant 2019-TN8661, 2020-TN8662, 2021-TN8663, 2022-TN8664, 2023-TN8660). A 5-year period provides a data set that covers a broad range of activities that occur at a nuclear power plant, such as refueling outages, routine operation, and maintenance that can affect the generation and release of radioactive effluents into the environment. The NRC staff looked for indications of adverse trends (i.e., increasing radioactivity levels) over the period of 2018 through 2022.

Based on its review of the REMP and inadvertent release data, the NRC staff finds no apparent increasing trend in concentration or pattern indicating either a new inadvertent release or persistently high tritium or other radionuclide concentration that might indicate an ongoing inadvertent release from Comanche Peak. The groundwater monitoring program data at Comanche Peak show that Vistra monitors, characterizes, and actively remediates spills, and that there have been no significant radiological impacts on the environment from operations at Comanche Peak.

2.1.5 Nonradioactive Waste Management Systems

Vistra's ER provides an expanded description of Comanche Peak's nonradioactive waste management systems (Luminant 2022-TN8655, Section E2.2.7, 2-20 – 2-27). The NRC staff incorporates this information here by reference. Like any other industrial facility, nuclear power plants generate wastes that are not contaminated with either radionuclides or hazardous chemicals. Comanche Peak generates nonradioactive waste as a result of plant maintenance, cleaning, and operational processes. Comanche Peak manages nonradioactive wastes in accordance with applicable Federal and State regulations, as implemented through its corporate procedures. Comanche Peak generates and manages the following types of nonradioactive wastes:

- <u>Hazardous Wastes</u>: Comanche Peak is classified by the EPA and Texas Council on Environmental Quality (TCEQ) as a small quantity generator of hazardous waste. The amounts of hazardous wastes generated are only a small percentage of the total wastes generated. These generally consist of paint wastes, spent and off specification (e.g., shelf-life expired) chemicals, gun cleaning rags with lead residue, and occasional project-specific wastes. Table E2.2-2 in the ER provides a list of the amounts of hazardous waste (Luminant 2022-TN8655).

- <u>Nonhazardous Wastes</u>: These generally include asbestos insulation and other asbestos-containing materials, lead material, nonhazardous used paint and solvents, batteries, expired shelf-life chemicals, grout and/or concrete, construction demolition debris, sand blasting and metal blasting materials, lamps, paper and office debris, water treatment room products such as used resin and used carbon, laboratory waste material, used oil and grease, cafeteria waste, antifreeze liquids, used refrigerants, scrap metal, scrap wood, used tires and nonradioactive liquid waste. Nonradioactive liquid waste typically comes from the secondary plant systems in the turbine building, the water treatment room backwash, and other miscellaneous liquid waste streams. Municipal waste is disposed of at the local permitted solid waste management facility (Luminant 2022-TN8655).

- <u>Universal Wastes</u>: These wastes typically consist of used lamps containing low quantities of mercury, paint-related materials, used batteries/nonpolychlorinated biphenyl ballasts, etc. (Luminant 2022-TN8655).

Vistra maintains a list of waste vendors that it has approved for use across the entire company to remove and dispose of the identified wastes off-site (Luminant 2022-TN8655).

2.1.6 Utility and Transportation Infrastructure

The utility and transportation infrastructure at Comanche Peak interfaces with public infrastructure systems available in the region. Such infrastructure includes utilities, such as suppliers of electricity, fuel, and water; as well as roads and railroads that provide access to the site. The following sections briefly describe the existing utility and transportation infrastructure at Comanche Peak. Site-specific information in this section is derived from Vistra's ER unless otherwise cited.

2.1.6.1 Electricity

Nuclear power plants generate electricity for other users, but they also use electricity to operate. Off-site power sources provide power to engineered safety features and emergency equipment in the event of a malfunction or interruption of power generation at the plant. If power is interrupted, planned independent backup power sources provide power from both the plant itself and off-site power sources.

2.1.6.2 Water

The portion of the CCR within the exclusion area boundary is subject to the waterway exclusion provided in 10 CFR Part 100.3 (TN282). Consistent with that regulation, arrangements are in place to control traffic on the reservoir to protect public health and safety in case of an emergency.

2.1.6.3 Transportation Systems

Nuclear power plants are served by controlled access roads that are connected to U.S. highways and interstate highways. In addition to roads, many plants also have railroad connections for moving heavy equipment and other materials. Section 3.10.6, "Local Transportation," describes the Comanche Peak transportation systems.

2.1.6.4 Power Transmission Systems

For LR, the NRC evaluates, as part of the proposed action, the continued operation of the Comanche Peak power transmission lines that connect to the substation where it feeds electricity into the regional power distribution system (NRC 2013-TN2654). The transmission lines that are in scope for the Comanche Peak LR environmental review are onsite and are not accessible to the general public (Luminant 2022-TN8655). The NRC also considers the continued operation of the transmission lines that supply outside power to the nuclear plant from the grid. Section 3.11.4 describes these transmission lines.

2.1.7 Nuclear Power Plant Operations and Maintenance

Maintenance activities conducted at Comanche Peak include inspection, testing, and surveillance to maintain the current licensing basis of the facility and to ensure compliance with environmental and safety requirements. These activities include in-service inspections of safety-related structures, systems, and components; quality assurance and fire protection programs; and radioactive and nonradioactive water chemistry monitoring.

Additional programs include those implemented to meet technical specification surveillance requirements and those implemented in response to NRC generic communications. Such additional programs include various periodic maintenance, testing, and inspection procedures necessary to manage the effects of aging on structures and components. Certain program activities are performed during the operation of the units, whereas others are performed during 18-month scheduled refueling outages per unit on an alternating schedule (Luminant 2022-TN8655, Section 2.2.2).

2.2 Proposed Action

As stated in Section 1.1, the NRC's proposed Federal action is to decide whether to renew the Comanche Peak operating licenses for an additional 20 years. Section 2.2.1, provides a description of normal nuclear power plant operations during the LR term.

2.2.1 Plant Operations During the License Renewal Term

Comanche Peak is a two-unit, nuclear powered steam electric generating facility. The nuclear reactor for each unit is a PWR with a power capacity of 3,612 MWt. Vistra's ER states that Comanche Peak would continue to operate during the LR term in the same manner as it operates during the current license term, except for additional conducting aging management programs, as necessary. Such programs would address structure and component aging in accordance with 10 CFR Part 54-TN4878, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

Most plant operation activities during the 20-year LR term would be the same as, or similar to, those occurring during the current license term. The LR GEIS (NRC 2013-TN2654) describes the issues that would have the same impact at all nuclear power plants, or a distinct subset of plants (generic issues), as well as the issues that would have different impact levels at different nuclear power plants (site-specific issues). The impacts of generic issues are described in the LR GEIS as Category 1 issues (NRC 2013-TN2654), and are set forth in Table B-1 in 10 CFR Part 51-TN250, Appendix B. The determinations of those impacts apply to each LR applicable to plants and sites within the designated generic classification, subject to the consideration of any new and significant information on a plant-specific basis. A second group of issues (Category 2) was identified in NUREG–1437 as having potentially different impacts at each plant, on a site-specific basis; any issues with plant-specific impact levels need to be discussed in a plant-specific SEIS such as this one.

2.2.2 Refurbishment and Other Activities Associated with License Renewal

Refurbishment activities include replacement and repair of major structures, systems, and components (SSCs). The major refurbishment class of activities characterized in the LR GEIS is intended to encompass actions that typically take place only once in the life of a nuclear plant, if at all. Examples of these activities include, but are not limited to, replacement of boiling water reactor recirculation piping and PWR steam generators. These actions may have an impact on the environment beyond those that occur during normal operations and may require evaluation, depending on the type of action and the plant-specific design.

In preparation for its LRA, Vistra performed an evaluation of the SSCs, in accordance with 10 CFR 54.21 (TN4878), to identify the need to undertake any major refurbishment activities that would be necessary to support the continued operation of Comanche Peak during the proposed 20-year period of extended operation.

As a result of its evaluation of SSCs, Vistra did not identify the need to undertake any major refurbishment or replacement activities associated with LR to support the continued operation of Comanche Peak beyond the end of the existing operating license. Therefore, refurbishment activities are not discussed under the proposed action in Chapter 3.

2.2.3 Termination of Nuclear Power Plant Operation and Decommissioning After the License Renewal Term

NUREG-0586, Supplement 1, Volumes 1 and 2, *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Regarding the Decommissioning of Nuclear Power Reactors* (the decommissioning GEIS) (NRC 2002-TN665), describes the impacts of decommissioning. The majority of plant operational activities would cease with reactor shutdown. However, some activities (e.g., security and oversight of spent nuclear fuel) would remain unchanged, whereas others (e.g., waste management, administrative work, laboratory analysis, surveillance, monitoring, and maintenance) would continue at reduced or altered levels. Systems dedicated to reactor operations would cease operations. However, if these systems are not removed from the site after reactor shutdown, their physical presence may continue to affect the environment. Impacts associated with dedicated systems that remain in place, or with shared systems that continue to operate at normal capacities, could remain unchanged.

Decommissioning will occur whether Comanche Peak is shut down at the end of its current operating license or at the end of the period of extended operation 20 years later. There is no site-specific issue related to decommissioning, which the LR GEIS identified as a Category 1 issue. The LR GEIS concludes that LR would have a negligible (SMALL) effect on the impacts of terminating operations and decommissioning on all resources (NRC 2013-TN2654).

2.3 Alternatives

As stated above, NEPA requires the NRC to consider reasonable alternatives to the proposed action renewing Comanche Peak operating licenses. For a replacement energy alternative to be reasonable, it must be either (1) commercially viable on a utility scale and operational before the reactor’s operating license expires or (2) expected to become commercially viable on a utility scale and operational before the reactor’s operating license expires.

The LR GEIS incorporated the latest information about replacement power alternatives, but rapidly evolving technologies will inevitably outpace the information presented in the LR GEIS (NRC 2013-TN2654). Additionally, the range of reasonable alternatives will also vary by location because of availability of renewable energy resources, current status of infrastructure and technology within the region, and local laws and regulations that may promote or inhibit certain energy-producing technologies.

The first alternative to the proposed action renewing the Comanche Peak operating licenses is for the NRC to not issue the licenses. This is called the no-action alternative and is described in Section 2.3.1. In addition to the no-action alternative, this section discusses three reasonable replacement energy alternatives. As described in Section 2.3.1, these alternatives seek to replace Comanche Peak’s generating capacity by meeting the region’s energy needs through other means or sources.

2.3.1 No-Action Alternative

At some point, all operating nuclear power plants will permanently cease operations and undergo decommissioning. Under the no-action alternative, the NRC takes “no-action” and does not renew the Comanche Peak operating licenses and the units would shut down at or before the expiration of the current licenses. The NRC expects the impacts to be relatively similar, whether they occur at the end of the current renewed license term. If the NRC takes no action, the two units would shut down at or before the end of the current licenses or at the end of a renewed license term.

After shutdown, plant operators would initiate decommissioning in accordance with 10 CFR 50.82 (TN249). The environmental impacts of decommissioning and related activities are addressed in several other documents, including the *decommissioning GEIS* (NRC 2002-TN665); the LR GEIS (NRC 2013-TN2654, Chapter 3); and Chapter 3 of this SEIS. These analyses bound the environmental impacts of decommissioning when Vistra terminates reactor operations at Comanche Peak. A licensee in decommissioning must assess in its post shutdown decommissioning activities report submitted to the NRC, whether there are planned decommissioning activities with reasonably foreseeable environmental impacts that are not bounded in previous EISs. Section 3.15.2, “Terminating Plant Operations and Decommissioning,” describes the incremental environmental impacts of license renewal on decommissioning activities.

Termination of reactor operations at Comanche Peak would result in the total cessation of electrical power production. Unlike the replacement energy alternatives described in Section 2.2.2, the no-action alternative does not meet the purpose and need of the proposed action, as described in Section 1.2, because the no-action alternative does not provide a means of delivering baseload power to meet future electric system needs. Assuming that a need currently exists for the power generated by Comanche Peak, the no-action alternative would likely create a need for replacement energy.

2.3.2 Replacement Power Alternatives

The following sections describe replacement energy alternatives. The potential environmental impacts of these alternatives are described in Chapter 3. Although NRC’s authority only extends to deciding whether to renew Comanche Peak Units 1 and 2 operating licenses, the replacement energy alternatives represent possible options for energy-planning decision-makers may need to consider if the operating licenses are not renewed.

In evaluating replacement energy alternatives, the NRC considered energy technologies in commercial operation, as well as technologies likely to be commercially available by the time the current Comanche Peak operating licenses expire. Because energy technologies continually evolve in capability and cost, and because regulatory structures change to either promote or impede the development of certain technologies, the evaluation determined which replacement energy alternatives would be available and commercially viable when the operating licenses expire.

If the NRC does not renew the Comanche Peak operating licenses, procurement of replacement energy may be necessary. The State of Texas is considered the region of influence in which alternatives for replacement power for Comanche Peak could reasonably be sited. Texas is broken up into four different power grids: Southwest Power Pool, Midcontinent Independent System Operator, Western Electricity Coordinating Council, and Electric Reliability Council of

Texas (ERCOT) (Quick Electricity 2023-TN8842). ERCOT is by far the largest; it serves 90 percent of the electric load in Texas and works with more than 1,800 active electricity-generating entities to provide electricity to consumers (ERCOT 2023-TN8843). ERCOT currently manages an electricity infrastructure consisting of more than 1,030 generating units and almost 53,000 mi of high-voltage transmission lines. Power production in Texas consists of approximately 47.4 percent from natural gas, approximately 1.1 percent from solar, approximately 20.3 percent from coal, approximately 10.8 percent from nuclear, and approximately 20 percent from wind (Vault Electricity 2023-TN8844). Energy consumption by sector involves 11.7 percent by commercial entities, 53.9 percent by industrial entities, 12.2 percent by residential consumers, and 22.2 percent by transportation consumers (EIA 2023-TN8777). The Texas electric utility industry is regulated pursuant to Texas Utilities Code Section 39.905 (TN8880).

Texas first adopted the Renewable Portfolio Standard (RPS) in 1999, setting a rule called the Goal for Renewable Energy. The RPS requires the State to install 5,000 MW of new renewable energy capacity by 2015 and sets a target of 10,000 MW of renewable energy capacity by 2025. The RPS applies to all retail entities in Texas, and the share of the mandate for each entity is determined by that retailer's pro rata share of statewide retail energy sales (Quick Electricity 2023-TN8842). As stated in the annual compliance report prepared by the ERCOT, Texas had already reached the 2025 goal in 2009 and had 26,045 MW of additional renewable energy capacity (24,381 MW of which was wind) in 2017 relative to 1999.

Alternatives that cannot meet future system needs or whose costs or benefits do not justify their inclusion in the range of reasonable alternatives were eliminated from detailed study. These alternatives are discussed in Section 2.4:

- Replacement power alternatives evaluated:
  - new small modular reactors
  - natural gas-fired combined-cycle (NGCC) facility
  - combination of solar photovoltaic, onshore wind, and new small modular reactor
- Alternatives considered but dismissed:
  - solar power
  - wind power
  - biomass power
  - hydroelectric power
  - geothermal power
  - ocean wave, current, and tide energy
  - municipal solid waste-fired power
  - petroleum-fired power
  - coal-fired power
  - fuel cells
  - purchased power
  - delayed retirement of other power producing facilities
  - demand-side management/energy conservation/energy efficiency

Because many energy technologies are continually evolving in capability and cost and vary by geographic area, and because regulatory structures have changed to either promote or impede development of particular alternatives, the analyses in this chapter include updated information from the following sources:

- Energy Information Administration (EIA)

- other DOE offices
- the EPA
- industry sources and publications
- information submitted by Vistra in its ER

In addition, energy-relevant statutes, regulations, and policies were reviewed to ensure that the alternatives analysis is consistent with State and regional energy policies. Current generation capacity mix and electricity production data in the State of Texas were considered.

Various technology options and replacement energy alternatives to the proposed action were considered and then narrowed to three alternatives and evaluated in detail. These alternatives are discussed in Section 2.3.2.

The environmental impacts of each reasonable alternative are evaluated in Chapter 3. The evaluation considers the following types of impacts: land use and visual resources, air quality and noise, geologic environment, water resources, ecological resources, historic and cultural resources, socioeconomics, human health, environmental justice, and waste management.

Table 2-1 summarizes key characteristics of the replacement power technologies evaluated in detail.

Table 2-1 Summary of Replacement Power Alternatives and Key Characteristics Considered in Detail

Key Characteristics	New Small Modular Reactors	Natural Gas-fired Combined-Cycle	Combination Alternative
Summary of Alternative	The small modular reactor alternative would comprise six, 400 MWe reactor modules with a total net generating capacity of approximately 2,400 MWe.	The NGCC facility would have an approximate net generating capacity of 2,460 MWe (2,830 MWe nameplate capacity with an 87 percent capacity factor). The facility would use four combined-cycle combustion turbines, with a net capacity of approximately 615 MWe per unit.	The combination alternative would include approximately 1,200 MWe from solar photovoltaic generation coupled with battery storage, 800 MWe from onshore wind generation coupled with battery storage, and 400 MWe from new small modular reactors (SMRs), for a net total replacement of approximately 2,400 MWe.
Location	On the site	On the site	On the site
Cooling System	Closed-cycle with mechanical draft cooling towers	The required NGCC cooling system components and features (intake structures, discharge structures, the blowdown treatment facility (BDTF), and connective pipelines) would be like those described for the new SMR alternative but scaled down to accommodate for the reduced cooling requirements of the NGCC. Cooling water withdrawal would be approximately 14 MGD (53,000 m3/d) and	The SMR unit would also use closed-cycle cooling with mechanical draft cooling towers. Blowdown from the cooling towers would require the construction of a new BDTF but scaled down to accommodate the reduced cooling requirements of the single unit SMR. The discharge from the BDTF would also require construction of a new discharge structure in Lake Granbury and new piping along the Lake Granbury shore. Cooling water

Key Characteristics	New Small Modular Reactors	Natural Gas-fired Combined-Cycle	Combination Alternative
		consumptive water use would be 11 MGD (46,000 m3/d) (NETL 2022-TN8820).	withdrawal is estimated to be 13 MGD (50,000 m3/d) and consumptive water use would be 9.2 MGD. No cooling system would be required for solar and onshore wind components.
Land Requirements	The SMR facility and mechanical draft cooling towers would be sited within a 275 ac parcel to the northwest, and an associated BDTF would be sited within a 400 ac area to the south.	Land use requirements for a 2,460 MWe NGCC facility would be approximately 120 ac (48 ha). An additional 40 ac (16 ha) would be required for the associated BDTF consisting of filtration equipment buildings, evaporation ponds, and storage ponds located outside of the southern site boundary. The discharge piping from the BDTF to Lake Granbury would extend off-site and disturb approximately an additional 81 ac (32 ha).	SMR component: land use requirements for each 400 MWe SMR unit would be approximately 36 ac (14 ha) (Luminant 2022-TN8655). An additional 40 ac (16 ha) would be required for the BDTF consisting of filtration equipment buildings, evaporation ponds, and storage ponds located outside of the southern site boundary. The discharge piping from the BDTF to Lake Granbury would extend off-site and disturb approximately an additional 81 ac (32 ha). Onshore wind component: Assuming utility-scale wind facilities would require 85 ac (34.5 ha) of land per megawatt of installed capacity, approximately 122,000 ac (49,000 ha) would be required for an installed capacity of 1,440 MWe. Land disturbance was estimated using a value of 1.7 ac of temporary disturbance per megawatt of generation and 0.7 ac/MW of permanent disturbance (within the footprints of the turbine towers, access roads, and power collection and transmission system. The battery storage systems supporting these wind farms would also result in an additional 240 ac (97 ha) of permanent disturbance. Accordingly, the wind component would result in approximately 2,450 ac (990 ha) of temporary disturbance and 1,250 ac

Key Characteristics	New Small Modular Reactors	Natural Gas-fired Combined-Cycle	Combination Alternative
			(500 ha) of permanent disturbance. Solar photovoltaic component: the solar facilities may require approximately 6.2 ac per installed megawatt. Each of the 24 collocated battery storage systems would require an additional 20 ac (8 ha). In total, approximately 19,000 ac (7,700 ha) would be required to support 3,000 MWe of installed solar capacity.
Work Force	Approximately 3,300 workers would be required during peak construction and 1,500 workers would be required for operations.	Approximately 800 workers would be required during peak construction and 150 workers would be required during operations.	SMR component: approximately 600 workers would be required during peak construction and 250 workers would be required for operations. Onshore wind component: the onshore wind portion would require a total estimated workforce of 870 workers during peak construction, and 80 workers during operation. Solar component: collectively, the solar component would require a total estimated workforce of 2,100 workers during peak construction and 100 workers during operation.

2.3.2.1 New Nuclear (Small Modular Reactors)

The small modular reactor (SMR) alternative would consist of six, 400 MWe reactor modules with a total net generating capacity of approximately 2,400 MWe—sufficient to replace approximately 98 percent of Comanche Peak's 2,460 MWe net generation (Luminant 2022-TN8655). The new nuclear alternative configuration is scaled up from the two-module/800 MWe generic plant parameter envelope approach analyzed in the Clinch River early site permit environmental impact statement (NUREG-2226) (NRC 2019-TN6136).

Consistent with the material in Vistra's ER, the NRC assumes that the SMR alternative would be located at the Comanche Peak site. Approximately 675 ac (273 ha) spread across three parcels of partially wooded land are available for siting these reactors and their associated facilities (Luminant 2022-TN8655). As noted in Vistra's ER (and differentiated by green shading on the attached map from Vistra's response to request for additional information [RAI] ALT-1), this land comprises a 275 ac (111 ha) area northwest of the existing Comanche Peak power block, and two parcels totaling 400 ac (161 ha) south of the Comanche Peak site boundary. The SMR facility and mechanical draft cooling towers (MDCTs) would be sited within a 275 ac parcel to the northwest, and an associated blowdown treatment facility (BDTF) would be cited within a 400 ac area to the south (Luminant 2022-TN8655, 2023-TN8692). Although some infrastructure upgrades may be required, the NRC assumes that the existing transmission line infrastructure would be sufficient to support the SMR alternative (Luminant 2022-TN8655).

The SMR facilities would use closed-cycle cooling with MDCTs. Source water for the cooling system would require construction of a new intake structure on CCR, and makeup water would be drawn from an existing intake on Lake Granbury (located approximately 7 mi (11 km) northeast of Comanche Peak). Blowdown from the cooling towers would require the construction of a new BDTF, like that described in NUREG-1943—the combine license EIS for Comanche Peak Units 3 and 4 (NRC 2011-TN6437, 2011-TN8693). The discharge from the BDTF would also require construction of a new discharge structure in Lake Granbury and new piping along the Lake Granbury shore (Luminant 2022-TN8655). Cooling water withdrawal would be approximately 80 MGD (300,000 m^3/d), and consumptive water use would be approximately 55 MGD (210,000 m^3/d) (NRC 2019-TN6136).

Plant structures would include MDCTs (estimated to be approximately 65 ft [20 m] tall) with the tallest buildings in the power block reaching approximately 160 ft (50 m) in height (NRC 2019-TN6136). Approximately 3,300 workers would be required during peak construction and 1,500 workers would be required for operations (NRC 2019-TN6136). Air quality and noise impacts can result from construction of the SMR facilities. Emissions from operation would be like those of Comanche Peak, and noise impacts would result from cooling towers, generators, etc. (see Section 4.3.2 of the LR GEIS; TN2654).

Land use requirements for a 2,400 MWe SMR facility would be approximately 220 ac (89 ha) Luminant 2022-TN8655). The associated BDTF would require an additional 175 ac (70 ha) for filtration equipment buildings, evaporation ponds, and storage ponds located outside of the southern site boundary (Luminant 2023-TN8692). The discharge piping from the BDTF to Lake Granbury would extend off-site and disturb approximately an additional 81 ac (32 ha) (Luminant 2022-TN8655).

2.3.2.2 Natural Gas-fired Combined-Cycle

The NGCC facility would have an approximate net generating capacity of 2,460 MWe (2,830 MWe nameplate capacity with an 87 percent capacity factor). The NRC staff assumes the facility would use four combined-cycle combustion turbines, with a net capacity of approximately 615 MWe per unit. An existing natural gas transmission line traverses north–south on the Comanche Peak site, and another natural gas pipeline transverses the Comanche Peak site east–west in Hood County. Therefore, the NRC assumes that only a short natural gas pipeline would have to be installed to tie into the existing pipelines to supply the NGCC facility with natural gas (Luminant 2022-TN8655). Although some infrastructure upgrades may be required, the NRC assumes that the existing transportation and transmission line infrastructure at Comanche Peak would be adequate to support the alternative.

The NGCC facility would be constructed in the same general location as that described for the new SMR alternative, i.e., within a 275 ac (111 ha) parcel northwest of the existing Comanche Peak power block, with an associated BDTF that would be constructed and operated within two parcels totaling 400 ac (161 ha) south of the Comanche Peak site boundary (see green shading on the attached map from Vistra’s response to RAI ALT-1)(Luminant 2023-TN8692). The NGCC facility and MDCTs would be sited within the 275 ac parcel to the northwest, and an associated

BDTF would be cited within the collective 400 ac parcels to the south ((Luminant 2022-TN8655, 2023-TN8692). The tallest NGCC structures would be the plant stacks and cooling towers; the plant stacks would be approximately 150 ft (46 m) tall (Luminant 2022-TN8655), and the MDCTs would be approximately 55 ft (17 m) tall (NRC 2011-TN6437, 2011-TN8693). Approximately 800 workers would be required during peak construction and 150 workers would be required during operations (NRC 2011-TN6437, 2011-TN8693).

The required NGCC cooling system components and features (intake structures, discharge structures, the BDTF, and connective pipelines) would be like those described for the new SMR alternative but scaled down to accommodate the reduced cooling requirements of the NGCC (Luminant 2022-TN8655). Cooling water withdrawal would be approximately 14 MGD (53,000 m^3/d) and consumptive water use would be 11 MGD (46,000 m^3/d) (NETL 2022-TN8820).

Construction and operation of the NGCC alternative would emit criteria pollutants and more greenhouse gases (GHGs) than would a nuclear alternative. The burning of fossil fuels is a major source of criteria pollutants and GHGs, primarily carbon dioxide (CO_2), as well as other hazardous air pollutants. The exact nature of these pollutants depends on the chemical composition of the fuel, combustion technology, and air pollution control devices. The emission factors, heat content, and heat rate data used to quantify emissions resulting from operation of the NGCC alternative are based on information published by the National Energy Technology Laboratory (see Case B31A) (NETL 2022-TN8820). Land use requirements for a 2,460 MWe NGCC facility would be approximately 120 ac (48 ha) (Luminant 2022-TN8655, p. 7-15). An additional 40 ac (16 ha) would be required for the associated BDTF consisting of filtration equipment buildings, evaporation ponds, and storage ponds located outside of the southern site boundary (NRC 2011-TN6437, 2011-TN8693; Luminant 2023-TN8692). The discharge piping from the BDTF to Lake Granbury would extend off-site and disturb approximately 81 additional ac (32 ha) (Luminant 2022-TN8655, p. 7-15).

2.3.2.3 Combination Solar Photovoltaic, Onshore Wind, and New Small Modular Reactors (Combination Alternative)

The combination alternative includes approximately 1,200 MWe from solar photovoltaic (PV) generation coupled with battery storage, 800 MWe from onshore wind generation coupled with battery storage, and 400 MWe from a new SMR, for a net total replacement of approximately 2,400 MWe.

<u>Solar Photovoltaic</u>

The NRC assumes that 24 utility-scale solar PV plants averaging approximately 125 MWe each would be constructed, for a total installed capacity of 3,000 MWe. Each of these plants would be paired with a 125 MW/500MWh battery energy storage system. This new solar and battery storage capacity would be located off-site of Comanche Peak at locations within the region of influence. Combining an assumed 25 percent solar PV capacity factor (DOE/EIA 2023-TN8821) with the energy dispatch capabilities of the associated battery systems, the solar units collectively would have a net generating capacity of approximately 1,200 MWe.

Collectively, the solar PV component would require a total estimated workforce of 2,100 workers during peak construction and 100 workers during operation. (DOE 2011-TN8387; BLM 2019-TN8386). Air quality and noise impacts can result from construction (vehicles and equipment) and maintenance of solar PV (see Section 4.3.2 of the LR GEIS; TN2654). Virtually no discernible noise or air quality impacts would result from the routine operation of the solar facility.

The solar facilities may require approximately 6.2 ac per installed megawatt (NRC 2013-TN2654). Each of the 24 collocated battery storage systems would require an additional 20 ac (8 ha) (Solar Industry 2019-TN8881). In total, approximately 19,000 ac (7,700 ha) would be required to support 3,000 MWe of installed solar capacity.

<u>Onshore Wind</u>

The NRC assumes that 12 wind farms averaging approximately 120 MWe each would be constructed, for a total installed capacity of 1,440 MWe. Each of these wind farms would be paired with a 120 MW/480MWh battery energy storage system. The average nameplate capacity of newly installed wind turbines in the United States in 2018 was 2.4 MW (DOE 2019-TN7706). Assuming the use of 2.4 MW turbines, a total of approximately 600 wind turbines would be required to provide the required installed capacity. The wind farms and battery storage capacity would be located off-site of Comanche Peak at locations within the region of influence. Combining an assumed a 40 percent onshore wind capacity factor (DOE 2019-TN7706) with the energy dispatch capabilities of the associated battery systems, the solar PV units collectively would have a net generating capacity of approximately 800 MWe.

Utility-scale wind farms would require relatively large areas and would be installed at utility-scale facilities located in multiple sites scattered across the region of influence. (The NRC assumes a wind turbine hub height of 95 m (312 ft) and a rotor diameter of 100 m (328 ft) for a maximum height of approximately 145 m (475 ft) (Vestas 2023-TN8825). Assuming utility-scale wind facilities would require 85 ac (34.5 ha) of land per megawatt of installed capacity, approximately 122,000 ac (49,000 ha) would be required for an installed capacity of 1,440 MWe (NREL 2009-TN8724; WAPA/FWS 2015-TN8725). However, much of the overall land requirement associated with the wind farms would remain largely unaffected by operation of the wind turbines. Land disturbance was estimated using a value of 1.7 ac of temporary disturbance per megawatt of generation and 0.7 ac/MW of permanent disturbance (within the footprints of the turbine towers, access roads, and power collection and transmission system) (NREL 2009-TN8724, WAPA/FWS 2015-TN8725). The battery storage systems supporting these wind farms would also result in an additional 240 ac (97 ha) of permanent disturbance. Accordingly, the wind component would result in approximately 2,450 ac (990 ha) of temporary land disturbance and 1,250 ac (500 ha) of permanent land commitment.

The onshore wind portion would require a total estimated workforce of 870 workers during peak construction, and 80 workers during operation (Tegen 2016-TN8826). Air quality and noise impacts can result from construction (vehicles and equipment) and maintenance of wind turbines (see Section 4.3.2 of the LR GEIS). Wind farms would have no discernible impacts on air quality from operation. Noise impacts would include aerodynamic noise from the turbine rotor and mechanical noise from turbine drivetrain components.

<u>New Small Modular Reactors</u>

The NRC assumes one 400 MWe SMR unit, of the same type described for the SMR alternative, would be installed at Comanche Peak in the same location as that used for the SMR alternative, i.e., northwest and south of Comanche Peak Units 1 and 2. Approximately 600 workers would be required during peak construction and 250 workers would be required for operations (NRC 2019-TN6136).

Radiological air emissions would be proportionally less than the SMR alternative and the SMR would also use closed-cycle cooling with MDCTs. As with the SMR alternative, the cooling system would require construction of a new intake structure on CCR and makeup water would be drawn from an existing intake on Lake Granbury (located approximately 7 mi [11 km] northeast of Comanche Peak). Blowdown from the cooling towers would require the construction of a new BDTF, like that described in the combined license EIS for Comanche Peak Units 3 and 4, but scaled down to accommodate the reduced cooling requirements of the single unit SMR (NRC 2011-TN6437, 2011-TN8693). The discharge from the BDTF would also require construction of a new discharge structure in Lake Granbury and new piping along the Lake Granbury shore (Luminant 2023-TN8692). Cooling water withdrawal is estimated to be 13 MGD (50,000 m^3/d) and consumptive water use would be 9.2 MGD (35,000 m^3/d) (NRC 2019-TN6136). The power block height would be the same as those assumed for the SMR alternative.

Land requirements for a single 400 MWe SMR unit would be approximately 36 ac (14 ha) (Luminant 2022-TN8655). An additional 40 ac (16 ha) would be required for the BDTF consisting of filtration equipment buildings, evaporation ponds, and storage ponds located outside of the southern site boundary. The discharge piping from the BDTF to Lake Granbury would extend offsite and disturb approximately an additional 81 ac (32 ha) (Luminant 2022-TN8655).

2.4 Alternatives Considered but Dismissed

The NRC eliminated 13 alternatives from detailed study due to resource availability and commercial or regulatory limitations. Many of these limitations will likely still exist when the current Comanche Peak operating licenses expire. This section briefly describes the 13 alternatives as well as the reasons why they were eliminated from detailed study.

2.4.1 Solar Power

Solar power, including PV and concentrating solar power technologies, generates power from sunlight. Solar PV components convert sunlight directly into electricity using solar cells made from silicon or cadmium telluride. Concentrating solar power uses heat from the sun to boil water and produce steam. The steam then drives a turbine connected to a generator to produce electricity (NREL Undated-TN7710).

Solar generators are considered an intermittent electrical power resource because their availability depends on exposure to the sun, also known as solar insolation. To be viable, a utility-scale solar alternative must replace the amount of electrical power that Comanche Peak currently provides. Assuming a capacity factor of 25 percent (DOE/EIA 2023-TN8821), approximately 9,840 MWe of additional solar energy capacity would need to be installed in the region of influence to replace the electricity generated by Comanche Peak.

Accordingly, key design characteristics associated with the solar portion of the combination alternative presented in Section 2.3.2.3, could be scaled to suggest the relative impacts of using solar as a stand-alone technology to replace the Comanche Peak generating capacity. Utility-scale solar facilities would require large areas of land for the solar panels. A utility-scale solar alternative would require approximately 36,000 acres of land.

Based on this information, a utility-scale solar energy alternative would not be a reasonable to Comanche Peak's LR. However, a limited amount of solar power generation, in combination with other energy generating technologies, would be a reasonable alternative to Comanche Peak's LR, as explained in Section 2.3.2.3.

2.4.2 Wind Power

As is the case with other renewable energy sources, the feasibility of wind energy providing baseload power depends on the location (relative to electricity users), value, accessibility, and constancy of the resource. Wind energy must be converted to electricity at or near the point where it is used, and there are limited energy storage opportunities available to overcome the intermittency and variability of wind resources.

The American Clean Power Association reports a total of more than 122,000 MW of installed wind energy capacity nationwide as of December 31, 2020. Approximately 200 MW of this wind energy capacity is installed within the region of influence (DOE Undated-TN8431). To be considered a reasonable replacement energy alternative to Comanche Peak's LR, a wind power alternative must replace the amount of electrical power that Comanche Peak provides. Assuming a capacity factor of 40 percent (NREL 2020-TN8425), land-based wind energy facilities would need to generate 6,150 MW of electricity to replace Comanche Peak's generating capacity of 2,460 MWe. Land-based wind energy is assumed to have a capacity factor of around 28–35 percent (DOE/EIA 2020-TN7528), along with a land requirement of 60 ac/MW of installed capacity (NRC and USACE 2016-TN6562, NRC and USACE 2016-TN7343).

Assuming a capacity factor of 50 percent for offshore wind facilities (NREL 2020-TN8425), these power generating facilities would need to generate 4,920 MW of electricity to fully replace Comanche Peak's generating capacity of 2,460 MWe. Given the amount of wind capacity necessary to replace Comanche Peak, the intermittency of the resource, the limited amount of offshore Federal waters currently designated for wind energy leasing, and the status of wind development, a wind-only alternative—either land based, offshore, or some combination of the two—would be an unreasonable alternative to Comanche Peak's LR. However, a limited amount of onshore wind power generation, in combination with other power generating technologies, would be a reasonable alternative to Comanche Peak's LR, as explained in Section 2.3.2.3.

2.4.3 Biomass Power

Biomass resources used for biomass fuel-fired power generation include agricultural residues, animal manure, wood wastes from forestry and industry, residues from food and paper industries, municipal green wastes, dedicated energy crops, and methane from landfills (IEA 2007-TN8436). Using biomass fuel-fired generation for baseload power depends on the geographic distribution, available quantities, constancy of supply, and energy content of biomass resources. For this analysis, biomass fuel would be combusted for power generation in the electricity sector. As of 2022, biomass fuel in Texas powered approximately 0.3 percent of total state electricity, most from wood fuel (EIA 2023-TN8777).

For utility-scale biomass fuel-fired electricity generation, technologies used for biomass energy conversion would be similar to the technology used in other fossil fuel-fired power plants, including the direct combustion of biomass fuel in a boiler to produce steam (NRC 2013-TN2654). Accordingly, biomass generation is considered a carbon-emitting technology.

Biomass energy generation is generally more cost-effective when co-fired with coal-fired power plants (IEA 2007-TN8436). However, most biomass fuel-fired power generation plants generally only reach capacities of 50 MWe, which means replacing the 2,460 MWe generating capacity of Comanche Peak, using only biomass fuel, would require 49 new power plants. Increasing biomass fuel-fired generation capacity by constructing new units by the time Comanche Peak's operating licenses expire is unlikely. For these reasons, biomass fuel-fired generation would not be a reasonable alternative to Comanche Peak's LR.

2.4.4 Hydroelectric Power

There are about 2,000 operating hydroelectric power facilities in the United States. Hydroelectric power technologies captures flowing water and directs it to turbines and generators to produce electricity (NRC 2013-TN2654). There are three variants of hydroelectric power generation: (1) run of the river (diversion) facilities that direct the natural flow of a river, stream, or canal through a hydroelectric power facility; (2) store and release facilities that block the flow of the river by using dams that cause water to accumulate in an upstream reservoir; and (3) pumped storage facilities that use electricity from other power sources to pump water to higher elevations during off peak hours to be released during peak load periods to generate electricity (EIA 2020-TN8352, EIA 2021-TN8353).

Non-powered dams in the United States were assessed by DOE to estimate their potential to generate electricity using existing hydroelectric facilities. Electricity generation from retrofitted non-powered dams in Texas would not provide sufficient power to replace Comanche Peak's generation capacity (ORNL 2012-TN8440). Two Texas dams with the greatest power generation potential would only generate 152 MWe and 42.2 MWe, with capacity from other non-power dams being much smaller.

Given the projected lack of growth in hydroelectric power, the competing demands for water resources, public opposition to the environmental impacts from the construction of large hydroelectric power facilities, and the scarcity of surface water resources in Texas, the use of hydroelectric power would not be a reasonable alternative to Comanche Peak's LR.

2.4.5 Geothermal Power

Geothermal technologies extract the heat contained in geologic formations to produce steam to drive a conventional steam turbine generator. Facilities producing electricity from geothermal energy have demonstrated capacity factors of 95 percent or greater, making geothermal energy a potential source of baseload electric power. However, the feasibility of geothermal power generation to provide baseload power depends on the regional quality and accessibility of geothermal resources. Utility-scale geothermal energy generation requires geothermal reservoirs that have a temperature above 200 °F (93 °C). Known utility-scale geothermal resources are concentrated in the western United States, specifically Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. Geothermal resources in most of Texas have limited potential for geothermal energy (NREL 2018-TN8871). Given its low potential, geothermal power generation would not be a reasonable alternative to Comanche Peak's LR.

2.4.6 Ocean Wave, Current, and Tide Energy

Ocean waves, currents, and tides are often predictable and reliable, making them attractive candidates for potential renewable energy generation. Four major technologies may be suitable for harnessing wave energy: (1) terminator devices that range from 500 kW to 2 MW, (2) attenuators, (3) point absorbers, and (4) overtopping devices (BOEM Undated-TN7696). Point absorbers and attenuators use floating buoys to convert wave motion into mechanical energy, driving a generator to produce electricity. Overtopping devices trap a portion of a wave at a higher elevation than the sea surface; waves enter a tube and compress air that is then used to drive a generator producing electricity (NRC 2013-TN2654). Some of these technologies are undergoing demonstration testing at commercial scales, but none of the technologies are currently used to provide baseload power (BOEM Undated-TN7696).

The potential for ocean energy along the Texas coast is marginal, and wave and ocean energy-generation technologies are still in their infancy and currently lack commercial application (EPRI 2011-TN8442). For these reasons, wave and ocean energy power generation would not be a reasonable alternative to Comanche Peak's LR.

2.4.7 Municipal Solid Waste-Fired Power

Energy recovery from municipal solid waste converts nonrecyclable waste materials into usable heat, electricity, or fuel through combustion. Three types of municipal solid waste combustion technologies include mass burning, modular systems, and refuse-derived fuel systems. Mass burning is the method used most frequently in the United States. The heat released from combustion is used to convert water to steam, which is then used to drive a turbine generator to produce electricity. Ash is collected and taken to a landfill, and particulates are captured through a filtering system (BOEM Undated-TN7696).

Currently, 75 waste-to-energy power plants are in operation in 21 states, processing approximately 29 million tons of waste per year. These waste-to-energy power plants have an aggregate capacity of 2,725 MWe (Michaels and Krishnan 2019-TN7700). Although some power plants have expanded to handle additional waste and to produce more energy, only one new municipal solid waste combustion power plant has been built in the United States since 1995 (Maize 2019-TN7699). The average waste-to-energy power plant produces about 50 MWe, which is a very small percentage of the energy produced by Comanche Peak.

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills rather than a need for energy, and additional stable supplies of municipal solid waste would be needed to support new facilities in the region of influence. Based on this information, municipal solid waste-to-energy power plants would not be a reasonable alternative to Comanche Peak's LR.

2.4.8 Petroleum-Fired Power

Petroleum-fired electricity generation accounted for less than 1 percent of the region of influence's total electricity generation in 2020 EIA 2021-TN8353). The variable costs and environmental impacts of petroleum-fired electrical power generation tend to be greater than those of natural gas-fired generation. Petroleum-fired generation emits large amounts of greenhouse gases and hazardous air pollutants. The historically higher cost of oil has also resulted in a steady decline in its use for electricity generation, and the EIA forecasts no growth in capacity using petroleum-fired power plants through 2040 (DOE/EIA 2013-TN2590, 2015-TN4585).

As stated in Vistra's ER, Vistra's long-term sustainability strategy involves closing fossil fuel-fired power units to assist in achieving the goal of a 60 percent reduction in CO_2 equivalent (CO_2eq) emissions by 2030 (Luminant 2022-TN8655). Since petroleum-fired generation has higher cost and greater environmental impacts than other generation options, and building new facilities would not contribute to meeting cleaner energy source policies and regulations, it is unlikely petroleum-fired electric power generation would be part of Vistra's long-term strategy. Therefore, based on this information, petroleum fired generation would not be a reasonable alternative to Comanche Peak's LR.

2.4.9 Coal-Fired Power

Although coal has historically been the largest source of electricity in the United States, both natural gas generation and nuclear energy generation surpassed coal generation at the national level in 2020. Coal-fired electricity generation in the United States has continued to decrease as coal-fired generating units have been retired or converted to use other fuels and as the remaining coal-fired generating units have been used less often (DOE/EIA 2021-TN7718).

Early power plants produced electricity primarily from coal, steam, or hydroelectric energy. Today, Texas still generates electricity from some of these traditional sources but increasingly relies on natural gas as well as renewable resources, primarily wind. According to ERCOT, nearly half of Texas' electricity was generated by natural gas-fired power plants in 2019. Coal-fired plants and wind power each generated about 20 percent, while the state's two nuclear power plants—the South Texas Project near Bay City and Comanche Peak near Glen Rose—supplied a total of 11 percent. Solar, hydroelectric, and biomass resources provided most of the remainder (Texas Comptroller 2020-TN8845).

Texas' fuel mix has changed considerably in the past decade. In 2009, coal-fired plants generated nearly 37 percent of the state's electricity while wind provided about 6 percent. Since then, three Texas coal-fired plants have closed and the use of wind power has more than quadrupled, as more transmission lines bringing electricity from remote wind farms to urban market centers came online (Texas Comptroller 2020-TN8845).

Baseload coal-fired power units have proven their reliability and can routinely sustain capacity factors as high as 85 percent. Among the technologies available, pulverized coal boilers producing supercritical steam (supercritical pulverized coal boilers) have become increasingly common given their generally high thermal efficiencies and overall reliability.

Supercritical pulverized coal facilities are more expensive to build than subcritical coal-fired power plants but consumes less fuel per unit output. Integrated gasification combined cycle combines modern coal gasification technology with both gas turbine and steam turbine power generation. The technology is cleaner than conventional pulverized coal plants because some of the major pollutants are removed before combustion. Although several smaller, integrated gasification combined-cycle power plants have been in operation since the mid-1990s, large-scale projects have experienced setbacks and public opposition have hindered it from being fully integrated into the energy market.

As part of its long-term sustainability strategy to reduce GHG emissions, Vistra is closing coal-fired plants. Based on these considerations, coal-fired power plants would not be a reasonable alternative to the Comanche Peak's LR.

2.4.10 Fuel Cells

Fuel cells oxidize fuels without combustion and, therefore, without the environmental side effects of combustion. Fuel cells use a fuel (e.g., hydrogen) and oxygen to create electricity through an electrochemical process. The only byproducts are heat, water, and CO_2 (depending on the hydrogen fuel type) (DOE Undated-TN7695). Hydrogen fuel can come from a variety of hydrocarbon resources including natural gas. As of October 2020, the United States had only 250 MW of fuel cell power generation capacity (DOE/EIA 2022-TN7828).

Currently, fuel cells are not economically or technologically competitive with other electricity generating alternatives. The EIA estimates that fuel cells may cost $6,639 per installed kilowatt (total overnight capital costs in 2021 dollars), which is high compared to other replacement energy alternatives (DOE/EIA 2022-TN7694). In June 2021, DOE launched an initiative to reduce the cost of hydrogen production to spur fuel cell and energy storage development over the next decade (DOE 2021-TN7693). However, it is unclear whether or to what degree this initiative will lead to increased future development and deployment of fuel cell technologies.

More importantly, fuel cell units used for power production are likely to be small (approximately 10 MW). The world's largest industrial hydrogen fuel cell power plant is a 50 MWe plant in South Korea (Larson 2020-TN8401). Using fuel cells to replace the power that Comanche Peak provides would require the construction of approximately 246 units. Given limited deployment and high cost of fuel cell technology, fuel cells would not be a reasonable alternative to the Comanche Peak's LR.

2.4.11 Purchased Power

Power may be purchased and imported from outside the region. Although purchased power would likely have little or no measurable impact, environmental impacts could occur where the power is being generated, depending on the technologies used to generate the power. The electric grid in Texas is managed by ERCOT. As a merchant plant, Comanche Peak does not own the distribution system, but provides power to Texas customers through the ERCOT grid. Purchased power may require the construction of new power generation facilities to replace Comanche Peak's generation.

Purchased power is generally economically adverse because, historically, the cost of generating power has been less than the cost of purchasing the same amount of power from a third-party supplier. Purchased power agreements also carry the inherent risk that the supplier may not deliver all of the contracted power. Given the uncertainties of the availability of baseload power on a long-term basis at the scale of Comanche Peak's power generation capacity and potential environmental impacts of developing new power generation, purchased power would not be a reasonable alternative to Comanche Peak's LR.

2.4.12 Delayed Retirement of Other Generating Facilities

Delaying the retirement of a power plant enables it to continue supplying electricity. Because some power generators are required to adhere to regulations requiring significant reductions in power plant emissions, some owners may opt to retire older less efficient units rather than incur the cost for compliance. Retirements may also be driven by low competing commodity prices (such as low natural gas prices), slow growth in electricity demand, and EPA's Mercury and Air Toxics Standards (DOE/EIA 2015-TN4585; EPA 2020-TN8379).

Multiple coal-fired and natural gas-fired power plants owned by Vistra in Texas have been closed or are planned to close. (Luminant 2017-TN8874, 2017-TN8875). These include Big Brown, Monticello, Sandow, Trinidad, Martin Lake and others. Some of these power plants, if not sold, could be reactivated and the service life of other power plants could be extended. Reactivating or continuing to operate fossil fuel-fired power plants would impact air quality.

Continued use of fossil fuel-fired power generation sources is contrary to Vistra's strategy to achieve GHG emission targets. As stated in Vistra's ER, Vistra established a goal to achieve a 60 percent reduction in CO_2eq emissions by 2030, compared to the 2010 baseline, and has a long-term objective to achieve net-zero carbon emissions by 2050 (Luminant 2022-TN8655). Because of these conditions, delayed retirement of older power generating units would not provide a reasonable replacement alternative to Comanche Peak's LR.

2.4.13 Demand-Side Management/Energy Conservation/Energy Efficiency

Demand-side management refers to energy conservation and efficiency programs that do not require the addition of new generating capacity. Demand side management programs can include reducing energy demand through consumer behavioral changes or through altering the characteristics of the electrical load. These programs can be initiated by a utility, transmission operators, the State, or other load serving entities. In general, residential electricity consumers have been responsible for the majority of peak load reductions, and participation in most demand-side management programs is voluntary (NRC 2013-TN2654).

Therefore, the existence of a demand-side management program does not guarantee that reductions in electricity demand will occur. The LR GEIS concludes that, although the energy conservation or energy efficiency potential in the United States is substantial, there have been no cases in which an energy efficiency or conservation program alone has been implemented expressly to replace or offset a large baseload generation station (NRC 2013-TN2654). Therefore, demand-side management programs alone would not be a reasonable alternative to Comanche Peak's LR.

2.5 Comparison of Alternatives

In this chapter, the NRC staff present three alternatives to the proposed action (Comanche Peak LR): (1) new small modular reactors (SMRs); (2) NGCC facility; and (3) a combination of solar PV, onshore wind, and a new SMR. Chapter 3 describes the environmental impacts of the proposed action and the alternatives. Table 2-2 summarizes the environmental impacts of the proposed action (Comanche Peak LR) and the alternatives to LR considered in this SEIS.

The environmental impacts of the proposed action (renewing the Comanche Peak operating licenses) would be SMALL for all impact categories. In comparison, each of the three replacement power alternatives has environmental impacts in at least nine resource areas that are greater than the environmental impacts of the proposed license renewal action. In addition, the replacement energy alternatives also would also result in construction impacts. If the NRC does not renew the Comanche Peak operating licenses (no action alternative), energy planning decisionmakers would have to choose a replacement power alternative similar to the ones evaluated in this SEIS. Based on the review of the replacement energy alternatives, the no action alternative, the proposed action, the environmentally preferred alternative is the proposed LR action. Therefore, the NRC staff's preliminary recommendation is to renew the Comanche Peak operating licenses.

Table 2-2 Summary of Environmental Impacts of Proposed Action and Alternatives

Resource Area	Proposed Action – License Renewal	No Action	New Small Modular Reactors	Natural Gas-fired Combined-Cycle	Combination Alternative
Air Quality	SMALL	SMALL	SMALL	MODERATE	SMALL
Noise	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Groundwater and Surface Water	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL
Aquatic Resources	SMALL	SMALL	SMALL	SMALL	MODERATE to LARGE
Terrestrial Resources	SMALL	SMALL	SMALL	SMALL to MODERATE	MODERATE to LARGE
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL
Land Use	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to LARGE
Visual Resources	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL to LARGE
Socioeconomics	SMALL	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE
Transportation	SMALL	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE
Environmental Justice	[a]	[b]	[c]	[c]	[c]
Historic and Cultural Resources	[d]	[e]	[f]	[f]	[f]
Waste Management	SMALL	SMALL	SMALL	SMALL	SMALL

(a) There would be no disproportionate and adverse human health and environmental effects on minority and low-income populations.

(b) A reduction in tax revenue resulting from the shutdown of Comanche Peak could decrease the availability of public services. Minority and low-income populations dependent on these services could be disproportionately affected.

(c) Based on the analysis of human health and environmental effects presented in this SEIS, this alternative would not likely have disproportionate and adverse human health and environmental effects on minority and low-income populations. However, this determination would depend onsite location, plant design, and operational characteristics of the new power plant, unique consumption practices and interactions with the environment of nearby populations, and the location of minority and low-income populations.

(d) Based on (1) that no new ground disturbance, construction, or modifications are anticipated during the license renewal period; 2) State Historic Preservation Office input; and 3) Vistra procedures, license renewal would not adversely affect any known historic properties (Title 36, "Parks, Forest, and Public Property," of the Code of Federal Regulations 800.4(d)(1), "No Historic Properties Affected" (36 CFR Part 800-TN513)), or historic and cultural resources.

(e) As a result of facility shutdown, land-disturbance activities or dismantlement are not anticipated because these activities would be conducted during decommissioning, and therefore facility shutdown would have no immediate effect on historic properties.

(f) The potential for impacts on historic and cultural resources from construction and operation of a replacement power alternative would vary greatly depending on the location of the site. The impacts on historic and cultural resources could range from will not adversely affect known historic and cultural resources to may adversely affect known historic and cultural resources.

3 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES AND MITIGATING ACTIONS

3.1 Introduction

In conducting its environmental review of the Comanche Peak Nuclear Power Plant (Comanche Peak), Units 1 and 2 LRA, the NRC staff defines and describes the environment that could be affected by the proposed action (issuing renewed licenses authorizing an additional 20 years of operation). The staff then evaluates the environmental consequences of the proposed action as well as reasonable alternatives to the proposed action.

In this chapter, the NRC staff first defines the affected environment as the environment that currently exists at and around the Comanche Peak site. Because existing conditions are at least partially the result of past construction and nuclear power plant operations, this chapter considers the nature and impacts of past and ongoing operations and evaluates how, together, these actions have shaped the current environment. This chapter also describes reasonably foreseeable environmental trends. The effects of ongoing reactor operations at the site have become well established as environmental conditions have adjusted to the presence of the facility.[1] Sections 3.2 through 3.13 describe the affected environment for each resource area, followed by the staff's evaluation of the environmental consequences of the proposed action and alternatives to the proposed action. The NRC staff compares the environmental impacts of license renewal (LR) with those of the no-action alternative and replacement power alternatives to determine whether the adverse environmental impacts of LR are so great that it would be unreasonable to preserve the option for energy-planning decisionmakers.

The NRC staff's evaluation of environmental consequences includes the following:

- impacts associated with continued operations during the period of extended operation
- impacts of the reasonable power replacement alternatives to the proposed action and the no-action alternative (not issuing the renewed licenses)
- impacts common to all alternatives: (1) fuel cycle including uranium fuel cycle, (2) terminating power plant operations and decommissioning, and (3) greenhouse gas emissions and climate change
- impacts associated with the uranium fuel cycle
- impacts of postulated accidents (design-basis accidents and severe accidents)
- cumulative impacts of the proposed action
- resource commitments associated with the proposed action, including unavoidable adverse impacts, the relationship between short-term use and long-term productivity, and irreversible and irretrievable commitment of resources
- new and potentially significant information about environmental issues related to the impacts of operation during the renewal term

As stated in Sections 1.4 and 1.5, this SEIS documents the NRC staff's environmental review of the LRA and supplements the information provided in NUREG–1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (LR GEIS) (NRC 2013-TN2654). The

[1] Where appropriate, the NRC staff has summarized referenced information (incorporated information by reference) in this supplemental environmental impact statement. This allows the staff to focus on new and potentially significant information identified since initial EIS of Comanche Peak Units 1 and 2 in 1989.

LR GEIS identifies 78 issues (divided into Category 1 [generic] and Category 2 [site-specific] issues) to be evaluated for the proposed action. Section 1.4 of this SEIS provides an explanation of the criteria for Category 1 issues and Category 2 issues, as well as the definitions of SMALL, MODERATE, and LARGE impact significance.

For Category 1 issues, the NRC staff relies on the analysis in the LR GEIS unless otherwise noted. Table 3-1 lists the applicable Category 1 issues for Comanche Peak. For these issues, the NRC staff did not identify any new and significant information that would change the conclusions of the LR GEIS (see Section 3.14 of this SEIS). Therefore, there are no impacts related to these issues beyond those discussed in the LR GEIS (Table 3-1 and Table 3-2) as cited in Sections 3.2 to 3.13 of this SEIS. Section 3.14 of this SEIS describes the staff's process for evaluating new and significant information.

The NRC staff analyzed the applicable Category 2 (site-specific) issues for Comanche Peak and assigned impacts for these issues as shown in Table 3-2.

Table 3-1 Applicable Category 1 (Generic) Issues for Comanche Peak

Issue	LR GEIS Section	Impact
Land Use – Onsite land use	4.2.1.1	SMALL
Land Use – Offsite land use	4.2.1.1	SMALL
Visual Resources – Aesthetic Impacts	4.2.1.2	SMALL
Air Quality – Air quality impacts (all plants)	4.3.1.1	SMALL
Air Quality – Air quality effects of transmission lines	4.3.1.1	SMALL
Noise – Noise impacts	4.3.1.2	SMALL
Geologic Environment – Geology and soils	4.4.1	SMALL
Surface Water Resources – Surface water use and quality (non-cooling system impacts)	4.5.1.1	SMALL
Surface Water Resources – Altered current patterns at intake and discharge structures	4.5.1.1	SMALL
Surface Water Resources – Altered thermal stratification of lakes	4.5.1.1	SMALL
Surface Water Resources – Scouring caused by discharged cooling water	4.5.1.1	SMALL
Surface Water Resources – Discharge of metals in cooling system effluent	4.5.1.1	SMALL
Surface Water Resources – Discharge of biocides, sanitary wastes, and minor chemical spills	4.5.1.1	SMALL
Surface Water Resources – Surface water use conflicts (plants with once-through cooling systems)	4.5.1.1	SMALL
Surface Water Resources – Effects of dredging on surface water quality	4.5.1.1	SMALL
Surface Water Resources – Temperature effects on sediment transport capacity	4.5.1.1	SMALL
Ground Water Resources – Groundwater contamination and use (non-cooling system impacts)	4.5.1.2	SMALL
Ground Water Resources – Groundwater use conflicts (plants that withdraw less than 100 gallons per minute [gpm])	4.5.1.2	SMALL
Terrestrial Resources – Exposure of terrestrial organisms to radionuclides	4.6.1.1	SMALL
Terrestrial Resources – Cooling tower impacts on vegetation (plants with cooling towers)	4.6.1.1	SMALL
Terrestrial Resources – Bird collisions with plant structures and transmission lines	4.6.1.1	SMALL
Terrestrial Resources – Transmission line right-of-way (ROW) management impacts on terrestrial resources	4.6.1.1	SMALL
Terrestrial Resources – Electromagnetic fields on flora and fauna (plants,	4.6.1.1	SMALL

Issue	LR GEIS Section	Impact
agricultural crops, honeybees, wildlife, livestock)		
Aquatic Resources – Entrainment of phytoplankton and zooplankton (all plants)	4.6.1.2	SMALL
Aquatic Resources – Infrequently reported thermal impacts (all plants)	4.6.1.2	SMALL
Aquatic Resources – Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication	4.6.1.2	SMALL
Aquatic Resources – Effects of non-radiological contaminants on aquatic organisms	4.6.1.2	SMALL
Aquatic Resources – Exposure of aquatic organisms to radionuclides	4.6.1.2	SMALL
Aquatic Resources – Effects of dredging on aquatic organisms	4.6.1.2	SMALL
Aquatic Resources – Effects on aquatic resources (non-cooling system impacts)	4.6.1.2	SMALL
Aquatic Resources – Impacts of transmission line right-of-way (ROW) management on aquatic resources	4.6.1.2	SMALL
Aquatic Resources – Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.6.1.2	SMALL
Socioeconomics – Employment and income, recreation and tourism	4.8.1.1	SMALL
Socioeconomics – Tax revenues	4.8.1.2	SMALL
Socioeconomics – Community services and education	4.8.1.3	SMALL
Socioeconomics – Population and housing	4.8.1.4	SMALL
Socioeconomics – Transportation	4.8.1.5	SMALL
Human Health – Radiation exposures to the public	4.9.1.1.1	SMALL
Human Health – Radiation exposures to plant workers	4.9.1.1.1	SMALL
Human Health – Human health impact from chemicals	4.9.1.1.2	SMALL
Human Health – Microbiological hazards to plant workers	4.9.1.1.3	SMALL
Human Health – Physical occupational hazards	4.9.4.1.5	SMALL
Postulated Accidents – Design-basis accidents	4.9.1.2	SMALL
Waste Management – Low-level waste storage and disposal	4.11.1.1	SMALL
Waste Management – Onsite storage of spent nuclear fuel	4.11.1.2	SMALL
Waste Management – Offsite radiological impacts of spent nuclear fuel and high-level waste disposal	4.11.1.3	[(a)]
Waste Management – Mixed waste storage and disposal	4.11.1.4	SMALL
Waste Management – Nonradioactive waste storage and disposal	4.11.1.4	SMALL
Uranium Fuel Cycle – Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste	4.12.1.1	SMALL
Uranium Fuel Cycle – Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste	4.12.1.1	[(b)]
Uranium Fuel Cycle – Nonradiological impacts of the uranium fuel cycle	4.12.1.1	SMALL
Uranium Fuel Cycle – Transportation	4.12.1.1	SMALL
Termination of plant operations and decommissioning	4.12.2.1	SMALL

(a) The environmental impact of this issue for the time frame beyond the licensed life for reactor operations is contained in NUREG–2157 (NRC 2014-TN4117).

(b) There are no regulatory limits applicable to collective doses to the general public from fuel cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel cycle facilities are designed and operated to meet the applicable regulatory limits and standards. The Commission concludes that the collective impacts are acceptable.
The Commission concludes that the impacts would not be sufficiently large to require the National Environmental Policy Act conclusion, for any plant, that the option of extended operation under Title 10 of the *Code of Federal Regulations* Part 54 (TN4878) should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective impacts of the uranium fuel cycle. This issue is considered Category 1.

Source: Table B-1 in Appendix B, Subpart A, to 10 CFR Part 51-TN250; NRC 2013-TN2654.

Table 3-2 Applicable Category 2 (Site-Specific) Issues for Comanche Peak

Issue	LR GEIS Section	Impact[(a)]
Groundwater Resources – Radionuclides released to groundwater	4.5.1.2	SMALL
Terrestrial Resources – Effects on terrestrial resources (non-cooling system impacts)	4.6.1.1	SMALL
Aquatic Resources – Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	4.6.1.2	SMALL
Aquatic Resources – Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	4.6.1.2	SMALL
Special Status Species and Habitats – Threatened, endangered, and protected species and essential fish habitat	4.6.1.3	May affect, but is not likely to adversely affect the golden-cheeked warbler, tricolored bat, or monarch butterfly
Historic and Cultural resources – Historic and cultural resources	4.7.1	Would not adversely affect historic properties
Human Health – Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river)	4.9.1.1.1	SMALL
Human Health – Chronic effects of electromagnetic fields[(b)]	4.9.1.1.1	Uncertain Impact
Human Health – Electric shock hazards	4.9.1.1.1	SMALL
Postulated Accidents – Design-basis accidents	4.9.1.2	SMALL
Postulated Accidents – Severe accidents	4.9.1.2	See Appendix F of this SEIS
Environmental Justice – Minority and low-income populations	4.10.1	No disproportionate and adverse human health and environmental effects on minority and low-income populations No disproportionate and adverse human health effects in special pathway receptor populations in the region because of subsistence consumption of water, local food, fish, and wildlife
Cumulative Impacts – Cumulative impacts	4.13	See SEIS Chapter 3.16

(a) Impact determinations for Category 2 issues based on findings described in Sections 3.2 through 3.13, as applicable, for the proposed action.
(b) This issue was not designated as Category 1 or 2 and is discussed in Section 3.11.6.2.
Source: Table B-1 in Appendix B, Subpart A, to 10 CFR Part 51-TN250; NRC 2013-TN2654.

3.2 Land Use and Visual Resources

This section describes current onsite and off-site land use and visual resources on or near the Comanche Peak site, including potential land use and visual impacts from the proposed action (LR) and alternatives. Vistra's ER (Luminant 2022-TN8655), Section E3.2, and Vistra's Responses to Requests for Additional Information (Luminant 2023-TN8692) support the NRC's analysis of the impacts of the proposed action and alternatives.

3.2.1 Land Use

3.2.1.1 Onsite Land Use

The Comanche Peak site is located on approximately 7,700 ac (3,116 ha) on a peninsula extending into CCR, formerly Squaw Creek Reservoir, in Hood and Somervell Counties, Texas. The exclusion area boundary of the Comanche Peak site is approximately 4,170 ac (1,688 ha). Access to the Comanche Peak site is by a road connected to Farm-to-Market road 56 (FM 56) and a railroad spur owned by Comanche Peak Power Company, LLC (CP PowerCo), which connects to the Fort Worth and Western Railroad (Luminant 2013-TN8669) approximately 11 mi (18 km) from the Comanche Peak. Communities near the Comanche Peak site include Glen Rose, approximately 5 mi (8 km) south-southeast, and Granbury, approximately 10 mi (16 km) north of the site.

There are no zoning or land development regulations for unincorporated areas of Somervell and Hood Counties, including the Comanche Peak site. Various other land use activities within the site boundary include land leased for hay production and cattle grazing and a deer management program that allows for seasonal bow hunting on the site. SCP, owned and maintained by CP PowerCo, is also located within the site boundary. Subsurface mineral rights at Comanche Peak are owned in part by CP PowerCo and a private interest, with existing oil and gas wells. However, little or no production is expected from these wells. CP PowerCo has also granted easements and access of rights-of-way to owners of pipelines that cross the Comanche Peak site.

As shown in Table 3-3, the Comanche Peak site is approximately 42 percent open water (primarily the CCR). Other land cover on the site includes evergreen forest (approximately 27 percent) and grassland/herbaceous (approximately 18 percent). Developed areas, including the nuclear plant, cover approximately 8 percent of the site (Luminant 2022-TN8655).

Table 3-3 Land Use/Land Cover on the Comanche Peak Site

Category	Acres	Percent
Open Water	3,208.93	41.9
Developed, Open Space	231.74	3.0
Developed, Low Intensity	154.12	2.0
Developed, Medium Intensity	122.54	1.6
Developed, High Intensity	120.54	1.6
Barren Land (Rock/Sand/Clay)	1.33	0.02
Deciduous Forest	310.02	4.0
Evergreen Forest	2,048.25	26.7
Mixed Forest	12.01	0.2
Shrub/Scrub	3.11	0.04
Grassland/Herbaceous	1,366.62	17.8
Cultivated Crops	1.56	0.02
Woody Wetlands	77.17	1.0
Emergent Herbaceous Wetlands	7.34	0.1
Total	**7,665.28**	**100.00**

Source: Luminant 2022-TN8655.

3.2.1.2 Off-site Land Use

The primary land cover in the 6 mi radius surrounding Comanche Peak is undeveloped herbaceous grassland (55 percent). Other land cover includes evergreen forest (18 percent), developed lands (8 percent), and deciduous forest (7 percent) (Table 3-4) (Luminant 2022-TN8655).

Table 3-4 Land Use/Land Cover Within the 6-Mile Radius of the Comanche Peak Site

Category	Acres	Percent
Open Water	3,981.75	5.5
Developed, Open Space	3,758.69	5.2
Developed, Low Intensity	1,356.38	1.9
Developed, Medium Intensity	581.34	0.8
Developed, High Intensity	278.66	0.4
Barren Land (Rock/Sand/Clay)	129.21	0.2
Deciduous Forest	4,836.86	6.7
Evergreen Forest	13,137.07	18.1
Mixed Forest	88.74	0.1
Shrub/Scrub	787.72	1.1
Grassland/Herbaceous	39,748.37	54.9
Pasture/Hay	2,503.72	3.5
Cultivated Crops	244.63	0.3
Woody Wetlands	953.18	1.3
Emergent Herbaceous Wetlands	33.14	0.05
Total	72,419.46	100.00

Source: Luminant 2022-TN8655.

Somervell County is approximately 119,337 ac (48,294 ha) in size. Approximately 70 percent of Somervell County is farmland (82,967 ac [33,576 ha]), and there are a total of 352 farms in the county. Of these farms, 184 produce crops, including forage and orchards; 294 farms report producing livestock such as cattle, sheep, and pigs (USDA 2017-TN8756).

Hood County is approximately 269,238 ac (108,957 ha) in size. Approximately 76 percent of Hood County is farmland (205,407 ac [83,125 ha]), and there are a total of 1,176 farms in the county. Of these farms, 578 produce crops, including forage and orchards; 954 farms report being used for pasturelands; 867 farms are used for permanent pasture and rangeland, and 272 farms are wooded (USDA 2017-TN8756).

In Texas, authority for implementing land use and zoning regulations, “with the goal of promoting public health, safety, morals, general welfare, and protection, and preserving places and areas of historical, cultural, or architectural importance and significance,” is provided to municipalities rather than counties (TCS 2021-TN8758; Lumen 2021-TN8686; TAC 2022-TN8687). Both Glen Rose and Granbury have enacted zoning laws (Glen Rose Code of Ordinances 14.02-TN8688; Granbury 2023-TN8689). In 2016, Granbury issued a comprehensive plan to govern present and future development (Granbury 2016-TN8690), and in 2022, Glen Rose issued an update to its comprehensive plan (Glen Rose 2023-TN8809). Both Somervell and Hood Counties are part of the North Central Texas Council of Governments, an association of 235 political jurisdictions that adopted a Comprehensive

Economic Development Strategy in 2016. This comprehensive strategy focused on methods to achieve sustainable regional growth and economic development (NCTCOG 2022-TN8691).

3.2.2 Visual Resources

The land area surrounding the Comanche Peak site is primarily rural grasslands, deciduous and evergreen forest, and some agricultural cropland interspersed with residential housing (Luminant 2013-TN8669, 2022-TN8655). The residences nearest to the Comanche Peak site are approximately 0.8 mi south-southwest and 0.8 mi southwest of the plant. (Luminant 2013-TN8669, 2022-TN8655).

The predominant visual features on the Comanche Peak site are the Units 1 and 2 reactor containment buildings, which are the tallest structures on the site at approximately 260.5 ft (79 m) tall. Hilly terrain surrounding the Comanche Peak site generally screens these visual features, with views limited to nearby residents and on portions of the CCR. The containment buildings can be seen from areas within Oakdale Park in Glen Rose and Dinosaur Valley State Park, but the visual effect beyond 20 mi (32 km) is minimal (Luminant 2013-TN8669, 2022-TN8655).

3.2.3 Proposed Action

3.2.3.1 Land Use

According to the 1996 and 2013 LR GEISs, land use would not be affected by continued operations and refurbishment associated with LR. In addition, nuclear plant operations at Comanche Peak have not changed appreciably with time, and no change in land use impacts are expected during the LR term.

No new or significant information was identified during the review of the Vistra ER, site visit, the scoping process, or the evaluation of other available information. The communities in the vicinity of Comanche Peak site have preestablished patterns of development and have adequate public services to support and guide development. Consequently, people living in the vicinity of Comanche Peak would not experience any land use changes during the renewal term beyond what they have already experienced. Therefore, the impact of continued reactor operations during the LR term would not exceed the land use impacts predicted in the LR GEIS. For these issues, the LR GEIS predicted that the impacts would be SMALL for all nuclear plants.

3.2.3.2 Visual Resources

According to the 1996 and 2013 LR GEISs, visual resources would not be affected by continued operations and refurbishment associated with LR. In addition, nuclear plant operations at Comanche Peak have not changed appreciably with time, and no change in visual impacts are expected during the LR term.

No new or significant information was identified during the review of the ER, site audit, scoping process, or evaluation of other available information. Therefore, the impact of continued reactor operations during the LR term would not exceed the visual impacts predicted in the LR GEISs. For these issues, the LR GEISs predicted that the impacts would be SMALL for all nuclear plants.

3.2.4 No-Action Alternative

3.2.4.1 Land Use

Comanche Peak Units 1 and 2 shutdown would not affect onsite land use. Plant structures and other facilities would remain in place until decommissioning. The LR GEIS (NRC 2013-TN2654) notes that land use impacts could occur beyond the immediate nuclear plant site as a result of the no-action alternative if new power-generating facilities are needed. Most transmission lines would remain in service after Comanche Peak ceases operations. Maintenance of most existing infrastructure would continue as before. Therefore, land use impacts from the termination of nuclear reactor operations at the Comanche Peak site would be SMALL.

3.2.4.2 Visual Resources

Shutdown of reactor operations would not significantly change the visual appearance of the Comanche Peak site. The containment buildings, the most visible structures at the site, would remain in place until dismantled, which would reduce the visual impact. Therefore, visual impacts from the termination of reactor operations at the Comanche Peak site would be SMALL.

3.2.5 Replacement Power Alternatives: Common Impacts

3.2.5.1 Land Use

The analysis of land use impacts focuses on the amount of land area that would be affected by the construction and operation of a replacement power-generating facility.

Construction would require the permanent commitment of land chosen for industrial use at the new power plant site and supporting infrastructure. Material laydown areas and onsite concrete batch plants could also result in temporary land use changes. Existing transmission lines and infrastructure would support each of the replacement power alternatives, thus reducing the need for additional land commitments.

Operation of new power-generating facilities on the Comanche Peak site would have no land use impacts beyond the amount of land committed for the permanent use of the replacement power plant. Additional land may be required to support power plant operations, including land for mining, extraction, and waste disposal activities associated with each alternative.

3.2.5.2 Visual Resources

The visual impact analysis focuses on the degree of contrast between the replacement power plant and the surrounding landscape and the visibility of the new power plant.

Construction of any replacement power-generating facilities would require clearing, excavation, and the use of construction equipment. The use of equipment and cranes may create short-term visual impacts during the construction.

Visual impacts during power plant operations would be similar in type and magnitude. New cooling towers and associated steam plumes would be the most obvious visual impact and could be visible at a greater distance than new buildings and infrastructure. Tall structures requiring aircraft warning lights would be visible at night.

3.2.6 New Nuclear (Small Modular Reactors) Alternative

3.2.6.1 Land Use

Approximately 675 ac (273 ha) are available for siting a SMR on the Comanche Peak site (Luminant 2022-TN8655). These parcels were previously considered for the construction of Comanche Peak Units 3 and 4 (Luminant 2023-TN8692) and are not under cultivation. The SMR facility and MDCTs would be sited within a 275 ac (111 ha) parcel to the northwest, and an associated BDTF would be sited within 400 ac (162 ha) parcels to the south (Luminant 2022-TN8655, 2023-TN8692). The existing transmission line infrastructure would be sufficient to support the SMR alternative (Luminant 2022-TN8655). The discharge piping from the BDTF to Lake Granbury would extend off-site and disturb approximately 81 additional ac (32 ha) (Luminant 2022-TN8655).

Land use impacts during new nuclear power plant operations would be no different from those experienced during Comanche Peak operation.

Based on this information, land use impacts of constructing and operating a new nuclear alternative at the Comanche Peak site could range from SMALL to MODERATE depending on size of the new reactor, the need for new land clearing, new infrastructure, and additional land as needed for uranium mining and fuel fabrication.

3.2.6.2 Visual Resources

Visual impacts would be similar to the common impacts described in Section 3.2.5.2. The visual appearance of the power block for the new SMR power plant would be similar to the Comanche Peak power blocks although not as tall.

Power plant structures would include MDCTs (estimated to be approximately 65 ft [20 m] in height) with the tallest buildings in the power block reaching approximately 160 ft (50 m) in height (NRC 2019-TN6136). These structures would be constructed north of the existing Comanche Peak site on an adjacent peninsula (NRC 2011-TN6437, 2011-TN8693, Section 4.3.1.1), expanding the industrial appearance of the site. Development of the BDTF along the southern boundary would be adjacent to an existing residential area. However, the hilly topography would likely reduce its visibility. Therefore, visual impacts during construction and operation of the new SMR power plant at the Comanche Peak site including steam plumes that could be visible from great distances, could range from SMALL to MODERATE depending on seasonal weather conditions.

3.2.7 Natural Gas-fired Combined-Cycle Alternative

3.2.7.1 Land Use

The NGCC facility would be constructed in the same general location as that described for the new nuclear alternative (i.e., within a 275 ac (111 ha) parcel northwest of the existing Comanche Peak power block) with an associated BDTF that would be constructed and operated within two parcels totaling 400 ac (161 ha) south of the Comanche Peak site boundary (Luminant 2023-TN8692). Discharge piping from the BDTF to Lake Granbury would extend off-site and disturb approximately 81 additional ac (32 ha) (Luminant 2022-TN8655, p. 7-15). The development of the BDTF would convert land including prime farmland to industrial use.

Given the current industrial nature of the Comanche Peak site, land use impacts during construction would be SMALL. This is primarily due to the small amount of land that could be affected by this alternative.

3.2.7.2 Visual Resources

Visual impacts would be similar to the common impacts described in Section 3.2.5.2. However, construction and operation of the natural gas power plant at the Comanche Peak site would have little to no additional visual impact and would be consistent with the industrial nature of the developed portions of the site. The tallest structures would be the plant stacks and cooling towers; the plant stacks would be approximately 150 ft (46 m) tall (Luminant 2022-TN8655), and the MDCTs would be approximately 55 ft (17 m) tall (NRC 2011-TN6437, 2011-TN8693). The MDCTs would have a low profile.

Visual impacts during the natural gas plant operations would be similar to those experienced during Comanche Peak operation. Development of the BDTF along the southern boundary would be similar to the new nuclear alternative. Visual impacts during construction and operation of the NGCC at the Comanche Peak site, including steam plumes, could therefore range from SMALL to MODERATE depending on seasonal weather conditions.

3.2.8 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [Small Modular Reactor])

3.2.8.1 Land Use

Solar PV facilities may require approximately 6.2 ac per installed megawatt (NRC 2013-TN2654). Each of the 24 collocated battery storage systems would require an additional 20 ac (8 ha) (Solar Industry 2019-TN8881). In total, approximately 19,000 ac (7,700 ha) would be required to support 3,000 MWe of installed solar capacity.

Utility-scale wind farms would require large land areas at multiple sites (see Section 2.4.2). Much of the land associated with the wind farms would be unaffected by the operation of the wind turbines. Land disturbance within the wind farm would be limited to the footprints of the turbine towers, access roads, and power collection and transmission system) (NREL 2009-TN8724; WAPA/FWS 2015-TN8725). Additional land would be needed for battery storage systems.

The SMR portion of this alternative would involve the construction of a single control room, four clusters of eleven SMRs, Approximately 123 acres would be required for the reactors, 152 acres for the cooling towers, and 400 acres for blowdown treatment facility (Luminant 2022-TN8655, Section 7.2.3.2).

Overall land use impacts from the construction and operation of the combination alternative at multiple locations, avoiding prime and unique farmland, would range from SMALL to LARGE. This is primarily due to the large amounts of land and land uses affected by the wind farms and solar PV facilities.

3.2.8.2 Visual Resources

Solar installations would require large land areas, and solar panels could be visible to the public from off-site locations, depending on buffer areas or screening. Solar installations would be sited to comply with land use zoning and any required buffers or screening.

The wind turbines of each wind installation would be visible from all directions and could have a large impact on the viewshed depending on the location of the wind farm site. Avoiding impacts on the most scenic viewsheds would reduce the most significant visual impacts, allowing the impact to be noticeable but not destabilizing.

The turbines would also be marked and lighted according to Federal Aviation Administration guidelines making them highly visible to pilots. Red obstruction lights would be mounted atop selected turbines and at the end of each turbine string, allowing the entire facility to be perceived as a single unit. The specific location of aviation lighting and the operation of the lighting system would be determined in consultation with the Federal Aviation Administration (FAA 2018-TN8759).

The visual impacts of the solar and wind components of this alternative would vary, depending on their location and topography. Depending on location, solar and wind farm installations could have a MODERATE to LARGE visual impact. The visual appearance of the power block for the new SMR power plant would be similar to the Comanche Peak power blocks but not as tall and would likely have a SMALL visual impact. Visual impacts of the combination alternative could therefore range from SMALL to LARGE. This range is primarily due to the potential visual impacts from the solar and wind components of this alternative.

3.3 Meteorology, Air Quality, and Noise

3.3.1 Meteorology and Climatology

Texas exhibits a wide range of climatic conditions. Three geographic features primarily influence the state’s climate: (1) the Rocky Mountains block moist Pacific air from the west but direct arctic air masses southward during the winter; (2) the Gulf of Mexico provides moisture primarily to the eastern part of the state; and (3) the relatively flat topography allows north and south movement of air masses with ease (Runkle et al. 2022-TN8674). Texas exhibits large east–west variations in precipitation and experiences frequent and varied extreme events (e.g., hurricanes, tornadoes, droughts, heat waves). Average annual temperature increases from 52 °F in the northern Panhandle of Texas to 68 °F in the Lower Rio Grande Valley (TWDB 2011-TN8813). Annual precipitation can range from less than 10 in. in the far west to more than 60 in. in the southeast (Runkle et al. 2022-TN8674).

Vistra maintains a meteorological monitoring system comprising two onsite meteorological towers. The primary meteorological tower is located east of the reactor buildings and monitors wind speed, wind direction, ambient temperature, dewpoint, temperature stability, and precipitation. The backup tower is located 75 ft east-northeast of the primary tower and monitors the same parameters as the primary tower. In the ER (Luminant 2022-TN8655), Vistra provided meteorological observations from Comanche Peak’s onsite meteorological monitoring system. The NRC staff obtained climatological data from the Waco, TX, weather station. This station is approximately 60 mi (96 km) southeast of the Comanche Peak site and is used to characterize the region’s climate because of its relative location and long period of record. The staff evaluate these data in context with the climatological record from Comanche Peak.

The mean annual temperature from Comanche Peak's onsite meteorological towers is 67.6 °F (19.8 °C) for the 21-year period of record (1999–2020), with a mean monthly temperature ranging from a low of 48.2 °F (9.0 °C) in January and high of 85.9 °F (29.9 °C) in August (Luminant 2022-TN8655). The mean annual temperature for the 93-year period of record (1929–2022) at the Waco weather station is 66.9 °F (19.3 °C), with a mean monthly temperature ranging from a low of 46.9 °F (8.2 °C) in January to a high of 85.7 °F (29.8 °C) in June and July (NOAA 2017-TN6064).

The mean annual total precipitation for the 93-year period of record (1929–2022) at the Waco weather station is 33.38 in (84.8 cm), with a mean month precipitation ranging from a low of 1.85 in (4.70 cm) in July to a high of 3.42 in (8.69 cm) in October (Runkle et al. 2022-TN8674). The Comanche Peak onsite meteorological towers do not measure precipitation in volume but as a rate. Therefore, precipitation measured at the Comanche Peak onsite meteorological monitoring system and at the Waco weather station is not compared.

The mean annual wind speed from Comanche Peak's onsite meteorological towers is 10.2 mph (16.4 km/hr) for the 21-year period of record, with the prevailing wind direction being from the southeast (Luminant 2022-TN8655). The mean annual wind speed from the Waco weather station for the 39-year period of record is 9.9 mph (15.9 km/hr), with a prevailing wind direction from the south (NOAA 2017-TN6064).

Texas is subject to extreme weather events. The following number of severe weather events have been reported in Somerville County from January 1950 to February 2023 (NOAA 2023-TN8432):

- Hail: 77 events
- Thunderstorm wind: 197 events
- Tornadoes: 6 events
- Flash flood: 18 events

3.3.2 Air Quality

Under the Clean Air Act (CAA) of 1963, as amended (42 U.S.C 7401, et seq.), the EPA has set primary and secondary National Ambient Air Quality Standards (NAAQSs; 40 CFR Part 50-TN1089, "National Primary and Secondary Ambient Air Quality Standards") for six common criteria pollutants to protect sensitive populations and the environment. The NAAQS criteria pollutants include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), and particulate matter (PM). Particulate matter is further categorized by size—PM_{10} (diameter of 10 micrometers or less) and $PM_{2.5}$ (diameter of 2.5 micrometers or less).

The EPA designates areas of attainment and nonattainment with respect to meeting NAAQSs. Areas for which there are insufficient data to determine attainment or nonattainment are designated as unclassifiable. Areas that were once in nonattainment, but are now in attainment, are called maintenance areas; these areas are under a 10-year monitoring plan to maintain their attainment designation status. States have primary responsibility for ensuring attainment and maintenance of the NAAQSs. Under CAA Section 110 (42 U.S.C. 7410) (Clean Air Act-TN1141) and related provisions, States are to submit, for EPA approval, state implementation plans that provide for the timely attainment and maintenance of the NAAQSs.

In Texas, air quality designations are made at the county level. For the purpose of planning and maintaining ambient air quality with respect to the NAAQSs, EPA has developed air quality control regions (AQCRs). AQCRs are intrastate or interstate areas that share a common airshed. Comanche Peak is located in Somervell County, which is part of the Metropolitan Dallas-Fort Worth Intrastate AQCR (40 CFR 81.39; TN7226). With respect to NAAQSs, EPA designates Somervell County in attainment for all criteria pollutants (EPA 2023-TN8814). The nearest designated or nonattainment area is Johnson County. Johnson County is designated nonattainment with respect to ozone (8 hr 2008 and 2015 standard) (EPA 2023-TN8814).

The TCEQ regulates air emissions at Comanche Peak under an air quality permit. Comanche Peak's air permit was renewed on September 26. 2014 and will expire on September 26, 2024 (TCEQ 2023-TN8815). Comanche Peak's permitted air emission are listed in Table 3-5. In addition to the air emission sources listed in Comanche Peak's air permit, maintenance activities conducted at Comanche Peak that result in air emissions are authorized under a permit by rule. A permit by rule is the State authorization for activities that produce more than a de minimis level of emissions but too little for new source review permitting (Tx. Admin. Code 30-106-TN8846). Maintenance activities include one 167 hp emergency generator, one 165 hp pump, four 1,750 hp diesel power generators, four 80 hp diesel generators, abrasive blast cleaning maintenance, and a fluorescent bulb crusher (Luminant 2023-TN8665). Maximum annual air emissions from permitted onsite sources and maintenance activities are presented in Table 3-6.

Table 3-5 Permitted Air Emissions Sources at Comanche Peak Nuclear Power Plant, Units 1 and 2

Equipment	Air Permit Condition
Auxiliary Boiler	Limited to 150 hr/yr SO_2 limited to 51.16 lb/hr and 3.84 T/yr NO_x limited to 14.73 lb/hr and 1.11 T/yr CO limited to 14.73 lb/hr and 1.11 T/yr PM limited to 8.29 lb/hr and 0.62 T/yr VOC limited to 0.46 lb/hr and 0.04 T/yr Planned maintenance startup and shutdown VOC limited to 26.34 lb/hr and 0.15 T/yr
Four (4) 9,717 HP Emergency Generators	Limited to 600 combined hours per year SO_2 limited to 36.2 lb/hr each and 10.9 T/yr combined NO_x limited to 278.5 lb/hr each and 83.6 T/yr combined CO limited to 23.6 lb/hr each and 7.1 T/yr combined PM limited to 4.3 lb/hr each and 1.3 T/yr combined VOC limited to 1.3 lb/hr each and 0.39 T/yr combined
One (1) 640 HP Generator	Limited to 100 hours per year SO_2 limited to 2.7 lb/hr and 0.13 T/yr NO_x limited to 9.1 lb/hr and 0.45 T/yr CO limited to 2.1 lb/hr and 0.10 T/yr PM limited to 0.6 lb/hr and 0.03 T/yr VOC limited to 0.1 lb/hr and <0.01 T/yr
One (1) 167 HP Emergency Generator	Limited to 100 hours per year each SO_2 limited to 0.8 lb/hr and 0.04 T/yr NO_x limited to 5.2 lb/hr and 0.26 T/yr CO limited to 1.2 lb/hr and 0.06 T/yr PM limited to 0.4 lb/hr and 0.02 T/yr VOC limited to 0.4 lb/hr and 0.02 T/yr

Equipment	Air Permit Condition
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined
Four (4) 9,717 HP Emergency Generators	Limited to 600 combined hours per year SO_2 limited to 36.2 lb/hr each and 10.9 T/yr combined NO_x limited to 278.5 lb/hr each and 83.6 T/yr combined CO limited to 23.6 lb/hr each and 7.1 T/yr combined PM limited to 4.3 lb/hr each and 1.3 T/yr combined VOC limited to 1.3 lb/hr each and 0.39 T/yr combined
One (1) 640 HP Generator	Limited to 100 hours per year SO_2 limited to 2.7 lb/hr and 0.13 T/yr NO_x limited to 9.1 lb/hr and 0.45 T/yr CO limited to 2.1 lb/hr and 0.10 T/yr PM limited to 0.6 lb/hr and 0.03 T/yr VOC limited to 0.1 lb/hr and <0.01 tons/yr
One (1) 167 HP Emergency Generator	Limited to 100 hours per year each SO_2 limited to 0.8 lb/hr and 0.04 T/yr NO_x limited to 5.2 lb/hr and 0.26 T/yr CO limited to 1.2 lb/hr and 0.06 T/yr PM limited to 0.4 lb/hr and 0.02 T/yr VOC limited to 0.4 lb/hr and 0.02 T/yr
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year. SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined

Equipment	Air Permit Condition
	PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined
Two (2) 400 HP Diesel Fire Engine Pump	Limited to 150 combined hours per year SO_2 limited to 2.9 lb/hr each and 0.22 T/yr combined NO_x limited to 12.4 lb/hr each and 0.93 T/yr combined CO limited to 2.7 lb/hr each and 0.20 T/yr combined PM limited to 0.9 lb/hr each and 0.07 T/yr combined VOC limited to 1.0 lb/hr each and 0.08 T/yr combined

Note: CO = carbon monoxide, HP = horsepower; lb/hr = pounds per hour; NOx = nitrogen oxide; PM = particulate matter, SO_2 = sulfur dioxide; T/yr = tons per year; VOC = volatile organic compounds.
Source: TCEQ 2023-TN8815.

Table 3-6 Maximum Annual Air Emissions from Comanche Peak Nuclear Power Plant, Units 1 and 2 (T/yr)

CO	NOx	PM	SO_2	VOC	HAP
11.68	91.62	3.15	15.21	4.70	1.22

Note: CO = carbon monoxide; HAP = hazardous air pollutants; NO_x = nitrogen oxides; PM = particulate matter micrometers; SO_2 = sulfur dioxide, VOCs = volatile organic compounds.
To convert tons per year to metric tons per year, multiply by 0.90718.
Source: Luminant 2022-TN8655.

Vistra reports no notices of violation or noncompliance associated with Comanche Peak's air permit between 2016-2022 (Luminant 2022-TN8655, 2023-TN8665). The NRC staff's review of EPA's Enforcement and Compliance History Online system 3-year compliance history (from July 2020 through March 2023) revealed no notices of violation (EPA 2023-TN8803). Vistra did not identify any future upgrades or replacement activities necessary for plant operation that would affect Comanche Peak's current air emissions (Luminant 2022-TN8655).

The EPA promulgated the Regional Haze Rule to improve and protect visibility in national parks and wilderness areas from haze, which is caused by numerous, diverse air pollutant sources located across a broad region (40 CFR Part 51-TN1090). Specifically, 40 CFR 81 Subpart D (TN7226), "Identification of Mandatory Class I Federal Areas Where Visibility Is an Important Value," lists mandatory Federal areas where visibility is an important value. The Regional Haze

Rule requires States to develop state implementation plans to reduce visibility impairment at Class I Federal Areas. The nearest Class 1 Federal Area is the Wichita Mountains Wilderness approximately 175 mi away from Comanche Peak. Federal land management agencies that administer Federal Class I areas consider an air pollutant source that is located more than 31 mi (50 km) from a Class I area to have negligible impacts with respect to Class I areas if the total sulfur dioxide, nitrogen oxide, PM_{10}, and sulfuric acid annual emissions from the source are less than 500 T/yr (70 FR 39104-TN8374; NPS 2010-TN7925). Given the location of Comanche Peak and the air emissions presented in Table 3-6 there is little likelihood that ongoing activities at Comanche Peak adversely affect air quality in the Wichita Mountains Wilderness Area.

3.3.3 Noise

Noise is unwanted sound and can be generated by many sources. Sound intensity is measured in logarithmic units called decibels (dB). A dB is the ratio of the measured sound pressure level to a reference level equal to a normal person’s threshold of hearing. Most people barely notice a difference of 3 dB or less. Another characteristic of sound is frequency or pitch. Noise may be composed of many frequencies, but the human ear does not hear very low or very high frequencies. To represent noise as closely as possible to the noise levels people experience, sounds are measured using a frequency-weighting scheme known as the A-scale. Sound levels measured on this A-scale are given in units of A-weighted decibels (dBA). Levels can become annoying at 80 dBA and very annoying at 90 dBA. To the human ear, each increase of 10 dBA sounds twice as loud (EPA 1981-TN7412).

Several different terms are commonly used to describe sounds that vary in intensity over time. The equivalent sound intensity level (Leq) represents the average sound intensity level over a specified interval (e.g., 1 hr, 8 hr, or 24 hr). The day-night sound intensity level (Ldn) is a single value calculated from hourly Leq over a 24-hour period, with the addition of 10 dBA to sound levels from 10 p.m. to 7 a.m. This addition accounts for the greater sensitivity of most people to nighttime noise. Statistical sound level (Ln) is the sound level that is exceeded ‘n’ percent of the time during a given period. For example, L90, is the sound level exceeded 90 percent of time and is considered the background level. There are no Federal regulations for public exposures to noise. When noise levels are below the levels that result in hearing loss, impacts have been judged primarily in terms of adverse public reactions to noise. The Department of Housing and Urban Development considers day-night average sound level outside a residence not exceeding 65 dBA acceptable (24 CFR Part 51-TN1016).

Primary off-site noises in the vicinity of the Comanche Peak site include primarily vehicular traffic, farming activities, and boats along the northern fence line (Luminant 2022-TN8655, 2013-TN8669). Primary off-site noises in the vicinity of the Comanche Peak site include primarily vehicular traffic, farming activities, and boats along the northern fence line (Luminant 2022-TN8655, 2013-TN8669). Primary noise sources at the Comanche Peak site include the firing range and steam relief valves. The steam release occurs four times over each 3-year period during shutdowns, and therefore are short-term and intermittent. The firing range is only active on weekdays and the associated noise is similarly intermittent. The residents nearest to the Comanche Peak site are located approximately 0.8 mi (1.3 km) south-southwest and 0.8 km southwest (measured from a point centered between the two containment buildings; Luminant 2023-TN8665). The firing range is 1,710 ft (0.3 mi; 0.4 km) from the closest point of the site boundary and approximately 0.7 mi (1.1 km) from the nearest resident (Luminant 2022-TN8655, 2023-TN8665). The firing range is 1,710 ft (0.3 mi; 0.4 km) from the closest point of the site boundary and approximately 0.7 mi (1.1 km) from the nearest resident (Luminant 2022-TN8655, 2023-TN8665). In 2007, Luminant commissioned a noise study within a 5 mi (8.0 km) radius of the site that included various receptors including the nearest residential neighborhood south-southwest of the site, the nearest church and cemetery, site property fence lines, and a beach north of the site. Day-night average recorded sound levels ranged between 44–68 dBA, with day-night average sound levels in the 56–57 dBA range at the property fence lines (NRC 2011-TN6437, 2011-TN8693). Day-night average recorded sound levels ranged between 44–68 dBA, with day-night average sound levels in the 56–57 dBA range at the property fence lines (NRC 2011-TN6437, 2011-TN8693).

Between 2016–January 2023, Vistra has not received noise complaints a result of operation of Comanche Peak (Luminant 2023-TN8665, 2022-TN8655). Vistra does not anticipate any LR-related refurbishment or changes in operation from the current term and therefore, noise levels are anticipated to remain the same during the LR term (Luminant 2022-TN8655).

3.3.4 Proposed Action

3.3.4.1 Air Quality

As described in the LR GEIS (NRC 2013-TN2654) and as cited in Table 3-1 for generic issues related to air quality, the impacts of nuclear power plant LR and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of the Comanche Peak site on air quality would be SMALL. There are no site-specific (Category 2) air quality issues applicable to the Comanche Peak site (Table 3-2).

3.3.4.2 Noise

As described in the LR GEIS (NRC 2013-TN2654) and as cited in Table 2-2 for generic issues related to noise, the impacts of nuclear power plant license renewal and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of the Comanche Peak site on noise would be SMALL. There are no site-specific (Category 2) air quality issues applicable to the Comanche Peak site (Table 3-2).

3.3.5 No-Action Alternative

3.3.5.1 Air Quality

Under the no-action alternative, the permanent cessation of Comanche Peak site operations would reduce overall air emissions (e.g., from boiler and vehicle traffic). Therefore, the NRC staff concludes that if emissions decrease, the impact on air quality from the shutdown of the Comanche Peak site would be SMALL.

3.3.5.2 Noise

The permanent cessation of Comanche Peak site operations would result in a reduction in noise from the turbine generators, transformers, firing range, main steam safety values, and from vehicle traffic (e.g., workers, deliveries). As site activities are reduced, the NRC staff expects the impact on ambient noise levels to be less than current plant operations; therefore, the NRC staff concludes that impacts on noise levels from the no-action alternative would be SMALL.

3.3.6 Replacement Power Alternatives: Common Impacts

3.3.6.1 Air Quality

Construction

Construction of a replacement power alternative would result in temporary impacts on local air quality. Air emissions include criteria air pollutants (PM, nitrogen oxides, carbon monoxide, and sulfur dioxide), volatile organic compounds, hazardous air pollutants, and GHGs. Air emissions would be intermittent and would vary based on the level and duration of specific activities throughout the construction phase. During the construction phase, the primary sources of air emissions would consist of engine exhaust and fugitive dust emissions. Engine exhaust emissions would be from heavy construction equipment and commuter, delivery, and support vehicular traffic traveling to and from the facility as well as within the site. Fugitive dust emissions would be from soil disturbances by heavy construction equipment (e.g., earthmoving, excavating, and bulldozing), vehicle traffic on unpaved surfaces, concrete batch plant operations, and wind erosion to a lesser extent.

Various mitigation techniques and best management practices (BMPs; e.g., watering disturbed areas, reducing equipment idle times, and using ultra-low sulfur diesel fuel) could be used to minimize air emissions and to reduce fugitive dust.

Operations

The impacts on air quality as a result of operation of a facility for a replacement power alternative would depend on the energy technology (e.g., nuclear or renewable). Worker vehicles and auxiliary power equipment would result in additional air emissions. MDCTs would also result in air emissions for the new nuclear, natural gas alternative, and combination alternative.

3.3.6.2 Noise

Construction

Construction of a replacement power facility would be similar to the construction of any industrial facility in that they all involve many noise-generating activities. In general, noise emissions would vary during each phase of construction, depending on the level of activity, types of equipment and machinery used, and site-specific conditions. Typical construction equipment, such as dump trucks, loaders, bulldozers, graders, scrapers, air compressors, generators, and mobile cranes, would be used, and pile-driving and blasting activities could take place. Other noise sources include construction worker vehicle and truck delivery traffic. However, noise from vehicular traffic would be intermittent.

Operations

Noise generated during operations could include noise from transformers, turbines, equipment, speakers, as well as off-site sources, such as employees and delivery vehicular traffic. Noise from vehicles would be intermittent. MDCTs would also contribute to noise levels.

3.3.7 New Nuclear (Small Modular Reactors) Alternative

3.3.7.1 Air Quality

<u>Construction</u>

Air emissions and sources associated with construction of the new nuclear alternative would include those identified as common to all replacement power alternatives in Section 3.3.6.1. Air emissions from construction of the SMR portion would be limited, local, and temporary (NRC 2019-TN6136). Because air emissions from construction activities would be limited, local, and temporary, the NRC staff concludes that the associated air quality impacts from construction of a new nuclear alternative would be SMALL.

Air emissions and sources associated with construction of the new nuclear alternative would include those identified as being common to all replacement power alternatives in Section 3.3.6.1. Air emissions from construction of the SMR portion would be limited, local, and temporary (NRC 2019-TN6136). Because air emissions from construction activities would be limited, local, and temporary, the NRC staff concludes that the associated air quality impacts from construction of a new nuclear alternative would be SMALL.

<u>Operations</u>

Operation of the new nuclear alternative would result in air emissions similar in magnitude to air emissions from the operation of Comanche Peak. Sources of air emissions would include stationary combustion sources (e.g., diesel generators, auxiliary boilers, and gas turbines) and mobile sources (e.g., worker vehicles, onsite heavy equipment, and support vehicles). The NRC staff expects the air emissions for combustion sources from a new nuclear plant to be similar to those currently being emitted from Comanche Peak. Additional air emissions would result from the new nuclear plant’s use of MDCTs and could contribute to impacts associated with the formation of visible plumes, fogging, and subsequent icing downwind of the towers. In general, most stationary combustion sources at a nuclear power plant would operate only for limited periods, often during periodic maintenance testing. A new nuclear power plant would need to secure a permit from the TCEQ for air pollutants associated with its operations (e.g., criteria pollutants, volatile organic compounds, hazardous air pollutants). Therefore, the NRC staff expects that the combined air quality impact of emissions from onsite sources would be minor.

Additional air emissions would result from the approximately 1,500 employees commuting to and from the new nuclear facility. Given that the NRC estimates that air emissions would be minor and the attainment status of Somervell County, the NRC staff does not expect air emissions from operation of a new nuclear alternative to contribute to NAAQS violations. The NRC staff concludes that the impacts of operation of a new nuclear alternative on air quality would be SMALL.

3.3.7.2 Noise

<u>Construction</u>

Noise generated during the construction and operation of a new nuclear power plant would be similar to noise for all replacement power alternatives, as discussed in Section 3.3.6.2. Noise impacts during construction would be limited to the immediate vicinity of the Comanche Peak site. Based on the temporary nature of construction activities, the distance of noise-sensitive receptors from the site (exceed 0.5 mi [0.8 km]), consideration of noise attenuation from the construction site, and good noise control practices, the NRC staff concludes that the potential noise impacts of construction activities from a new nuclear alternative would be SMALL.

Operations

Sources of noise during nuclear power plant operations would include industrial equipment, machinery, vehicles, and communications. Noise levels from these sources would be similar to or less than noise levels generated during the operation of Comanche Peak. MDCTs generate noise during operations. However, given the distance of nearby noise-sensitive receptors from the Comanche Peal site (exceed 0.5 mi [0.8 km]), the NRC staff does not expect off-site noise levels from MDCTs to nearby receptors to be greater than current levels. Therefore, noise impacts during power plant operations for a SMR power plant would be SMALL.

3.3.8 Natural Gas-fired Combined-Cycle Alternative

3.3.8.1 Air Quality

Construction

Air emissions and sources for construction of the natural gas alternative would include those identified as being common to all replacement power alternatives in Section 3.3.6.1. Air emissions would result from infrastructure construction upgrades at the Comanche Peak site and construction of a short natural gas pipeline to tie into the existing pipelines to supply the facility. The use of the existing infrastructure (e.g., transmission lines, roads) would be maximized, thereby minimizing fugitive dust and engine exhaust air emissions. Air emissions would be localized and intermittent and adherence to well-developed and well-understood construction BMPs would mitigate air quality impacts. Therefore, the NRC staff concludes that construction-related impacts on air quality from a natural gas alternative would be SMALL.

Operations

Operation of a natural gas plant would result in emissions of criteria pollutants and GHGs released through the heat recovery steam generator stacks. The NRC staff estimated air emissions for the natural gas alternative using emission factors developed by the U.S. Department of Energy’s National Energy Technology Laboratory (NETL 2019-TN7596). Assuming a total gross capacity of 2,830 MWe and a capacity factor of 0.87, the NRC staff estimates the following air emissions would result from operation of a natural gas alternative:

- carbon monoxide—129 T (117 MT) per year
- nitrogen oxides—237 T (215 MT) per year
- sulfur dioxide—65 T (59 MT) per year
- particulate matter—129 T (117 MT) per year
- carbon dioxide—8.0 million tons (7.2 million MT) per year

Operation of MDCTs and up to 150 worker vehicles would result in additional air emissions. A new natural gas alternative would need to secure a permit from the TCEQ for air pollutants associated with its operation. A new natural gas plant would qualify as a major emitting industrial facility. As such, the new natural gas plant would be subject to Prevention of Significant Deterioration and Title V air permitting requirements under the CAA, as amended

(42 U.S.C. Subchapter V-TN5268), to ensure that air emissions are minimized and that the local air quality is not degraded substantially.

Based on the NRC staff's air emission estimates, nitrogen oxide and carbon dioxide emissions from a natural gas plant would be noticeable and significant. The NRC staff concludes that the overall air quality impacts associated with operation of a natural gas alternative would be MODERATE.

3.3.8.2 Noise

Construction

Noise generated during the construction and operation of a new nuclear power plant would be similar to noise for all replacement power alternatives, as discussed in Section 3.3.6.2. Noise impacts during construction would be limited to the immediate vicinity of the Comanche Peak site. Given the distance to noise-sensitive receptors (exceed 0.5 mi [0.8 km]), noise generated as a result of construction of a natural gas alternative at the Comanche Peal site would not be noticeable. Therefore, the NRC staff concludes that the potential noise impacts of construction activities from a natural gas alternative would be SMALL.

Operations

During operations, noise sources from a natural gas alternative would include those discussed in Section 3.3.6.2, as well as off-site mechanical noise from compressor stations and pipeline blowdowns. The majority of noise-producing equipment (turbines, pumps, MDCTs) would be located inside the power block, and the NRC staff does not anticipate noise levels at noise-sensitive receptors to be significantly greater than noise levels from operation of the Comanche Peak site. The Federal Energy Regulatory Commission requires that any new compressor station or any modification, upgrade, or update of an existing station must not exceed day-night sound intensity level of 55 dBA at the closest noise-sensitive area (18 CFR Part 157-TN7483). EPA designated a day-night sound intensity level limit of 55 dBA to be adequate to protect against outdoor activities (EPA 1974-TN3941). Additionally, noise from pipeline blowdowns would not constitute a new noise source given the two existing natural gas transmission lines transverse the site. Noise from pipeline blowdowns is not expected to be significantly greater than current levels. Therefore, the NRC staff concludes that the noise impacts from operation of a natural gas alternative would be SMALL.

3.3.9 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

3.3.9.1 Air Quality

Construction

Air emissions associated with the construction of the new nuclear portion of the combination alternative would be similar to, but greater than, those associated with the SMR portion discussed in Section 3.3.7.1, because it would consist of one SMR located at the Comanche Peak site. Some infrastructure construction upgrades would be required for the SMR portion at the Comanche Peak site, and the use of the existing infrastructure (e.g., transmission lines,) would be maximized. Engine exhaust emission sources would include heavy construction equipment and commuter vehicles and would be temporary and intermittent. Therefore, the

NRC staff concludes that the air quality impacts associated with construction of the new nuclear portion of the combination alternative would be SMALL.

The solar PV and onshore wind portion of the combination alternatives would not have a power block building. Accordingly, the number of heavy equipment and workforce, level of activities, and construction duration would be substantially lower than those for the other alternatives and consequently would result in less air emissions. Therefore, the NRC staff concludes that the overall air quality impacts associated with construction of the solar PV and onshore wind component of the combination alternatives would be SMALL.

The NRC staff concludes that the overall air quality impacts associated with construction of the combination alternative would be SMALL.

Operations

Air emissions associated with the operation of the new nuclear portion would be similar to, but less than those associated with the SMR portion discussed in Section 3.3.7.1, because this new nuclear portion would consist of one SMR. Operation of onsite combustion sources would be intermittent, primarily during testing. Worker and delivery emissions would similarly be intermittent. Therefore, the NRC concludes that air quality impacts from operations of the new nuclear portion would be SMALL.

Direct air emissions associated with operation of the solar PV and onshore wind components of the combination alternatives would be negligible because no fossil fuels would be burned to generate electricity. Emissions from wind turbine arrays and solar fields would include fugitive dust and engine exhaust from worker vehicles and heavy equipment associated with site inspections, maintenance activities, and wind erosion from cleared lands and access roads. Emissions would be localized and intermittent. The NRC staff concludes that the overall air quality impacts associated with operation of the combination alternative would be SMALL.

The NRC staff concludes that the overall air quality impacts associated with operation of the combination alternative would be SMALL.

3.3.9.2 Noise

Construction

Construction-related noise sources for the new nuclear portion of the combination alternative would be similar to those of the SMR portion of the new nuclear alternative discussed in Section 3.3.7.2 of this SEIS, because it would consist of one SMR located at the Comanche Peak site. Noise impacts during construction of the new nuclear portion of the combination alternative would be limited to the immediate vicinity of the Comanche Peak site. Based on the temporary nature of construction activities, the distance of noise-sensitive receptors from the Comanche Peak site (exceed 0.5 mi [0.8 km]), and consideration of noise attenuation from the construction site, the NRC staff concludes that the potential noise impacts of construction activities from the new nuclear portion would be SMALL.

The solar PV and onshore wind components would primarily be located off-site of the Comanche Peak site. The solar PV and onshore wind component of the combination alternative would have no power block buildings requiring construction. The heavy equipment and workforce numbers, level of activities, and construction duration would be lower than those for the other alternatives. However, noise levels generated by construction activities for a solar PV facility can range from 70 to 80 dBA at 50 ft (15 m) (BLM 2019-TN8386). Noise levels from the solar PV of the combination alternative to nearby sensitive receptors would depend on the distance from the sites to nearby receptors and might be noticeable. Blasting might be required during construction of turbine foundations (WAPA/FWS 2015-TN8725; BLM 2013-TN8882). Noise levels from the solar PV and onshore wind portion of the combination alternative to nearby sensitive receptors would depend on the distance from the site to the nearby receptors and might be noticeable. Therefore, noise impacts associated with construction of the solar PV and onshore wind component of the combination alternative would be SMALL to MODERATE.

The NRC staff concludes that the overall noise impacts associated with construction of the combination alternative would be SMALL to MODERATE.

<u>Operation</u>

Noise sources associated with the new nuclear portion of the combination alternative would be similar to those described for the SMR portion of new nuclear alternative in Section 3.3.7 of this SEIS, because it would consist of one SMR located at the Comanche Peak site. Given the distance of nearby sensitive receptors (approximately 1 mi [1.6 km] away) from the Comanche Peak site and consideration of noise attenuation, the NRC staff does not expect off-site noise levels from transformers, turbines, cooling towers, or speakers to nearby receptors to be greater than current levels experienced from operation of the Comanche Peak site. Therefore, the NRC staff concludes that operation-related noise impacts from the new nuclear portion of the combination alternative would be SMALL.

Because the solar PV portion of the combination alternative would have no power block or cooling towers, a minimal number of noise sources, such as transformers and vehicular traffic, would be associated with maintenance and inspection activities. Therefore, the NRC staff concludes that operations-related noise impacts from the solar PV portion of the combination alternative would be SMALL.

Noise generated by wind turbines would include aerodynamic noise from the blades and mechanical noise from turbine drivetrain components (generator, gearbox). Depending on the location, layout, and proximity of wind farms to noise-sensitive receptors, noise associated with operation of the wind portion of the combination alternative could be noticeable. Therefore, noise impacts associated with operation of the onshore wind component of the combination alternative could range from SMALL to MODERATE. The NRC staff concludes that the overall noise impacts associated with operation of the combination alternative would be SMALL to MODERATE.

The NRC staff concludes that the overall noise impacts associated with operation of the combination alternative would be SMALL to MODERATE.

3.4 Geologic Environment

This section describes the geologic environment of the Comanche Peak site and vicinity, including landforms, geology, soils, and seismic conditions. The description of the resources is followed by the staff’s analysis of the potential impacts on geologic and soil resources from the proposed action (LR) and alternatives to the proposed action.

3.4.1 Physiography and Geology

Section 2.8 of the NRC staff's EIS for a combined license at Comanche Peak (NUREG-1943, *Final Environmental Impact Statement for Combined Licenses for Comanche Peak Nuclear Power Plant Units 3 and 4*) (NRC 2011-TN6437, 2011-TN8693) describes the physiographic and geologic environment at the Comanche Peak site and vicinity. The staff incorporates this reference herein and summarizes key information below. Section 3.5 of Vistra's ER also describes the geologic environment of the site and vicinity.

The Comanche Peak site lies within the central Texas section of the Great Plains physiographic province of the United States, bounded to the north by the Central Lowlands Province and to the south by the Coastal Plain Province (Luminant 2022-TN8655; USGS 2021-TN8694). The bedrock of the Great Plains generally comprises sandstones, shales, limestones, conglomerates, and lignite, and the topography is generally flat (Luminant 2022-TN8655). At the Comanche Peak site, elevation ranges from 870 ft (260 m) above mean sea level (MSL) between the drainage divide of Comanche Creek and Panther Branch to 775 ft (236 m) MSL at the water level of CCR (NRC 2011-TN6437, 2011-TN8693).

In the vicinity of the Comanche Peak site, the Great Plains province predominantly comprises Lower Cretaceous limestone, which has been variably eroded. Directly underlying the site, Quaternary fluvial and terrace deposits are found in low-lying drainage areas (e.g., Comanche Creek) and comprise gravel, sand, silt, silty clay, and organic matter (Luminant 2022-TN8655; TNRIS 2014-TN8695). The bedrock of the site lies uncomformably beneath these superficial deposits and predominantly comprises three formations: the Paluxy, the Glen Rose, and the Twin Mountains (NRC 2011-TN6437, 2011-TN8693). The Twin Mountains Formation is the oldest of the three formations and is composed of sandstone, limestone, and claystone. It does not outcrop at the site but is water-bearing and used for supply purposes in the surrounding area (Luminant 2022-TN8655). The Glen Rose Formation is the principal bedrock formation of the Comanche Peak site and overlies the Twin Mountains Formation. It is composed of clayey limestone containing variable amounts of clay, marl, and sand. The Paluxy Formation overlies the Glen Rose but has been locally eroded/excavated from the immediate plant area (Luminant 2022-TN8655). Where it outcrops near the edges of the site boundary, it is composed of sandstone with occasional siltstone and claystone interbeds (Luminant 2022-TN8655).

3.4.2 Geologic Resources

Mining activities within the vicinity of the Comanche Peak site occur in the form of strip mining for aggregate (NRC 2011-TN6437, 2011-TN8693). According to online mapping, three operations mining sand and gravel resources exist approximately 5 mi (8 km) east of the site (Air Alliance Houston 2023-TN8696).

The extraction of oil and natural gas from Paleozoic rocks in the vicinity of the site has been undertaken for several decades (Pollastro et al. 2007-TN8885). Natural gas production in Texas increased more than 40 percent between 2005 and 2018, with a large majority of the increase originating from Barnett Shale, which is present up to 5,000 ft (1.5 km) below the site (BOEG 2018-TN8698; NRC 2011-TN6437, 2011-TN8693). Natural gas extraction involves hydraulic fracturing and fluid injection to enhance gas recovery. Numerous gas production wells exist within the vicinity of the site (Luminant 2009-TN8704, Section 2.5.1.2.5.10.1). As of June 2023, the NRC staff calculated there to be 300 gas production wells and 3 injection/disposal wells within a 6 mi (9.6 km) radius of the overall site center (Figure 3-1) (RRC 2023-TN8699).

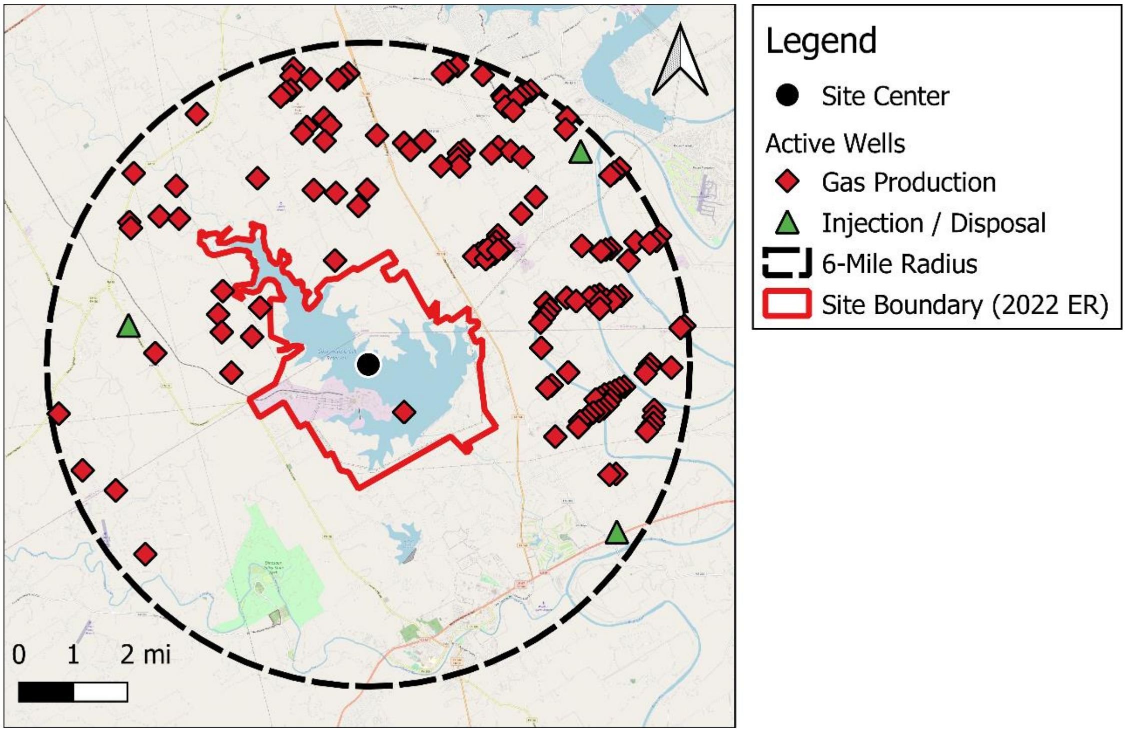


Figure 3-1 Active Wells (Gas and Injection/Disposal) in Hood and Somervell Counites within a 6 mi Radius of the Center of the Site Boundary (Red Outline). Data from Railroad Commission of Texas (RRC 2023-TN8699): Well 221 and 425 Digital Data Sets.©OpenStreetMap.

The nearest gas production well is approximately 1,000 ft (292 m) west of the overall site boundary (RRC 2023-TN8699). Mapping also indicates the base of another gas production well to be beneath the site complex, approximately 1,850 ft (565 m) east of the ISFSI building. The surface location of this well, however, is indicated to be off-site to the south, 1,810 ft (553 m) from the overall site boundary (RRC 2023-TN8699). The nearest injection/disposal well is indicated to be to the northwest of the plant complex, approximately 2.6 mi west of the overall site boundary (RRC 2023-TN8699). Potential effects on seismic activity at the Comanche Peak site due to fluid extraction and injection are described in more detail by Luminant (in Section 2.5.1.2.5.10.2; Luminant 2009-TN8704).

3.4.3 Soils

Section 3.5.3 of Luminant's 2022 ER (Luminant 2022-TN8655) provides a detailed description of soils across the site. NRC staff have summarized key features below.

Native soils, weathered rock, and limestone of the Paluxy and Glen Rose Formations were disturbed during nuclear power plant construction (Luminant 2022-TN8655). Units 1 and 2 of the power plant lie directly on unweathered Glen Rose limestone (Luminant 2022-TN8655). Soil unit mapping by the Natural Resources Conservation Service (NRCS) identifies site soils underlying the majority of the Comanche Peak complex and extending north and south of the larger site area as loamy soils derived from limestone weathering (USDA 2019-TN7319). Soils that coincide predominantly with the shoreline of CCR are described as clayey soils weathered from limestone (USDA 2019-TN7319). A minority of soils within the site boundary (11.4 percent of the total mapped soil area) are considered prime farmland (USDA 2019-TN7319). The majority of soil units mapped in the vicinity of the Comanche Peak site are rated as having a slight to moderate erosion potential (USDA 2019-TN7319). One soil unit, Windthorst fine sandy loam, is found in small undeveloped patches north and south of the plant complex and is rated as having severe erosion potential (USDA 2019-TN7319; Luminant 2022-TN8655). Nevertheless, soils and fill materials across developed areas of the site are less prone to erosion due to stabilization measures. Additionally, Luminant maintains a Stormwater Pollution Prevention Plan (SWPPP) for the Comanche Peak site that includes soil erosion and sediment control measures to prevent erosion and potential water quality impacts (Luminant 2022-TN8655).

3.4.4 Seismic Setting

The Comanche Peak site is located in an area of historically low seismic activity resulting from low rates of crustal deformation and the absence of tectonic plate boundary conditions (Section 2.5.11.4, Luminant 2009-TN8704). No geologic faults have been recorded within the Lower Cretaceous rocks that underlie the site. The nearest tectonically active feature in the vicinity of the site is Meer’s Fault, located approximately 180 mi from the site in southern Oklahoma (Luminant 2022-TN8655). The Comanche Peak site is located in an area predicted to experience earthquake-induced peak horizontal ground accelerations between 0.02 and 0.04 g (based on a 2 percent probability of exceedance in 50 years), which is less than that of the acceleration needed to cause damage to buildings of good design (Petersen et al. 2020-TN7281).

Seismicity in Texas has increased in the last decade, with the total number of earthquakes recorded at greater than or equal to 2.5 magnitude surpassing the State of California in 2022 (Savvaidis 2022-TN8700). This increase may be induced by fluid injection activities including hydraulic fracturing oil and gas production wells, enhanced oil and gas recovery wells, and wastewater disposal wells (SOGRE 2021-TN8701). Seismic activity in Texas is increasing compared to the historical baseline in six main areas, including the Midland Basin in west Texas, approximately 200 mi west of the Comanche Peak site (Savvaidis 2022-TN8700). In the United States, the largest recorded earthquake to date that has been associated with hydraulic fracturing operations has been a magnitude 4.0 earthquake in the Eagle Ford play in south Texas (Fasola et al. 2019-TN8705).

From 1970 through June 2023, 187 earthquakes with a magnitude equal to or greater than 3.0 have been recorded within a 200 mi (322 km) radius of the Comanche Peak site (USGS 2023-TN8808). The maximum magnitude recorded was a 4.7 earthquake that occurred on February 16, 2023 outside of Hermleigh, Texas, approximately 167 mi west of the site. Of the 187 earthquakes, 157 occurred since 2009 and coincide geographically with regions where oil and gas recovery occur (e.g., Fort Worth and Permian Basins) (USGS 2023-TN8808; RRC 2023-TN8699; RRC 2023-TN8702).

After the accident at the Fukushima Dai-ichi nuclear power plant caused by the March 11, 2011, Great Tohoku Earthquake and subsequent tsunami, the NRC established the Near-Term Task Force as directed by the Commission on March 23, 2011 in COMGBJ-11-0002. The Near-Term Task Force assessment resulted in the NRC issuing three orders (EA-12-049, EA-12-050, and EA-12-051) on March 12, 2012, to nuclear power plant licensees to mitigate beyond-design-basis events, and issuing 10 CFR 50.54(f) (TN249) letters directing licensees to conduct seismic and flooding reevaluations (NRC 2012-TN2198). In August 2018, the NRC staff issued its determination that Luminant had implemented NRC-mandated safety enhancements at Comanche Peak in response to the NRC orders and that it had also completed its response to the 10 CFR 50.54(f) letter (NRC 2018-TN8703).

3.4.5 Proposed Action

The NRC staff did not identify any new and significant information associated with the Category 1 geology and soils issue identified in Table 3-1during the review of the applicant's ER (Luminant 2022-TN8655), the site audit, the scoping process, or the evaluation of other available information. As a result, no information or impacts related to this issue were identified that would change the conclusions presented in the LR GEIS (NRC 2013-TN2654). For this issue, the LR GEIS concludes that the impacts are SMALL. No incremental impacts related to this Category 1 issue during the renewal term, beyond those discussed in the LR GEIS, are expected to occur.

3.4.6 No-Action Alternative

Under the no-action alternative, there would be little or no incremental impacts onsite geology and soils associated with the shutdown of Comanche Peak. This is because prior to the commencement of decommissioning activities, little or no new ground disturbance would occur at the plant site as operational activities are reduced and eventually cease. As a result, the NRC staff concludes that the impact of the no-action alternative on geology and soils would be SMALL.

3.4.7 Replacement Power Alternatives: Common Impacts

Construction

During facility construction for replacement power alternatives and associated components, aggregate material (such as crushed stone, riprap, sand and gravel) would be required to construct buildings, foundations, roads, parking lots, pad sites, transmission lines, and other supporting infrastructure, as applicable. The NRC staff presumes that these resources would be obtained from commercial suppliers using local or regional sources. Land clearing, grading, and excavation work expose soils to erosion and alter surface drainage. The NRC staff also presumes that BMPs would be implemented in accordance with applicable State and local permitting requirements to reduce soil erosion and associated off-site impacts. These practices would include measures such as the use of sediment fencing, staked hay bales, check dams, sediment ponds, riprap aprons at construction and laydown yard entrances, mulching and geotextile matting of disturbed areas, and rapid reseeding of temporarily disturbed areas, where applicable. Standard construction practice dictates that topsoil removed during construction and any suitable excavated materials would be stored onsite for redistribution such as for backfill at the end of construction.

Operations

Replacement power facilities would be built in accordance with applicable State and local building codes and would consider such siting and design factors to mitigate potential impacts from natural phenomena. Once facility construction is completed, areas disturbed during construction, whether on land or offshore, would be within the footprint of the completed facilities, overlain by other impervious surfaces (such as roadways and parking lots), or revegetated or stabilized as appropriate, so there would be no additional land disturbance and no direct operational impacts on geology and soils. Consumption of aggregate materials or topsoil for maintenance purposes during operations would be negligible.

3.4.8 New Nuclear (Small Modular Reactors) Alternative

The impacts on geologic and soil resources from construction and operations associated with the new nuclear alternative would likely be similar to those described and assumed to be common to all alternatives in Section 3.4.7. According to the applicant's ER, an area of approximately 675 ac of semi-wooded land is available for the citing of a new SMR, including the associated MDCTs and a BDTF. A new intake structure on CCR would be required for source water for the cooling system, although makeup water would be drawn from an existing intake on Lake Granbury. Total land disturbance for a 2,400 MWe SMR facility, BDTF, equipment buildings, evaporation ponds, storage ponds, and discharge piping infrastructure would be approximately 476 ac (NuScale 2018-TN8706). Overall, construction of the nuclear units and support facilities would require a substantial volume of geologic material (e.g., aggregate and soil backfill).

Implementation of the SMR component would use existing infrastructure at the Comanche Peak site to the maximum extent possible, which would reduce construction impacts and related impacts onsite geology and soils, as well as consumption of geologic resources for new facility construction. Disturbance of geologic strata and soil erosion and loss under this alternative would generally be localized to the construction sites, and off-site soil erosion impacts would be mitigated by using BMPs. However, excavation work for the nuclear power block associated with the SMR modules may extend to a depth of approximately 140 ft (43 m) below grade (proposed in NUREG-2226, the EIS for an early site permit at the Clinch River Nuclear Site) (NRC 2019-TN6136). This would likely require excavation in weathered and sound rock and the application of methods (e.g., grouting and dewatering) to stabilize the deep excavation during construction. Because this alternative would require multiple excavations, including a deep excavation for the SMR, and substantial natural soil disturbance, the NRC staff concludes that the overall impacts on geology and soil resources from the new nuclear alternative would be SMALL to MODERATE.

3.4.9 Natural Gas-fired Combined-Cycle Alternative

The impacts on geologic and soil resources from construction and operations associated with the NGCC alternative would likely be similar to those described and assumed as being common to all alternatives described in Section 3.4.7. Impacts are also similar to, but less than, those described in Section 3.4.8. According to the applicant's ER, the NGCC would be constructed in the same general location as the new nuclear alternative. NRC staff estimated the land use requirements for a 2,460 MWe NGCC facility, BDTF and associated structures (e.g., equipment buildings, evaporation ponds, storage ponds, etc.), and discharge piping infrastructure would be approximately 241 ac (NRC 2011-TN6437, 2011-TN8693; Luminant 2022-TN8655, 2023-TN8692). Construction of a new intake structure on CCR and use of the existing intake on Lake Granbury would be required, despite the reduced demand for cooling and consumptive water use in comparison to the new nuclear alternative (Luminant 2022-TN8655).

Implementation of the NGCC alternative would use existing transportation and transmission line infrastructure, which would reduce construction impacts and related impacts onsite geology and soils, as well as consumption of geologic resources. Disturbance of geologic strata and soil erosion and loss under this alternative would generally be localized to the construction sites, and off-site soil erosion impacts would be mitigated by using BMPs. Based on these considerations, the NRC staff concludes that the potential impacts on geology and soil resources from the NGCC would be SMALL.

3.4.10 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

Under this combination alternative, the impacts on geologic and soil resources would likely be similar to, but greater in overall magnitude, than those described and assumed to be common to all alternatives in Section 3.4.7, and greater than those under the new nuclear or natural gas alternatives. This greater potential for impacts is driven primarily by the substantial land area that would be disturbed at multiple off-site locations, in addition to impacts on and adjacent to the Comanche Peak site associated with the SMR component of this alternative. Overall impacts would be driven by the potential for soil erosion and loss of natural soils and sediments from the conversion of land to industrial uses for the buildout of the solar PV and wind components of the alternative. Based on these considerations, the NRC staff concludes that the potential impacts on geology and soil resources from the combination alternative could range from SMALL to MODERATE.

3.5 Water Resources

This section describes surface water and groundwater resources at and around the Comanche Peak site. The description of the resources is followed by the staff's analysis of the potential impacts on surface water and groundwater resources of the proposed action (LR) and alternatives to the proposed action.

3.5.1 Surface Water Resources

Surface water encompasses all water bodies that occur above the ground surface, including rivers, streams, lakes, ponds, and human-made reservoirs or impoundments.

3.5.1.1 Surface Water Hydrology

Local and Regional Hydrology

The Comanche Peak site is located on a peninsula between the CCR and the SSI within the Middle Brazos basin (Luminant 2022-TN8655) (Figure 3-2). The Brazos River Basin is the second-largest river basin in Texas, having a total area of approximately 45,700 mi^2, and it is located within the Texas-Gulf Region (U.S. Geological Survey [USGS] Region 12). The Brazos River Basin is further subdivided into the Brazos Headwaters, the Middle Brazos, and the Lower Brazos basin. The Middle Brazos basin occupies approximately 15,500 mi^2 (Luminant 2022-TN8655). The Comanche Peak site is located within the approximately 2,500 mi^2 Middle Brazos-Lake Whitney watershed, the USGS hydrologic unit code 12060201.

The CCR, a 3,272 ac impoundment of the Comanche Creek, provides cooling water for Comanche Peak units. The SSI is an impoundment created by a dam across one of the arms of the CCR south of the plant and serves as the ultimate heat sink for the Comanche Peak units. The CCR was formed by impounding Comanche Creek (formerly Squaw Creek) by a dam located approximately 4.3 stream miles upstream of the confluence of Comanche Creek and Paluxy River (Luminant 2022-TN8655). The Paluxy River joins the Brazos River a short distance downstream of its confluence with Comanche Creek.

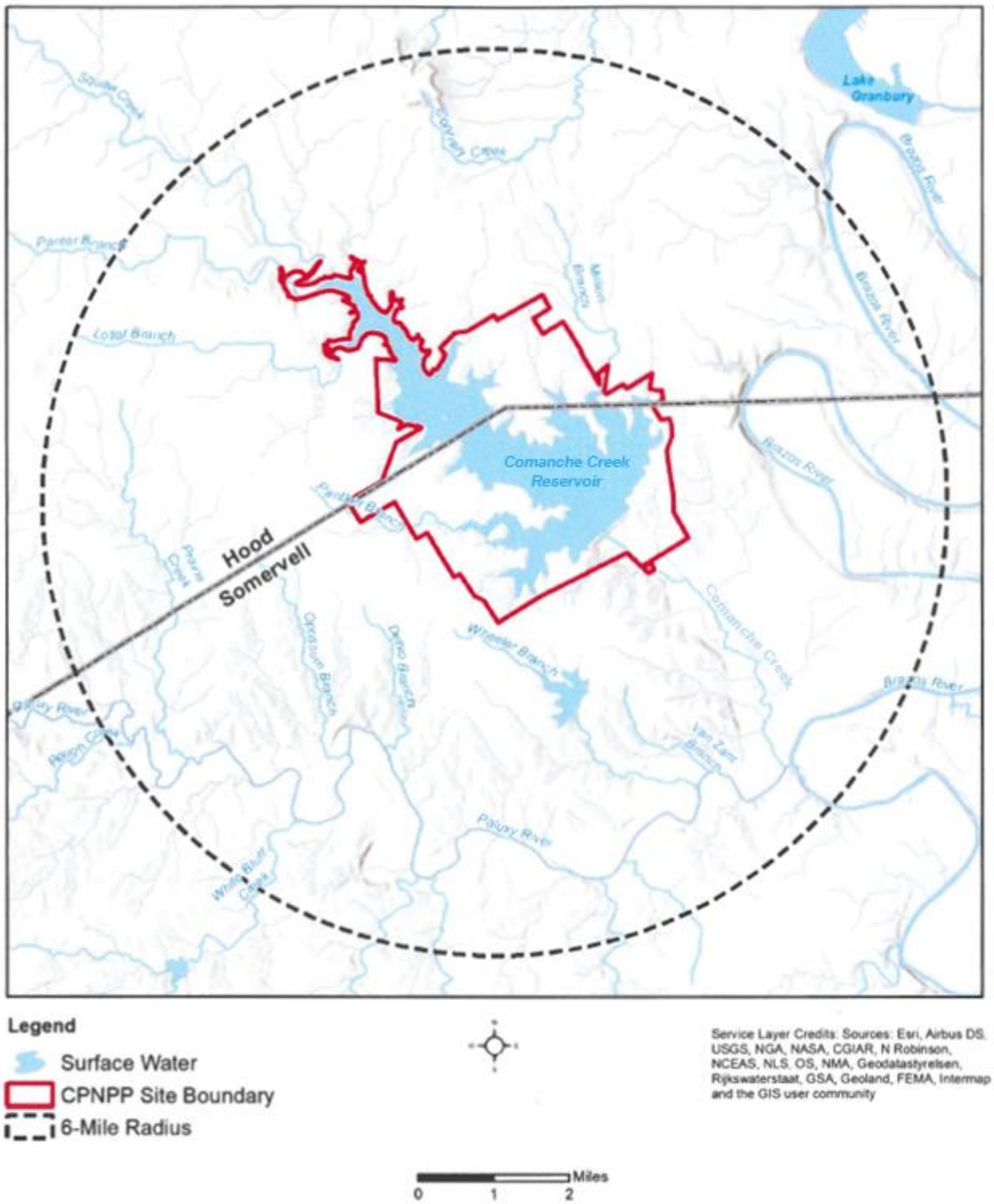


Figure 3-2 Major Surface Water Features Associated with the Comanche Creek Reservoir Watershed. Adapted from: Luminant 2022-TN8655

Six intermittent streams—Comanche Creek, Panter Branch, Lollar Branch, Panther Branch, Million Branch, and an unnamed branch—flow into the CCR (Luminant 2022-TN8655). The CCR has a drainage area of 64 mi^2 at the dam and has a surface area of 3,297 ac at its conservation pool elevation of 775 ft MSL. The CCR and the dam are owned by CP PowerCo and operated by Vistra (Luminant 2022-TN8655). The Comanche Creek Dam is a 4,360 ft earthfill embankment with a maximum height of 159 ft and a crest elevation of 796 ft MSL (Luminant 2022-TN8655). The dam has two spillways—an uncontrolled concrete ogee type with a width of 100 ft at a crest elevation of 775 ft MSL and an emergency spillway with a width of 2,000 ft at a crest elevation of 783 ft MSL. Outlet works consist of three gate-controlled outlets and a 30 in. diameter low-flow outlet. A minimum discharge of 1.5 cfs to Comanche Creek downstream of the dam is maintained.

The SSI is impounded by a safety-related, 1,520 ft long rock-fill embankment across Panther Branch (Luminant 2022-TN8655). The embankment has a maximum height of 70 ft above the streambed with a crest elevation of 796 ft MSL. The spillway is a 40 ft wide, 400 ft long earthcut channel (also called the equalization channel) that connects the SSI to the CCR. Based on a 2017 acoustic survey, the CCR has an estimated total capacity of 149,732 ac-ft including the SSI's estimated capacity of 653 ac-ft, both at a pool elevation of 775 ft MSL (Luminant 2022-TN8655).

Lake Granbury is an impoundment of the Brazos River formed by the DeCordova Bend Dam (NRC 2011-TN6437, 2011-TN8693). Located approximately 7.5 mi northwest of the Comanche Peak site, the lake has a total drainage area of 24,691 mi^2 including a noncontributing drainage area of approximately 9,240 mi^2 (TWDB 2016-TN8707). According to the 2015 volumetric survey, Lake Granbury has a storage capacity of 133,858 ac-ft with a surface area of 8,172 ac at the normal operating pool elevation of 692.7 ft Brazos River Authority (BRA) Datum or 691.59 ft National Geodetic Vertical Datum of 1929 (TWDB 2016-TN8707). At the emergency spillway elevation of 693 ft BRA Datum or 691.89 ft National Geodetic Vertical Datum of 1929, Lake Granbury has a surface area of approximately 8,282 ac and a capacity of 136,326 ac-ft. Approximately 100 river miles downstream from the DeCordova Bend Dam, Whitney Dam forms Lake Whitney, which is a U.S. Army Corps of Engineers (USACE) flood-control reservoir with a capacity of 1.3 million ac-ft.

In addition to the CCR and the SSI, some wastewater treatment ponds and cattle ponds are located on the Comanche Peak site (Luminant 2022-TN8655). Six double-lined wastewater ponds are located on the site with a total surface area of approximately 6 ac. Three of these ponds are low-volume, flow-through ponds where wastewaters are monitored before being discharged to the CCR through a TPDES-permitted outfall (Luminant 2022-TN8655). A metal cleaning waste impoundment is also permitted through the TPDES permit but has no installed discharge and has only been used once to support Unit 1 steam generator cleaning (Luminant 2022-TN8655).

Flooding

Flooding in the Brazos River Basin is generally caused by precipitation runoff. Upstream of Lake Granbury near Dennis, Texas, at USGS gauge 08090800, peak streamflow records indicate that the recorded streamflow is affected by regulation. Morris Sheppard Dam, located approximately 60 mi west of Dallas, Texas, and completed in 1941, affects streamflow at the Dennis gauge. Based on historical data, the largest peak streamflow for the period May 8, 1969 through October 2, 2021 was 96,600 cfs on October 14, 1982 (USGS 2023-TN8708). During that period, peak streamflow exceeding 40,000 cfs was recorded 10 times, the latest time being on April 18, 2016. Downstream of Lake Granbury near Glen Rose, Texas, at USGS gauge 08091000, peak streamflow records indicate that the largest peak streamflow for the period October 17, 1923 through October 16, 2022 was 97,600 cfs on May 18, 1935 (USGS 2023-TN8709). This 1935 peak discharge was unaffected by regulation but streamflow since 1941 has been affected by the Morris Shephard and DeCordova Bend Dams. During the period October 17, 1923 through October 16, 2022, peak streamflow exceeding 50,000 cfs was recorded 18 times, the latest time being on June 3, 2016. Upstream of the Paluxy River's confluence with Comanche Creek, peak streamflow records are available at USGS gauge 08091500 for the period April 17, 1908 through August 22, 2022 (USGS 2023-TN8710). The largest peak streamflow of 59,000 cfs was recorded on April 17, 1908. Streamflow exceeding 40,000 cfs has been recorded six times, the latest time being on October 4, 1959.

The maximum flood water surface elevation at gauging station 8-0910, located upstream of the Brazos River's confluence with Paluxy River, was 601.69 ft MSL (Luminant 2022-TN8655). In comparison, the Comanche Peak site grade is at 810 ft MSL (Luminant 2022-TN8655). The Comanche Peak site is listed by the Federal Emergency Management Agency as having minimal flood hazard (Zone X without a base flood elevation; Luminant 2022-TN8655, Figure 3).

In accordance with the NRC's General Design Criteria (Appendix A to 10 CFR Part 50 [TN249]), plant SSCs important to safety are designed to withstand the effects of natural phenomena, such as flooding, without loss of capability to perform safety functions. The Comanche Peak site is designed and located such that the plant site is protected from flooding by Lake Granbury and CCR, and from local intense precipitation and ponding. The plant grade lies above the maximum expected flood water surface elevation, including possible wind and wave action. All seismic Category I SSCs important to safety at Comanche Peak are designed to withstand flooding commensurate with the probable maximum flood (Luminant 2022-TN8655).

Additionally, the NRC evaluates nuclear power plant operating conditions and physical infrastructure to ensure ongoing safe operations through its Reactor Oversight Process. If new information about changing environmental conditions becomes available, the NRC will evaluate the new information to determine whether any safety-related changes are needed.

3.5.1.2 Surface Water Use

Comanche Peak Units 1 and 2 use a once-through condenser cooling system (Luminant 2022-TN8655). The Comanche Peak circulation water system withdraws water from the CCR using eight pumps, each of 275,000 gpm capacity, for a maximum design flow of 2,200,000 gpm (Luminant 2022-TN8655). Each of the two units is supported by four pumps during warm months. Three pumps per unit are needed during cooler months. The units can operate on reduced loads using two or three pumps. The cooling water is returned to the CCR through a tunnel connecting to a discharge structure. Lake Granbury provides make up water to the CCR. Under an agreement with the BRA, 39,350 ac-ft of water can be withdrawn per year from the Lake Granbury and/or Possum Kingdom Lake through August 31, 2066 (Luminant 2022-TN8655). Comanche Peak also has access to an additional 10,000 ac-ft of water per year from the closed DeCordova Plant's contract permit through December 31, 2030 (Luminant 2022-TN8655).

The SSWS withdraws cooling water from the SSI using four 17,000 gpm capacity service water pumps (Luminant 2022-TN8655). The service water pumps are located in the seismic Category I service water intake structure. The SSWS cools the component cooling water system heat exchangers and the emergency diesel generators. The cooling water is returned to the SSI using the service water discharge canal. The fire protection system is supported by two 524,000 gal capacity water storage tanks. After water is used to extinguish a fire, the tanks are filled from the SSI using a separate pump.

As shown in Table 3-7 below, between 2016 and 2020, the annual total surface water withdrawals from Lake Granbury averaged 15,496 MGY or 42.38 MGD; these data were reported in ER Table 3.6-5a (Luminant 2022-TN8655). The range of annual total surface water withdrawal ranged from a minimum of 14,672 MGY or 40.09 MGD in 2016 to a maximum of 16,060 MGY or 44.00 MGD in 2017. The maximum annual total surface water withdrawal in 2017 amounts to 49,286 ac-ft. During the same period, monthly total surface water withdrawals from Lake Granbury ranged from a minimum of 0 MGM or 0 gpm in 2016 and 2018 to a maximum of 1,869 MGM or 41,869 gpm in 2016, as listed in ER Table 3.6-5a (Luminant 2022-TN8655). The average total monthly total surface water withdrawal from Lake Granbury between 2016 and 2020 was 1,216 MGM or 27,608 gpm.

Table 3-7 Surface Water Withdrawals from Lake Granbury (2016–2020)

Year	Yearly Withdrawals (MGY)	Daily Withdrawals (MGD)[(a)]
2016	14,672	40.09
2017	16,060	44.00
2018	14,680	40.22
2019	16,057	43.99
2020	16,010	43.74
Average	**15,496**	**42.38**

(a) All reported values are rounded. To convert million gallons per year (MGY) to million cubic meters per year (m^3/y) divide by 264.2. To convert million gallons per day (MGD), to million liters per day (MLD) multiply by 3.7854.
Source: Luminant 2022-TN8655.

As shown in Table 3-8 below, between 2016 and 2020, the annual total surface water withdrawals from the CCR averaged 1,066,327 MGY or 2,918 MGD; these data were reported in ER Table 3.6-4a (Luminant 2022-TN8655). The annual total surface water withdrawal ranged from a minimum of 1,023,837 MGY or 2,797 MGD in 2017 to a maximum of 1,095,964 MGY or 2,994 MGD in 2016. During the same period, monthly total surface water withdrawals from the CCR ranged from a minimum of 59,630 MGM or 1,335,791 gpm to a maximum of 101,338 MGM or 2,270,278 gpm, as listed in ER Table 3.6-4a (Luminant 2022-TN8655). The average total monthly total surface water withdrawal from the CCR between 2016 and 2020 was 88,861 MGM or 2,025,996 gpm.

Table 3-8 Surface Water Withdrawals from Comanche Creek Reservoir (2016–2020)

Year	Yearly Withdrawals (MGY)	Daily Withdrawals (MGD)[(a)]
2016	1,095,964	2,994.44
2017	1,023,837	2,797.37
2018	1,086,997	2,978.07
2019	1,070,672	2,933.35
2020	1,054,165	2,880.23
Average	**1,066,327**	**2,918.22**

(a) All reported values are rounded. To convert million gallons per year (MGY) to million cubic meters per year (m^3/y) divide by 264.2. To convert million gallons per day (MGD), to million liters per day (MLD) multiply by 3.7854.
Source: Luminant 2022-TN8655.

In a letter dated February 14, 2023, the NRC staff requested the applicant to update ER Tables 3.6-4a, 3.6-4b, 3.6-5a, and 3.6-5b with 2021 and 2022 water withdrawal data if the data were available (NRC 2023-TN8711). During the site audit, the applicant provided annual total and monthly water withdrawal data from the CCR and Lake Granbury. The NRC staff's review of the 2021 and 2022 water withdrawal data determined that the 2021 and 2022 withdrawal amounts were consistent with the 2016–2020 withdrawal amounts presented in Table 3-7 and Table 3-8.

Two irrigation water withdrawals from the CCR have been proposed (Luminant 2022-TN8655). The withdrawal point for these proposed uses are within the CCR near the Hood and Somervell County line. These proposals are being reviewed by the Texas Water Rights Commission. The nearest irrigation water withdrawal on the Brazos River is approximately 3 river miles downstream of the confluence of Paluxy and Brazos Rivers. The nearest public water withdrawal is near Waco, Texas, approximately 109 river miles downstream of the confluence of Paluxy and Brazos Rivers.

The BRA has an Operation Permit issued by the TCEQ that addresses Brazos River and Lake Granbury current and future water supply needs in an environmentally sensitive manner (BRA 2023-TN8729). A Water Management Plan has been incorporated into the Operation Permit that governs the operating decisions for water diversion, storage, and use of water appropriated under the permit (e.g., the water used to supply Comanche Peak). The Water Management Plan also includes plans for drought contingency and water conservation. Aside from some drought periods (e.g., 2011–2015), the Brazos River has consistently met the Lake Granbury water level objectives per 1996–2023 data provided by the Texas Water Development Board (TWDB 2023-TN8735). In response to the 2011–2015 drought, the TCEQ required that the BRA submit a drought study within 9 months of issuance of their permit in 2016 (BRA 2023-TN8729). The purpose of the drought study was to evaluate the impacts of the 2011–2015 drought in relation to the water supply objectives (i.e., was it worse than the drought of the 1950s and has it decreased the water supply to be appropriate under the permit). The drought study was accepted by the TCEQ in 2017 and it concluded that future water level goals can be met by operational flexibility and that neither total water supply yields or allocations need to be reduced (Freese and Nichols 2017-TN8736). The Operation Permit helps to support Lake Granbury as part of the managed water system that can support a healthy and stable aquatic ecosystem while providing supplemental water to CCR.

3.5.1.3 Surface Water Quality and Effluents

Water Quality Assessment and Regulation

In accordance with Section 303(c) of the Federal Water Pollution Control Act (i.e., Clean Water Act of 1972, as amended [CWA; 33 U.S.C. 1251-1387; TN662]), states have the primary responsibility for establishing, reviewing, and revising water quality standards for the Nation's navigable waters. Such standards include the designated uses of a water body or water body segment, the water quality criteria necessary to protect those designated uses, and an anti-degradation policy with respect to ambient water quality. As established under Section 101(a) of the CWA, water quality standards are intended to restore and maintain the chemical, physical, and biological integrity of the Nation's waters and to attain a level of water quality that provides for designated uses. The EPA reviews each state's water quality standards to ensure they meet the goals of the CWA and Federal water quality standards regulations (40 CFR Part 131 [TN4814], "Water Quality Standards").

Section 303(d) of the CWA requires states to identify all "impaired" waters for which effluent limitations and pollution control activities are not sufficient to attain water quality standards in such waters. Similarly, CWA Section 305(b) requires states to assess and report on the overall quality of waters in their state. States prepare a CWA Section 303(d) list that identifies the water quality limited stream segments that require the development of total maximum daily loads (TMDLs) to assure future compliance with water quality standards. The list also identifies the pollutant or stressor causing the impairment and establishes a priority for developing a control plan to address the impairment. The TMDLs specify the maximum amount of a pollutant that a water body can receive and still meet water quality standards. Once established, TMDLs are often implemented through watershed-based programs administered by the State, primarily through permits issued under the National Pollutant Discharge Elimination System (NPDES) permit program, pursuant to Section 402 of the CWA, and associated point and nonpoint source water quality improvement plans and associated BMPs. States are required to update and resubmit their impaired waters list every 2 years, which ensures that impaired waters continue to be monitored and assessed by the State until applicable water quality standards are met.

Under CWA Sections 305(b) and 303(d), Texas compiles an integrated report of surface water quality every 2 years in even-numbered years. The 2022 assessment of surface water quality was completed in June 2022 and the EPA approved the 2022 Texas 303(d) list on July 7, 2022 (TCEQ 2023-TN8712). Comanche Creek, Paluxy River, and Lake Granbury are not listed on the 2022 303(d) list as Category 4 (i.e., water quality standards are not supported or are threatened for one or more designated uses) or Category 5 (i.e., applicable water quality standards are not met or are threatened for one or more designated uses) (TCEQ 2023-TN8712). Within Lake Granbury, some instances of depressed dissolved oxygen were found (TCEQ 2023-TN8712). Segments of Paluxy River are listed as fully supporting or no concern for all water quality parameter except ammonia, which was not assessed. Brazos River downstream of Lake Granbury is listed as a concern for screening levels for exceedances of chlorophyll-a. Brazos River above Possum Kingdom Lake is listed as Category 5 because of bacteria in the water.

Texas Pollutant Discharge Eliminating System Permitting Status and Plant Effluents

To operate a nuclear power plant, NRC licensees must comply with the CWA, including associated requirements imposed by the EPA or the State, as part of the NPDES permitting system under Section 402 of the CWA. The Federal NPDES permit program addresses water pollution by regulating point sources (i.e., pipes, ditches) that discharge pollutants to waters of the United States. NRC licensees must also meet State water quality certification requirements under Section 401 of the CWA. The EPA or the States, not the NRC, sets the limits for effluents and operational parameters in plant-specific NPDES permits. Nuclear power plants cannot operate without a valid NPDES permit and a current Section 401 Water Quality Certification.

The Section 401 Water Quality Certification for Comanche Peak Units 1 and 2 was issued by the Texas Water Quality Board, a predecessor of the TCEQ, on March 1, 1974; subsequently, in a March 12, 2021 letter, TCEQ confirmed that the existing Section 401 Water Quality Certification remains valid (see Attachment B in Luminant 2022-TN8655).

Since September 14, 1998, the State of Texas has the authority to administer the NPDES program (TCEQ 2023-TN8712). This program is known as the TPDES and is run by the TCEQ. TPDES regulates discharges of pollutants to Texas surface waters other than discharges associated with oil, gas, and geothermal activities, which are regulated by the Railroad Commission of Texas. Comanche Peak Units 1 and 2 operate under TPDES Permit No. WQ0001854000 (Luminant 2022-TN8655). This permit was renewed by TCEQ on October 7, 2019, for a period of 5 years (see Attachment B in Luminant 2022-TN8655). Comanche Peak Units 1 and 2 TPDES permit allows Comanche Peak Power Company to treat and discharge waste via Outfalls 001, 002, and 003, and to the CCR and subsequently to Comanche Creek and Paluxy River (Figure 3-3).

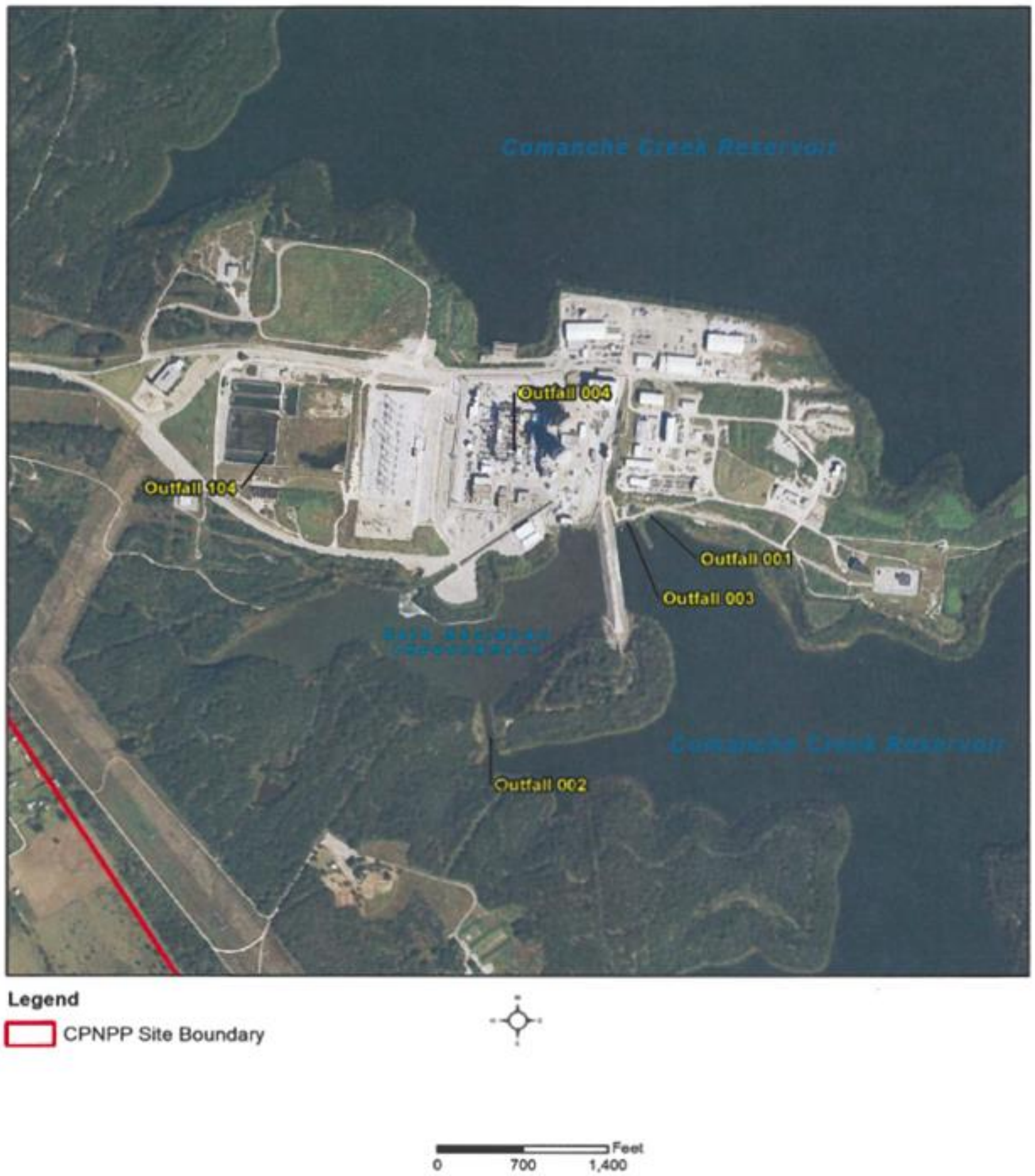


Figure 3-3 Comanche Peak Texas Pollutant Discharge Elimination System Permitted Outfalls. Adapted from: Luminant 2022-TN8655

Under TPDES Permit No. WQ0001854000, process wastewaters from Units 1 and 2 are monitored and discharged to the CCR using Outfalls 001 and 002. Treated domestic wastewaters are discharged to the CCR using Outfall 003. There are two internal outfalls, Outfalls 104 and 400.

Comanche Peak Units 1 and 2 are permitted to discharge once-through and auxiliary cooling waters, and previously monitored effluents at Outfall 004 are permitted to be discharged to the

CCR at Outfall 001. The TPDES permit specifies limits and monitoring and reporting requirements for effluent flow, temperature, free available chlorine, and total residual chlorine at Outfall 001. The daily average and daily maximum flow limits are both 3,168 MGD. The daily average and daily maximum effluent temperature limits are 113 ºF and 116 ºF, respectively. Both effluent flow and temperature must be monitored continuously. Free available chlorine is limited to a daily average of 440 lb/day or 0.2 mg/L with a daily maximum limit of 1,101 lb/day or 0.5 mg/L. A single grab sample limit for free available chlorine is 0.5 mg/L. Only daily maximum limits are specified for total residual chlorine—880 lb/day or 0.2 mg/L, with a single grab sample limit of 0.2 mg/L. Chlorine must be sampled to represent the period of chlorination and reported weekly.

At Outfall 002, Comanche Peak Units 1 and 2 are permitted to discharge cooling water, auxiliary cooling water from the SSWS, and stormwater runoff from the SSI to the CCR. The TPDES permit specifies limits and monitoring and reporting requirements for effluent flow, total suspended solids, and oil and grease at Outfall 002. There is no specific limit for flow, but it must be measured when discharge occurs and reported daily. Total suspended solids are limited to a daily average of 30 mg/L and a daily maximum of 100 mg/L with a single grab sample limit of 100 mg/L. Total suspended solids must be reported weekly. Oil and grease limits are a daily average of 15 mg/L and a daily maximum of 20 mg/L with a single grab sample limit of 20 mg/L. Oil and grease must be measure when discharge occurs and reported weekly. In addition, the TPDES permit specifies that the pH must not be less than 6.0 or greater than 9.0 standard units and must be monitored weekly. The TPDES permit also requires no discharge of floating solids or visible foam other than trace amounts. There must not be discharge of any visible oil.

At Outfall 003, Comanche Peak Units 1 and 2 are permitted to discharge treated domestic wastewater to the CCR. The TPDES permit specifies limits and monitoring and reporting requirements for effluent flow, total suspended solids, 5-day biochemical oxygen demand, and *Escherichia coli*. There is no specific limit for flow, but it must be measured and reported daily except on weekends and holidays for which flow rates must be averaged from totals readings taken the next working day. The total suspended solids and the 5-day biochemical oxygen demand are each limited to a daily average of 20 mg/L and a daily maximum of 45 mg/L, with a single grab sample limit of 45 mg/L. These parameters must be reported twice per month. The *Escherichia coli* daily average limit is 126 colony-forming units (CFUs) or the most probable number (MPN) per 100 mL with a daily maximum and single gram sample limit of 399 CFUs or MPNs per 100 mL. *Escherichia coli* must be reported weekly. In addition, the TPDES permit specifies that the pH must not be less than 6.0 or greater than 9.0 standard units and must be monitored twice per month. If the ultraviolet radiation disinfection system is out of service and chlorination is used, the TPDES permit requires that residual chlorine after a minimum detention time of 20 minutes must be a minimum of 1.0 mg/L and must be a maximum of 4.0 mg/L. In this case, the residual chlorine must be monitored five times per week. The TPDES permit also requires no discharge of floating solids or visible foam other than trace amounts. There must not be discharge of any visible oil.

At Outfall 004, which is an internal outfall, Comanche Peak Units 1 and 2 are permitted to discharge stormwater runoff, low-volume waste sources, and previously monitored effluent. The TPDES permit specifies limits and monitoring and reporting requirements for effluent flow, total suspended solids, and oil and grease. There is no specific limit for flow, but it must be measured when discharge occurs and reported daily. Total suspended solids are limited to a daily average of 30 mg/L and a daily maximum of 100 mg/L with a single grab sample limit of 100 mg/L. Total suspended solids must be reported weekly. Oil and grease limits are a daily average of 15 mg/L and a daily maximum of 20 mg/L with a single grab sample limit of 20 mg/L. Oil and grease must be measured when discharge occurs and reported weekly. In addition, the TPDES permit specifies that the pH must not be less than 6.0 or greater than 9.0 standard units and must be monitored weekly. The TPDES permit also requires no discharge of floating solids or visible foam other than trace amounts. There must not be discharge of any visible oil.

At Outfall 104, which is also an internal outfall, Comanche Peak Units 1 and 2 are permitted to discharge metal cleaning waste. The TPDES permit specifies limits and monitoring and reporting requirements for effluent flow, total iron, and total copper. There is no specific limit for flow, but it must be measured when discharge occurs and reported daily. Total iron limits for daily average, daily maximum, and a single grab sample each are 1.0 mg/L. Total iron must be monitored when discharge occurs and must be reported weekly. The total copper limit for the daily average is 0.5 mg/L and the daily maximum and a single grab sample limits both are 1.0 mg/L. Total copper must be monitored when discharge occurs and must be reported weekly. The TPDES permit also requires no discharge of floating solids or visible foam other than trace amounts. There must not be discharge of any visible oil.

Other Surface Water Resources Permits and Approvals

Stormwater discharges from Comanche Peak Units 1 and 2 are permitted under TPDES stormwater multisector general permit No. TXR050000, authorization No. TXR05DA67 (Luminant 2022-TN8655). The Comanche Peak plant is required to implement and maintain a SWPPP. The SWPPP identifies pollutant sources and includes BMPs that help prevent or reduce contaminants in stormwater discharge.

Under CWA Section 311(j)(1)(C), Comanche Peak is required to develop a spill prevention, control, and countermeasures (SPCC) plan. The Comanche Peak SPCC plan identifies and describes the procedures, materials, equipment, and facilities to minimize the frequency and severity of any oil spills (Luminant 2022-TN8655). Nonradioactive spill response procedures are part of Comanche Peak’s station instruction and administration manuals. These procedures identify site personnel responsibilities and response protocols. Discharge of oil in quantities exceeding those identified in CWA Section 311(b)(4) must be reported to the EPA’s national response center.

Under Texas Administrative Code Title 30 (30 TAC), Chapter 327 (TN8812), Comanche Peak is required to report any release of oil, petroleum products, used oil, hazardous substances, industrial solid waste, or other substances in quantities greater than reportable quantities identified in 30 TAC Section 327.4 within 24 hours to the TCEQ regional office, the state emergency response center, and the State of Texas 24-hour spill reporting hotline (Luminant 2022-TN8655). Following reporting, Comanche Peak is required to clean up and remediate any spills.

Comanche Peak currently does not perform dredge-and-fill activities (Luminant 2022-TN8655). Therefore, Comanche Peak does not have a CWA Section 404 permit.

3.5.2 Groundwater Resources

This section describes the groundwater flow systems (aquifers) and water quality in and around the Comanche Peak site. An aquifer is a geologic formation, group of formations, or part of a formation that contains sufficient saturated, permeable material (e.g., sand, gravel, or fractured rock) to yield significant quantities of water to wells and springs.

3.5.2.1 Local and Regional Groundwater Resources

In the region where Comanche Peak is located, groundwater primarily occurs in sedimentary rocks, and to a lesser extent in the surficial alluvium along stream valleys. The sedimentary rocks in the region include the Lower Cretaceous Trinity Group of the Twin Mountains Formation, the Glen Rose Formation, and the Paluxy Formation.

As the lowermost of the Trinity Group, the Twin Mountains Formation outcrops about 15 miles northwest of the Comanche Peak site. The Twin Mountains Formation consists of fine- to medium-grained sandstone with pebble and gravel conglomerates and clays and silts, with a thickness of approximately 150 ft. The Glen Rose Formation forms the surficial material and lies above the Twin Mountains Formation at the Comanche Peak facility. It consists of bedded, argillaceous (clayey) limestone alternating with variable amounts of clay, marl, and sand. The Glen Rose Formation is the most laterally continuous unit in the Trinity Group, extending from north to southwest Texas. It is approximately 160 to 270 ft thick at the site (Luminant 2020-TN8662). Based on limited groundwater level measurements, local groundwater flow directions in the Glen Rose Formation are variable and influenced by weathering, the extent and connectedness of fractures, and the potential occurrence of perched groundwater (Luminant 2022-TN8655). (Perched groundwater is locally saturated weathered rock located above and separated from the regional groundwater.) The NRC staff anticipates that local groundwater in the Glen Rose Formation ultimately discharges to the Comanche Creek Reservoir. The Paluxy Formation lies stratigraphically above the Glen Rose Formation, is composed of sand with interbedded clay and shale, but is absent at the Comanche Peak facility due to excavation and local erosion.

Groundwater in the Paluxy, the Glen Rose, and the Twin Mountains Formations generally is unconfined at or near the formation outcrops and occurs under confined conditions in the down-dip direction (southeast) from the outcrop areas. The outcrop areas of the Paluxy and Glen Rose Formations are located near the Comanche Peak site to the west. Down-dip from the outcrop, groundwater in the Twin Mountains Formation is confined by fine-grained materials of the overlying Glen Rose Formation. The source of recharge to these units includes percolation of precipitation in the outcrop areas and recharge from streams and other surface water bodies (e.g., ponds and lakes). The average annual precipitation in the area is about 31 in., and only a small fraction of it is available for recharge to the aquifers due to surface runoff and evapotranspiration.

3.5.2.2 Local and Regional Water Consumption

In the vicinity of the Comanche Peak site, groundwater use from the Paluxy and Glen Rose Formations is small due to very limited well yield. The Twin Mountains Formation is the primary source of groundwater in the area. It provides moderate to large quantities of fresh to slightly saline water for public supply and industrial and agricultural uses in north-central Texas. Although the Glen Rose Formation is not considered a source of groundwater in the vicinity of Comanche Peak, small amounts of perched groundwater are found in isolated sandy or silty units, or in weathered material near the surface. Groundwater is withdrawn from a few domestic wells completed in the Glen Rose Formation in counties north of the Comanche Peak site.

The Paluxy Formation also yields small to moderate quantities of fresh to slightly saline water for various uses in the region, including Somervell County. The Paluxy Formation is absent at the Comanche Peak facility, but it is a groundwater supply to the north and east of Comanche Peak.

The Comanche Peak site uses little groundwater to provide potable water to the plant and associated structures and buildings because most of the potable water has been provided by the Somervell County Water District (SCWD) public water system since 2012. A small quantity (35,900 gal, less than 1 gpm) of groundwater was pumped from the Rifle Range Well (PW #2130037) primarily for potable and sanitary purposes at the recreation training facility in 2020 (Luminant 2022-TN8655, Sec 2.2.3.4), with an average 143.27 gpd between 2016 and 2020 (Table 3.6-9b in Luminant 2022-TN8655). The Rifle Range Well had a permitted maximum withdrawal rate of 82,000 gpy (0.16 gpm).

A number of onsite wells were either plugged or deactivated between 2013 and 2021 (Figure 3-4). The plugged water supply wells included four in 2013. In 2018, three water supply wells were deactivated, including the Somervell Training Center well, the SCP Office water well, and the SCP Boat Dock water well. The Somervell Training Center water well was used to supply water for cattle, with a groundwater withdrawal limit at 281,750 gpy (0.54 gpm). The maximum groundwater withdrawal from the SCP Office well and the SCP Boat Dock well ranged from of 32,104 gal (0.06 gpm) to 162,060 gal (0.31 gpm) in 2017 and 2018. On August 24, 2021, the one remaining Rifle Range Well was also deactivated.

Based on recent available data, groundwater withdrawals in Somervell County were reported as 1.16 MGD in 2015, with domestic supply and mining withdrawals as the largest uses each at 0.41 MGD. Public water supply was the largest groundwater use in Hood County in 2015, reported at 4.66 MGD (Table 3.6-7 in Luminant 2022-TN8655).

According to the Texas Water Development Board Groundwater Database, there are 39 off-site registered groundwater wells within 2-mi of the Comanche Peak site boundary. The majority of these wells are completed in the Twin Mountains Formation and used primarily for public supply and some domestic uses (TWDB 2023-TN8817).

3.5.2.3 Groundwater Quality

The quality of groundwater in the vicinity of the Comanche Peak site is dependent on the aquifer and geologic setting. Water quality in the Glen Rose Formation is variable and not potable in some areas (Luminant 2022-TN8655). Groundwater from the Twin Mountains Formation is used for irrigation in and near the outcrop areas, but it is unsuitable for irrigation at the site due to elevated sodium content and local soil conditions. Groundwater use from the Glen Rose and Paluxy Formations is not expected to increase significantly due to limited capacity and variable quality.

<u>Nonradiological Spills</u>

No permitted discharges to groundwater are identified in the ER (Luminant 2022-TN8655). Review of site records from 2016–2020 indicates there have been no inadvertent nonradioactive releases or incident spills at the Comanche Peak site. On June 7, 2021, approximately 100 gal of mineral oil was accidently released as a result of overflow from containment of a Unit 2 transformer. Vistra notified TCEQ of this non-reportable-quantity spill on June 8, 2021 (Luminant 2022-TN8655). During the site audit, Vistra confirmed that there have been no impacts on groundwater quality as a result of inadvertent nonradioactive releases since the ER was submitted in October 2022 (Luminant 2023-TN8665).

Figure 3-4 Monitoring, Observation, and Deactivated Water Supply Wells at the Comanche Peak Site. Adapted from: Luminant 2022-TN8655

Historical Radiological Spills and Tritium in Groundwater

Based on the Industrial Groundwater Protection Initiative (NEI 2007-TN1913, 2019-TN6775), Comanche Peak implemented a groundwater protection program in 2008 to detect and effectively manage inadvertent release of licensed materials to groundwater in a timely manner. Vistra established a groundwater monitoring network, which includes eight wells (Well Nos. 9, 10, 11, 12, 14, 15, 16, and 25) completed in the unweathered Glen Rose Formation installed around the power unit block and four wells (Well Nos. 19, CP-A, CP-B, and CP-C) completed in the weathered Glen Rose Formation immediately adjacent to the wastewater management system underground piping system (Figure 3-4). Each monitoring well is monitored on a quarterly basis for radioactive releases via gamma spectroscopy and liquid scintillation.

The established groundwater monitoring network has been used to assess the potential impact on groundwater from a number of historical releases of radioactive liquid that occurred at the plant (Luminant 2023-TN8665). In 2013, tritium was detected in groundwater as a result of a leaking pipe that connects the water treatment plant and microfiltration building sumps to the low-volume waste (LVW) pond. In 2015, CCR water containing low levels of tritium leaked from the water treatment plant's filter water storage tank. In 2016, tritium was detected in groundwater from a leak in a pipe connecting the LVW pond to the water treatment waste sump. These leaks were repaired in mid-2016 and January 2017 (Luminant 2023-TN8665). These historical releases resulted in tritium levels above detection limits in well CP-A and the downgradient well MW-11. Tritium in well CP-A has been below detection limits for samples obtained between 2018 and 2022 (Annual Radioactive Effluent Release Reports Luminant 2019-TN8661, 2020-TN8662, 2021-TN8663, 2022-TN8664, 2023-TN8660). Samples from well MW-11 have continued to show intermittent tritium levels above the detection limits. Groundwater monitoring performed in 2021 and 2022 showed most samples from well MW-11 contained tritium above detection limits, with measured values from 2,130 pCi/L to 3,360 pCi/L. The percolation of treated CCR water from the water treatment plant's filter water storage tank is suspected to have been the primary source of tritium observed in MW-11 (Luminant 2023-TN8665). All tritium results from 2018 to 2022 were well below the drinking water standard of 20,000 pCi/L).

As part of the Comanche Peak REMP, groundwater samples are collected quarterly from five additional monitoring locations for gamma isotopes and tritium (Luminant 2023-TN8811). There were no radionuclides, including tritium, identified in any of the groundwater samples monitored in 2022, and tritium was less than the required lower limits of detection.

3.5.3 Proposed Action

3.5.3.1 Surface Water Resources

As documented in the LR GEIS (NRC 2013-TN2654) and cited in Table 3-1 for generic surface water resources issues, the impacts of nuclear power plant LR and continued operations would generally be SMALL for Category 1 issues applicable to Comanche Peak. These issues include:

- surface water use and quality (non-cooling system impacts)
- altered current patterns at intake and discharge structures
- altered thermal stratification of lakes
- scouring caused by discharged cooling water
- discharge of metals in cooling system effluent
- discharge of biocides, sanitary wastes, and minor chemical spills

- surface water use conflicts (plants with once-through cooling systems)
- temperature effects on sediment transport capacity

Two generic surface water resources issues listed in the LR GEIS (NRC 2013-TN2654) do not apply to Comanche Peak. These issues are described below.

- Altered salinity gradients: as stated in the LR GEIS, this issue is related to plants located on estuaries where cooling system water withdrawals and discharges may cause changes in salinity. Because Comanche Peak is not located on an estuary, this issue does not apply.
- Effects of dredging on surface water quality: as stated in the LR GEIS, this issue is related to dredging in the vicinity of surface water intakes, canals, and discharge structures to remove deposited sediment and maintain cooling system functions. Dredging may also be needed to maintain barge shipping lanes. Comanche Peak has not performed any dredging in the past and does not anticipate any future dredging (Luminant 2022-TN8655). Therefore, this issue does not apply.

The LR GEIS lists one Category 2 issue for surface water resources—surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river) (NRC 2013-TN2654). Comanche Peak has a once-through condenser cooling system (Luminant 2022-TN8655; see Table 3.1-2 in NRC 2013-TN2654). Therefore, the Category 2 issue related to surface water resources does not apply to Comanche Peak.

3.5.3.2 Groundwater Resources

As documented in the LR GEIS (NRC 2013-TN2654) and cited in Table 3-1 for generic groundwater resource issues, the impacts of nuclear power plant LR and continued operations would be SMALL for the Category 1 issues applicable to Comanche Peak. These issues are:

- groundwater contamination and use (non-cooling system impacts)
- groundwater use conflicts (plants that withdraw less than 100 gpm)

These applicable Category 1 issues were determined to result in a SMALL impact in 10 CR Part 51, Subpart A, Appendix B, Table B-1. No significant groundwater impacts with respect to Category 1 (generic) issues are anticipated during the LR term that would be different from those occurring during the current license term. As discussed in Section 3.5.2 of this SEIS, the staff performed a review of groundwater use and quality. This review did not identify any new and significant information during its independent review of the ER, the scoping process, the audit, and evaluation of available information that would change the conclusion reached in the LR GEIS. The staff concluded the following.

- No discharges to groundwater requiring permits by regulatory agencies are expected during the renewal period. There are currently no regulated discharges to groundwater and none were identified by the applicant during the renewal period.
- There are no foreseeable conditions during the renewal term under which onsite groundwater withdrawal increases to close to or above the 100 gpm limit included in the LR GEIS conclusion.

As a result, as concluded in the LR GEIS (NRC 2013-TN2654), for these Category 1 (generic) issues, which are reported in Table 3-1, the impacts on groundwater resources of continued operation of Comanche Peak would be SMALL.

As shown in Table 3-2, the NRC staff identified one site-specific, Category 2, issue related to groundwater resources applicable to Comanche Peak during the LR term. This issue is analyzed below.

Radionuclides Released to Groundwater

This issue was added for consideration as part of the groundwater review for LR in the LR GEIS revision (NRC 2013-TN2654) because of the accidental releases of liquids containing radioactive material into the groundwater at power reactor sites. The majority of these inadvertent releases involved leakage of water containing tritium or other radioactive isotopes from spent fuel pools, buried piping, or failed valves on effluent discharge lines. In 2006, the NRC released a report documenting lessons learned from a review of these incidents that ultimately concluded that these instances had not adversely affected public health and safety (Liquid Radioactive Release Lessons Learned Task Force Report; NRC 2006-TN1000). This report concluded, in general, that groundwater affected by radionuclide releases is expected to remain onsite, but instances of off-site migration have occurred. The LR GEIS (NRC 2013-TN2654) determined that impacts on groundwater quality from the release of radionuclides could be SMALL or MODERATE, depending on the magnitude of the leak, the radionuclides involved, hydrogeologic factors, distance to receptors, and the response time of plant personnel to identify and stop the leak in a timely fashion. As a result, this is a Category 2 issue requiring a site-specific evaluation.

This issue was discussed and evaluated in Sections 3.6.4.2 and 4.5.5 of Comanche Peak's ER (Luminant 2022-TN8655) and is summarized in Section 3.5.2.3 of this SEIS. Comanche Peak monitors groundwater for inadvertent releases as part of its groundwater protection program, which was implemented in 2008 under NEI 07-07 (NEI 2007-TN1913), and to satisfy requirements of 10 CFR 20.1501 (10 CFR Part 20-TN283). Tritium is the only radionuclide that has been historically detected above the minimum detectable activity at the Comanche Peak site, but all previous and current measurements are in the shallow Glen Rose Formation at concentrations well below the EPA safe drinking water standard of 20,000 pCi/L. Site hydrogeologic evaluations indicate that the affected groundwater is limited to the Glen Rose Formation within the plant boundary. In addition, the substantial thickness of the Glen Rose Formation (approximately 160 to 270 ft) with very limited permeability will prevent migration of radionuclides and other contaminants to the underlying Twin Mountains Formation aquifer. The continued operation of the plant does not affect onsite and off-site groundwater uses and users.

The NRC staff has not identified new and significant information during the audit, scoping process, or review of available information cited in this SEIS. The NRC staff has concluded that, over the period of extended operation, potentially low levels of groundwater contamination would likely remain onsite and no off-site wells would be affected. Comanche Peak has implemented a groundwater protection program to identify and monitor leaks through the monitoring well network and to take corrective actions if required. Therefore, over the period of continued operations, there is little chance of significant impacts on the groundwater quality of onsite and off-site aquifers. Therefore, the NRC staff concludes that the impacts on groundwater use and quality related to radionuclide release from continued operations would be SMALL.

3.5.4 No-Action Alternative

3.5.4.1 Surface Water Resources

With the cessation of Comanche Peak operations, there would be a large reduction in the amount of water withdrawn from CCR and Lake Granbury. Wastewater discharges would also greatly decrease. Stormwater runoff would continue to be discharged from the site. As a result, Comanche Peak shutdown would reduce the overall impacts on surface water use and quality. Therefore, the NRC staff concludes that the impact of the no-action alternative on surface water resources would be SMALL.

3.5.4.2 Groundwater Resources

With the cessation of operations, there would be a reduction in the already small amount of onsite groundwater consumption and little or no additional impacts on groundwater quality. Therefore, the NRC staff concludes that the impact of the no-action alternative on groundwater resources would be SMALL.

3.5.5 Replacement Power Alternatives: Common Impacts

3.5.5.1 Surface Water Resources

Construction

Construction activities associated with replacement power alternatives may cause temporary impacts on surface water quality by increasing sediment loading to water bodies and waterways. Construction of intake and discharge structures, if needed, could result in within-water activities including dredge-and-fill, underwater construction, and tunneling. Construction activities might also affect surface water quality through pollutants in stormwater runoff from disturbed areas and excavations, spills and leaks from construction equipment, and from sediment and other pollutants disturbed due to associated dredge-and-fill activities. These pollutants could be detrimental to downstream surface water quality, where applicable, and to ambient water quality in waterways near work sites.

Facility construction activities might alter surface water drainage features within the construction footprints of replacement power facilities, including any wetland areas. Impervious areas may increase, resulting in a potential for greater and quicker surface runoff. Potential hydrologic impacts would vary depending on the nature and acreage of the land area disturbed and the intensity of excavation work. Changes in stormwater runoff volume, timing, and quality are usually controlled and managed with applicable Federal, State, and local permits and implementation of BMPs.

The NRC staff assumes that construction contractors would implement BMPs for soil erosion and sediment control to minimize water quality impacts in accordance with applicable Federal, State, and local permitting requirements. These measures would include spill prevention and response procedures, such as measures to avoid and respond to spills and leaks of fuels and other materials from construction equipment and activities. Surface water use during construction is generally related to concrete preparation, dust suppression, and potable and sanitary water for the workforce and is limited to the construction duration. These water needs are usually small compared to cooling water needs during thermoelectric plant operation.

Operation

Thermoelectric generation may require varying amounts of surface water for the cooling of plant components depending on the selected cooling technology and, therefore, may require new water use permits from and agreements with State and local agencies. Potable and sanitary water use for the plant would depend on the workforce size and, therefore, may also require new potable water use permits from and sanitary water disposal agreements with local agencies or municipalities.

Discharge of wastewater including cooling system discharges would require permits from Federal, State, and local agencies, including a certification that the discharges are consistent with State water quality standards. Wastewater discharges would be subject to treatment and monitoring and reporting requirements of relevant permitting agencies. The NRC staff assumes that plant operations would follow the requirements of any applicable Federal, State, and local permits.

3.5.5.2 Groundwater Resources

<u>Construction</u>

Excavation dewatering for foundations and substructures during construction of replacement power-generation facilities, as applicable, may be required to stabilize slopes and permit placement of foundations and substructures below the water table. Groundwater levels in the immediate area surrounding an excavation may be temporarily affected, depending on the hydrogeologic conditions of the site, the duration of dewatering, and the methods (e.g., cofferdams, sheet piling, sumps, dewatering wells) used for dewatering. The NRC staff expects that any impacts on groundwater flow and quality affected by dewatering would be highly localized, of short duration, and expects that there would be no effects on other groundwater users due to the site location, the depth of the Glen Rose Formation, and the confinement of the Twin Mountains Formation used as a source of water in the region. Discharges resulting from dewatering operations would be released in accordance with applicable State and local permits as described above.

Although foundations, substructures, and backfill may alter onsite groundwater flow patterns, local and regional trends would remain unaffected. Construction of replacement power-generating facilities may contribute to onsite changes in groundwater infiltration and quality due to removal of vegetation and the construction of buildings, parking lots, and other impervious surfaces. The potential impacts of increased runoff and subsurface pollutant infiltration or discharge to nearby water bodies would be prevented or mitigated through implementation of BMPs and a SWPPP.

In addition to construction dewatering, onsite groundwater could be used to support construction activities (e.g., dust abatement, soil compaction, water for concrete batch plants). Groundwater withdrawal during construction would have a temporary impact on local water tables or groundwater flow, and these withdrawals and resulting discharges would be subject to applicable permitting requirements. This issue was considered in the LR GEIS (NRC 2013-TN2654) and determined to be a Category 1 issue that has a SMALL impact.

<u>Operation</u>

Dewatering for building foundations and substructures may be required during the operational life of the replacement power facility. Operational dewatering rates, if required, would likely be lower than those rates required for construction and would be managed subject to applicable permitting requirements. Dewatering discharges and treatment would be properly managed in accordance with applicable NPDES permitting requirements. The NRC staff expects that any impacts on groundwater flow and quality affected by dewatering would be highly localized and of short duration, and expects that there would be no effects on other groundwater users.

Effluent discharges (e.g., cooling water, sanitary wastewater, and stormwater) from a facility are subject to applicable Federal, State, and other permits specifying discharge standards and monitoring requirements. Adherence by replacement power facility operators to proper procedures during all material, chemical, and waste handling and conveyance activities would reduce the potential for any releases to the environment, including releases to soil and groundwater.

For replacement power alternatives, groundwater use during operation is assumed to be less than 100 gpm, determined by the LR GEIS (NRC 2013-TN2654) to result in a SMALL impact. Onsite groundwater withdrawals would be subject to applicable State water appropriation, permitting, and registration requirements.

3.5.6 New Nuclear (Small Modular Reactors) Alternative

3.5.6.1 Surface Water Resources

Surface water resources impacts common to all replacement power alternatives are described in Section 3.5.5.1. The workforce needed for the new nuclear alternative would be approximately 3,300 workers during peak construction and 1,500 workers during operations (NRC 2019-TN6136). As stated in Section 3.10.1, Comanche Peak currently employs a permanent full-time workforce of approximately 1,159 workers.

Based on workforce size, potable and sanitary water use during construction would increase from that currently needed to operate Comanche Peak. However, this water use would be limited to the construction duration. Construction-related impacts on surface water quality would be limited to the construction duration and managed under applicable Federal, State, and local permits. Implementation of BMPs and adherence to Federal, State, and local permit requirements minimize the impacts on surface water resources. The NRC staff concluded that the impacts on surface water resources during construction of SMRs at the Comanche Peak site would be SMALL.

During operations, the SMRs would use a closed-cycle condenser cooling system with MDCTs (Luminant 2022-TN8655). As stated in Section 2.3.2.1, a new intake structure would be constructed on the CCR, a new discharge structure in Lake Granbury, and piping along Lake Granbury’s shore. Cooling water withdrawal would be approximately 80 MGD or 89,611 ac-ft/yr (300,000 m^3/d). Consumptive use is estimated to be approximately 55 MGD or 61,608 ac-ft/yr (210,000 m^3/d) (NRC 2019-TN6136). The water to offset consumptive loss would need to be obtained from Lake Granbury. As stated in Section 3.5.1.2, currently Comanche Peak has surface water use permits that allow for withdrawal of approximately 44.1 MGD or 49,350 ac-ft/yr (166,774 m^3/d) from Lake Granbury. Therefore, the water use permit may need to be renegotiated or other sources of cooling water may need to be considered, which might cause water use impacts to be noticeable. Based on the estimated workforce size for the new nuclear alternative, potable and sanitary water needs may be somewhat greater than the current operational needs of Comanche Peak. Some portion of this water may come from surface water resources, based on the sources used by providers of potable and sanitary water. Discharges of stormwater, cooling system effluent, and wastewater during operations would be managed under applicable Federal, State, and local permits. These permits usually require the implementation of BMPs, monitoring and reporting of effluent quantity and quality, and remediation of any exceedances. The NRC staff concluded that the impacts on surface water resources during operations of SMRs at the Comanche Peak site would be MODERATE.

3.5.6.2 Groundwater Resources

The hydrologic and water quality assumptions and implications for construction and operations described in Section 3.5.5.2 as common to all replacement power alternatives also apply to this alternative. The NRC staff did not identify any impacts on groundwater resources for this alternative beyond those discussed above as being common to all replacement power alternatives. Therefore, the NRC staff concludes that the impacts on groundwater resources from construction and operation of a new SMR power plant complex would be SMALL.

3.5.7 Natural Gas Combined-Cycle Alternative

3.5.7.1 Surface Water Resources

Surface water resources impacts common to all replacement power alternatives are described in Section 3.5.5.1. The workforce needed for the new nuclear alternative would be approximately 800 workers during peak construction and 150 workers during operations (NRC 2011-TN6437, 2011-TN8693). As stated in Section 3.10.1, Comanche Peak currently employs a permanent full-time workforce of approximately 1,159 workers.

Based on workforce size, potable and sanitary water use during construction would be smaller than that currently needed to operate Comanche Peak. This water use would be limited to the construction duration. Construction-related impacts on surface water quality would be limited to the construction duration and managed under applicable Federal, State, and local permits. Implementation of BMPs and adherence to Federal, State, and local permit requirements minimize impacts on surface water resources. The NRC staff concluded that the impacts on surface water resources during construction of an NGCC plant at the Comanche Peak site would be SMALL.

Cooling system components for an NGCC plant on the Comanche Peak site would be similar to those for a SMR. The cooling water withdrawal would be approximately 14 MGD or 15,682 ac-ft/yr (53,000 m^3/d). Consumptive use is estimated to be approximately 11 MGD or 12,322 ac-ft/yr (46,000 m^3/d) (NETL 2022-TN8820). The water to offset consumptive loss would need to be obtained from Lake Granbury. As stated in Section 3.5.1.2, currently Comanche Peak has surface water use permits that allow for withdrawal of approximately 44.1 MGD or 49,350 ac-ft/yr (166,774 m^3/d) from Lake Granbury. Because surface water use for the NGCC plant would be within the current Comanche Peak surface water use permitted amount, the cooling-related surface water use impacts would not be noticeable. Based on estimated workforce size for the NGCC alternative, potable and sanitary water needs would be smaller than the current operational needs of Comanche Peak. Some portion of this water may come from surface water resources, based on the sources used by providers of potable and sanitary water. Discharges of stormwater, cooling system effluent, and wastewater during operations would be managed under applicable Federal, State, and local permits. These permits usually require implementation of BMPs, monitoring and reporting of effluent quantity and quality, and remediation of any exceedances. The NRC staff concluded that the impacts on surface water resources during operations of an NGCC plant at the Comanche Peak site would be SMALL.

3.5.7.2 Groundwater Resources

The hydrologic and water quality assumptions and implications for construction and operations described in Section 3.5.5.2 as being common to all replacement power alternatives also apply to this alternative. The NRC staff did not identify any impacts on groundwater resources for this alternative beyond those discussed above as being common to all replacement power alternatives. Therefore, the NRC staff concludes that the impacts on groundwater resources from construction and operations under the NGCC alternative would be SMALL.

3.5.8 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

3.5.8.1 Surface Water Resources

Surface water resources impacts common to all replacement power alternatives are described in Section 3.5.5.1. The workforce needed for the solar PV portion of the combination alternative would be approximately 2,100 workers during peak construction and 100 workers during operations (DOE 2011-TN8387, BLM 2019-TN8386). The workforce needed for the onshore wind portion of the combination alternative would be approximately 870 workers during peak construction and 80 workers during operations (DOE 2011-TN8387, BLM 2019-TN8386). The workforce needed for the new nuclear portion of the combination alternative would be approximately 600 workers during peak construction and 250 workers during operations (NRC 2019-TN6136). Therefore, a total workforce of approximately 3,750 and 430 workers may be needed during peak construction and operation of the combination alternative, respectively. It is possible that peak construction for the three portions of the combination alternative may not coincide, leading to a total workforce somewhat smaller than 3,750 workers. As stated in Section 3.10.1, Comanche Peak currently employs a permanent full-time workforce of approximately 1,159 workers.

The solar PV and onshore wind portions of the generating capacity would be located off-site of Comanche Peak at locations within the region of influence. Therefore, construction-related impacts of the solar and onshore wind portions would occur at the respective selected locations. Although these activities would occur at multiple sites, a combination of energy-generation technologies does not substantially change construction activities. Based on workforce size, potable and sanitary water use during construction would likely increase from that currently needed to operate Comanche Peak. However, this water use would be limited to the construction duration and would be distributed across multiple sites. Construction-related impacts on surface water quality would be limited to the construction duration and managed under applicable Federal, State, and local permits. Implementation of BMPs and adherence to Federal, State, and local permit requirements minimize impacts on surface water resources. The NRC staff concluded that the impacts on surface water resources during construction of a combination alternative plant at the Comanche Peak site would be SMALL.

During operations, the solar PV and the onshore wind portions would not require condenser cooling. Therefore, for these portions of the combination alternative, consumptive water use for cooling and cooling system effluent discharges would be eliminated. The new nuclear portion of the combination alternative would use a closed-cycle condenser cooling system with MDCTs (Luminant 2022-TN8655). As stated in Section 2.3.2.3, the new nuclear portion a new intake structure would be constructed on the CCR with makeup water drawn from an existing intake on Lake Granbury. Construction of a new discharge structure in Lake Granbury and new piping along the Lake Granbury shore would also be required (Luminant 2022-TN8655). Cooling water withdrawal is estimated to be 13 MGD or 14,562 ac-ft/yr (50,000 m^3/d) and consumptive water use would be 9.2 MGD or 10,305 ac-ft/yr (35,000 m^3/d) (NRC 2019-TN6136). The water to offset consumptive loss would need to be obtained from Lake Granbury. As stated in Section 3.5.1.2, currently Comanche Peak has surface water use permits that allow for withdrawal of approximately 44.1 MGD or 49,350 ac-ft/yr (166,774 m^3/d) from Lake Granbury.

Because surface water use for the combination alternative would be within the current Comanche Peak surface water use permitted amount, the cooling-related surface water use impacts would not be noticeable. Based on the estimated workforce size for operation of the combination alternative, potable and sanitary water needs would be smaller than the current operational needs of Comanche Peak. Some portion of this water may come from surface water resources, based on the sources used by providers of potable and sanitary water. Discharges of stormwater, cooling system effluent, and wastewater during operations would be managed under applicable Federal, State, and local permits. These permits usually require implementation of BMPs, monitoring and reporting of effluent quantity and quality, and remediation of any exceedances. The NRC staff concluded that the impacts on surface water resources during operations of the combination alternative would be SMALL.

3.5.8.2 Groundwater Resources

The hydrologic and water quality assumptions and implications for construction and operations described in Section 3.5.5.2 as being common to all replacement power alternatives also apply to this alternative. The NRC staff did not identify any impacts on groundwater resources for this alternative beyond those discussed above as being common to all replacement power alternatives. Therefore, the NRC staff concludes that the impacts on groundwater resources from construction and operations under the combination alternative would be SMALL.

3.6 Terrestrial Resources

This section describes the terrestrial resources of the Comanche Peak site and the surrounding landscape. Following the description, the NRC staff analyzes potential impacts on terrestrial resources from the proposed action (LR) and alternatives to the proposed action.

3.6.1 Ecoregion

The Comanche Peak site lies within the Cross Timbers Ecoregion (Luminant 2022-TN8655). EPA characterizes this ecoregion (Level III Ecoregion 29) as transitional between forested low mountains and hills of eastern Oklahoma and Texas and the former prairie (now winter wheat growing regions) to the west (EPA 2013-TN8737). Within the Cross Timbers Ecoregion, Griffith et al. 2007-TN8738 described five Level IV Ecoregions: (1) Eastern Cross Timbers (29b); Western Cross Timbers (29c); Grand Prairie (29d), and Limestone Cut Plain (29e). Topography is mixed irregular plains with low hills and tablelands. Natural vegetation is a mosaic of forest, woodland, savanna, and prairie (Griffith et al. 2007-TN8738). Much of the regional land use is currently rangeland and pastureland.

The descriptions, presented in Vistra’s ER (Luminant 2022-TN8655, pages 3-140 to 3-144) characterize the land covers or habitats in the vicinity. Descriptions of land covers and associated tree, shrub, and herbaceous strata are incorporated herein by reference:

- Edwards Plateau limestone savanna and woodland
- Cross Timbers oak forest and woodland
- Edwards Plateau limestone shrubland
- Southeastern Great Plains floodplain forest
- Southeastern Great Plains riparian forest
- urban low intensity
- Edwards Plateau dry-mesic forest
- open water

- native invasive: mesquite shrubland
- row crops

The USACE defines wetlands as areas either inundated or saturated by surface or groundwater at a frequency and duration sufficient to support (and that under normal circumstances do support) a prevalence of vegetation typically adapted for life in saturated soil conditions. Vistra characterizes the National Wetland Inventory features in the landscape surrounding the Comanche Peak site as follows:

- freshwater emergent wetlands—43.78 ac (17.72 ha)
- freshwater forested/shrub wetlands—3,354.64 ac (1,357.57 ha)
- freshwater ponds—256.36 ac (103.75 ha)
- lakes—2904.26 ac (1175.31 ha)
- riverine waters—1,328.99 ac (537.82 ha)

3.6.2 Comanche Peak Site

Vistra's ER (Luminant 2022-TN8655, p. 3-140) states that the Comanche Peak site lies within the Grand Prairie Ecoregion (Level IV ecoregion 29d). The Grand Prairie Ecoregion is an undulating plain with wide lowlands and limestone mesa uplands. Soils are generally well drained. Natural upland vegetation is primarily maintained by fire and consists of tall grasses, including big bluestem, little bluestem, hairy grama, sideoats grama, Indiangrass, and Texas cupgrass. With fire suppression following settlement, woody species such as Ashe juniper and mesquite have invaded the formerly grass-dominated landscape. Streams meander and deeply incise the limestone surface, and the riparian woodlands consist of mixed elm, pecan, bur oak, and hackberry (Griffith et al. 2007-TN8738).

Comanche Peak is on a peninsula extending into the CCR, formed to create cooling water for the plant. About 42 percent of the Comanche Peak site is covered by open water from the CCR Table 3-3). Most abundant terrestrial land covers are forested types (31 percent – deciduous, evergreen, or mixed) and grassland/herbaceous (17.8 percent). About 7 percent of the site is developed (low intensity, medium intensity, and open space). Minor types (less than 2 percent) are barren, shrub/scrub, cultivated crops, woody wetlands, and emergent herbaceous wetlands.

Comanche Peak site boundaries contain a total of 3,269.78 ac of wetlands, lakes, ponds, and riverine waters (National Wetland Inventory (NWI) data presented in Luminant 2022-TN8655). Table 3-9 summarizes NWI wetlands and surface water features on the Comanche Peak site. Figure 3-5 shows the location of NWI wetlands on the Comanche Peak site.

Table 3-9 Wetlands and Surface Water Features on the Comanche Peak Site

Wetland or Water Feature	Area (ac)	Percent of Onsite Wetland Habitat
Freshwater lakes	2,904.26	88.82
Freshwater forested/shrub wetlands	285.36	8.73
Riverine waters	32.12	0.98
Freshwater ponds	17.80	0.54
Freshwater emergent wetlands	30.24	0.93
Total	**3,269.78**	**100.00**

Source: Luminant 2022-TN8655.

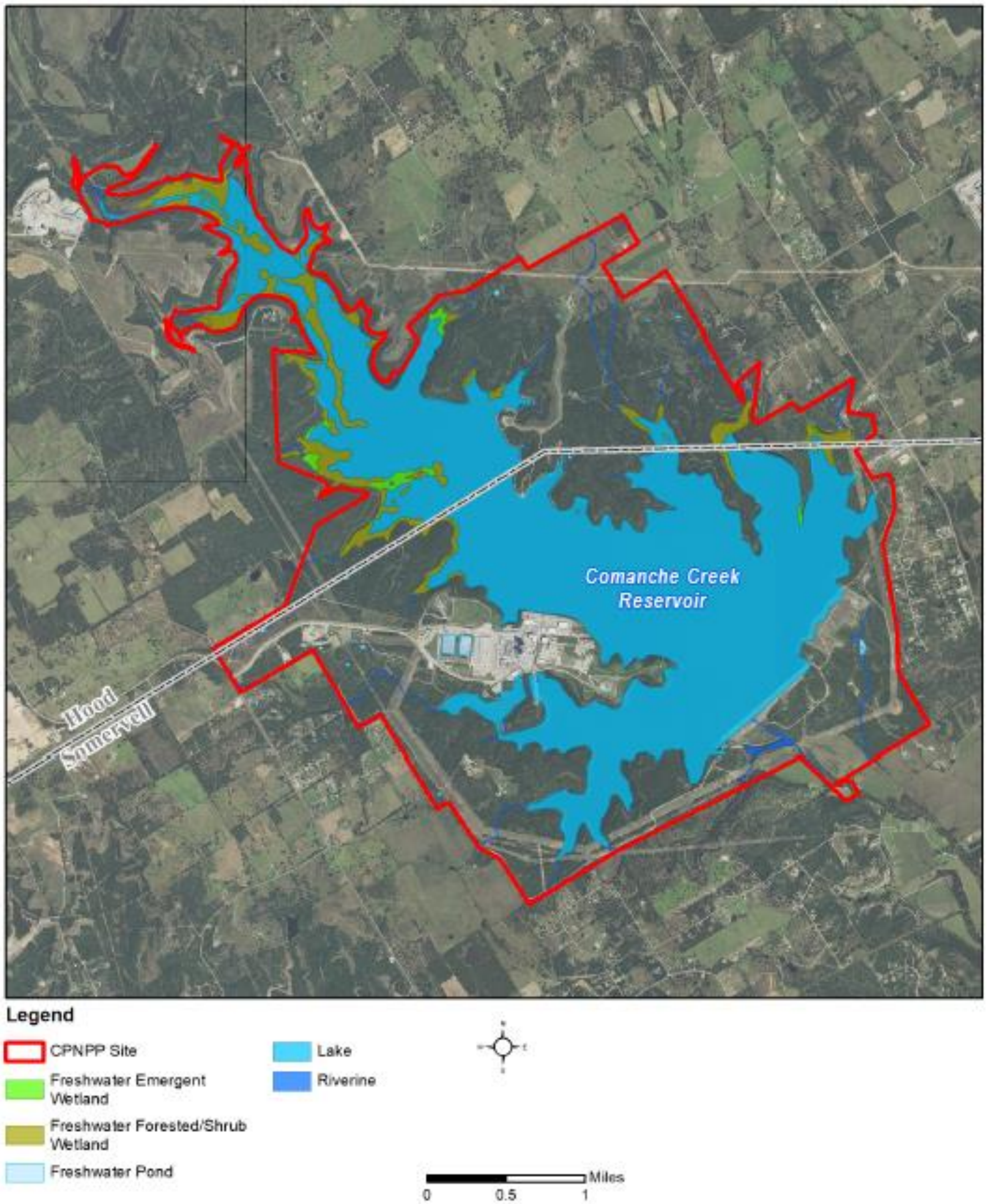


Figure 3-5 National Wetlands Inventory Wetlands Mapped on the Comanche Peak Site. Adapted from: Luminant 2022-TN8655

The wildlife species occurring on the Comanche Peak site consist of species typically found in central Texas forests, woodlands, savannas, developed areas, and riparian areas. Common mammals include white-tailed deer (*Odocoileus virginianus*), coyotes (*Canis latrans*), raccoons (*Procyon lotor*), beavers (*Castor canadensis*), skunks (*Mephitis mephitis*), opossums (*Didelphis virginiana*), armadillos (*Dasypyus novemcinctus*), fox-squirrels (*Scirurus niger*), rabbits (*Oryctolagus cuniculus*), and small rodents. Table 3.7-3 in the ER presents a list of the terrestrial wildlife species likely to occur in Hood or Somervell Counties, and includes 7 amphibians, 35 reptiles (snakes, turtles, lizards, and the American alligator, *Alligator mississippiensis*), 13 mammals, 34 butterflies, and 163 birds (Luminant 2022-TN8655).

The Comanche Peak site offers bird habitats for year-round residents, seasonal residents, and transients (birds stopping briefly during migration). Comanche Peak site is located within the Central flyway, a major migratory bird route that extends from Mexico, the Gulf of Mexico, north through the Great Plains. Migrant birds seek suitable habitats called stopovers to feed, rest, and avoid predators. Comanche Peak site, CCR, and the surrounding areas provide stopover habitat for migrating birds.

3.6.3 Important Species and Habitats

3.6.3.1 Federally Listed Species

For a discussion of terrestrial species and habitats that are federally protected under the Endangered Species Act of 1973, as amended, see Section 3.8, "Special Status Species and Habitats," of this document.

3.6.3.2 State-Listed Species

Vistra (Luminant 2022-TN8655) identified nine State-listed animal species known to occur or potentially to occur in Somervell and Hood Counties. Of these nine State-listed species, four species are also federally listed as threatened or endangered and are addressed in Section 3.8 of this document. Table 3-10 shows four terrestrial State-listed species for Hood and Somervell Counties that are not also federally listed. The four terrestrial State-listed species above include two bird and two reptile species. No State-listed plants occur in Somervell or Hood Counties (TPWD 2023-TN8739).

Table 3-10 State-Listed Species for Hood or Somervell Counties, Texas, Potentially Occurring in the Vicinity of the Comanche Peak Site (That Are not Federally Listed)

Common Name	Scientific Name	Class	State Legal Status
Black Rail	*Laterallus jamaicensis*	Bird	State Threatened
White-Faced Ibis	*Plegadis chihi*	Bird	State Threatened
Texas Horned Lizard	*Phrynosoma cornutum*	Reptile	State Threatened
Brazos Water Snake	*Nerodia harteri*	Reptile	State Threatened

Source: Vistra (Luminant 2022-TN8655 Table 3.7.4, p. 3-189).

Potential habitat for the two State-listed bird species, the black rail and the white-faced ibis, exists along the Brazos River and portions of the CCR. These species, like most native birds, are also protected under the Migratory Bird Treaty Act (TN3331; 50 CFR Part 10-TN5490). According to the ER (Luminant 2022-TN8655, p.3-169 to 3-171) the black rail is not known to occur in the vicinity, but multiple observations of the white-faced ibis have occurred along CCR and the Brazos River.

Habitat for both State-listed reptiles, the Texas horned lizard and the Brazos water snake, occurs in the vicinity, although neither species has been documented onsite (Luminant 2022-TN8655, p. 3-171 to 3-173). Texas horned lizard habitats consist of arid and semiarid habitats with sparse plant cover. A primary prey species for Texas horned lizard is harvester ants, which do occur on the Comanche Peak site. The Brazos water snake occurs in fast-flowing, rocky waters that are free of dense vegetation. The Brazos water snake is known to occur within 6 mi of Comanche Peak.

3.6.3.3 Species Protected Under the Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668 and 668c-TN1447) extends regulatory protections to the bald eagle and golden eagle. The Act prohibits anyone without a permit from the Secretary of the Interior from “taking” bald eagles or golden eagles, including their parts, nests, or eggs.

The ER states that bald eagles and golden eagles have been observed within 6 mi of Comanche Peak site (Luminant 2022-TN8655, p. 3-173 to 3-175). Bald eagles have been observed flying, foraging, and resting on CCR but not on the operation facilities. No nests of either species have been documented onsite. Comanche Peak has no permitting requirements related to eagles for site operations or in-scope transmission lines. Vistra expects to maintain compliance with all Federal requirements protecting bald and golden eagles throughout the LR term.

3.6.3.4 Species Protected Under the Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, any migratory bird or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued under Federal regulations. Vistra follows the MBTA, but it does not hold any MBTA-related permits (Luminant 2022-TN8655, Section 9.5.6) nor does it have an Avian Protection Plan (Luminant 2022-TN8655, Section 3.7.7.2). Vistra evaluates site activities to ensure compliance. Comanche Peak implements deterrents such as anti-nesting measures and routine housekeeping to keep birds away from some operational areas (Luminant 2022-TN8655, Section 3.7.7.2).

Vistra lists 163 birds that are likely to be observed in Hood and Somervell Counties (Luminant 2022-TN8655, Table 3.7-3). The majority of these are migratory birds protected under the MBTA (50 CFR Part 10-TN5490). Four of these birds are listed as Birds of Conservation Concern (BCC; FWS 2021-TN8740). These BCC species include the Harris’s sparrow (*Zonotrichia querula*), lesser yellowlegs (*Tringa flavipes*), red-headed woodpecker (*Melanerpes erythocephalus*), and semi-palmated sandpiper (*Calidris pusilla*).

3.6.3.5 Invasive Species

Invasive species are identified as non-native organisms whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health (EO 13751, 81 FR 88609-TN8375). Executive Order (EO) 13112 (64 FR 6183-TN4477) directs Federal agencies to not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species unless they determine that the benefits of the action clearly outweigh the harm from invasive species and that all feasible and prudent measures to minimize risk of harm are taken (64 FR 6183-TN4477, Section 2).

Vistra identified the following important invasive terrestrial plant and animal species:

- giant reed (*Arundo donax*)
- non-native and hybrid cattails (*Typha angustifolia* and *Typha* x *glauca*)
- wild boar (*Sus scrofa*)

Giant reed propagates quickly and is tolerant of poor growing conditions. This quickly spreading species outcompetes native foliage and does not provide quality wildlife habitat. Although Vistra identified it as a potential species of concern, it has not been found near CCR, and there are no current monitoring or control mitigations plans (Luminant 2022-TN8655).

Like the giant reed, cattails can outcompete native vegetation. Cattails have been documented near CCR, but there are no monitoring or mitigation protocols established for this species by Comanche Peak (Luminant 2022-TN8655).

Wild boar have been observed near Comanche Peak. This species can damage vegetation and soil resources through foraging behavior, which can displace other species. Wild boar are also vectors for parasites and zoonotic diseases. No information is available about the numbers of these feral hogs near Comanche Peak, and Comanche Peak does not have a monitoring or control program (Luminant 2022-TN8655).

3.6.3.6 Important Habitats

Important habitats include any wildlife sanctuaries, refuges, preserves, or habitats identified by State or Federal agencies as unique, rare; or of priority for protection; wetlands and floodplains; and land areas identified as critical habitat for species listed by the Fish and Wildlife Service (FWS) as threatened or endangered. Important habitats on and surrounding the Comanche Peak site include the CCR, wetlands (discussed above in Sections 3.6.1 and 3.6.2), Dinosaur Valley State Park, SPC, and Wheeler Branch Park (Luminant 2022-TN8655, p. 3-150 to 3-151). There are no protected critical habitats on the site or within the vicinity of the Comanche Peak site.

3.6.4 Proposed Action

Table 3-1 and Table 3-2 in this SEIS list the generic (Category 1) and site-specific (Category 2) issues that apply to terrestrial resources at the Comanche Peak Units 1 and 2 during the proposed LR period. The NRC staff did not identify any new and significant information associated with the Category 1 terrestrial resource issues identified in Table 3-1 during the review of the applicant’s ER and available scientific literature, the site audit, and the Federal and State agency and public comments received during the scoping process. As a result, no information or impacts related to these issues were identified that would change the conclusions presented in the LR GEIS (NRC 2013-TN2654). For these issues, the LR GEIS concludes that the impacts are SMALL. Table 3-2 identifies only one site-specific (Category 2) issue related to terrestrial resources during the Comanche Peak LR term: effects on terrestrial resources from non-cooling system impacts. This issue is analyzed below. The Comanche Peak site uses a once-through cooling system to remove waste heat from the reactor steam electric system and plant auxiliary (service water) systems and does not use cooling ponds or cooling towers (see

Section 2.1.3). Therefore, the Category 2 issue identified in the LR GEIS related to the effects of water use conflicts with terrestrial resources does not apply.

Category 2 Issue Related to Terrestrial Resources: Effects on Terrestrial Resources (Non-cooling System Impacts)

According to the LR GEIS, non-cooling system impacts on terrestrial resources can include impacts that result from site and landscape maintenance activities, stormwater management, elevated noise levels, and other ongoing operations and maintenance activities that would occur during the LR period on and near a plant site. The NRC staff based its analysis in this section on information derived from Vistra's ER (Luminant 2022-TN8655), unless otherwise cited. Vistra has not identified any refurbishment activities during the proposed relicensing term (Luminant 2022-TN8655). No further analysis of potential impacts from refurbishment activities is therefore necessary.

In its ER (Luminant 2022-TN8655), Vistra states that it will conduct ongoing operational and maintenance activities at Comanche Peak throughout the LR term, including landscape maintenance activities, stormwater management, piping installation, and fencing. The NRC staff expects that physical disturbance would be limited to paved or disturbed areas or to areas of mowed grass or early successional vegetation and not encroach into wetlands or into the remaining areas of mixed forest. The NRC staff concludes that the anticipated activities would have only minimal effects on terrestrial resources, based on information presented in the ER and the staff's independent analysis.

Vistra (Luminant 2022-TN8655) states that it has administrative controls in place at Comanche Peak to ensure that it reviews operational changes or construction activities and minimizes environmental impacts through BMPs, permit modifications, or new permits, as needed. Vistra (Luminant 2022-TN8655) further states that regulatory programs for issues like stormwater management, spill prevention, dredging, and herbicides further minimize impacts on terrestrial resources. The NRC staff concludes that continued adherence to environmental management practices and BMPs already established for Comanche Peak would continue to protect terrestrial resources during the LR operational period.

The NRC staff presumes that Vistra would continue to comply with applicable requirements of the State of Texas's regulatory programs. Furthermore, the staff presumes that if appropriate, Vistra will obtain required incidental take permits for impacts on bald eagles.

Operational noise from Comanche Peak site facilities extends into the remaining natural areas on the site. However, Comanche Peak has exposed these habitats to similar operational noise levels since it began construction approximately 55 years ago. The NRC staff therefore expects that wildlife in the affected habitats have long ago acclimated to the noise and human activity of Comanche Peak operations and adjusted behavior patterns accordingly. Extending the same level of operational noise levels during the 20-year LR period is therefore unlikely to noticeably change the patterns of wildlife movement and habitat use.

Based on its independent review, the NRC staff concludes that the landscape maintenance activities, stormwater management, elevated noise levels, and other ongoing operations and maintenance activities that Vistra might undertake during the LR term would primarily be confined to already disturbed areas of the Comanche Peak site. These activities would neither have noticeable effects on terrestrial resources nor would they destabilize any important attribute of the terrestrial resources on or in the vicinity of the site. Accordingly, the NRC staff concludes that non-cooling system impacts on terrestrial resources during the relicensing term would be SMALL.

3.6.5 No-Action Alternative

Under the no-action alternative, the NRC would not issue a renewed license, and Comanche Peak would shut down on or before the expiration of the current facility operating licenses. Much of the operational noise and human activity at Comanche Peak would cease, thereby reducing disturbance to wildlife in forest cover, grasslands, wetlands, and other natural vegetation on and near the site. However, some continued maintenance of Comanche Peak would still be necessary; thus, at least some human activity, noise, and herbicide application would continue at the site with possible impacts resembling, but perhaps of a lower magnitude than, those described for the proposed action. Shutdown itself is unlikely to noticeably alter terrestrial resources. Reduced human activity and frequency of operational noise may constitute minor beneficial effects on wildlife inhabiting nearby natural habitats. The NRC staff therefore concludes that the impacts of the no-action alternative on terrestrial resources during the proposed LR term would be SMALL.

3.6.6 Replacement Power Alternatives: Common Impacts

Additional land would likely be temporarily disturbed for construction and laydown areas. If not already previously disturbed, the licensee could later revegetate temporarily disturbed land. The natural gas alternative and the combination alternative would also involve construction on developed or undeveloped lands outside the vicinity of the Comanche Peak site with indeterminate loss of off-site forest, grasslands, or wetlands.

Loss of habitat and increased noise generation during construction and operation of the new facilities could cause terrestrial wildlife to move into other habitats in the surrounding landscape, increasing demands on those habitats and competing with other wildlife. Erosion and sedimentation from clearing, leveling, and excavating land could affect adjacent riparian and wetland habitats. However, implementation of appropriate BMPs and revegetation of temporarily disturbed lands would minimize impacts.

The NRC assumes that the applicant would conduct required ecological surveys and develop any needed mitigation plans for any protected terrestrial species. The applicant would also have to conduct wetland delineations of affected lands and apply for permits for any wetland fill from USACE and the Texas Parks and Wildlife Department. The NRC staff expects that any Federal or State permits authorizing wetland impacts would require mitigation. Wetland losses of this magnitude can typically be mitigated through various forms of compensatory wetland mitigation, such as mitigation banks.

3.6.7 New Nuclear (Small Modular Reactors) Alternative

For the new nuclear alternative, the NRC assumes that the applicant would replace Comanche Peak Units 1 and 2 with six SMRs, each with 400 MWe generating capacity. Using the assumption that a SMR alternative would be consistent with Vistra’s ER, the SMR facility and MDCTs would be sited on a 275 ac (111 ha) parcel on the Comanche Peak site, on a peninsula northwest of the existing power block. The BDTF filtration buildings, evaporation ponds, and storage ponds would be sited on two parcels totaling 400 ac (161 ha) south of the Comanche Peak site boundary. Source water would be the same as existing units: CCR with makeup water from Lake Granbury. Discharge from the BDTF would be to Lake Granbury. No new transmission corridors would be built.

The three parcels proposed for the SMR and BDTF total 675 ac (273 ha). The SMR facility and cooling towers would require approximately 220 ac (89 ha), using the same construction footprint on the Comanche Peak site considered for Comanche Peak Units 3 and 4. The footprint of the blow down treatment facility would cover approximately 175 ac (70 ha) of the two parcels south of the Comanche Peak site boundary. In addition, the BDTF would require an additional 81 ac (32 ha) ground disturbance along the shoreline to install discharge piping and to construct a new discharge structure. The total area permanently converted from vegetated to developed is approximately 476 ac (193 ha).

Vistra (Luminant 2022-TN8655, Section 7.2.3.2.7) stated that the three parcels that would support the SMR and associated facilities are vegetated. Dominant cover type is Ashe juniper woodland-savanna. Figure 3-5 shows a freshwater forested/shrub wetland on the edge of the northwestern peninsula and possible riverine wetland extending into the southern parcels that would support the BDTF.

Clearing the forested areas of the three parcels would displace forest-associated wildlife to surrounding forest habitats. More mobile species would be able to reach forested areas in the vicinity or region, whereas less mobile species would likely be limited to the forested areas on the east side of the Comanche Peak site boundary.

Because the new nuclear SMR facility would use existing Comanche Peak transmission lines, the NRC staff expects no increased potential for wildlife injury from transmission lines. However, the SMR cluster will require adding new, tall structures to the landscape, including MDCTs, 65 ft (20 m) in height, and a power block, 160 ft (50 m) in height. The addition of tall structures on the Comanche Peak site may result in increased bird and bat mortality or injury from collisions. However, the NRC staff expects that bird and bat populations would become accustomed to the presence of the towers and avoid them.

The NRC staff recognizes that the three parcels provide habitat for terrestrial wildlife (Section 3.6.2), for important State-protected species (Table 3-9), and for other protected species and habitats (Section 3.6.3). Construction noise could affect wildlife in adjoining forested areas and wetlands. Operational noise from the new cooling towers could also affect wildlife.

Once the SMR and associated facilities are built, operational impacts on terrestrial resources would likely remain as expected for the proposed action. Based on the preceding analysis, the NRC staff concludes that impacts on terrestrial resources from the new nuclear option of six SMRs would be SMALL to MODERATE for construction and SMALL for operations.

3.6.8 Natural Gas Combined-Cycle Alternative

For the NGCC alternative, the NRC assumes that the applicant would replace the generating capacity of Comanche Peak Units 1 and 2 with four combined-cycle combustion turbines with a net capacity of approximately 615 MW/unit. The NGCC facility and cooling towers would be sited on a 275-ac (111-ha) parcel on the Comanche Peak site, on a peninsula northwest of the existing power block (Luminant 2022-TN8655, 2023-TN8692). The BDTF filtration buildings, evaporation ponds, and storage ponds would be sited on two parcels totaling 400 ac (161 ha) south of the Comanche Peak site boundary. Source water would be the same as existing units:

CCR with makeup water from Lake Granbury. Discharge from the BDTF would be to Lake Granbury. No new transmission corridors would be built. The NRC assumes that only a short natural pipeline would be needed to tie into two existing pipelines that cross the site north–south and east–west.

The three parcels proposed for the natural gas facility and BDTF total 675 ac (273 ha). The SMR facility and cooling towers would require approximately 120 ac (48 ha). The footprint of the BDTF facilities would cover approximately 40 ac (16 ha) of the two parcels south of the Comanche Peak site boundary. The BDTF would require additional 81 ac (32 ha) ground disturbance along the shoreline to install discharge piping and to construct a new discharge structure.

Vistra (Luminant 2022-TN8655) stated that the three parcels that would support the SMR and associated facilities are vegetated. Dominant cover type is Ashe juniper woodland-savanna. NWI Wetland map of the Comanche Peak site (Figure 3-5) shows a freshwater forested/shrub wetland on the edge of the northwestern peninsula and possible riverine wetland extending into the southern parcels that would support the BDTF facilities.

Clearing the forested areas of the three parcels would displace forest-associated wildlife to surrounding forest habitats. More mobile species would be able to reach forested areas in the vicinity or region, whereas less mobile species would likely be limited to the forested areas on the east side of the Comanche Peak site boundary.

Because the natural gas facility would use existing Comanche Peak transmission lines, the NRC staff expects no increased potential in wildlife injury from transmission lines. However, the natural gas plant will require adding new, tall structures to the landscape. The addition of tall structures on the Comanche Peak site might result in increased bat or bird mortality or injury from collisions. However, the NRC staff expects that bird and bat populations would become accustomed to the presence of the towers and avoid them.

The NRC staff recognizes that the three parcels provide habitat for terrestrial wildlife (Section 3.6.2), for important State-protected species (Table 3-9), and for other protected species and habitats (Section 3.6.3). Construction noise could affect wildlife in adjoining forested areas and wetlands. Operational noise from the new cooling towers could also affect wildlife.

Once the SMR and associated facilities are built, operational impacts on terrestrial resources would likely be the same as those expected for the proposed action. Based on the preceding analysis, the NRC staff concludes that impacts on terrestrial resources from the NGCC alternative would be SMALL to MODERATE for construction and SMALL for operations.

3.6.9 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

The combination alternative includes about 1,200 MWe from solar PV with battery storage, 800 MWe from onshore wind generation with battery storage, and 40 MWe from new nuclear (SMR), for a total replacement of 24,000 MWe. The total land area required to support this alternative is approximately 141,157 ac (57,124 ha).

Solar Photovoltaic

Impacts on terrestrial habitats and biota from the construction and operation of solar PV plants as part of the combination alternative would depend largely on the amount of land required and the location of the land. The NRC staff estimates that the solar portion of the alternative would require 19,000 ac (7,689 ha) of cleared land for 24 solar PV plants in the Comanche Peak region of influence with access to Vistra transmission infrastructure. If the lands chosen for the plants were previously cleared and used for industrial activity, the impacts on terrestrial resources would be less significant than if the lands were forests or grasslands containing important species and habitats. Vegetation clearing and tree removal would displace wildlife to nearby habitats though some species would return at the end of construction when temporarily disturbed land is restored.

Operation of solar PV plants would likely cause the injury and/or death of birds and bats from collisions with solar panels or powerlines or electrocutions on poles and powerlines (Walston et al. 2016-TN8743). The majority of bird deaths at solar farms tend to be songbirds (Smallwood 2022-TN8742). Roadrunner, other ground bird, and bat deaths also occur from solar fence collisions and subsequent predation (Smallwood 2022-TN8742; Katzner et al. 2020-TN8744). Shorebirds and waterbirds sometimes perceive the horizontally polarized light of PV solar panels as bodies of water and are injured or killed when they attempt to land on the panels as if they were water (Kosciuch et al. 2021-TN8745).

The MBTA makes it illegal to take any migratory bird (or parts, nests, or eggs) except under a valid permit issued under Federal regulations. The utility would likely need to commission avian impact studies and obtain a permit for take of MBTA-protected bird species. The Multiagency Avian-Solar Collaborative Working Group is a collection of Federal and State agencies identifying information needs and best practices for reducing avian impacts from solar energy. Collaboration with government agencies on best practices in the construction and siting of the solar installations can mitigate their impacts on birds.

Based on the preceding analysis, the NRC staff concludes that impacts on terrestrial resources from construction and operation of 24 solar photovoltaic plants would be MODERATE to LARGE. Construction of the solar plants would result in the significant loss of vegetation and wildlife habitat, and operational impacts would negatively affect bird and bat populations.

Onshore Wind

Impacts on terrestrial habitats and biota from the construction and operation of onshore wind farms as part of the combination alternative would depend largely on the amount of land required and the location of the land. The NRC staff estimates that the onshore wind portion of the alternative would require 122,000 ac (49,000 ha) of land for 12 onshore wind plants in the Comanche Peak region of influence with access to Vistra transmission infrastructure. If the lands chosen for the plants were previously cleared and used for industrial activity, the impacts on terrestrial resources would be less significant than if the lands were forests or grasslands containing important species and habitats. Vegetation clearing and tree removal would displace wildlife to nearby habitats though some species would return at the end of construction when temporarily disturbed land is restored.

Not all the land required to operate 12 onshore wind farms would be disturbed or developed. Assuming 1.7 ac (0.69 ha) of temporary disturbance per MW of generation, 0.7 ac (0.3 ha) per megawatt of permanent disturbance, and 240 ac (97 ha) of permanent disturbance for battery storage, the NRC estimates that 2,450 ac (991 ha) would be temporarily disturbed, and 1,250 ac (506 ha) would be permanently disturbed for turbine towers, access roads, battery storage, and powerline corridors for power generation and distribution.

Operation of onshore wind farms would likely cause the injury and/or death of bats and birds that collide with wind turbines (Allison et al. 2019-TN8847). Species composition of deaths varies regionally. Bat collision mortality appears to be largest for migratory tree-roosting species and lowest in areas with greatest grassland cover around the onshore wind farm (Thompson et al. 2017-TN8746). Most of the observed bird deaths at onshore wind farms are small songbirds (57 percent of deaths) or diurnal raptors (9 percent). The MBTA makes it illegal to take any migratory bird (or parts, nests, or eggs) except under a valid permit issued under Federal regulations. The utility would likely need to commission avian impact studies and obtain a permit for take of MBTA-protected bird species.

Based on the preceding analysis, the NRC staff concludes that impacts on terrestrial resources from construction and operation 12 onshore wind farms would be MODERATE to LARGE. Construction of the wind farms would result in the significant loss of vegetation and wildlife habitat, and operational impacts would negatively impact bird and bat populations.

New Nuclear (Small Modular Reactor)

The terrestrial impacts of the construction and operation of one SMR as part of the combination alternative would be similar to but less than the terrestrial impacts described above for the new nuclear alternative consisting of six SMRs (Section 3.5.6), Total land permanently developed would be approximately 157 ac (63.5 ha), instead of 476 ac (193 ha) for six SMR modules. The locations of the SMR and associated facilities would be the same. SMR and cooling towers would be on the Comanche Peak site, northwest of the existing power block. The BDTF footprint would be smaller in area and would be sited on two parcels south of the Comanche Peak site boundary.

Because of the reduced area developed, there would likely be a shorter period of construction activity and associated noise that would disturb wildlife. Construction of new tall structures (cooling tower and power block) would likely result in increased bird and bat collisions. Operational noise from the cooling tower might also disturb wildlife.

Once the SMR and associated facilities are built, operational impacts on terrestrial resources would likely remain as expected for the proposed action. Based on the preceding analysis and the conclusion of Section 3.5.6, the NRC staff concludes that impacts on terrestrial resources from construction and operation of one SMR would be SMALL.

Combination Alternative Conclusion

Based on the above discussion of SMR, solar, and offshore wind, the NRC staff concludes that the overall impacts on terrestrial resources from the combination alternative could range from MODERATE to LARGE, mainly because of the large area of land and the types of land that could be used for the solar PV and onshore wind portions, as well as the operational impacts on birds and bats.

3.7 <u>Aquatic Resources</u>

This section describes the aquatic resources of the affected environment, including CCR and Lake Granbury. Pages 3-177 and 3-178 of Vistra's ER describe the aquatic resources of the site and vicinity (Luminant 2022-TN8655). This information is incorporated here by reference with key information summarized in the sections below. Following the description of each aquatic environment, the staff analyzes the potential impacts of the proposed action (license renewal) and alternative on these resources.

3.7.1 Comanche Creek Reservoir

CCR is a 3,272 ac (1,324 ha) impoundment of Comanche Creek that lies about 4 mi (6.4 km) north of Glen Rose, Texas (Luminant 2022-TN8655). CCR was constructed in the 1970s to provide a cooling source for Comanche Peak. It is designated as an industrial cooling impoundment by the TCEQ (see Section 3.7.3.1). Comanche Peak routinely discharges water below the CCR Dam to maintain a minimum streamflow of 1.5 cfs) or 0.042 m^3/s. Comanche Peak maintains water rights to withdraw supplemental water from Lake Granbury (see Section 3.7.3.1) and to pump that water into CCR to maintain an adequate water level for cooling water withdrawals. CCR is considered mesotrophic (TPWD 2019-TN8747), which means that it is a moderately productive ecosystem. CCR is privately owned by Vistra, but it is open to the public for sportfishing. No commercial fishing is allowed. The Texas Parks and Wildlife Department (TPWD) began stocking CCR with forage fish and gamefish after impoundment was completed in 1979 in order to create a recreational fishery (TPWD 2019-TN8747). TPWD stopped stocking CCR in 1996, and the recreational fishery now relies upon natural reproduction of the reservoir's fish populations (TPWD 2019-TN8747).

The reservoir can be divided into two distinct sections. The first is the main body of CCR. This is the portion that Comanche Peak uses for cooling water intake and discharge during normal operations (Luminant 2023-TN8692). The second is the portion of the reservoir that is considered the SSI (Safe Shutdown Impoundment). The SSI constitutes a 45 ac (18.2 ha) impoundment of the CCR right next to Comanche Peak. It provides service water to Comanche Peak and is the emergency source of cooling water if there is a loss of water in the CCR. An equalization channel allows water exchange between the CCR and SSI at normal operating pool, but there is a concrete weir located 4 ft (1.2 m) below the surface that keeps water levels in the SSI high even if the CCR water levels drop. A barrier in the SSI minimizes the entry of fish and debris from the CCR to the SSI (Luminant 2022-TN8655); however, cross-migration is still possible, and the species compositions of the SSI and CCR are similar (Luminant 2023-TN8692; TPWD 2019-TN8747).

Vistra has monitored the SSI since the early 2000s due to NRC concerns that the Harris mud crab (*Rhithropanopeus harrisii*), an invasive species, could block cooling water intake flow from the SSI in the event of emergency withdrawals (Luminant 2023-TN8692). Section 3.7.3.1 describes this monitoring in more detail.

3.7.1.1 Biological Communities of CCR

The trophic structure of CCR includes primary producers (plankton, macrophytes, and periphyton), primary consumers (zooplankton and benthic macroinvertebrates), and bottom-feeding, planktivorous, and piscivorous fish that serve as secondary and tertiary consumers. Primary producers are organisms that capture solar energy and synthesize organic compounds from inorganic chemicals. They form the trophic structure's foundation by producing the organic nutrients and energy used by consumers. Primary producers in reservoir systems include phytoplankton, aquatic macrophytes, and periphyton. Of the three, phytoplankton are the major producers in all but very shallow lakes and reservoirs. Figure 3-6 illustrates the trophic structure of CCR.

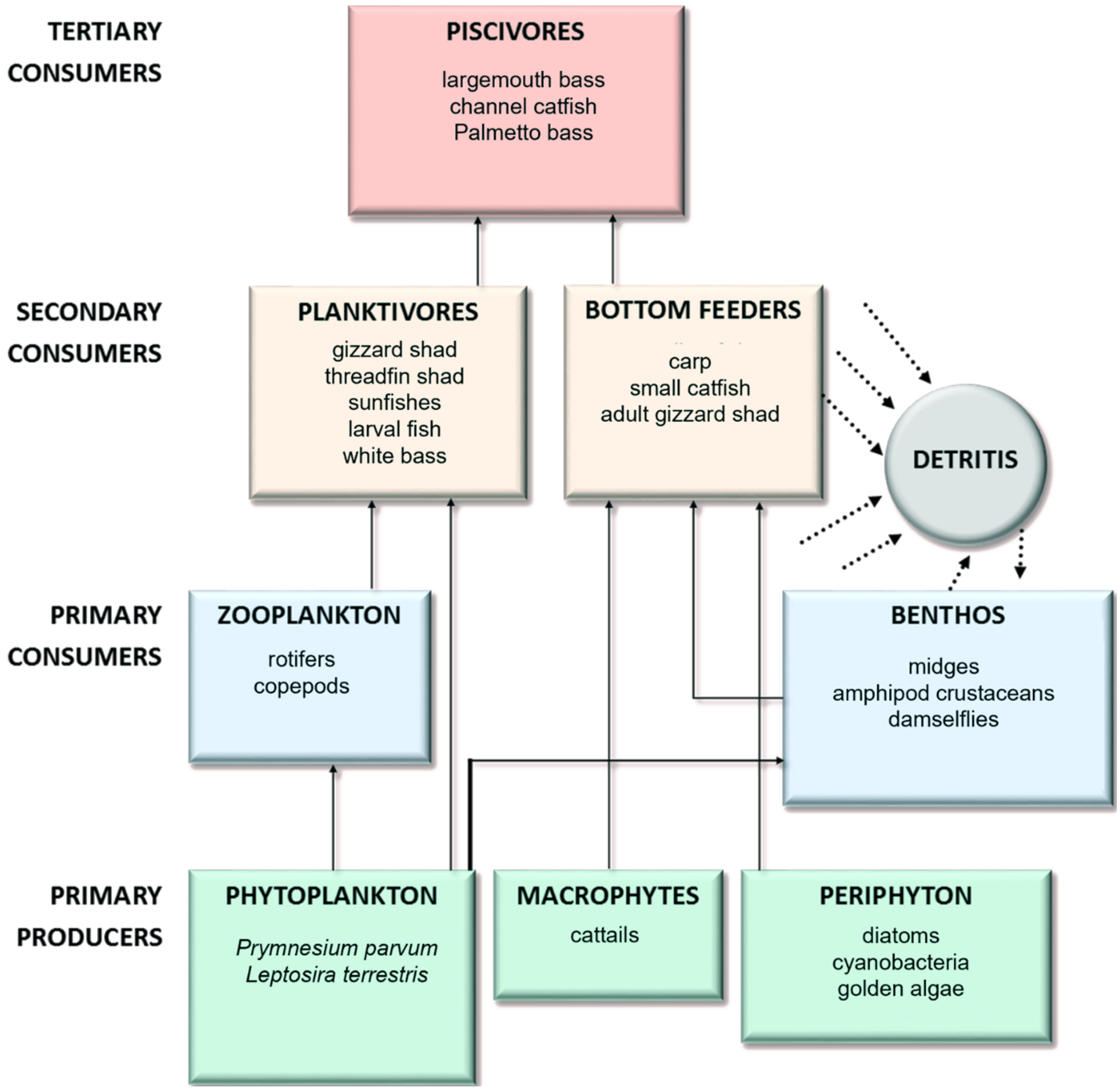


Figure 3-6 Trophic Structure of the Comanche Creek Reservoir Aquatic Ecosystem

3.7.1.2 Plankton

Plankton are small and often microscopic organisms that drift or float in the water column. Phytoplankton are single-celled plant plankton and include diatoms (single-celled yellow algae) and dinoflagellates (a single-celled organism with two flagella). Phytoplankton live suspended in the water column and occur in the limnetic (open water) zone of a lake. A 2008 CCR characterization study identified two taxa of phytoplankton in the reservoir: *Prymnesium parvum* and *Leptosira terrestris* (Enercon 2008-TN8748).

Zooplankton are animals that either spend their entire lives as plankton (holoplankton) or exist as plankton for a short time during development (meroplankton). Zooplankton include rotifers, isopods, protozoans, marine gastropods, polychaetes, small crustaceans, and the eggs and larval stages of insects and other aquatic animals. Table 3-11 shows seasonal abundance (counts of individuals) of zooplankton collected in 2008. Researchers collected seven taxa of zooplankton during this characterization study. Rotifers (*Rotifera* spp.) and copepods (*Nauplii* spp.) dominated collections (Enercon 2008-TN8748).

Table 3-11 Seasonal Comanche Creek Reservoir Zooplankton Abundance, 2008

Genus	Winter	Spring	Summer	Fall	Total	Percent
Cyclopoida	160	19	1,468	446	2,093	13.7
Calanoida	2	9	125	20	156	1.0
Nauplii	1,439	201	2,486	1,332	5,458	35.8
Rotifera	1,900	2,126	363	2,436	6,825	44.7
Bosminidae	3	-	11	5	19	0.1
Daphniidae	47	1	612	11	671	4.4
Conchostraca	-	-	6	29	35	0.2

Source: Enercon 2008-TN8748.

3.7.1.3 Macrophytes and Periphyton

Aquatic macrophytes are large plants, both emergent and submerged, that inhabit shallow water areas. Periphyton consist of single-celled or filamentous species of algae that attach to benthic or macrophytic surfaces. Macrophytes and periphyton occur in the littoral (nearshore and shallow) zone. They tend to be highly productive because they have more access to nutrients through their roots than do phytoplankton. Macrophytes within CCR include scattered groups of cattails (*Typha* spp.) (TPWD 2019-TN8747; Enercon 2008-TN8748).

3.7.1.4 Benthic Invertebrates

Benthic invertebrates inhabit the bottom of the water column and its substrates. They include macroinvertebrates (clams, crabs, oysters, and other shellfish) as well as certain zooplankton, such as polychaetes. Researchers identified 59 different genera of invertebrates during the 2008 characterization study of CCR (Enercon 2008-TN8748). Midges (*Chironomidae* family) were the most numerous (over 90 percent of captured individuals in each sampling season) and the most diverse (18 out of the 59 genera) of the invertebrates.

3.7.1.5 Ichthyoplankton

Because CCR is a closed system, ichthyoplankton of all aquatic species that inhabit the lake are present. Vistra last conducted ichthyoplankton sampling in CCR in 1994 in connection with CWA Section 316(b) requirements to characterize entrainment (Foster Wheeler 1995 in Luminant 2023-TN8692, Enclosure 8). Researchers collected ichthyoplankton samples by towing a 1.6 ft (0.5 m) net with 500-micron mesh in the vicinity of the intake at CCR. Samples yielded ichthyoplankton of gizzard shad (*Dorosoma cepedianum),* threadfin shad (*Dorosoma petenense),* largemouth bass (*Micropterus salmoides),* channel catfish (*Ictalurus punctatus)*, mixed sunfish species (*Lepomis* spp.*)*, mixed crappie species (*Pomoxis* spp.*),* freshwater drum (*Aplodinotus grunniens),* and inland silverside (*Menidia beryllina*). Section 3.7.1.3 this EIS discusses the results of this study in more detail.

3.7.1.6 Juvenile and Adult Fish

Twenty-two species of fish have been captured during CCR fish surveys (Table 3-12). As previously described, CCR was created in the 1970s to create a cooling water source for Comanche Peak. The TPWD then stocked it with gamefish, including channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), palmetto bass (a hybrid between white bass (*Morone chrysops*) and striped bass (*Morone saxatilis*), smallmouth bass (*Micropterus dolomieu*), and walleye (*Sander vitreus*). The TPWD also stocked threadfin shad as a forage fish (Luminant 2023-TN8692). Stocking continued until 1991. The species that persist are present through natural reproduction.

Largemouth bass, channel catfish, and sunfish continue to be important recreational fishing species. Catch rates of these species in gill net surveys from 1990 through 2019 indicate stable population abundances (Table 3-12). Walleye, smallmouth bass, and palmetto bass are no longer present according to fish surveys conducted by TPWD (Table 3-12). Walleye and smallmouth bass are regarded as cooler water species that were unable to sustain their populations in the warmer water conditions of the CCR without stocking (Luminant 2022-TN8655).

Table 3-12 Catch Rates of Fish in the Comanche Creek Reservoir in Texas Parks and Wildlife Department Gillnet Surveys, 1990–2019 (Expressed as Number Caught Per 5 Net Nights)

Common Name	Scientific Name	1990	1994	1997	2011	2015	2019
Black bullhead	*Ameiurus melas*	-	-	-	-	-	-
Bluegill sunfish	*Lepomis macrochirus*	0.6	1.8	4.2	0	0	0.4
Channel catfish	*Ictalurus punctatus*	4.2	15	18.4	30.2	15.4	10
Common carp	*Cyprinus carpio*	-	-	-	-	-	-
Flathead catfish	*Pylodictis olivaris*	0	0.4	0	0.4	0	0
Freshwater drum	*Aplodinotus grunniens*	-	-	-	-	-	-
Gambusia	*Gambusia* spp.	-	-	-	-	-	-
Gizzard shad	*Dorosoma cepedianum*	24.6	31.6	13.4	0	0	8.6
Green sunfish	*Lepomis cyanellus*	0	0	0.6	0	0	0.2
Inland silverside	*Menidia beryllina*	-	-	-	-	-	-
Largemouth bass	*Micropterus salmoides*	2	2	6	1.4	5.4	10.6
Longear sunfish	*Lepomis megalotis*	-	-	-	-	-	-
Palmetto bass (hybrid)	*Morone chrysops x M. saxatilis*	0	0	4.8	0	0.4	0
Redear sunfish	*Lepomis microlophus*	0	0.2	0	0	0	0
Smallmouth bass	*Micropterus dolomieu*	0.7	1.4	0	0	0	0
Spotted bass	*Micropterus punctulatus*	3	0.4	0	0	0	0
Threadfin shad	*Dorosoma petenense*	5.2	0	0	0	0	0
Tilapia	*Oreochromis spp.*	0	0	0	0.2	0	32.4
Warmouth	*Lepomis gulosus*	0	0.2	0.4	0	0	0
Western mosquitofish	*Gambusia affinis*	-	-	-	-	-	-
White Bass	*Morone chrysops*	5	0.8	0.2	2.8	0	0
Yellow bullhead	*Ameiurus natalis*	-	-	-	-	-	-

- = present in 2008 CCR Characterization Study but not in TPWD reports.
Sources: TPWD 2019-TN8747 and Enercon 2008-TN8748

Separate from the TPWD's stocking efforts, Vistra stocked palmetto bass, a sterile hybrid, to manage threadfin shad populations. This species appears to have died off following the original stocking attempts; Vista last stocked this species in the CCR in 1996 (Luminant 2023-TN8692). Vistra also stocked palmetto bass in the SSI in 2013 and 2014 (Foster Wheeler 1995 in Luminant 2023-TN8692, Enclosure 6).

The main forage stocks in CCR include gizzard and threadfin shad (Luminant 2022-TN8655; TPWD 2019-TN8747; Enercon 2008-TN8748). As described above, overpopulation and die-offs of threadfin shad in the SSI have been a concern because an overabundance of dead fish could block the flow of SSI water used for emergency cooling water. Gizzard shad have been abundant in gillnet fishery surveys, but threadfin shad are generally too small (~1 in. [2.5 cm]) to be caught by gillnets (TPWD 2019-TN8747). Threadfin shad have overpopulated the SSI and are probably abundant in the CCR as well because their life history is similar to that of gizzard shad.

3.7.1.7 Important Species and Habitats of CCR

This section summarizes important fisheries of CCR as well as State-protected and other special status species. Section 3.8 discusses federally listed species separately; however, none occur in CCR.

3.7.1.8 Commercially Important Fisheries

Commercial fishing is not permitted on CCR. Thus, there are no commercially important fisheries.

3.7.1.9 Recreationally Important Fisheries

CCR is a popular sport fishing location that is available to the public (Luminant 2022-TN8655). The primary species sought by recreational fishers are largemouth bass, channel catfish, and mixed sunfish species. These species each exhibit stable populations based on survey data collected between 1990 and 2019. In addition, length composition data indicate a good balance of large spawning size fish and new juvenile recruits (Enercon 2008-TN8748). TPWD maintains a fishery management plan for CCR that includes management strategies and fishing regulations, as well as information about stocking history and gill net survey results (TPWD 2019-TN8747).

3.7.1.10 State-Protected and Other Special Status Species

In Texas, species of conservation concern may be listed as threatened or endangered under the authority of State law (TAC 65.175-176 and TAC 69.8). Species may be listed as State threatened or endangered and not federally listed. The Texas Conservation Action Plan also provides a roadmap for addressing Species of Greatest Conservation Need (TPWD 2012-TN8750, TPWD Undated-TN8751).

No State-listed or Species of Greatest Conservation Concern were identified in CCR by Vistra (Luminant 2022-TN8655), in TPWD surveys (TPWD 2019-TN8747), or in the 2008 CCR Characterization Study (Enercon 2008-TN8748). Although the Texas fawnsfoot (*Truncilla macrodon*) and Brazos heelsplitter (*Potamilius streckersoni),* which are State-listed species, occur in the vicinity of Comanche Peak, these species are not known to occur in CCR.

3.7.1.11 Invasive and Nuisance Species of CCR

Non-native species are those species that are present only because of introduction and that would not naturally occur either currently or historically in an ecosystem. Invasive species are non-native organisms whose introduction causes or is likely to cause economic or environmental harm or harm to human, animal, or plant health (81 FR 88609-TN8375). For purposes of this discussion, nuisance species are non-native species that alter the environment but that do not rise to the level of being considered invasive.

Vistra considers several aquatic species as concerns because of their potential to affect withdrawal of emergency cooling water from the SSI (Luminant 2022-TN8655; Freese and Nichols 2019 in Luminant 2023-TN8692, Enclosure 6). During the initial licensing period, the main concerns were Asian clams (*Corbicula fluminea*) and filamentous algae, both of which can biofoul intake screens. Vistra has periodically used Bulab, a pesticide for bivalves, to control Asian clams and blue inert dye to limit growth of filamentous golden algae (Freese and Nichols 2019 in Luminant 2023-TN8692, Enclosure 6). In 2007, the NRC became concerned that Harris mud crabs that were introduced from marine estuaries could block the flow of cooling water through pump strainers. In 2011, the NRC then recognized that die-offs of threadfin shad (*Dorosoma petenense*) due to golden algal blooms (*Prymnesium parvum*) in the SSI could hinder withdrawal of emergency cooling water from the SSI and cause a safety hazard. In response, Vistra began using Rotenone, a fish poison, and stocked palmetto bass to reduce shad populations in the SSI (Freese and Nichols 2019 in Luminant 2023-TN8692). Zebra mussels (*Dreissena polymorpha*) have not been detected in the SSI yet, but they are a species of concern because they have been found in Lake Waco downstream of Comanche Peak. Tilapia (*Oreochromis niloticus),* an invasive species from Africa, were introduced into CCR around 2010 and have rapidly increased in abundance since then (Freese and Nichols 2019 in Luminant 2023-TN8692, Enclosure 6; TPWD 2019-TN8747). Vistra monitors tilapia populations in the SSI because they could become an operational concern, similar to shad, and may be subject to mitigation in the future.

Vistra has conducted regular monitoring of these species since 2011 and has implemented mitigation measures to control Asian clams, filamentous algae, and threadfin shad (Luminant 2022-TN8655). Vistra will continue to monitor these species during the proposed LR period and take mitigative actions, as needed (Luminant 2022-TN8655).

Other invasive species in CCR include Hydrilla *(Hydrilla verticillate)* and common carp *(Cyprinus carpio) (*Luminant 2022-TN8655; Enercon 2008-TN8748*).* Hydrilla is a noxious aquatic plant that can form dense mats that clog waterways, block intakes, and outcompetes native vegetation. Common carp can destroy vegetation, increase turbidity by foraging on the bottom, and consume fish eggs. Hydrilla and common carp have not risen to levels that warrant mitigation in the CCR.

3.7.2 Lake Granbury

Granbury Reservoir is an 8,282 ac (3,350 ha) impoundment of the Brazos River that was built in 1969. The primary human uses of Lake Granbury are storage for flood control, municipal water supply, recreation, cooling waters for a natural gas plant, and makeup cooling water for Comanche Peak. Lake Granbury is a eutrophic reservoir, which means that it is a nutrient-rich and high productivity system. The aquatic biota of Lake Granbury and CCR are similar.

Lake Granbury is the primary makeup water source for maintaining adequate water levels in CCR required for Comanche Peak cooling water needs (see Section 3.5.1). Vistra pumps water from Lake Granbury through a pipeline that contains protective screens with 0.25 in. (0.064 cm) diameter bars spaced 2 in. (5.1.cm) apart to the northeastern cove of CCR.

Section 3.5.1 describes that Vistra pumps approximately 47,555 ac-ft/yr (19,244 ha-ft/yr) of supplemental water from Lake Granbury to CCR to maintain water levels for Comanche Peak operations (Luminant 2022-TN8655). Vistra has a Certificate of Adjudication from the TCEQ for this pumping.

3.7.2.1 Biological Communities of Lake Granbury

The aquatic communities of CCR and Lake Granbury are similar in habitat, fish species composition, and fishery abundance trends. However, survey data for Lake Granbury are sparser than for CCR. The staff reviewed information from TPWD and Texas A&M to describe Lake Granbury aquatic biota (TWDB 2016-TN8707; TAM 2010-TN8752). The same forage and gamefish stocks reside in both Lake Granbury and CCR, except that white crappie (*Pomoxis annularis*) and striped bass are more commonly found in Lake Granbury (Table 3-13). Similar to the CCR, the main forage fish in Lake Granbury are threadfin shad, gizzard shad, and sunfishes. Like CCR, the Lake Granby forage and gamefish populations are healthy and diverse based on time series of relative abundance (catch rates), species compositions, and length compositions from TPWD survey data (TPWD 2021-TN8755).

Table 3-13 Fish Catch Rates and Stocking Histories in Lake Granbury

Common Name	Species	Years Stocked	Survey Gear	2012–2013	2017–2018	2020–2021
Bluegill sunfish	*Lepomis macrochirus*	–	electrofishing	8.7	45	38
Blue catfish	*Ictalurus furcatus*	1991	gill nets	0.1	1.5	2.1
Channel catfish	*Ictalurus punctatus*	1969–1993	gill nets	6	11	6
Flathead catfish	*Pylodictis olivaris*	–	gill nets	0.2	0.4	0.4
Gizzard shad	*Dorosoma cepedianum*	–	electrofishing	151	226	320
Green sunfish	*Lepomis cyanellus*	–	electrofishing	0	7.6	2.4
Largemouth bass	*Micropterus salmoides*	1969–2018	electrofishing	34.7	52	31
Longear sunfish	*Lepomis megalotis*	–	electrofishing	0.7	23	18
Redear sunfish	*Lepomis microlophus*	–	electrofishing	0	10	2.4
Spotted ass	*Micropterus punctulatus*	–	electrofishing	0	0.8	0
Striped bass	*Morone saxatilis*	1972–2022	gill nets	0.1	2.3	3.4
Threadfin shad	*Dorosoma petenense*	–	electrofishing	0	6.4	170
Warmouth	*Lepomis gulosus*	–	electrofishing	0	4.8	0
White bass	*Morone chrysops*	–	gill nets	0.8	2.2	2.2
White crappie	*Pomoxis annularis*	–	gill nets	0.1	2.3	2.3

Note: electrofishing catch rate = fish per hour; gill net catch rate = fish per net night.
"-" indicates species naturally occurring in Lake Granbury, Texas (i.e., already present and not stocked).
Sources: TPWD 2019-TN8747 and Enercon 2008-TN8748.

The BRA and TPWD have the same invasive species and prevention programs for Lake Granbury as they do for CCR (BRA 2023-TN8753; TPWD 2019-TN8747). One difference is that tilapia have become dominant in CCR but not yet in Lake Granbury (see Table 3-13). The invasive species plans include routine monitoring, public education, and boat inspections. See Section 3.7.1.11 for a summary of invasive and nuisance species that occur in both CCR and Lake Granbury.

3.7.3 Proposed Action

As described in the LR GEIS (NRC 2013-TN2654) and cited in Table 3-1 of this SEIS, the impacts of all Category 1 (generic) aquatic resource issues would be SMALL. Table 3-2 identifies two Category 2 issues that require site-specific analysis for each proposed LR to determine whether impacts would be SMALL, MODERATE, or LARGE. These issues are (1) impingement and entrainment of aquatic organisms and (2) thermal impacts on aquatic organisms. The sections below analyze these issues in detail.

3.7.3.1 Impingement and Entrainment of Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

For plants with once-through cooling systems or cooling ponds such as Comanche Peak, the NRC staff determined in the LR GEIS that impingement and entrainment of aquatic organisms is a Category 2 issue that requires site-specific evaluation (NRC 2013-TN2654).

Impingement occurs when organisms are trapped against the outer part of an intake structure's screening device (79 FR 48300-TN4488). The force of the intake water traps the organisms against the screen, and individuals are unable to escape. Impingement can kill organisms immediately or cause exhaustion, suffocation, injury, and other physical stresses that contribute to later mortality. The potential for injury or death is generally related to the amount of time an organism is impinged, its fragility (susceptibility to injury), and the physical characteristics of the screen wash and fish return systems of the intake structure. The EPA has found that impingement mortality is typically less than 100 percent if the cooling water intake system includes fish return or backwash systems (79 FR 48300-TN4488). Because impingeable organisms are typically fish with fully formed scales and skeletal structures and well-developed survival traits, such as behavioral responses to avoid danger, many impinged organisms can survive under proper conditions (79 FR 48300-TN4488).

Entrainment occurs when organisms pass through the screening device and travel through the entire cooling system, including the pumps, condenser or heat exchanger tubes, and discharge pipes (79 FR 48300-TN4488). Organisms susceptible to entrainment are of smaller size, such as ichthyoplankton, larval stages of shellfish and other macroinvertebrates, zooplankton, and phytoplankton. During travel through the cooling system, entrained organisms experience physical trauma and stress, pressure changes, excess heat, and exposure to chemicals (Mayhew et al. 2000-TN8458). Because entrainable organisms generally consist of fragile life stages (e.g., eggs, which exhibit poor survival after interacting with a cooling water intake structure, and early larvae, which lack a skeletal structure and swimming ability), the EPA has concluded that, for purposes of assessing the impacts of a cooling water intake system on the aquatic environment, all entrained organisms die (79 FR 48300-TN4488).

Entrainment susceptibility is highly dependent upon life history characteristics. For example, broadcast spawners with non-adhesive, free-floating eggs that drift with water current may become entrained in a cooling water intake system. Nest-building species or species with adhesive, demersal eggs are less likely to be entrained in early life stages. The susceptibility of larval life stages to entrainment depends on body morphometrics and swimming ability.

If several life stages of a species occupy the source water, that species can be susceptible to both impingement and entrainment. For instance, adults and juveniles of a given species of fish may be impinged against the intake screens, while larvae and eggs may pass through the screening device and be entrained through the cooling system. The susceptibility to either impingement or entrainment is related to the size of the individual relative to the size of the mesh on the screening device. By definition, the EPA considers aquatic organisms that can be collected or retained on a sieve with 0.56 in. (1.4 cm) diagonal openings to be susceptible to impingement (79 FR 48300-TN4488). This equates to screen device mesh openings of 1/2 in. by 1/4 in. (1.3 cm by 0.635 cm), which is slightly larger than the openings on the typical 3/8 in. square mesh found at many nuclear power plants. Organisms smaller than the 0.56 in. (1.4 cm) mesh are considered susceptible to entrainment.

The magnitude of impact that impingement and entrainment creates on the aquatic environment depends on plant-specific characteristics of the cooling system as well as characteristics of the local aquatic community. Relevant plant characteristics include location of the cooling water intake structure, intake velocities, withdrawal volumes, screening device technologies, and the presence or absence of a fish return system. Relevant characteristics of the aquatic community include species present in the environment, life history characteristics, population abundances and distributions, special species statuses and designations, and regional management objectives.

3.7.3.2 Comanche Peak Cooling Water Intake System

The Comanche Peak cooling water intake system impinges and entrains aquatic organisms as it withdraws water from CCR. Section 2.1.3 of this SEIS describes Comanche Peak's cooling and auxiliary water systems in detail. This section summarizes features of these systems relevant to the impingement and entrainment analysis.

Comanche Peak withdraws water from the CCR through an intake structure that lies at the north end of the site. As Comanche Peak withdraws water, fish and other aquatic organisms that cannot swim fast enough to escape the flow of water may be swept into the intake. Approach velocity at the intake is approximately 0.427 fps (0.13 m/s) under full power operations (Foster Wheeler 1995 in Luminant 2023-TN8692, Enclosure 8). Organisms within the source water that cannot resist or escape this flow are drawn into the cooling water intake structure along with the water.

Once drawn into the intake structure, organisms will encounter trash racks. These racks are composed of 4 in. (10 cm) by 0.5 in. (1.3 cm) steel bars with 2 in. (5 cm) spacing. Once past the racks, organisms enter the screenhouse, at which point, they encounter vertical traveling screens with 0.38 in (0.95 cm) square mesh openings. Debris and organisms impinged on these screens are washed off, transported through a debris sump, and returned to CCR.

Organisms small enough to pass through the traveling screen mesh, such as fish eggs, larvae, and other zooplankton, are entrained into the cooling water system. Entrained organisms pass through the entire cooling system, along with heated effluent, and reenter the CCR via a discharge tunnel located southeast of Comanche Peak. During this process, entrained organisms are subject to mechanical, thermal, and toxic stresses.

Separately, aquatic organisms can also be impinged and entrained during the pumping of makeup water from Lake Granbury (see Section 3.7.3.1).

3.7.3.3 Clean Water Act Section 316(b) Requirements for Existing Facilities

CWA Section 316(b) addresses the adverse environmental impacts caused by the intake of cooling water from waters of the United States (Federal Water Pollution Control Act of 1972-TN662). This section of the CWA grants the EPA the authority to regulate cooling water intake structures to minimize adverse impacts on the aquatic environment. Under CWA Section 316(b), the EPA has issued regulations for existing facilities, such as Comanche Peak, at 40 CFR 122 (TN8648) and 40 CFR 125, Subpart J (TN254). Existing facilities include power-generation and manufacturing facilities that are not new facilities as defined at 40 CFR 125.83 and that withdraw more than 2 MGD of water from waters of the United States and use at least 25 percent of the water they withdraw exclusively for cooling purposes.

Under the CWA Section 316(b) regulations, the location, design, construction, and capacity of cooling water intake structures of regulated facilities must reflect the best technology available (BTA) for minimizing impingement mortality and entrainment. The EPA, or authorized States and Tribes, impose BTA requirements through NPDES permitting programs. In Texas, the TCEQ administers the NPDES program and issues TPDES permits to regulated facilities.

With respect to impingement mortality, the BTA standard requires that existing facilities comply with one of the following seven alternatives (40 CFR 125.94(c)) (TN254):

1. operate a closed-cycle recirculating system as defined at 40 CFR 125.92 (subsequently referred to in this EIS as “IM Option 1”)
2. operate a cooling water intake structure that has a maximum through-screen design intake velocity of 0.5 fps (0.15 m/s)
3. operate a cooling water intake structure that has a maximum through-screen intake velocity of 0.5 fps (0.15 m/s)
4. operate an offshore velocity cap as defined at 40 CFR 125.92 that is installed before October 14, 2014
5. operate a modified traveling screen that the NPDES Permit Director determines meets the definition at 40 CFR 125.92(s) and that the NPDES Permit Director determines is the BTA for impingement reduction
6. operate any other combination of technologies, management practices, and operational measures that the NPDES Permit Director determines is the BTA for impingement reduction
7. achieve the specified impingement mortality performance standard

Options (1), (2), and (4) above are essentially preapproved technologies requiring no demonstration or only a minimal demonstration that the flow reduction and control measures are functioning as the EPA envisioned. Options (3), (5), and (6) require that more detailed information be submitted to the permitting authority before the permitting authority may specify it as being a BTA for a given facility. The permitting authority may also review site-specific data and conclude that a de minimis rate of impingement exists and, therefore, no additional controls are warranted to meet the BTA impingement mortality standard.

With respect to entrainment, the CWA Section 316(b) regulations do not prescribe a single nationally applicable entrainment performance standard because the EPA did not identify a technology for reducing entrainment that is effective, widely available, feasible, and does not lead to unacceptable non-water quality impacts (79 FR 48300-TN4488). Instead, the permitting authority must establish the BTA entrainment requirement for each facility on a site-specific basis. In establishing site-specific requirements, the regulations direct the permitting authority to consider the following factors (40 CFR 125.98(f)(2)) (TN254):

1. numbers and types of organisms entrained, including, specifically, the numbers and species (or lowest taxonomic classification possible) of federally listed, threatened and endangered species, and designated critical habitat (e.g., prey base)
2. impact of changes in particulate emissions or other pollutants associated with entrainment technologies
3. land availability inasmuch as it relates to the feasibility of entrainment technology
4. remaining useful plant life
5. quantified and qualitative social benefits and costs of available entrainment technologies when such information on both benefits and costs is of sufficient rigor to make a decision

In support of entrainment BTA determinations, facilities must conduct site-specific studies and provide data to the permitting authority to aid in its determination of whether site-specific controls would be required to reduce entrainment and which controls, if any, would be necessary.

3.7.3.4 Analysis Approach

When available, the NRC staff relies on the expertise and authority of the NPDES permitting authority with respect to the impacts of impingement and entrainment. Therefore, if the NPDES permitting authority has made BTA determinations for a facility under CWA Section 316(b) in accordance with the current regulations at 40 CFR 122 (TN8648) and 40 CFR 125 (TN254), which were issued in 2014 (79 FR 48300-TN4488), and that facility has implemented any associated requirements, the NRC staff assumes that adverse impacts on the aquatic environment will be minimized (see 10 CFR 51.10(c); 10 CFR 51.53(c)(3)(ii)(B); 10 CFR 51.71(d) -TN250). In such cases, the NRC staff concludes that the impacts of either impingement, entrainment, or both would be SMALL for the proposed LR term.

In cases where the NPDES permitting authority has not made BTA determinations, the NRC staff analyzes the potential impacts of impingement, entrainment, or both, using a weight of evidence approach. In such an approach, the staff considers multiple lines of evidence to assess the presence or absence of ecological impairment (i.e., noticeable or detectable impact) on the aquatic environment. For instance, as its lines of evidence, the staff might consider the cooling water intake system design, the results of impingement and entrainment studies performed at the facility, and trends in fish and shellfish population abundance indices. The staff then considers these lines of evidence together to predict the level of impact (SMALL, MODERATE, or LARGE) that the aquatic environment is likely to experience over the course of the proposed LR term.

3.7.3.5 Baseline Condition of the Resource

For the purposes of this analysis, the NRC staff assumes that the baseline condition of the resource is the CCR aquatic community as it occurs today. The current community is a combination of species that were present during initial impoundment and those that have been stocked for recreational purposes. Section 3.7.1 describes CCR aquatic resources. In summary, TPWD stocked CCR after its impoundment and ended stocking in 1996 (Luminant 2022-TN8655). All fish and benthic invertebrate populations present in CCR today are self-sustaining. TPDW gill net surveys conducted between 1990 and 2019 indicated no major upward or downward trends in juvenile or adult fish populations (TPWD 2019-TN8747). While species richness, evenness, and diversity within the community may change or shift between now and when the proposed LR period would begin, the NRC staff finds the aquatic community as it occurs today to be a reasonable surrogate in the absence of fishery and species-specific projections.

3.7.3.5.1 CCR Impingement

Impingement Mortality BTA

TCEQ determined that CCR meets the criteria of a closed-cycle recirculating system as defined in 40 CFR 125.92(c) (TN254) in a letter dated May 26, 2015 (TCEQ 2015 in Luminant 2023-TN8692, Enclosure 9). As such, Comanche Peak meets the BTA standard for the IM Option 1 listed above. The TCEQ found that CCR is the BTA for impingement mortality because (1) Vistra demonstrated that the CCR was built for industrial cooling purposes, (2) the CCR is designed to minimize makeup flows, and (3) because reservoir systems essentially eliminate blowdown and drift as required in 40 CFR 125.92(c) (TN254). Under the regulatory definition, a closed-cycle recirculating system is one that reuses water for cooling multiple times and can include impoundments of U.S. waters that were constructed before October 1, 2014, and were created for the purpose of serving as part of the cooling water system. CCR meets these regulatory requirements since it was built in the 1970s to allow the reuse of cooling water to support Comanche Peak operations (TEQ 1995 in Luminant 2023-TN8692, Enclosure 9; EPRI 2018 in Luminant 2023-TN8692, Enclosure 10).

Impingement Mortality Studies

In 2006 and 2007, Atkins (2012 in Luminant 2023-TN8692, Enclosure 7) performed an impingement mortality characterization study at Comanche Peak. Researchers collected samples of fish impinged onto the facility's intake screens on a biweekly basis from February 2006 through February 2007 for a total of 27 sample events. During each event, researchers also recorded water temperature, conductivity, and dissolved oxygen levels.

Atkins (2012 in Luminant 2023-TN8692, Enclosure 7) collected a total of 58,121 aquatic organisms comprising 12 species of finfish and one species of shellfish. Threadfin shad accounted for 92 percent of the total impingement, followed by bluegill (3.9 percent), Harris mud crab (1.8 percent), inland silverside (0.7 percent), largemouth bass (0.7 percent), channel catfish (0.3 percent), and green sunfish (0.2 percent). All other species accounted for less than 0.1 percent of total organisms collected (see Table 3-14). Notably, in August 2006, a large threadfin shad die-off occurred. Threadfin shad are particularly sensitive to changes in temperature and dissolved oxygen levels, and die-offs of this species are frequent in late summer and fall in reservoirs and lakes across the country. In the sampling event that corresponded with this die-off, researchers collected 39,071 dead threadfin shad, which significantly skewed the study’s total impingement numbers and percent species composition. This single event accounted for 69 percent of the total fish collected during the entire study.

Table 3-14 Fish and Shellfish Taxa Collected in Impingement Samples, 2006–2007

Species	Common Name	No. Collected	Percent of total
Dorsoma petenense	threadfin shad	53,680[(a)]	92.4
Lepomis macrochirus	bluegill	2,245	3.9
Rhithropanopeus harrisii	Harris mud crab	1,030	1.8
Menidia beryllina	inland silverside	429	0.7
Micropterus salmoides	largemouth bass	414	0.7
Ictalurus punctatus	channel catfish	173	0.3
Lepomis cyanellus	green sunfish	140	0.2
Dorosoma cepedianum	gizzard shad	1	<0.01
Pylodictis olivaris	flathead catfish	2	<0.01
Gambusia affinis	western mosquitofish	1	<0.01
Lepomis spp.	sunfish species	1	<0.01
Lepomis megalotis	longear sunfish	3	<0.01
Aplodinotus grunniens	freshwater drum	1	<0.01
Total	**-**	**58,120**	**100**

(a) Number significantly influenced by a large die-off event of this species in August 2006.
Source: Atkins 2012 in Enclosure 7 of Luminant 2023-TN8692.

Impingement rates during the study varied from 0.02 fish per milligram of intake screen area in January 2007 to 1.2 fish per milligram of intake screen area in June 2006 with a one-time peak of 37 fish per milligram of intake screen area during the threadfin shad die-off event in August 2006. Impingement was generally highest in summer and lowest in fall and winter. Diurnal analysis revealed that impingement was generally higher at night than during the day, although the difference in impingement rates between these periods was not significant.

Atkins (Attachment C, Enclosure 7 of Luminant 2023-TN8692) used study results to estimate total impingement. Comanche Peak impinged approximately 295,000 individuals during the study year, including 253,000 threadfin shad and 28,844 bluegill. Most threadfin shad (83 percent) and bluegill (96 percent) were believed to be less than one year of age. Researchers estimated that more than 25 percent of fish were alive and healthy upon collection, excluding individuals collected during the threadfin shad die-off event. Notably, however, the study only considered the condition of fish when impinged on the screen. Following impingement, debris and organisms impinged on these screens are washed off, transported through a debris sump, and returned to CCR. Survival rates of fish returned to CCR are unknown.

The study's primary conclusions were that the large number of threadfish shad impinged during the study was the result of high summer temperatures rather than impingement. These individuals were dead or moribund prior to impingement. Impingement of largemouth bass and channel catfish, the two most important recreational species in CCR, is very low and is unlikely to contribute to noticeable impacts on these species. Aquatic survey data on these species during this time period support this conclusion. Additionally, the cooling water intake system's location in a deep embayment with little littoral habitat or spawning habitat likely reduces potential impingement compared to the intake being located in an area of more habitat diversity or complexity.

Impingement Conclusion

Because IM Option 1 is a preapproved alternative under CWA Section 316(b) regulations, and because the TCEQ has confirmed that Comanche Peak meets the criteria for a closed-cycle recirculating system for purposes of CWA Section 316(b) compliance, the NRC staff finds that the adverse impacts on the aquatic environment associated with impingement are minimized. Further, the available impingement mortality surveys indicate that impingement is not noticeably affecting CCR fish populations. The characteristics of the cooling water intake system are expected to remain the same under the proposed action, and the NRC staff anticipates similar effects during the proposed LR period. Accordingly, the NRC staff finds that the impacts of impingement during the proposed LR term would neither destabilize nor noticeably alter any important attribute of the aquatic environment and would, therefore, result in SMALL impacts on aquatic resources.

3.7.3.5.2 CCR Entrainment

Entrainment BTA

TCEQ has not yet made an entrainment BTA determination for Comanche Peak. The TCEQ will make that determination as a component of issuing a renewed TPDES permit after its review of Vistra's 2018 renewal application. When TCEQ makes its BTA determination for entrainment, it may (or may not) impose additional requirements to reduce or mitigate the effects of entrainment at Comanche Peak. Such requirements would be incorporated as conditions of the renewed TPDES permit, which would be issued and take effect before the renewed operating license period. The NRC staff assumes that any additional requirements that TCEQ may impose would minimize the impacts of entrainment over the course of the proposed LR term, in accordance with CWA Section 316(b) requirements.

Because TCEQ's entrainment BTA determination is currently pending, the NRC staff considers other lines of evidence below to evaluate the magnitude of impact that entrainment would likely represent during the proposed LR period of operation. In its analysis, the NRC staff considers results of entrainment studies, finfish monitoring trends, and entrainment reduction methods.

Entrainment Studies

Entrainment Sampling, 1994

In 1994, Foster Wheeler Environmental Corporation conducted an entrainment study at Comanche Peak (Foster Wheeler 1995 in Luminant 2023-TN8692). Researchers collected ichthyoplankton samples by towing a 1.6 ft (0.5 m) net with 500-micron mesh directly upstream of the trash racks from April 6 through August 24. Researchers then analyzed samples in a laboratory to identify eggs, larvae, and juveniles to the lowest practicable taxon. Foster Wheeler then estimated daily, weekly, monthly, annual entrainment of taxa based upon actual and maximum operating conditions.

Eggs and larvae of gizzard shad, threadfin shad, largemouth bass, channel catfish, mixed sunfish species, crappies, freshwater drum, and inland silverside composed the majority of ichthyoplankton in samples. Foster Wheeler estimated that in total, 30 million eggs and larvae were entrained in 1994, assuming operation of both Comanche Peak units at full capacity (Foster Wheeler 1995 in Luminant 2023-TN8692). The majority (55 percent) of entrainment losses were freshwater drum eggs and larvae (15.4 million individuals) and mixed sunfish species larvae (10.5 million individuals). Assuming 100 percent mortality, researchers estimated that these losses would correspond with an equivalent loss of 1,500 adult fish for all taxa combined. Threadfin shad and gizzard shad accounted for more than half of the adult equivalent losses.

Based on this study, Foster Wheeler (1995 in Luminant 2023-TN8692) came to the following conclusions:

- The location of Comanche Peak's cooling water intake structure minimizes the potential for entrainment because it is located in an area that lacks complex habitat that would be more suitable for productive fish habitat.
- The low number of adult equivalents calculated from entrainment sample numbers indicates that entrainment has a low impact on CCR gamefish populations.
- Comanche Peak draws a small percentage (6.4 percent) of CCR waters at full capacity operations.

Entrainment Review, 2018

In 2018, Freese and Nichols (2018 in Luminant 2023-TN8692, Enclosure 10), on behalf of the Electric Power Research Institute (EPRI), reviewed the 1994 entrainment results as part of a submittal to TCEQ to inform its entrainment BTA determination for Comanche Peak. In an analysis of the species and life stages most susceptible to entrainment, EPRI found that gizzard shad, threadfin shad, and sunfish are the most at risk. Gizzard and threadfin shad produce many eggs and broadcast them over a wide area. Eggs released near or within the draw of the cooling water intake structure are susceptible to entrainment. Peak entrainment is expected in the spring during the primary period of reproduction, although entrainment can continue as eggs develop into larvae. Sunfish eggs are unlikely to be entrained because these species nest along shallow shorelines and fry are generally confined to shallow, littoral habitats. Once larvae leave nesting areas, entrainment is possible for those larvae near the cooling water intake structure. However, EPRI determined that sunfish entrainment susceptibility is still generally low at this life stage because Comanche Peak's cooling water intake structure withdraws water from a deep, excavated embayment of the main reservoir shore, which is suboptimal habitat for sunfish. Similarly, EPRI determined that the entrainment potential for largemouth bass eggs and larvae is low because early life stages of this species occur among shallow, littoral habitats, which do not occur near the cooling water intake structure. Juvenile largemouth bass are also unlikely to occur in this region due to lack of suitable shoreline habitat. Catfish spawn in cavities within littoral habitats. This habitat is also absent in the area, and EPRI concluded that entrainment of any life stage of this species would be low.

Synthesis of Entrainment Study Results

The above-described entrainment studies indicate that the majority of entrainment is of gizzard and threadfin shad eggs and larvae. Because they are broadcast spawners, these species produce many eggs that float in the water column where they may be entrained. Gamefish do not appear to be as susceptible to entrainment because they produce demersal eggs that sink to the bottom of the water column and because the habitat required for these species' successful spawning does not occur near the Comanche Peak cooling water intake structure. Therefore, early life stages of these species are unlikely to occur in areas where they may be entrained into the cooling system. Notably, shellfish were not specifically evaluated in

Comanche Peak entrainment studies, so conclusions cannot be drawn about the entrainment of early life stages of shellfish.

This line of evidence alone, however, does not provide a complete enough picture for the NRC staff to evaluate whether entrainment is measurably affecting these species' populations. The potential effects of entrainment on these taxa are further evaluated below.

Finfish Monitoring Trends

As described in Section 3.7.1, TPWD conducts periodic surveys of CCR fish populations to evaluate the health of the recreational fishery on an approximately 4-year cycle. TPWD's most recently available Fisheries Management Survey Report (TPWD 2019-TN8747) states that largemouth bass, channel catfish, and other gamefish were collected in good numbers in 2018, and the collected fish exhibited good to excellent body condition and size. Catch rates of these species and other species, including both game and forage species, in TPWD gill net surveys from 1990 through 2019 indicate stable population abundances (see Table 3-12 in Section 3.7.1.6).

This line of evidence indicates that the level of entrainment of fish into the Comanche Peak cooling water intake system is not causing noticeable or detectable impacts on CCR aquatic populations. Because water withdrawals, and the associated risk of entrainment, would remain the same under the proposed action, the NRC staff anticipates similar (i.e., nondetectable) effects during the proposed LR period.

Entrainment Reduction Methods

As explained previously, the CWA Section 316(b) regulations direct the permitting authority to establish BTA entrainment requirements for each facility on a site-specific basis. For Comanche Peak, TCEQ will make that determination as one component of issuing a renewed TPDES permit that expires in October 2024 (Luminant 2022-TN8655).

As part of the 2018 entrainment characterization report, EPRI evaluated entrainment reduction technologies (Enclosure 10 of Enercon 2008-TN8748). Specifically, EPRI considered (1) flow reduction using a closed-cycle recirculating system, (2) fine-mesh screens that include both fine-mesh traveling water screens and natural wedgewire screens, and (3) alternative water sources.

With respect to flow reduction, the TCEQ has found that CCR meets the criteria of a closed-cycle recirculating system as defined in 40 CFR 125.92(c) (TN254), as explained in Section 3.7.3.5.1. EPRI further evaluated flow reduction by considering retrofitting Comanche Peak with cooling towers but found that this would be technically and logistically infeasible and would not appreciably reduce current entrainment.

With respect to fine-mesh screens, EPRI considered whether modifying Comanche Peak's traveling screens would increase survival or otherwise reduce entrainment. EPRI did not find that modifying the traveling screens would appreciably reduce entrainment because survival of early life stages of fish is generally poor. Entrainment survival is especially low for fragile species, such as gizzard and threadfin shad, which constitute much of the entrainment at Comanche Peak, according to the 1994 study described previously in this section. EPRI cited an additional concern about installing fine-mesh screens paired with a fish return system: Vistra is prohibited from releasing tilapia, a non-native invasive species, back to CCR, and separating out this species, especially early life stages of this species, would be logistically challenging and would require coordination with the State to resolve. For these reasons, EPRI did not find that modifying the traveling screen system at Comanche Peak would result in worthwhile reductions in entrainment.

As indicated previously, TCEQ is currently reviewing Vistra's TPDES permit renewal application. TCEQ could require Vistra to implement additional measures beyond the closed-cycle recirculating system as BTA for entrainment. However, TCEQ will not make such a determination until it completes its review. Accordingly, the NRC staff is currently unable to predict what TCEQ might require as an outcome of that process.

Entrainment Conclusion

The available information about entrainment indicates that the location of Comanche Peak's cooling water intake structure minimizes the potential for entrainment of many CCR species because it is located in an area that lacks complex habitat suitable for spawning. Entrainment is primarily expected to affect species such as gizzard shad and threadfin shad that broadcast spawn in open waters. TPDW surveys of CCR indicate that game and forage fish populations have remained stable over the last several decades, which suggests that entrainment is not having a noticeable or detectable impact on the overall health of CCR fish populations. Notably, shellfish were not specifically evaluated in Comanche Peak entrainment studies, so conclusions cannot be drawn about the entrainment of early life stages of shellfish.

Because water withdrawals, and the associated risk of entrainment, would remain the same under the proposed action, the NRC staff anticipates similar (i.e., nondetectable) effects during the proposed LR period. Further, TCEQ will make an entrainment BTA determination as part of issuing a renewed TPDES permit, which would be issued and take effect before the renewed operating license period. If the TPDES permit imposes any additional requirements beyond those contained in the current permit, those requirements would likely further reduce the impacts of entrainment over the course of the proposed LR term, in accordance with CWA Section 316(b) requirements. The NRC staff assumes that any additional requirements that TCEQ imposes would further reduce the impacts of entrainment over the course of the proposed LR term.

For the reasons described above, the NRC staff finds that the impacts of entrainment of CCR aquatic organisms resulting from the proposed license renewal of Comanche Peak would be SMALL.

3.7.3.5.3 Lake Granbury Impingement and Entrainment

Impingement and entrainment can also occur when Vistra withdraws makeup water from Lake Granbury water to maintain adequate CCR water levels (see Section 3.7.2). The CWA 316(b) regulations do not require Vistra to evaluate these effects because the Lake Granbury pump house is not a cooling water intake structure as defined in this statute. Therefore, there are no studies available to evaluate these effects. The NRC staff expects that some fish and shellfish may become injured or die as a result of impingement or entrainment at this location; entrained organisms that survive would be permanently removed from the Lake Granbury ecosystem and would enter CCR. Without further information, the NRC staff can make no specific conclusions on how impingement and entrainment at Lake Granbury is affecting the ecosystem. However, as explained in Section 3.7.2.1, TWPD survey data indicate that the Lake Granbury forage and gamefish populations are healthy and diverse.

3.7.3.5.4 Impingement and Entrainment Conclusion

For the reasons summarized in the preceding sections, the NRC staff concludes that the impacts of impingement and entrainment on aquatic organisms resulting from the proposed LR of Comanche Peak would be SMALL.

3.7.3.6 Thermal Impacts on Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

For plants with once-through cooling systems, such as Comanche Peak, the NRC determined in the LR GEIS (NRC 2013-TN2654) that thermal impacts on aquatic organisms is a Category 2 issue that requires site-specific evaluation.

The primary form of thermal impact of concern at Comanche Peak is heat shock. Heat shock occurs when the water temperature meets or exceeds the thermal tolerance of an aquatic species for some duration of exposure (NRC 2013-TN2654). In most situations, fish can avoid areas that exceed their thermal tolerance limits, although some aquatic species or life stages lack such mobility. Heat shock is typically observable only for fish because fish tend to float when dead. In addition to heat shock, thermal plumes resulting from thermal effluent can create barriers to fish passage, which is of particular concern for migratory species. Thermal plumes can also reduce the available aquatic habitat or alter habitat characteristics in a manner that results in cascading effects on the local aquatic community.

Comanche Peak Effluent Discharge

Comanche Peak discharges heated effluent to CCR via a tunnel that discharges into an open, offshore discharge structure (Luminant 2022-TN8655). The tunnel conveys water to the discharge structure at a velocity of approximately 9.8 fps (3.0 m/s), as measured at the end of the tunnel. The discharge structure is designed to encourage temperature stratification (i.e., hot water remains at the surface) in order to transfer heat to the atmosphere.

In 1993, researchers evaluated Comanche Peak’s thermal plume. Vistra’s environmental report (Luminant 2022-TN8655) summarizes the results of this study. The study found that the thermal plume extends vertically into the water column for about 40 to 50 ft (12 to 15 m) in depth. The water in this area is about 2 to 4 °F (1.1 to 2.2 °C) warmer than water in the surrounding areas. Continuing in depth, temperatures drop off sharply at around 60 ft (18 m) and from there, decrease slowly to the bottom of the reservoir.

In August 2007, Vistra commissioned a thermal discharge study to support the power uprate, which was approved and implemented in 2008. This study found that the uprate would result in a small increase in temperatures at both the intake and discharge locations of approximately 0.6 °F (0.3 °C). The plume’s size would increase slightly and would remain largest in winter and smallest in summer.

In 2018, Ward (Luminant 2023-TN8692, Enclosure 12) performed an analysis of the area of Comanche Peak’s thermal plume encompassed by the Texas Surface Water Quality Standards temperature differential above the ambient of 3 °F (1.7 °C). This analysis used previously collected temperature data to model the plume. The 3°F (1.7°C) thermocline encompassed an area of approximately 1,623 to 1,864 ac (657 to 754 ha) in the summer depending on the weather scenario, with the plume being larger under normal summer air temperatures and smallest during periods of extreme heat. In winter, the area of the plume encompassed 2,914 ac (1,179 ha) under normal midwinter conditions.

Clean Water Act Section 316(a) Requirements for Point Source Discharges

CWA Section 316(a) addresses the adverse environmental impacts associated with thermal discharges into waters of the United States. This section of the Act grants the EPA the authority to impose alternative, less-stringent, facility-specific effluent limits (called “variances”) on the thermal component of point source discharges. To be eligible, facilities must demonstrate, to the satisfaction of the NPDES permitting authority, that the facility-specific effluent limitations will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving body of water. CWA Section 316(a) variances are valid for the term of the NPDES permit (i.e., 5 years). Facilities must reapply for variances with each NPDES permit renewal application. The EPA issued regulations under CWA Section 316(a) at 40 CFR 125, Subpart H (TN254).

Analysis Approach

When available, the NRC staff relies on the expertise and authority of the NPDES permitting authority with respect to thermal impacts on aquatic organisms. Therefore, if the NPDES permitting authority has made a determination under CWA Section 316(a) that thermal effluent limits are sufficiently stringent to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving body of water, and that facility has implemented any associated requirements, then the NRC staff assumes that adverse impacts on the aquatic environment will be minimized. In such cases, the NRC staff concludes that thermal impacts on aquatic organisms would be SMALL for the proposed LR term.

In cases where the NPDES permitting authority has not granted a 316(a) variance, the NRC staff analyzes the potential impacts of thermal discharges using a weight of evidence approach. In this approach, the staff considers multiple lines of evidence to assess the presence or absence of ecological impairment (i.e., noticeable or detectable impact) on the aquatic environment. For instance, as its lines of evidence, the staff might consider the characteristics of the cooling water discharge system design, the results of thermal studies performed at the facility, and trends in fish and shellfish population abundance indices. The staff then considers these lines of evidence together to predict the level of impact (SMALL, MODERATE, or LARGE) that the aquatic environment is likely to experience over the course of the proposed LR term.

Baseline Condition of the Resource

For the purposes of this analysis, the NRC staff assumes that the baseline condition of the resource is the CCR aquatic community as it occurs today. The current community is a combination of species that were present during initial impoundment and those that have been stocked for recreational purposes. Section 3.7.1 describes CCR aquatic resources. In summary, TPWD stocked CCR after its impoundment and ended stocking in 1996 (Luminant 2022-TN8655). All fish and benthic invertebrate populations present in CCR today are self-sustaining. TPDW gill net surveys conducted between 1990 and 2019 indicated no major upward or downward trends in juvenile or adult fish populations (TPWD 2019-TN8747). While species richness, evenness, and diversity within the community may change or shift between now and when the proposed LR period would begin, the NRC staff finds the aquatic community as it occurs today to be a reasonable surrogate in the absence of fishery and species-specific projections.

CWA 316(a) Thermal Variance

In the Texas Surface Water Quality Standards (TCEQ §307.1 – 307.10 2022-TN8754), the TCEQ has established temperatures limits for the thermal effluent discharges from industrial facilities to ensure the protection of biota. These limits establish numerical temperature criteria, such as maximum discharge temperatures and maximum temperature rise over ambient, that facilities must meet in order to discharge to water bodies. As explained previously in this section, facilities may apply for alternative, less-stringent, facility-specific effluent limits. These are referred to as CWA 316(a) thermal variances.

The TCEQ has designated CCR an “industrial cooling water impoundment” and an “industrial cooling water area” as defined by Texas Surface Water Quality Standard §307.a.33 and §307.a.34 (TCEQ §307.1 – 307.10 2022-TN8754; Luminant 2022-TN8655). Water bodies with this designation are those that are built, owned, and operated for the purpose of providing industrial cooling. In the State of Texas, thermal effluent discharges to industrial cooling water impoundments do not have to meet temperature criteria established in the Texas Surface Water Quality Standards. However, the TCEQ has established facility-specific temperature limits in the Comanche Peak TPDES permit. Daily average temperatures at Outfall 001 may not exceed 113 °F (45 °C), and daily maximum temperatures may not exceed 116 °F (46.7 °C) (Luminant 2022-TN8655).

Vistra reports fish mortality events to the TCEQ and TPWD. Since 2015, Vistra has reported two temperature-related fish mortality events. One event occurred in August 2015 and involved the mortality of an estimated 10,000 to 20,000 threadfin shad due to high water temperatures and low dissolved oxygen levels (Luminant 2023-TN8692). However, this event was observed in the farthest northwest region of CCR and was, therefore, unlikely to have been related to Comanche Peak’s thermal effluent discharge. The second event was in July 2022 and involved the mortality of 20,000 to 50,000 threadfin shad, tilapia, and bass (Luminant 2023-TN8692). This event happened near Comanche Peak’s cooling water intake structure. Vistra cited high air temperatures exceeding 100 °F (38 °C) to be the primary cause. However, given the proximity of the fish kill to Comanche Peak’s discharge, the thermal effluent may have been a contributing factor. Nonetheless, finfish monitoring in CCR indicates that fish populations are stable and healthy, as discussed in Section 3.7.1. This indicates that Comanche Peak operations are not causing thermal effects that are noticeably affecting forage or gamefish populations.

Thermal Impacts Conclusion

The TCEQ has established facility-specific temperature limits for Comanche Peak’s thermal effluents to protect the aquatic environment, and aquatic monitoring in CCR indicates that fish populations are stable and healthy. The characteristics of the thermal effluent are expected to remain the same under the proposed action, and the NRC staff anticipates similar effects during the proposed LR period. Further, TCEQ will continue to review the temperature limits with each successive TPDES permit renewal and may require additional mitigation or monitoring in a future renewed TPDES permit if it deems such actions to be appropriate to assure the protection of the aquatic environment. The NRC staff assumes that any additional requirements that TCEQ imposes would further reduce the impacts of the Comanche Peak thermal effluent over the course of the proposed LR term. For these reasons, the NRC staff finds that thermal impacts during the proposed LR period would neither destabilize nor noticeably alter any important attribute of the aquatic environment and would, therefore, result in SMALL impacts on aquatic organisms.

3.7.4 No-Action Alternative

If Comanche Peak were to cease operating, impacts on the aquatic environment would decrease or stop following reactor shutdown. Some withdrawal of water by Comanche Peak would continue during the shutdown period to provide cooling to spent fuel in the spent fuel pool until that fuel could be transferred to dry storage. The amount of water withdrawn for these purposes would be a small fraction of water withdrawals during operations, would decrease over time, and would likely end within the first several years following shutdown. The reduced demand for cooling water would substantially decrease the effects of impingement, entrainment, and thermal effluent on aquatic organisms, and these effects would wholly cease following the transfer of spent fuel to dry storage. Effects from cold shock would be unlikely, given the small area of lake affected by thermal effluent under normal operating conditions, combined with the phased reductions in withdrawal and discharge of lake water that would occur following shutdown. The NRC staff concludes that the impacts of the no-action alternative on aquatic resources would be SMALL.

3.7.5 Replacement Power Alternatives: Common Impacts

Construction impacts for many components of either replacement power alternative would be qualitatively and quantitatively similar. Construction could result in aquatic habitat loss, alteration, or fragmentation; disturbance and displacement of aquatic organisms; mortality of aquatic organisms; and increase in human access. For instance, construction-related chemical spills, runoff, and soil erosion could degrade water quality in CCR or Comanche Creek by introducing pollutants and increasing sedimentation and turbidity. Dredging and other in-water work could directly remove or alter the aquatic environment and disturb or kill aquatic organisms. Because construction effects would be short term, associated habitat degradation would be relatively localized and temporary. Effects could be minimized by the use of existing infrastructure, such as the Comanche Peak intake and discharge systems, as well as the use of existing transmission lines, roads, parking areas, and certain existing buildings and structures on the site. Aquatic habitat alteration and loss could be minimized by siting components of the alternatives farther from water bodies and away from drainages and other aquatic features.

Water quality permits required through Federal and State regulations would control, reduce, or mitigate potential effects on the aquatic environment. Through such permits, the permitting agencies could include conditions requiring Vistra to follow BMPs or to take certain mitigation measures if adverse impacts are anticipated. Notably, the EPA final rule under Phase I of the CWA Section 316(b) regulations applies to new facilities and sets standards to limit intake capacity and velocity to minimize impacts on fish and other aquatic organisms in the source water (40 CFR 125.84-TN254). Any new replacement power alternative subject to this rule would be required to comply with the associated technology standards.

With respect to operation of a new replacement power alternative, operational impacts for either alternative would be qualitatively similar but would vary in intensity, based on each alternative’s water use and consumption. Both alternatives would involve new nuclear power generation in the form of SMRs. The new reactors would use MDCTs to dissipate waste heat. The NRC staff analyzed the impacts of operating cooling tower plants on the aquatic environment in the LR GEIS (NRC 2013-TN2654) and determined that operation of nuclear facilities with cooling towers would result in SMALL impacts on the aquatic environment, including those impacts resulting from impingement, entrainment, and thermal effluents. This is due to the relatively low volume of makeup water withdrawal for nuclear power plants that have a cooling tower system and the minimal heated effluent that would be discharged. Water use conflicts would be unlikely, given that any new power alternative would be sited on the existing Comanche Peak site and would consume supplemental source water from Lake Granbury that is well managed.

3.7.6 New Nuclear (Small Modular Reactors) Alternative

The types of impacts that the aquatic environment would experience from this alternative are characterized in the previous section that discusses impacts common to all replacement power alternatives. In that section, construction impacts are sufficiently addressed as they would apply to the new nuclear alternative. Based on that discussion, the NRC staff finds that impacts of construction would be SMALL because construction effects would be of limited duration, the new nuclear power plant would use some of the existing site infrastructure and buildings, and required Federal and State water quality permits would likely include conditions requiring BMPs and mitigation strategies to minimize environmental effects.

With respect to operation, Federal and State water quality permits would control and mitigate many of the potential effects on the aquatic environment, including water withdrawal and discharge, such that the associated effects would be unlikely to noticeably alter or destabilize any important attribute of the aquatic environment. The NRC staff finds that the impacts of operation of a new nuclear (SMR) alternative would be SMALL.

The NRC staff concludes that the impacts on aquatic resources from construction and operation of a new nuclear (SMR) alternative would be SMALL.

3.7.7 Natural Gas-fired Combined-Cycle Alternative

The types of impacts that the aquatic environment would experience from this alternative are characterized in the previous Section 3.7.5 that discusses impacts common to all replacement power alternatives. This alternative would also require construction of some short onsite natural gas pipelines to connect to two existing natural gas pipelines that already cross the Comanche Peak site and run in north/south and east/west directions (Luminant 2022-TN8655). Although some infrastructure upgrades may be required, it is assumed that the existing transportation and transmission line infrastructure at Comanche Peak would be adequate to support the alternative.

The NRC staff finds that the impacts of construction on aquatic resources would be SMALL because construction effects would be of limited duration, the new plant would use some of the existing site infrastructure and buildings, and required Federal and State water quality permits would likely include conditions requiring BMPs and mitigation strategies to minimize environmental effects.

With respect to operation, Federal and State water quality permits would control and mitigate many of the potential effects on the aquatic environment, including water withdrawal and discharge, such that the associated effects would be unlikely to noticeably alter or destabilize any important attribute of the aquatic environment. Therefore, the NRC staff finds that the impacts of operation on aquatic resources would be SMALL.

Based on the above, the NRC staff concludes that the impacts on aquatic resources from construction and operation of a natural gas alternative would be SMALL.

3.7.8 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

The impacts of constructing onshore wind are addressed in the previous Section 3.7.5 that discuss impacts common to all alternatives. Construction of utility-scale onshore wind farms requires relatively large amounts of off-site land disturbance associated with the footprints of the wind turbines, access roads, and transmission lines. The roads and transmission lines would likely cross aquatic water bodies (e.g., creeks) depending on where they are placed. During operation of the onshore wind, accidental releases of contaminants from fuel and chemical spills would pose a hazard to the aquatic environment. As explained under the discussion of impacts common to all alternatives, water quality permits required through State and Federal regulations would control, reduce, or mitigate the effects on the aquatic environment for replacement power sources such as onshore wind. Through such permits, the permitting agencies can include conditions requiring Vistra to follow BMPs or take certain mitigation measures if adverse impacts are anticipated. These water quality permits apply to both the construction and operational phases of onshore wind. The impacts of construction of the onshore wind component of this alternative on aquatic resource would likely be SMALL to MODERATE, depending on the where the wind turbines would be placed and the types of aquatic habitats that are affected. The impacts of operations would be SMALL to MODERATE depending on the effectiveness of measures designed to control accidental releases of contaminants and to clean up such releases if they occur.

The impacts of constructing the solar PV component of this alternative are also addressed in the previous sections that discuss impacts common to all alternatives. These effects would be SMALL to MODERATE, depending on the site(s) selected, the aquatic habitats present, and the extent to which construction would degrade, modify, or permanently alter those habitats. Operation of the solar PV component would have no discernible effects on the aquatic environment.

The types of impacts that the aquatic environment would experience from the SMR component of this alternative are characterized in the previous two Sections 3.7.5 and 3.7.7 that discuss impacts common to all alternatives and impacts of the new nuclear alternative. Construction and operation impacts of this component of the combination alternative would be qualitatively similar. Because the nuclear component of the combination alternative would involve construction and operation of only one SMR, less cooling water would be required, which would result in fewer impacts on the aquatic environment. The impacts of construction and operation of this component of the alternative on aquatic resources would be SMALL.

The NRC staff concludes that the impacts on aquatic resources from construction and operation of a combination alternative would be MODERATE to LARGE during construction and SMALL to MODERATE during operation. The higher magnitude of potential impacts experienced by the aquatic environment is primarily attributable to the onshore wind component of the alternative due to the relatively high amount of land disturbance.

3.8 Special Status Species and Habitats

The NRC must consider the effects of its actions on ecological resources protected under several Federal statutes and must consult with the FWS or the National Oceanic and Atmospheric Administration (NOAA) prior to acting in cases where an agency action may affect those resources. These statutes include the following:

- Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.) (TN1010)

- Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (16 U.S.C. § 1801 et seq.) (TN1061)
- National Marine Sanctuaries Act (NMSA) (16 U.S.C. § 1431 et seq.) (TN4482)

This section describes the species and habitats that are federally protected under these statutes and analyzes how the proposed LR and alternatives may affect these resources.

3.8.1 Endangered Species Act

Congress enacted the ESA in 1973 to protect and recover imperiled species and the ecosystems upon which they depend. The ESA provides a program for the conservation of endangered and threatened plants and animals (collectively, “listed species”) and the habitats in which they are found. The FWS and National Marine Fisheries Service (NMFS) are the lead Federal agencies for implementing the ESA, and these agencies determine species that warrant listing. The following sections describe the Comanche Peak action area and the species and habitats that may occur in the action area under each of the Services’ jurisdictions.

3.8.1.1 Endangered Species Act: Action Area

The implementing regulations for Section 7(a)(2) of the ESA define “action area” as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Part 402-TN4312). The action area effectively bounds the analysis of federally listed species and critical habitats because only species and habitats that occur within the action area may be affected by the Federal action.

For the purposes of assessing the potential impacts of Comanche Peak LR, the NRC staff considers the action area to consist of the following.

- <u>Comanche Peak Site</u>: The terrestrial region of the action area consists of the 7,700 ac (3,100 ha) Comanche Peak site in north-central Texas. The area is part of the Grand Prairie and North-Central Plains physiographic regions. CCR constitutes the majority (42 percent) of the site’s surface area. The developed plant area lies on a small peninsula of land on the western shore of the reservoir within Somervell County. However, Luminant controls the entire reservoir, including a land buffer around it, which extends north into Hood County. Evergreen forest makes up approximately 2,050 ac (830 ha), deciduous forest makes up 310 ac (125 ha), grasslands occupy 1,370 ac (550 ha), and wetlands occupy 85 ac (34 ha). Luminant leases portions of the grasslands under 5-year agricultural leases for hay production. Section 3.2 and Section 3.6 of this SEIS describe the developed and natural features of the site and the characteristic vegetation and habitats.
- <u>Comanche Creek Reservoir</u>: The aquatic region of the action area encompasses the impingement area of influence, the entrainment area of influence, and the area of CCR that experiences increased temperatures from discharge of heated effluent. Section 3.7 of this SEIS describes these regions in detail.

The NRC staff recognizes that, although the described action area is stationary, federally listed species can move in and out of the action area. For instance, a migratory bird could occur in the action area seasonally as it forages or breeds within the action area. Thus, in its analysis, the NRC staff considers not only those species known to occur directly within the action area but those species that may passively or actively move into the action area. The NRC staff then considers whether the life history and habitat requirements of each species make it likely to occur in the action area where it could be affected by the proposed LR. The following sections first discuss listed species and critical habitats under FWS jurisdiction, followed by those under NMFS jurisdiction.

3.8.1.2 Endangered Species Act: Federally Listed Species and Critical Habitats Under FWS Jurisdiction

This section evaluates seven species, four of which are listed, two of which are proposed for listing under the ESA, that may be present in the action area. The NRC staff determined these species to be relevant to this review based on desktop analysis of the Comanche Peak action area, available scientific literature and studies, and the results of past ESA Section 7 consultations in connection with the Comanche Peak site Table 3-15 lists each of these species and its Federal status. No designated or proposed critical habitat occurs in the action area.

Table 3-15 Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction Evaluated for Comanche Peak License Renewal

Common Name	Species	Federal Status[(a)]
golden-cheeked warbler	*Setophaga chrysoparia*	FE
piping plover	*Charadrius melodus*	FT
red knot	*Calidris canutus rufa*	FT
whooping crane	*Grus americana*	FE
tricolored bat	*Perimyotis subflavus*	FPE
Texas fawnsfoot	*Truncilla macrodon*	FPT
monarch butterfly	*Danaus plexippus*	FC

FE = federally endangered; FT = federally threatened; FPE = proposed for Federal listing as endangered; FPT = proposed for Federal listing as endangered; FC = candidate for Federal listing.
(a) Indicates protection status under the Endangered Species Act.

<u>Golden-Cheeked Warbler</u>

The FWS listed the golden-cheeked warbler as endangered wherever found in 1990 (55 FR 53153). No critical habitat is designated for this species. Information in this section is drawn from the FWS's Information for Planning and Conservation (IPaC) species profile (FWS 2023-TN8834) unless otherwise cited.

The golden-cheeked warbler is a small, neo-tropical songbird. In the United States, this species occurs only in central Texas. During the spring and summer, golden-cheeked warblers inhabit dense-canopied old growth stands of juniper-oak woodlands. These woodlands generally occur in relatively moist areas, such as steep-sided canyons, slopes, and adjacent uplands. The essential element for successful nesting is that mature Ashe juniper (*Juniperus ashei*) with shedding bark are present, a feature that occurs when trees are 20 years or older. Mating pairs stay together throughout the season, and evidence from banding experiments suggests that birds return to the same territories and may even choose the same mate year after year. Females lay three to four eggs, which hatch after approximately 12 days. Young fledge at 9 days and remain close to the adults for approximately a month.

From July through August, golden-cheeked warblers migrate southward from Texas through the pine-oak woodlands of eastern Mexico through the Sierra Madre Oriental. Individuals winter in the mountainous regions of southern Mexico (Chiapas) and Central America (Guatemala, Honduras, El Salvador, and Nicaragua) and return to Texas again in March. In these areas, golden-cheeked warblers are associated with mixed species flocks, typically consisting of other warbler species.

Golden-cheeked warblers eat only insects, including caterpillars, spiders, and beetles typically found on foliage. In Texas, the birds take advantage of insect blooms associated with different plants as the growing season progresses. For example, broad-leaved trees, especially oaks (*Quercus* spp.), are particularly important in providing habitat for insects during the first part of the nesting season. Later in the season, golden-cheeked warblers forage in Ashe juniper and young live oaks (*Quercus virginiana*), Texas oaks (*Q. buckleyi*), and shin oak (*Q. sinuate*).

Factors Affecting the Species

Habitat loss or degradation is the main reason the golden-cheeked warbler is endangered. Clearing of juniper-oak woodlands for grazing, agriculture, and urban expansion has decreased the species' available nesting habitat.

Occurrence Within the Action Area

The FWS identified the golden-cheeked warbler as potentially occurring in the action area in the IPaC report (FWS 2023-TN8835) for the proposed action. The TPWD (TPWD 2023-TN8836, 2023-TN8837) reports occurrences of the species in both Somervell and Hood Counties. The Cornell Lab of Ornithology eBird database reports numerous occurrences of golden-cheeked warblers in Dinosaur Valley State Park, which lies 3.5 mi (5.6 km) southwest of the Comanche Peak site (eBird 2023-TN8838). Within the Comanche Peak action area, however, the species has not been observed and suitable habitat does not exist there.

In 2007 and 2008, Post, Buckley, Schuh & Jernigan, Inc. (PBS&J 2008-TN8839) conducted surveys for the golden-cheeked warbler on the Comanche Peak site in support of Luminant's combined license application. Surveyors did not audibly or visually observe the species on the site in April 2007 or during a targeted presence/absence survey in May 2007. PBS&J (TN8839) also conducted surveys using the FWS protocol during the breeding season in April and May 2008 that concentrated on the peninsula area proposed for construction of new cooling towers for the project. Neither golden-cheeked warblers nor suitable habitat was present. PBS&J (TN8839) reported that most of the habitat present lacked the 20 percent mixture of hardwoods considered necessary for the species. However, surveyors identified a 3.7 ac (1.5 ha) area along a stream confluence near the reservoir shoreline just north of the developed plant area on the site that exhibited more favorable characteristics. In February 2009, FWS personnel visited the site to determine the suitability of the identified habitat patch. The FWS (DOI 2010-TN8840) determined that the patch was too small and distant from other suitable habitat to be likely to support golden-cheeked warblers. Additionally, the vegetation present consisted almost entirely of Ashe juniper with few other hardwood trees present that would be necessary to provide suitable nesting habitat. In 2021, Luminant coordinated with the FWS as part of preparing the LRA. The FWS (Luminant 2022-TN8655) confirmed that the habitat was unsuitable. In further correspondence, the FWS (Luminant 2022-TN8655) stated that it had no comments, concerns, or recommendations concerning the proposed LR because the relicensing would not involve any impacts on the physical or biological environment that might affect federally listed species, including the golden-cheeked warbler.

Based on the information presented in this section, the NRC staff concludes that the Comanche Peak action area does not provide suitable nesting habitat for the golden-cheeked warbler and that this species is unlikely to be present within the area. However, because the species occurs in Dinosaur Valley State Park, which lies 3.5 mi (5.6 km) away from the Comanche Peak site, the staff conservatively assumes that golden-cheeked warblers may occasionally transit the Comanche Peak action area annually from March to July when foraging or moving between areas of more suitable habitat. Accordingly, the staff assesses the potential impacts of the proposed action on this species in Section 3.8.4 of this SEIS.

Piping Plover

The FWS listed the Atlantic Coast and Great Plains populations of the piping plover as threatened in 1985. Information in this section is drawn from the FWS's 2016 draft revised recovery plan for the species (FWS 2003-TN8841) unless otherwise cited. In 2009, the FWS designated 18 critical habitat units for the wintering population of piping plovers in Texas (74 FR 23476-TN8848). All units are along the Gulf of Mexico.

The piping plover is small, plump, pale gray-brown plover. Two subspecies are recognized: *Charadrius melodus melodus* occurs along the Atlantic coast and *Charadrius melodus circumcinctus* occurs within the interior of the continent. Within *C. m. circumcinctus*, the FWS recognizes two distinct population segments: Northern Great Plains and Great Lakes Watershed. The FWS recognizes three breeding populations and treats them separately in the final rule listing the species.

Piping plovers occur in Texas from late July through March. While on wintering grounds, the species is associated with beaches, mud flats, sand flats, algal flats, and washover passes with no or very sparse emergent vegetation, and individual birds tend to return to the same wintering sites year after year. Piping plovers forage on exposed beach substrates by pecking for invertebrates near the surface of the sand. Diets consist of various invertebrates, including insects, marine worms, crustaceans, and mollusks. On wintering grounds, piping plovers prey on polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks.

Factors Affecting the Species

The FWS believes that hunting in the late 19th and early 20th centuries led to the piping plover's initial decline. Habitat loss and alteration, predation, and surface water contamination have contributed to further population declines. Shoreline development, specifically, has reduced available breeding grounds along the Great Lakes and wintering grounds along the Atlantic coast.

Occurrence Within the Action Area

The FWS identified the piping plover as potentially occurring in the action area in the IPaC report (FWS 2023-TN8835) for the proposed action. The TPWD (TPWD 2023-TN8836, 2023-TN8837) reports occurrences of the species in both Somervell and Hood Counties in geographic areas that the species may use during migration. The Cornell Lab of Ornithology eBird database reports rare occurrences of piping plovers in the region, although none were within Somervell or Hood Counties eBird 2023-TN8838). The NRC staff identified no information indicating the species' presence in the Comanche Peak action area, and suitable habitat does not exist there. Because this species specifically requires sparse, coastal habitat, the NRC staff concludes that the piping plover does not occur in the action area. Therefore, this SEIS does not assess this species in any further detail.

Red Knot

The FWS listed the red knot as threatened wherever found effective in 2015 (79 FR 73706-TN4267). The FWS later proposed critical habitat for the species in 2021 (86 FR 37410-TN8849); however, the FWS has yet to formally designate critical habitat. Within Texas, the FWS proposes 10 critical habitat units, many of which overlap with currently designated piping plover critical habitat. All proposed units are along the Gulf of Mexico. Information in this section is drawn from the FWS's species status assessment (FWS 2020-TN8850) unless otherwise cited.

The red knot is a medium-sized shorebird that migrates annually between breeding grounds in the Canadian Arctic and several wintering regions, including the southeastern United States, northeastern Gulf of Mexico, northern Brazil, and Tierra del Fuego in southern South America. During both spring and fall migrations, red knots use key staging and stopover areas to rest and feed. While most individuals travel along the Atlantic coast during migration, some Texas-wintering red knots pass over the Northern Plains region of the Central Flyway twice annually during migration.

During migration, red knots use coastal marine and estuarine habitats with large areas of exposed intertidal sediments; ocean- or bay-front areas; and tidal flats in more sheltered bays and lagoons (FWS 2014-TN8851). Along the Atlantic coast, dynamic and ephemeral features are important red knot habitats; these include sand spits, islets, shoals, and sandbars (Harrington 2008-TN8852). Inland stopovers include saline lakes within the northern Great Plains (Newstead et al. 2013-TN8853). The FWS (2014-TN8851) has found that although little information exists indicating whether red knots may use inland freshwater habitats during migration, current data suggest that certain freshwater areas may warrant further study as potential stopover habitat. The FWS (2014-TN8851) also concluded that the best available data show that small numbers of red knots may use impoundments and other manufactured freshwater habitats during inland migrations.

Red knots migrate long distances over a relatively brief period of time. According to a 2009–2012 geolocator study of midcontinent red knot migrations, individuals leave Texas between May 16 and 21 and fly 2 days directly to a stopover site in the northern Great Plains or fly 3 days to a stopover site at the southern edge of Hudson Bay in Manitoba or Ontario. Birds spent 15 to 21 days at the selected stopover site before leaving for breeding grounds between June 1 and 13. Similar flights are made in the fall with birds arriving in Texas-wintering grounds by October (Newstead et al. 2013-TN8853).

Factors Affecting the Species

In its final listing rule (79 FR 73706-TN4267), the FWS determined that the rufa red knot warranted threatened status under the ESA due to the following primary threats: loss of breeding and nonbreeding habitat (including sea level rise, coastal engineering, coastal development, and arctic ecosystem change); effects related to disruption of natural predator cycles on the breeding grounds; reduced prey availability throughout the nonbreeding range; and increasing frequency and severity of asynchronies (mismatches) in the timing of the birds' annual migratory cycle relative to favorable food and weather conditions.

Occurrence Within the Action Area

The FWS identified the red knot as potentially occurring in the action area in the IPaC report (FWS 2023-TN8835) for the proposed action. However, the TPWD (TPWD 2023-TN8836, 2023-TN8837) does not report occurrences of the species in either Somervell and Hood County, and the Cornell Lab of Ornithology eBird database reports no occurrences in the region (eBird 2023-TN8838). The NRC staff identified no information indicating the species' presence in the Comanche Peak action area, and suitable habitat does not exist there. Because this species specifically requires sparse, coastal habitat, the NRC staff concludes that the red knot does not occur in the action area. Therefore, this SEIS does not assess this species in any further detail.

<u>Whooping Crane</u>

The FWS listed the whooping crane as endangered wherever found in 1967 on the original endangered species list under the Endangered Species Preservation Act of 1966 prior to the ESA's promulgation (32 FR 4001-TN2750). The FWS designated critical habitat for the species in 1978. Within Texas, critical habitat occurs along the coastline north of Corpus Christi (43 FR 20938-TN8873). Information in this section is drawn from the FWS's IPaC species profile (FWS 2023-TN8854) unless otherwise cited.

The whooping crane is North America's tallest bird. It is a large snowy white wading bird with black markings on the face. Whooping cranes currently exist in the wild at three locations and in captivity at 12 sites. There is only one self-sustaining wild population, the Aransas-Wood Buffalo National Park population, which nests in Wood Buffalo National Park and adjacent areas in Canada, and winters in the coastal marshes of Aransas County, Texas. Migrations occur from March through April in the spring and from October through November in the fall (FWS 2018-TN5743). Migrants travel during the day along narrow corridors in small groups under limited cloud cover, tail winds, and otherwise favorable conditions. At night, whooping cranes roost in palustrine and riverine wetlands. The species typically selects stopover sites with wide, open views that are isolated from human disturbance (NGPC 2023-TN8876). In a 2009–2015 study of nocturnal roost and diurnal sites used by migrating whooping cranes, Pearse et al. (TN8855) determined that cranes selected roosts in emergent wetlands (50 percent), lacustrine wetlands (25 percent), riverbanks (20 percent), and dryland sites (5 percent). Migrants selected day-use sites in drylands (54 percent), wetlands (45 percent), and riverbanks (1 percent). Whooping cranes tend to stop wherever they happen to be later in the day when conditions are no longer suitable for migration such that stopover use patterns are often very unpredictable (FWS 2009-TN8856). Thus, whooping cranes could use a particular wetland pond regularly, rarely, or even just once over the course of several years of migrations.

Factors Affecting the Species

Direct mortality from hunting and prairie habitat destruction during agricultural development are the primary drivers of whooping crane population declines. Historically, more than 10,000 whooping cranes once populated North America. All whooping cranes alive today have come from the all-time low of 15 whooping cranes that were wintering at Aransas National Wildlife Refuge in Austwell, Texas in 1941 (FWS 2023-TN8857).

Occurrence Within the Action Area

The FWS identified the whooping crane as potentially occurring in the action area in the IPaC report (FWS 2023-TN8835) for the proposed action. The TPWD (2023-TN8836, 2023-TN8837) reports occurrences of the species in both Somervell and Hood Counties in geographic areas that the species may use during migration. The Cornell Lab of Ornithology eBird database reports no occurrences of whooping cranes in the region (eBird 2023-TN8838). The NRC staff identified no information indicating the species' presence in the Comanche Peak action area, and suitable habitat does not exist there. Because this species specifically requires wetland habitat, the NRC staff concludes that the whooping crane does not occur in the action area. Therefore, this SEIS does not assess this species in any further detail.

Tricolored Bat

The FWS issued a proposed rule to list the tricolored bat as endangered in 2022 (87 FR 56381-TN8546). The FWS proposed no critical habitat with the rule because it found that such a designation could increase the degree of threat to the species. Information in this section is drawn from the FWS's species status assessment (FWS 2021-TN8589) unless otherwise cited.

The tricolored bat is a small insectivorous bat that can be distinguished by its unique tricolored fur, which often appears yellowish to orange. The species occurs across 39 states in the eastern and central United States and in portions of southern Canada, Mexico, and Central America. During the winter, tricolored bats often inhabit caves and abandoned mines. In the southern United States, where caves are sparse, tricolored bats also roost in road culverts where they exhibit shorter hibernation bouts and may leave hibernacula to forage during warm nights. Tricolored bats hibernate singly, but sometimes in pairs or in small clusters of both sexes away from other bats. Between mid-August and mid-October, males and females converge at cave and mine entrances to swarm and mate, and females typically give birth to two young between May and July.

Tricolored bats disperse from winter hibernacula to summer roosting habitat in the spring. Tracking studies have recorded migration paths that span from 27 mi (44 km) to 151 mi (243 km). During the spring, summer, and fall, tricolored bats occupy forested habitats. Individuals roost among leaves of live or recently dead deciduous hardwood trees, but individuals may also roost in pines (*Pinus* spp.), eastern red cedar (*Juniperus virginiana*), Spanish moss (*Tillandsia usneoides*), *Usnea trichodea* lichen, and occasionally human structures. Tricolored bats are opportunistic feeders and consume small insects including caddisflies (Trichoptera), flying moths (Lepidoptera), small beetles (Coleoptera), small wasps and flying ants (Hymenoptera), true bugs (Homoptera), and flies (Diptera).

Factors Affecting the Species

Tricolored bats face extinction due primarily to the rangewide impacts of white-nose syndrome, a deadly disease affecting cave-dwelling bats. The FWS estimates that white-nose syndrome has caused population declines of 90 percent or more in affected tricolored bat colonies across most of the species' range.

Occurrence Within the Action Area

The FWS identified the tricolored as potentially occurring in the action area in the IPaC report (FWS 2023-TN8835) for the proposed action. Within Texas, the TPWD (TPWD 2023-TN8858) reports the species as occurring in the eastern half of the state, including the Rolling Plains west to Armstrong County and central Texas as far west as Val Verde County. Recent records from Lubbock, Brewster, and Presidio Counties suggest a northward and westward expansion of its range within the State (TNSRL 2023-TN8859). However, the Texas Natural Science Research

Laboratory reports no specific instances of the species in Somervell or Hood Counties (TNSRL 2023-TN8859). Luminant (Luminant 2023-TN8692) reports no occurrences of tricolored bats on the Comanche Peak site. However, Luminant has conducted no ecological surveys to specifically assess the species' presence or the suitability of onsite habitat.

Based on the above information, the NRC staff conservatively assumes that deciduous forest habitat within the action area, which covers 310 ac (125 ha), could support foraging, mating, and sheltering in the spring, summer, and fall. Accordingly, the staff assesses the potential impacts of the proposed action on this species in Section 3.8.4 of this SEIS.

Texas Fawnsfoot

The FWS issued a proposed rule to list the Texas fawnsfoot as threatened and designate critical habitat for the species in 2021 (86 FR 47916-TN8828). It is a small- to medium-sized mussel with an elongate oval shell. Host species are unconfirmed, but the FWS concludes in the proposed rule that the species uses freshwater drum (*Aplodinotus grunniens*) like other *Truncilla* species occurring in Texas and elsewhere. Texas fawnsfoot inhabit medium- to large-sized streams and rivers with flowing waters and mud, sand, and gravel substrates. The species historically occurred throughout the Colorado and Brazos River Basins. Today, seven populations are known from the lower reaches of the Colorado and Brazos Rivers and from the Trinity River.

Factors Affecting the Species

In its proposed rule (86 FR 47916-TN8828), the FWS identified five primary threats to the Texas fawnsfoot that justify listing the species as threatened under the ESA. These threats are primarily related to habitat changes and include the accumulation of fine sediments, altered hydrology, and impairment of water quality, all of which climate change exacerbates. Predation and collection, as well as barriers to movement, such as dams and impoundments, are also factors, especially for populations already experiencing low stream flow.

Occurrence Within the Action Area

Although the FWS identified the Texas fawnsfoot as potentially occurring in the action area in the IPaC report (FWS 2023-TN8835) for the proposed action, the species has not been documented in CCR, and it is intolerant of reservoirs generally because it requires flowing waters. Based on the lack of suitable habitat, the NRC staff concludes that the Texas fawnsfoot does not occur in the action area. Therefore, this SEIS does not assess this species in any further detail.

Monarch Butterfly

The monarch butterfly is a candidate for Federal listing. In 2020, the FWS issued a 12-month finding announcing its intent to prepare a proposed rule to list the monarch as threatened (85 FR 81813-TN8590). In 2022, the FWS identified the monarch listing action as a priority because the magnitude of threats is moderate to low; however, those threats are imminent for the eastern and western North American populations. Although the ESA does not require consultation for candidates, the NRC considers this species here at the recommendation of the FWS in its IPaC report (FWS 2023-TN8835) for the proposed project. Information in this section is drawn from the FWS's candidate review unless otherwise cited (87 FR 26152-TN8591).

The monarch is a large butterfly with bright orange wings and black veining and borders. During the breeding season, females lay eggs on milkweed (primarily *Asclepias* spp.). Developing larvae feed on milkweed, which allows them to sequester toxic chemicals as a defense against predators, before pupating into a chrysalis to transform into the adult butterfly form. Monarchs produce multiple generations each breeding season, and most adult butterflies live 2 to 5 weeks. Overwintering adults, however, enter reproductive diapause and live 6 to 9 months.

Monarch butterflies occur in 90 countries, islands, or island groups. Monarch butterflies have become naturalized at most of these locations outside of North America since 1840. The populations outside of eastern and western North America (including southern Florida) do not exhibit long-distance migratory behavior. In many regions, monarchs breed year-round. In temperate climates, such as eastern and western North America, monarchs migrate long distances and live for an extended period. In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites in the forests of California and Mexico. These overwintering sites provide protection from the elements and moderate temperatures, as well as nectar and clean water sources located nearby. Migrations can be of distances of over 1,900 mi (3,000 km) and span a 2-month period. In early spring (February-March), surviving monarchs break diapause and mate at overwintering sites before dispersing. The same individuals that undertook the initial southward migration begin flying back through the breeding grounds, and their offspring start the cycle of generational migration over again.

Within Texas, monarch migrate through the State in the fall and the spring. During the fall, monarchs migrate south using one of two principal flyways. One traverses Texas in a 300 mi (480 km) wide path stretching from Wichita Falls to Eagle Pass. Monarchs enter the Texas portion of this flyway at the end of September and cross over into Mexico by early November. The second flyway is situated along the Texas coast. Monarchs migrate through this area from the third week of October to the middle of November. In early March, monarchs begin arriving from their northward migration from overwintering grounds in Mexico. Females seek out emerging milkweed and lay eggs before dying. Their offspring continue heading north through the eastern United States and southern Canada (TPWD 2023-TN8860).

Factors Affecting the Species

The primary threats to the monarch's biological status include loss and degradation of habitat from conversion of grasslands to agriculture, widespread use of herbicides, logging/thinning at overwintering sites in Mexico, senescence and incompatible management of overwintering sites in California, urban development, drought, exposure to insecticides, and the effects of climate change.

Occurrence Within the Action Area

Monarchs are associated with prairie, meadow, and grassland habitats. Within the southern Great Plains, spider milkweed (*Asclepias asperula*), zizote milkweed (*A. oenotheroides*), and green antelope horn (*A. viridis*) are the three species most critical to monarch reproduction and recovery (NRCS 2015-TN8861). The action area includes approximately 1,370 ac (554 ha) of grassland. It is unknown whether milkweed occurs in this area, although grasslands within the action area are undeveloped and would remain undisturbed during the proposed LR period. Because the action area lies within a migratory flyway, the NRC staff conservatively assumes that monarchs could occur in the action area during spring and fall migration when individuals are moving between areas of more suitable habitat. Accordingly, the staff assesses the potential impacts of the proposed action on this species in Section 3.8.4 of this SEIS.

Summary of Potential Species Occurrences in the Action Area

Table 3-16 summarizes the potential for each federally listed species discussed in this section to occur in the action area. As explained in the beginning of this section, no proposed or designated critical habitat occurs in the action area.

Table 3-16 Occurrences of Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction in the Action Area

Species	Type of and Likelihood of Occurrence in the Action Area
golden-cheeked warbler	Occasional transitory presence possible from March to July when individuals are moving between areas of more suitable habitat.
piping plover	Not present.
red knot	Not present.
whooping crane	Not present.
tricolored bat	Presence possible in spring, summer, and fall in deciduous forest habitat within the action area.
Texas fawnsfoot	Not present.
monarch butterfly	Occasional transitory presence possible during spring and fall migration when individuals are moving between areas of more suitable habitat.

3.8.1.3 Endangered Species Act: Federally Listed Species and Critical Habitats Under NMFS Jurisdiction

No federally listed species or designated critical habitats under NMFS jurisdiction occur in the action area. Therefore, this SEIS does not discuss any such species or habitats.

3.8.2 Magnuson-Stevens Act: Essential Fish Habitat

Congress enacted the Magnuson-Stevens Act (MSA) in 1976 to foster long-term biological and economic sustainability of the Nation's marine fisheries. The MSA directs the Fishery Management Councils, in conjunction with NMFS, to designate areas of essential fish habitat (EFH) and to manage marine resources within those areas. EFH is the coastal and marine waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity (50 CFR 600.10) (TN1342). For each federally managed species, the Fishery Management Councils and NMFS designate and describe the EFH by life stage (i.e., egg, larva, juvenile, and adult). No coastal or marine waters occur near Comanche Peak. Therefore, this SEIS does not discuss EFH.

3.8.3 National Marine Sanctuaries Act: Sanctuary Resources

Congress enacted the NMSA in 1972 to protect areas of the marine environment that have special national significance. The NMSA authorizes the Secretary of Commerce to establish the National Marine Sanctuary System and designate sanctuaries within that system, which includes 15 sanctuaries and 2 marine national monuments, encompassing more than 600,000 square miles of marine and Great Lakes waters from Washington State to the Florida Keys, and from Lake Huron to American Samoa. Within these areas, sanctuary resources include any living or nonliving resource of a national marine sanctuary that contributes to the conservation, recreational, ecological, historical, educational, cultural, archaeological, scientific, or aesthetic value of the sanctuary. No coastal or marine waters or Great Lakes occur near Comanche Peak. Therefore, this SEIS does not discuss national marine sanctuaries or their resources.

3.8.4 Proposed Action

The following sections address the site-specific environmental impacts of Comanche Peak LR on the environmental issues identified in Table 3-1 that are related to special status species and habitats.

3.8.4.1 Endangered Species Act: Federally Listed Species and Critical Habitats Under U.S. Fish and Wildlife Service Jurisdiction

In Section 3.8.1.2, the NRC staff determined that one listed species, the golden-cheeked warbler, may occur in the action area. Additionally, the tricolored bat, which the FWS has proposed for Federal listing as endangered, and the monarch butterfly, which is a candidate for Federal listing, may occur in the action area. Section 3.8.1.2 includes relevant information about the habitat requirements, life history, and regional occurrence of these species. In the sections below, the NRC staff analyzes the potential impacts of the proposed Comanche Peak LR on this species. Table 3-17 identifies the NRC staff's ESA effect determination that resulted from the staff's analysis.

In Section 3.8.1.2, the NRC staff also describes several other federally listed or proposed species. The staff explains that these species do not occur in the action area; therefore, the staff does not address these species any further because LR would have no effect on them. Table 3-17 identifies these species and the NRC's staff's "no effect" findings.

Table 3-17 Effect Determinations for Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction

Species	Federal Status(a)	Potentially Present in the Action Area?	Effect Determination(b)
golden-cheeked warbler	FE	Yes	NLAA
piping plover	FT	No	NE
red knot	FT	No	NE
whooping crane	FE	No	NE
tricolored bat	FPE	Yes	NLAA
Texas fawnsfoot	FPT	No	NE
monarch butterfly	FC	Yes	NLAA

FE = federally endangered; NLAA = May affect but is not likely to adversely affect; FT = federally threatened; NE = no effect; FPE = proposed for Federal listing as endangered; FPT = proposed for Federal listing as endangered; FC = candidate for Federal listing.
(a) Indicates protection status under the Endangered Species Act.
(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and NMFS Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031).

<u>Golden-Cheeked Warbler</u>

In Section 3.8.1.2 of this SEIS, the NRC staff concludes that golden-cheeked warblers may occur in the action area from March through July when individuals are moving between areas of more suitable habitat during migration. If present, these warblers would occur occasionally and for short periods of time.

The FWS (FWS 2014-TN8862) identifies habitat destruction and fragmentation throughout its breeding range as the primary threat to the golden-cheeked warbler. Ashe juniper is slow-growing and, therefore, slow to regenerate once it has been altered. Clearing of deciduous oaks upon which the golden-cheeked warbler forages also presents a threat to the species, along with oak wilt infection in trees, nest parasitism by brown-headed cowbirds (Engels and Sexton 1994-TN8863), nest predation (Stake et al. 2004-TN8864; Reidy et al. 2008-TN8865), drought, fire, stress associated with migration, and competition with other avian species. However, habitat loss from urbanization and other development activities is the greatest threat to the species (Ladd and Gass 1999-TN8883).

In 2020, the FWS developed rationale to support a determination key for the golden-cheeked warbler. A determination key is a logically structured set of questions to assist a user in determining whether a proposed project qualifies for predetermined FWS concurrence that the project is not likely to adversely affect the species based on standing FWS analysis. In the memo supporting the determination key, the FWS (FWS 2020-TN8866) found that proposed activities may occur without adverse effects on the golden-cheeked warbler if the project area does not contain this species' preferred habitat and is located at least 300 ft (90 m) from habitat, or if suitable habitat occurs within 300 ft (90 m) of a project, but no suitable habitat would be removed or degraded and the action would be scheduled outside of the species' breeding season (March 1 through August 31). For projects that are anticipated to remove or degrade the species' habitat or are located within 300 ft (90 m) of habitat and would be constructed during the breeding season, the FWS recommends that surveys for the presence of birds be conducted prior to any disturbance activities. If the results of the survey indicate "absence" of golden-cheeked warblers, no further coordination would be necessary, provided construction was implemented and completed prior to the beginning of the breeding season immediately following the survey year.

The NRC staff used the FWS's golden-cheeked warbler determination key on the FWS's IPaC system to receive the FWS's (FWS 2023-TN8835) concurrence that the proposed Comanche Peak LR is not likely to adversely affect the golden-cheeked warbler. This determination is primarily because LR would not involve the removal, modification, or degradation of oak-juniper woodland habitat.

Additionally, during preparation of its LRA, Luminant coordinated with the FWS pursuant to the ESA in 2021. In a September 10, 2021, letter, the FWS (Luminant 2022-TN8655, Appendix C) stated that based on its understanding of the project, no federally listed species would be affected by the proposed LR.

The NRC staff concludes that the proposed Comanche Peak LR may affect, but is not likely to adversely affect, the golden-cheeked warbler. On March 8, 2023, the FWS (FWS 2023-TN8835) concurred with this determination. The FWS's concurrence documents that the NRC staff has fulfilled its ESA Section 7(a)(2) obligations with respect to the proposed Comanche Peak LR. The NRC staff notes that ESA regulations at 50 CFR 402.16 (TN4312) prescribe certain circumstances that require Federal agencies to reinitiate consultation. As of the date of issuance of this SEIS, the NRC staff has identified no information that would warrant reinitiation of consultation.

Tricolored Bat

In Section 3.8.1.2 of this SEIS, the NRC staff concludes that tricolored bats may occur in the action area's deciduous forest habitat in spring, summer, and fall. If present, bats would occur rarely and in small numbers.

The potential stressors that tricolored bats could experience from operation of a nuclear plant (generically) are as follows.

- mortality or injury from collisions with plant structures and vehicles
- habitat loss, degradation, disturbance, or fragmentation, and associated effects
- behavioral changes resulting from refurbishment or other site activities

This section addresses each of these stressors below.

Mortality or Injury from Collisions with Plant Structures and Vehicles

Listed bats can be vulnerable to mortality or injury from collisions with plant structures and vehicles. Bat collisions with human-made structures at nuclear power plants are not well documented but are likely rare based on the available information. In an assessment of the potential effects of operation of the Davis-Besse Nuclear Power Station (Davis-Besse) plant in Ohio, the NRC (NRC 2014-TN7385) noted that four dead bats were collected at the plant during bird mortality studies conducted from 1972 through 1979. Two red bats (*Lasiurus borealis*) were collected at the cooling tower, and one big brown bat (*Eptesicus fuscus*) and one tricolored bat (*Perimyotis subflavus*) were collected near other plant structures. During the initial LR review, the NRC (NRC 2014-TN7385) found that future collisions of bats would be extremely unlikely and, therefore, discountable given the small number of bats collected during the study and the marginal suitable habitat that the plant site provides. Notably, the tricolored bat was not yet proposed for listing when the NRC conducted this review; this consultation only considered the Indiana bat (*Myotis sodalis*), and northern long-eared bat (*M. septentrionalis*). The FWS (2014-TN7605) concurred with this determination. In a 2015 assessment associated with the Indian Point plant in New York, the NRC (2015-TN7382) determined that bat collisions were less likely to occur at the Indian Point plant than at the Davis-Besse plant because Indian Point does not have cooling towers or similarly large obstructions. The tallest structures on the Indian Point site are 134 ft (40.8 m) tall turbine buildings and 250 ft (76.2 m) tall reactor containment structures. The NRC (2015-TN7382) concluded that the likelihood of bats colliding with these and other plant structures on the Indian Point site during the LR period was extremely unlikely and, therefore, discountable. The FWS (2015-TN7612) concurred with this determination. In 2018, the NRC (2018-TN7381) determined that the likelihood of bats colliding with site buildings or structures on the Seabrook site in New Hampshire would be extremely unlikely. The tallest structures on that site are a 199 ft (61 m) tall containment structure and 103 ft (31 m) tall turbine and heater bay building. The FWS (FWS 2018-TN7610) concurred with the NRC's determination. In 2020, the NRC (2020-TN7324) determined that the likelihood of bats colliding with site buildings or structures on the Surry site in Virginia would be extremely unlikely. The FWS (FWS 2019-TN7609) again concurred with the NRC staff's determination on the basis that activities associated with the Surry plant subsequent LR would be consistent with the activities analyzed in the FWS's January 5, 2016, programmatic biological opinion (FWS 2016-TN7400). Most recently, the NRC (2021-TN7293) determined that the likelihood of bats colliding with site buildings or structures at the Point Beach plant in Wisconsin would be extremely unlikely based on structure height and operating experience. The FWS (2021-TN7606) also concurred with this determination based on the FWS's 2016 programmatic biological opinion (FWS 2016-TN7400).

On the Comanche Peak site, the tallest site structures are the reactor containment buildings, each of which is 260.5 ft (79.4 m) high (Luminant 2022-TN8655). The turbine buildings and transmission lines are also prominent features on the site that could pose collision hazard. To date, Luminant has reported no incidents of injury or mortality of any species of bat on the Comanche Peak site associated with site buildings or structures (Luminant 2023-TN8692). Accordingly, the NRC staff finds the likelihood of tricolored bat collisions with site buildings or structures to be extremely unlikely and, therefore, discountable.

Vehicle collision risk for bats varies depending on factors including time of year, location of roads and travel pathways in relation to roosting and foraging areas, the characteristics of individuals' flight, traffic volume, and whether young bats are dispersing. Although collision has been documented for several species of bats, the Indiana Bat Draft Recovery Plan (FWS 2007-TN934) indicates that bat species do not seem to be particularly susceptible to vehicle collisions. However, FWS also finds it difficult to determine whether roads pose a greater risk for bats colliding with vehicles or a greater likelihood of decreasing risk of collision by deterring bat activity (FWS 2016-TN7400). In most cases, FWS expects that roads of increasing size decrease the likelihood of bats crossing the roads and, therefore, reduce collision risk (FWS 2016-TN7400).

During the proposed Comanche Peak LR term, vehicular traffic from truck deliveries, site maintenance activities, and personnel commuting to and from the site would continue throughout the LR period as they have during the current licensing period. Vehicle use would occur primarily in areas that bats would be less likely to frequent, such as along established county and State roads or within industrial-use areas of the Comanche Peak site. Additionally, most vehicle activity would occur during daylight hours when bats are less active. To date, Luminant has reported no incidents of injury or mortality of any species of bat on the Comanche Peak site associated with vehicle collisions Luminant 2023-TN8692). Accordingly, the NRC staff finds the likelihood of future northern long-eared bat collisions with vehicles to be extremely unlikely and, therefore, discountable.

Habitat Loss, Degradation, Disturbance, or Fragmentation, and Associated Effects

As previously discussed in this SEIS, the Comanche Peak action area includes deciduous forest habitat that tricolored bats may inhabit in spring, summer, and fall.

In its final rule listing the northern long-eared bat (80 FR 17974-TN4216), the FWS identified forest conversion and forest modification as two of the most common causes of habitat loss, degradation, disturbance, or fragmentation affecting federally listed bats. Forest conversion is the loss of forest to another land use type, such as cropland, residential, or industrial. This can lead to loss of suitable habitat, fragmentation of remaining habitat patches, and elimination of travel corridors (80 FR 17974-TN4216). Forest management practices maintain forest habitat at the landscape level, but they involve practices that can have direct and indirect effects on bats. Impacts of forest management are typically temporary in nature and can include positive, neutral, and negative impacts.

The proposed action would not involve forest conversion or management and would generally not disturb existing forested habitat on the site. Luminant would continue to perform vegetation maintenance on the site over the course of the proposed LR term. Most maintenance would be of grassy, mowed areas between buildings and along walkways within the industrial portion of the site or on adjacent hillsides. Luminant would continue to maintain onsite transmission line rights-of-way in accordance with North American Electric Reliability Corporation standards.

Less-developed areas and forested areas would be largely unaffected. Luminant does not intend to expand the existing facilities or otherwise perform construction or maintenance activities within these areas (Luminant 2022-TN8655). Site personnel may occasionally remove select trees around the margins of existing forested areas if the trees are deemed hazardous to buildings, infrastructure, or other site facilities or to existing overhead clearances. Negative impacts on bats could result if such trees are potential roost trees. Bats could also be directly injured during tree clearing. However, tree removal would be infrequent, and Luminant personnel would follow company guidance to minimize the potential impacts on bats.

The NRC staff finds that infrequent to rare hazardous tree removal in forested areas during the proposed LR term would not measurably affect any potential bat habitat in the action area. Direct injury or mortality to bats during tree removal is also unlikely because Luminant company guidance would ensure that personnel take the appropriate measures to avoid this potential impact. For instance, Luminant could avoid this impact by removing hazardous trees in the winter when bats are unlikely to be present on the site. Additionally, the continued preservation of the existing forested areas on the site during the LR term would result in positive impacts on tricolored if they are present within or near the action area.

Behavioral Changes Resulting from Refurbishment or Other Site Activities

Construction or refurbishment and other site activities, including site maintenance and infrastructure repairs, could prompt behavioral changes in bats. Noise and vibration and general human disturbance are stressors that may disrupt normal feeding, sheltering, and breeding activities in bats (FWS 2003-TN8841). At low noise levels or farther distances, bats initially may be startled but would likely habituate to the low background noise levels. At closer range and louder noise levels, particularly if accompanied by physical vibrations from heavy machinery, many bats would likely be startled to the point of fleeing from their daytime roosts. Fleeing individuals could experience increased susceptibility to predation and would expend increased levels of energy, which could result in decreased reproductive fitness (FWS 2016-TN7400, Table 4-1). Increased noise may also affect foraging success. Schaub et al. (2008-TN8867) found that the foraging success of the greater mouse-eared bat (*Myotis myotis*) diminished in areas with noise mimicking the traffic sounds that would be experienced within 15 m (49 ft) of a highway.

Within the Comanche Peak action area, noise, vibration, and other human disturbances could dissuade bats from using the action area's forested habitat during migration, which could also reduce the fitness of migrating bats. However, bats that use the action area have likely become habituated to such disturbance because Comanche Peak has been consistently operating for several decades. According to the FWS, bats that are repeatedly exposed to predictable, loud noises may habituate to such stimuli over time (FWS 2010-TN8537). For instance, Indiana bats have been documented as roosting within approximately 1,000 ft (300 m) of a busy State route adjacent to Fort Drum Military Installation and immediately adjacent to housing areas and construction activities on the installation (Army 2014-TN8512). Tricolored bats would likely respond similarly.

Continued operation of Comanche Peak during the LR term would not include major construction or refurbishment and would involve no other maintenance or infrastructure repair activities besides routine activities already performed on the site. Levels and intensities of noise, lighting, and human activity associated with continued day-to-day activities and site maintenance during the LR term would be similar to ongoing conditions since Comanche Peak began operating, and such activity would only occur on the developed, industrial-use portions of the site. While these disturbances could cause behavioral changes in migrating or summer roosting bats, such as the expenditure of additional energy to find alternative suitable roosts, the NRC staff assumes that tricolored bats, if present in the action area, have already acclimated to regular site disturbances. Thus, continued disturbances during the LR term would not cause behavioral changes in bats to a degree that would be able to be meaningfully measured, detected, or evaluated or that would reach the scale where a take might occur.

Summary of Effects

The potential stressors evaluated in this section are unlikely to result in effects on the tricolored bat that could be meaningfully measured, detected, or evaluated, and such stressors are otherwise unlikely to occur for the following reasons:

- Bat collisions with nuclear power plant structures in the United States are rare, and none have been reported at Comanche Peak. Vehicle collisions attributable to the proposed action are also unlikely, and none have been reported at Comanche Peak.
- The proposed action would not involve any construction, land clearing, or other ground-disturbing activities.
- Continued preservation of the existing forested areas on the site would result in positive impacts on northern long-eared bats.
- Bats, if present in the action area, have likely already acclimated to the noise, vibration, and general human disturbances associated with site maintenance, infrastructure repairs, and other site activities. During the LR term, such disturbances and activities would continue at current rates and would be limited to the industrial-use portions of the site.

Conclusion for the Tricolored Bat

All potential effects on the tricolored bat resulting from the proposed action would be insignificant or discountable. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to adversely affect* the tricolored bat. After the issuance of this draft SEIS, the NRC staff will seek the FWS's concurrence regarding this finding.

<u>Monarch Butterfly (*Danaus plexippus*)</u>

In Section 3.8.1.2 of this SEIS, the NRC staff concludes that monarch butterflies may occur in the action area during spring and fall migration when individuals are moving between areas of more suitable habitat. If present, monarchs would occur occasionally and for short periods of time.

The FWS (2020-TN8593) identifies the primary drivers affecting the health of the two North American migratory populations of monarch butterfly as (1) habitat loss and degradation, (2) insecticide exposure, and (3) climate change effects.

Monarch habitat loss and degradation has resulted from conversion of grasslands to agriculture, widespread use of herbicides, logging/thinning at overwintering sites in Mexico, senescence and incompatible management of overwintering sites in California, urban development, and drought (FWS 2020-TN8593). The proposed Comanche Peak LR would not involve any habitat loss, land-disturbing activities, or any activities that would degrade existing natural areas or potential habitat for monarch butterflies. The continued preservation of existing natural areas on the site would result in positive impacts on monarch butterflies.

Most insecticides are non-specific and broad-spectrum in nature. Furthermore, the larvae of many Lepidopterans are considered major pest species, and insecticides are specifically tested on this taxon to ensure that they will effectively kill individuals at the labeled application rates (FWS 2020-TN8593). Although insecticide use is most often associated with agricultural production, any habitat where monarchs are found may be subject to insecticide use. Studies looking specifically at dose-response of monarchs to neonicotinoids, organophosphates, and pyrethroids have demonstrated monarch toxicity (e.g., Krischik et al. 2015-TN8596; James 2019-TN8595; Krishnan et al. 2020-TN8597; Bargar et al. 2020-TN8870). Moreover, the magnitude of risk posed by insecticides may be underestimated, because research usually examines the effects of the active ingredient alone, while many of the formulated products contain more than one active insecticide.

During the proposed LR period, Luminant would continue applying herbicides, as needed, according to labeled uses. Application would primarily be confined to industrial use and other developed portions of the site, such as perimeters of parking lots, roads, and walkways. Continued herbicide application could directly affect monarchs in the action area by injuring or killing individuals exposed to these chemicals. Certain herbicides, such as glyphosate (e.g., Round Up) can kill milkweed, which can affect the ability of female monarchs to lay eggs. However, milkweed is not specifically known to occur on the Comanche Peak site, and Luminant has no plans to apply herbicides to natural areas. Additionally, monarchs are only likely to occur in the action area seasonally during spring and fall migration when individuals are moving between areas of more suitable habitat. Because of the low likelihood of monarchs to be exposed to levels of hazardous chemicals, this potential impact is insignificant because it is unlikely to reach the scale at which a take might occur.

Because the current and projected monarch population numbers are low, both the eastern and western populations are more vulnerable to catastrophic events, such as extreme storms at the overwintering habitat, and other climate change-related phenomena. The FWS (2020-TN8593) anticipates that the eastern population will gain habitat in the north-central region of North America as the species expands northward in response to increasing ambient temperatures. The degree of and rate at which this expansion occurs will depend on the simultaneous northward expansion of milkweed. In the southern region of the continent, including Texas, the population will either experience no gain or some loss of habitat.

Impacts on climate change during normal operations at nuclear power plants can result from the release of GHGs from stationary combustion sources, refrigeration systems, electrical transmission and distribution systems, and mobile sources. However, such emissions are typically very minor because nuclear power plants do not normally combust fossil fuels to generate electricity. During the proposed LR term, the contribution of Comanche Peak operations to climate change-related effects on monarch butterflies would be too small to be meaningfully measured, detected, or evaluated.

Summary of Effects

The potential stressors evaluated in this section are unlikely to result in effects on the monarch butterfly that could be meaningfully measured, detected, or evaluated, and such stressors are otherwise unlikely to occur for the following reasons:

- The proposed action would not involve any habitat loss, land-disturbing activities, or any activities that would degrade existing natural areas or potential habitat for monarch butterflies.

- Continued preservation of the existing natural areas on the site would result in positive impacts on monarch butterflies.
- Herbicides would only be applied according to labeled uses in developed and manicured areas of the site. Herbicides would not be applied in natural areas. Monarchs would only have to potential to occur in the action area seasonally and infrequently, making the likelihood of herbicide exposure low. This represents an insignificant effect because it is unlikely to reach the scale at which a take might occur.
- The contribution of Comanche Peak operations to climate change-related effects on monarch butterflies would be too small to be meaningfully measured, detected, or evaluate.

Conclusion for the Monarch Butterfly

All potential effects on the monarch butterfly resulting from the proposed action would be insignificant. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to adversely affect* the monarch butterfly. Because the monarch is a candidate for Federal listing, the ESA does not require the NRC to consult with the or receive concurrence from the FWS regarding this species.

3.8.4.2 Endangered Species Act: Federally Listed Species and Critical Habitats Under National Marine Fisheries Service Jurisdiction

No federally listed species or critical habitats under NMFS jurisdiction occur within the action area (see Section 3.8.1.2). Therefore, the NRC staff concludes that the proposed action would have no effect on federally listed species or habitats under this agency's jurisdiction.

3.8.4.3 Endangered Species Act: Cumulative Effects

The ESA regulations at 50 CFR 402.12(f)(4) (TN4312) direct Federal agencies to consider cumulative effects as part of the proposed action effects analysis. Under the ESA, cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR Part 402-TN4312). Cumulative effects under the ESA do not include past actions or other Federal actions requiring separate ESA Section 7 consultation, which differs from the definition of "cumulative impacts" under NEPA.

When formulating biological opinions under formal ESA Section 7 consultation, FWS and NMFS (FWS and NMFS 1998-TN1031) consider cumulative effects when determining the likelihood of jeopardy or adverse modification. Therefore, cumulative effects need only be considered under the ESA if listed species will be adversely affected by the proposed action and formal Section 7 consultation is necessary (Vlex 2013-TN9085). Because the NRC staff concluded earlier in this section that the proposed LR is not likely to adversely affect any federally listed species and would not destroy or adversely modify designated critical habitats, the NRC staff did not separately consider cumulative effects for the listed species and designated critical habitats. Further, the NRC staff did not identify any actions within the action area that meet the definition of cumulative effects under the ESA.

3.8.4.4 Magnuson-Stevens Act

No EFH occurs within the area (see Section 3.8.2). Therefore, the NRC staff concludes that the proposed action would have no effect on EFH.

3.8.4.5 National Marine Sanctuaries Act

No national marine sanctuaries occur within the area (see Section 3.8.3). Therefore, the NRC staff concludes that the proposed action would have no effect on sanctuary resources.

3.8.5 No-Action Alternative

Under the no-action alternative, the NRC would not issue renewed licenses, and Comanche Peak would permanently shut down on or before the expiration of the current facility operating licenses. Upon shutdown, the plant would require substantially less cooling water and would produce little to no discernible thermal effluent. Thus, the potential for impacts on all aquatic species related to cooling system operation would be significantly reduced. The ESA action area under the no-action alternative would most likely be the same or similar to the area described in Section 3.8.1.1. The golden-cheeked warblers, tricolored bats, and monarch butterflies may occur within the action area (see Section 3.8.1.2). The NRC would consult with the FWS, as appropriate, to address potential effects on these species resulting from shutdown and decommissioning of the plant. No EFH or national marine sanctuaries occur in the region (see Sections 3.8.2 and 3.8.3). Thus, shutdown would not result in impacts on EFH or sanctuary resources. Actual impacts would depend on the specific shutdown activities and whether any listed species or critical habitats are present when the no-action alternative is implemented.

3.8.6 Replacement Power Alternatives: Common Impacts

The ESA action area and waters potentially containing designated EFH or national marine sanctuary resources for any of the replacement alternatives would depend on various factors, including site selection, current land uses, planned construction activities, temporary and permanent structure locations and parameters, and the timeline of the alternative. The listed species, critical habitats, EFH, and national marine sanctuaries potentially affected by a replacement power alternative would depend on the boundaries of that alternative's effects and the species and habitats federally protected at the time the alternative is implemented. For instance, if Comanche Peak continues to operate until the end of the current license term and a replacement power alternative is implemented at that time, the FWS and NMFS may have listed new species, delisted currently listed species whose populations have recovered, or revised EFH designations. These listing and designation activities would change the potential for the various alternatives to affect federally protected ecological resources. Additionally, requirements for consultation under ESA, MSA, and NMSA would depend on whether Federal permits or authorizations are required to implement each alternative.

Sections 3.8.5 and 3.8.6 describe the types of impacts that terrestrial and aquatic resources would experience under each alternative. Impacts on federally protected ecological resources would likely be similar in type. However, the magnitude and significance of such impacts could be greater for federally protected ecological resources because such species and habitats are rare and more sensitive to environmental stressors.

3.8.7 New Nuclear (Small Modular Reactors) Alternative

The impacts of the new nuclear alternative are largely addressed in the impacts common to all replacement power alternatives described in the previous section. Because the NRC would remain the licensing agency under this alternative, the ESA, MSA, and NMSA would require the NRC to consult with FWS, NMFS, and NOAA, as applicable, before issuing a license for construction and operation of the new facility. During these consultations, the agencies would determine whether the new reactors would affect any federally listed species, adversely modify or destroy designated critical habitat, or result in adverse effects on EFH or sanctuary resources. If the new facility requires a CWA Section 404 permit, USACE may be a cooperating agency for required consultations, or USACE may be required to consult separately. Ultimately, the magnitude and significance of adverse impacts on special status species and habitats would depend on the site location and layout, plant design, plant operations, and the protected species and habitats present in the area when the alternative is implemented.

3.8.8 Natural Gas-fired Combined-Cycle Alternative

The NRC does not license natural gas facilities; therefore, the NRC would not be responsible for ESA, MSA, or NMSA consultations for this alternative. The Federal and private responsibilities for addressing impacts on federally protected ecological resources under this alternative would be like those described in Section 3.8.6 of this SEIS. Ultimately, the magnitude and significance of adverse impacts on federally protected ecological resources resulting from the natural gas alternative would depend on the site location and layout, plant design, plant operations, and the protected species and habitats present in the area when the alternative is implemented.

3.8.9 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

Section 3.8.7 above addresses the impacts of the SMR component of this alternative. The NRC does not license solar PV or wind facilities; therefore, the NRC would not be responsible for ESA, MSA, or NMSA consultations for these components of this alternative. The Federal and private responsibilities for addressing impacts on federally protected ecological resources under this alternative would be like those described in Section 3.8.6 of this SEIS. Ultimately, the magnitude and significance of adverse impacts on federally protected ecological resources resulting from the combination alternative would depend on the site location and layout, plant design, plant operations, and the protected species and habitats present in the area when the alternative is implemented.

3.9 Historic and Cultural Resources

This section describes the cultural background and the historic and cultural resources found at Comanche Peak and in the surrounding area. The description of the resources is followed by the staff’s analysis of the potential impacts on historic and cultural resources from the proposed action (LR) and alternatives to the proposed action.

3.9.1 Cultural Background

Portions of the following chronology were adapted from NRC 2011-TN6437 and NRC 2011-TN8693.

3.9.1.1 Paleoindian Period (9200 to 6000 BC)

Paleoindian people in Texas ranged over large areas of land and traveled in small bands. Early Paleoindian groups are thought to have lived in small central base camps for varying periods throughout the year. Over the course of the Paleoindian era, occupation of fixed base camps gave way to a mobile foraging lifeway, with bands frequently moving their camps as they exhausted the food supply in their immediate area (NRC 2011-TN6437). Most Paleoindian sites that have been excavated in Texas are located in the Panhandle Region, northeast of the

Comanche Peak site, and very few Paleoindian finds have been recorded in the Brazos River drainage (NRC 2011-TN6437).

3.9.1.2 Archaic Period (6000 BC to AD 700)

The Early Archaic period in Texas saw a small increase in population; however, Early Archaic people did not stray greatly from Paleoindian lifeways, continuing to travel in small groups or "bands" hunting wild game and collecting seasonal and perennial edible flora. The climate in north-central Texas became increasingly arid during the Middle Archaic, causing food resources to become scarcer. As a result, Middle Archaic people became more resourceful, processing plants and burning rock middens to extract edible foods from previously unusable sources (NRC 2011-TN6437). During the Late Archaic, an increasingly moist climate, similar to today's climate, led to a greater abundance of food resources and to a continued increase in population. Greater technological diversity is also evident in the many new projectile point forms that appeared during this period.

3.9.1.3 Late Prehistoric Period (AD 700–1500)

The Late Prehistoric Period in north-central Texas is defined by major technological and subsistence developments such as the bow and arrow, pottery, and agriculture. The transition from use of the atlatl and dart for hunting to the bow and arrow was a very important development during this period. Pottery in north-central Texas, referred to as Henrietta Complex pottery, consisted mostly of plain shell-tempered jars and bowls (NRC 2011-TN6437). Some recovered specimens resemble cups or mugs and have been indented with corn. Though there is evidence of the introduction of agriculture during the Late Prehistoric Period, general subsistence remained geared to broad-based hunter-gatherer strategies (NRC 2011-TN6437).

3.9.1.4 Hood County

The northern half of the Comanche Peak is located in Hood County. Grandbury is the county seat, located about 40 mi southwest of Fort Worth. The county was formally established in 1866 by the Texas Legislature (TSHA 2020-TN8716). Settlers arrived around the 1840s, establishing their farms around the Brazos and Paluxy River valleys. In the late 1800s, the primary crops were cotton, corn, and oats. Residents were able to send their produce and livestock to market via the Fort Worth and Rio Grande Railway, which was completed in 1887. By the early 1900s, Hood County had several towns, including Acton, Tolar, Lipan, and Cresson. Several colleges, such as Texas Christian University (originally named Add-Ran Christian University) and Thorp Spring Christian College (1910) were established during this time (TSHA 2020-TN8716).

The county grew with the completion of Lake Granbury in 1969, which turned the county into a popular recreation and resort destination. This led to further economic growth in the retail sector. By the 1980s, more than 80 percent of the land within the county was used for farming and ranching. Beef cattle, nursery crops, hay, turf, pecans, and peanuts are the primary agricultural products (TSHA 2020-TN8716). Retail and social services continue to be the larger industries today (City of Granbury 2022-TN8719).

3.9.1.5 Somervell County

The southern portion of the Comanche Peak site is located in Somervell County, part of Texas' historically important Brazos River Area. Somervell County was created from portions of Hood and Johnson Counties in 1875 (TSHA 2019-TN8722). The area was first settled in 1840s by

Charles Barnard, and the small settlement that bore his name, Barnard's Mill, was granted a post office in 1859. Barnard's Mill was incorporated as Glen Rose in 1872 and currently serves as the Somervell County seat (TSHA 2019-TN8722). The area that became the Comanche Peak site saw only sparse occupation by settlers during the historic period. Ranchers ran cattle along Comanche Creek and the Brazos River, ranging into portions of the project area. The population of Somervell County was 3,931 in 1910, and more than 600 farms were in operation across the county (TSHA 2019-TN8722). By the middle part of the twentieth century, farming had declined dramatically, and the county began to shift to an industrial and commercial economy. The construction and operation of Comanche Peak in the mid-1970s led to rapid population growth and financial change. Today, Comanche Peak, agribusiness (cattle, hay, small grains, goats), and tourism contribute to the area's economy (TSHA 2019-TN8722).

3.9.1.6 Tribes

Comanche Peak is within the traditional lands of the Comanche Nation, Wichita, and the Kickapoo (Native Land Digital 2023-TN8730). A brief discussion of each Tribe is presented below.

The traditional territories of the Comanche include what is now Wyoming, Nebraska, Kansas, Colorado, New Mexico, Oklahoma, and Texas (Comanche Nation 2023-TN8731). The Comanche call themselves Nʉmʉnʉʉ" (NUH-MUH-NUH) which means "The People" in their language.

Known as Lords of the Plains, horses were a key element in the Comanche culture. The Comanche were master horsemen, which was advantageous in war times. Buffalo was also important as it provided food, clothing, tepee covering, and other goods. The Tribe migrated across the Plains in the late 1600s and early 1700s, ultimately settling in southwest Oklahoma. Today, the Comanche Tribe has approximately 17,000 members; approximately 7,000 live in and around Lawton Oklahoma, Ft. Sill, and surrounding counties near the Tribe's headquarters outside of Lawton.

The Wichita historically inhabited vast territory in the present-day states of Kansas, Oklahoma and most of northern Texas. The Kirikir?i:s—Wichita and Affiliated Tribes—consist of the Wichita, Waco, Taovaya, Tawakno, and Kichai (Wichita and Affiliated Tribes 2023-TN8732).

Similar to the Comanche, the Wichita used horses as an important resource to their culture, which allowed them to follow herds of buffalo and hunt more efficiently. The Wichita also traded extensively with the Spanish, exchanging commodities such as glazed painted pottery, obsidian, and turquoise pendants. Shell beads were acquired from the Pueblos in New Mexico and bois d'arc (Osange orange) and engraved pottery from the Caddo (Wichita and Affiliated Tribes 2023-TN8732). The Wichita's population was affected by contagious diseases contracted from European settlers and during hostilities trying to defend their lands. This continued into the 1900s when their reservation, established in 1855, was opened for settlement. This resulted in a destruction of their traditional grass house villages and their communal way of life. Today, the Tribe is based in Anadarko, Oklahoma (Wichita and Affiliated Tribes 2023-TN8733).

The Kickapoo Tribe is a Woodland Tribe who were related to the Sac and Fox. In the mid-eighteenth century, the Kickapoo primarily resided in what they refer to as the "Prairie Band" along the Sangamon River in Illinois and the "Vermillion Band" off the Wabash River in Indiana. The Prairie Band eventually migrated to the then-Spanish province of Texas before the 1821 Mexican Revolution (Kickapoo Tribe of Oklahoma 2023-TN8734). The Spanish had originally given them land, but they were forcibly removed from it in 1839 after the Texas Revolution. The Kickapoo reestablished in Nacimiento, Mexico, where the Mexican government gave them land in exchange for protecting Mexico's northern borders. Some Kickapoo stayed in Nacimiento; others settled with the Chickasaw and Creek nations. In 1873, the Mexican Kickapoo were forced to relocate to Indian Territory. The Kickapoo today are in McCloud, Oklahoma, and many Kickapoo reside in Lincoln and Pottawatomie Counties. Some of their members live near Topeka, Kansas, Eagle Pass, Texas, and Nacimiento (Kickapoo Tribe of Oklahoma 2023-TN8734).

3.9.2 Historic and Cultural Resources at Comanche Peak

A review of the Texas Archeological Sites Atlas indicated 33 previously recorded archaeological sites within the 7,700 ac archaeological area of potential effect (APE). Nineteen of the sites are prehistoric and nine are historic. The prehistoric sites mainly consist of lithic scatters now submerged and/or destroyed by the reservoir. The nine historic sites consist of early twentieth century farmsteads/homesteads or remnants of the farmsteads.

An additional eight sites are within a 1-mi radius of the APE. Seven of the eight sites consist of prehistoric lithic scatters. The one remaining historic site is an earthen dam with a dry laid stone skirt. None of the sites are eligible for inclusion in the National Register of Historic Places (NRHP).

Five cemeteries are within the 1 mi buffer area: Post Oak, Milam Chapel, Nubbin Ridge/Cedar Grove, Hopewell, and one unknown cemetery. Only the Hopewell cemetery is within the APE. There are no historic buildings or roads within the APE or within the 1 mi radius buffer. The nearest historic resource (a historic district) is more than 5 km south of the power plant.

3.9.2.1 Previously Recorded Surveys

Ten previous surveys were conducted within the 1 mi buffer area. Surveys do not appear to have been conducted prior to the construction of the plant and associated reservoir. The first survey in the area was conducted in 1973 to support the construction of Comanche Peak (Skinner and Humphreys 1973-TN8741). A total of 19 prehistoric sites and eight historic sites were recorded. Most of the sites were inundated once the reservoir was filled.

In 2009, Briscoe Consulting performed a survey as part of a water exchange line project (Briscoe and Walker 2009-TN8886). A total of seven sites were recorded as part of their effort. In 2010, Brazos Valley Research Associates (BVRA 2010-TN8780) surveyed sections south of the Comanche Peak site for the proposed Wheeler Branch Pipeline and Water Treatment Plant. A total of 58 ac were surveyed but no new sites were identified. A geoarchaeological survey conducted in association with the project encountered two isolates and sparce artifacts with one previously recorded site (BVRA 2010-TN8781). In 2012, AR Consultants, Inc. conducted a survey for a 40 mi water pipeline. The survey recorded four sites total. Of those, two were historic and the other two were prehistoric. The two prehistoric sites were considered potentially eligible for listing in the NRHP; the two farmsteads were determined not eligible (AR Consultants 2012-TN8782). The most recent survey within the 1 mi buffer area was in 2014 by Sunoco Pipeline, L.P. Atlas did not have any information regarding the survey's findings. The remaining five surveys were noted in Atlas, but their inventory records did not provide any information about each survey's findings beyond the date and/or agency associated with the survey.

3.9.2.2 Consultation

As part of the proposed action, the NRC initiated consultation in April 2023 with 18 Tribes, including the Apache Tribe of Oklahoma, Comanche Nation, Oklahoma, Coushatta Tribe of Louisiana, Delaware Nation, Oklahoma, Tonkawa Tribe of Indians of Oklahoma, Wichita and Affiliated Tribes (Wichita, Keechi, Waco, and Tawakoni,) Oklahoma, Alabama-Coushatta Tribe of Texas, Alabama-Quassarte Tribal Town, Caddo Nation, Cherokee Nation of Oklahoma, Kialegee Tribal Town Kickapoo Tribe of Oklahoma, Kiowa Tribe of Oklahoma, Mescalero Apache Tribe, Seminole Nation of Oklahoma, Thlopthlocco Tribal town, Tunica-Biloxi Tribe, and the United Keetowah Band of Cherokee Indians. The Caddo Nation responded on April 25, 2023, to the request indicating the Tribe did not have any additional information (see Appendix D).

Consultation was initiated with the Texas Historical Commission (THC) on April 18, 2023, and the Advisory Council on Historic Preservation (ACHP) on April 19, 2023. In their May 18, 2023, response, the THC did not indicate any concerns about the proposed action. No response was received from the ACHP.

3.9.2.3 Findings

The National Historic Preservation Act of 1966, as amended (NHPA; 54 U.S.C. 300101 et seq. TN4157), requires Federal agencies to consider the effects of their undertakings on historic properties. Issuing a renewed operating license to a nuclear power plant is an undertaking that could potentially affect historic properties. Historic properties are defined as resources included in, or eligible for inclusion in, the NRHP. The criteria for eligibility are listed in 36 CFR 60.4 (TN1682) (*Title 36*, “Parks, Forests, and Public Property,” Section 60.4, “Criteria for Evaluation”), and include (A) association with significant events in history; (B) association with the lives of persons significant in the past; (C) embodiment of distinctive characteristics of type, period, or construction; and (D) sites or places that have yielded, or are likely to yield, important information.

The Section 106 review process (NHPA Section 106 TN4157) is outlined in regulations issued by the ACHP in 36 CFR Part 800, “Protection of Historic Properties” (TN513). The NRC complies with the obligations required under NHPA Section 106 through the NEPA process (42 U.S.C. 4321 et seq. TN661). In accordance with NHPA provisions, the NRC is required to make a reasonable effort to identify historic properties included, or eligible for inclusion, in the NRHP in the APE.

The archaeological APE is defined as the 7,700 ac where ground disturbance might compromise the physical integrity of archaeological data. There are 36 previously recorded archaeological sites within the archaeological APE and the 1 mi buffer area. None are within the physical footprint of Comanche Peak. In addition, Vistra has no plans to physically modify Comanche Peak for the continued operation of the nuclear plant. Based on this information, the proposed action would have no adverse effect on historic properties at Comanche Peak.

3.9.3 No-Action Alternative

Known historic properties and cultural resources at Comanche Peak would be unaffected if the NRC does not renew the operating license, and Vistra terminates reactor operations. As stated in the decommissioning LR GEIS (NRC 2002-TN7254), the NRC concluded that impacts on cultural resources would be SMALL at nuclear plants where decommissioning activities would only occur within existing industrial site boundaries. Impacts cannot be predicted generically if decommissioning activities would occur outside of the previously disturbed industrial site boundaries, because impacts depend onsite-specific conditions. In these instances, impacts could only be determined through site-specific analysis (NRC 2002-TN665).

In addition, 10 CFR 50.82 (TN249), “Termination of license,” requires power reactor licensees to submit a post-shutdown decommissioning activities report (PSDAR) to the NRC. The PSDAR provides a description of planned decommissioning activities at the nuclear plant. Until the PSDAR is submitted, the NRC cannot determine whether historic properties would be affected outside the existing industrial site boundary after the nuclear plant ceases operations.

3.9.4 Replacement Power Alternatives: Common Impacts

If construction and operation of replacement power alternatives require a Federal license or permit (i.e., Federal undertaking), the Federal agency would need to make a reasonable effort to identify historic properties within the APE. The agency would then need to consider the effects of the undertaking on historic properties in accordance with NHPA Section 106. Identified historic and cultural resources would need to be recorded and evaluated for eligibility for listing in the NRHP. If it is determined that historic properties are present and could be affected by the undertaking, any adverse effects would need to be assessed and mitigated in consultation with the THC (State Historic Preservation Office) and any affected Indian Tribe through the Section 106 process.

<u>Construction</u>

The potential impact on historic properties and other cultural resources during the construction of replacement power-generating facilities would vary depending on the degree of ground disturbance. Undisturbed land areas would need to be surveyed to identify and record historic and cultural material. Any historic and cultural resources and archaeological sites found during these surveys would need to be evaluated for eligibility for listing in the NRHP. Areas of greatest cultural sensitivity should be avoided while maximizing the use of previously disturbed areas.

<u>Operation</u>

Historic properties and cultural resources could be affected by ground-disturbing maintenance activities when operating the replacement power plant.

3.9.5 New Nuclear (Small Modular Reactors) Alternative

Impacts on historic properties and cultural resources would depend on the location of the new nuclear power plant. Portions of the site may have been cleared and graded while some areas remain undisturbed. An archaeological survey would need to be conducted to identify any historic properties within the APE prior to new construction. Land acquired to support the power plant would also need to be surveyed to identify historic properties and archaeological resources.

3.9.6 Natural Gas-fired Combined-Cycle Alternative

Impacts on historic and cultural resources would be similar to those described for the new nuclear alternative and would include the effects of connecting to the existing natural gas pipelines.

3.9.7 Combination Alternative (Solar Photovoltaic, Onshore Wind, New Nuclear [SMR])

Impacts would be similar to those described for the new nuclear alternative and would depend on where the combination of replacement power-generating facilities are located. Most impacts would be limited to the power-generating facility footprint; however, adverse indirect effects may increase if historic properties are present within the viewshed. Wind turbines generally require a large land area, typically in remote/rural areas. Siting in remote areas increases the chance of encountering cultural resources.

3.10 Socioeconomics

This section describes current socioeconomic factors that have the potential to be affected by changes in power plant operations at Comanche Peak Units 1 and 2. Comanche Peak and the communities that support it can be described as a dynamic socioeconomic system. The communities supply the people, goods, and services required to operate the nuclear power plant. Power plant operations, in turn, supply wages and benefits for people and dollar expenditures for goods and services. The measure of a community's ability to support Comanche Peak operations depends on its ability to respond to changing environmental, social, economic, and demographic conditions.

3.10.1 Nuclear Power Plant Employment

The socioeconomic region of influence is defined by the areas where Comanche Peak workers and their families reside, spend their income, and use their benefits, thus affecting the economic conditions of the region. Luminant employs a permanent full-time workforce of approximately 1,159 workers (Luminant 2022-TN8655). Approximately, 64 percent of Comanche Peak permanent workers reside in Hood, Somervell, and Tarrant Counties, Texas (Luminant 2022-TN8655). The remaining workers are spread among other counties in Texas and the United States (Luminant 2022-TN8655) (Table 3-18). Because most of Comanche Peak's permanent workers are concentrated in Hood, Somervell, and Tarrant Counties, the greatest socioeconomics effects are likely to be experienced there. The focus of the impact analysis, therefore, is on the socioeconomic impacts of continued Comanche Peak operation on these three counties.

Table 3-18 Residence of Vistra Employees

State or County	Number of Employees	Percentage of Total
Hood	355	30.6
Somervell	192	16.6
Tarrant	196	16.9
Other Texas counties	343	29.6
Other states	73	6.3
Total	1,159	100

Source: Luminant 2022-TN8655.

Refueling outages occur on an 18-month staggered cycle. Refueling outages last approximately 28 days and additional 800 to 1,200 workers are onsite during a typical outage (Luminant 2022-TN8655).

3.10.2 Regional Economic Characteristics

Goods and services are needed to operate Comanche Peak Units 1 and 2. Although procured from a wider region, some portion of these goods and services are purchased directly from within the socioeconomic region of influence. These transactions sustain existing jobs and maintain income levels in the local economy. This section presents information about employment and income in the Comanche Peak Units 1 and 2 socioeconomic region of influence (ROI).

3.10.2.1 Regional Employment and Income

According to the U.S. Census Bureau's (USCB's) 2017–2021 American Community Survey 5-Year Estimates, educational services and the healthcare and social assistance industry represented the largest employment sector in the socioeconomic region of influence, followed by manufacturing (USCB 2021-TN8818). The Hood, Somervell, and Tarrant County civilian labor force was 1,134,643 persons and the number of employed persons was 1,076,999 (USCB 2021-TN8818). Estimated income information for the socioeconomic region of influence is presented in Table 3-19.

Table 3-19 Estimated Income Information for the Comanche Peak Socioeconomic Region of Influence (2017–2021, 5-Year Estimates)

Metric	Hood County	Somervell County	Tarrant County	Texas
Median household income (dollars)[(a)]	75,851	89,253	73,545	67,321
Per capita income (dollars)[(a)]	39,252	37,395	36,170	34,255
Families living below the poverty level (percent)	6.1	6.4	8.4	10.7
People living below the poverty level (percent)	8.6	10.8	11.3	14
Unemployment rate	3.5	3.2	3.5	3.5

(a) In 2019 inflation-adjusted dollars.
Source: USCB 2021-TN8818.

3.10.2.2 Unemployment

As shown in Table 3-19, according to the USCB 2017–2021 American Community Survey 5-Year Estimates, the unemployment rate in Hood County, Somervell, and Tarrant Counties were 3.3, 3.2, and 3.5 percent, respectively. Comparatively, the unemployment rate in Texas during this same time period was 3.5 percent (USCB 2021-TN8818).

3.10.3 Demographic Characteristics

According to the 2020 Census, an estimated 82,833 people lived within 20 mi (32 km) of Comanche Peak, which equates to a population density of 66 persons per square mile (Luminant 2022-TN8655). This amount translates to a Category 3, population density using the LR GEIS (NRC 1996-TN1162) measure of sparseness, which is defined as "60 to 120 persons per square mile within 20 mi (32 km)." An estimated 2,056,308 people live within a 50 mi (80 km) radius of the Comanche Peak site, which equates to a population density of 262 persons per square mile (Luminant 2022-TN8655). This translates to a Category 4 proximity index. Therefore, Comanche Peak is a combination of "sparseness" Category 3 and "proximity" Category 4 translating to a "high" population area based on the LR GEIS spareness and proximity matrix (NRC 1996-TN1162).

Table 3-20 shows population projections and percent growth from 2000 to 2060 for Hood, Somervell, and Tarrant Counties. During the last several decades, all three counties have experienced increasing population. Based on population projections, the population in all three counties is generally expected to continue to increase through 2060, but at a slower rate with the exception of Somervell County, which is expected to slightly decrease between 2050 and 2060.

The 2010 Census demographic profile of the Comanche Peak population in the region of influence is presented in Table 3-21. According to the 2010 Census, minorities (race and ethnicity combined) composed approximately 47 percent of the total population in the region of influence. The largest minority population of any race in the region of influence were Hispanic of any race (26.2 percent of the total population; 56 percent of the total minority population) (USCB 2010-TN8831).

Table 3-20 Population and Percent Growth in Comanche Peak Socioeconomic Region of Influence Counties

Metric	Year	Hood County Population	Hood County Percent Change	Somervell County Population	Somervell County Percent Change	Tarrant County Population	Tarrant County Percent Change
Recorded	2000	41,100	-	6,809	-	1,446,219	-
Recorded	2010	51,182	25%	8,490	25%	1,809,034	25%
Recorded	2020	61,598	20%	9,205	8%	2,110,640	17%
Projected	2030	70,845	15%	9,787	6%	2,356,541	12%
Projected	2040	79,468	12%	10,114	3%	2,604,655	11%
Projected	2050	88,216	11%	10,249	1%	2,809,558	8%
Projected	2060	97,684	11%	10,179	-1%	2,969,443	6%

Sources: USCB 2000-TN8829, TDC 2022-TN8830, and Luminant 2022-TN8655.

Table 3-21 Demographic Profile of the Population in the Comanche Peak Three-County Region of Influence, 2010

Demographic	Somervell County	Hood County	Tarrant County	Region of Influence
Total population	**8,490**	**51,182**	**1,809,034**	**1,868,706**
Percent White race	77.7	87.1	51.8	52.9
Percent Black or African American race	0.6	0.4	14.5	14.1
Percent American Indian and Alaska Native race	0.5	0.6	0.4	0.4
Percent Asian race	0.5	0.6	4.6	4.5
Percent Native Hawaiian and Other Pacific Islander race	0.0	0.1	0.2	0.2
Percent some other race	0.3	0.1	0.1	0.1
Percent two or more races	1.2	0.9	1.7	1.7
Hispanic, Latino, or Spanish Ethnicity of any race (total population)	**1,626**	**5,234**	**482,977**	**489,837**
Percent Hispanic, Latino, or Spanish Ethnicity of any race of total population	19.2	10.2	26.7	26.2

Source: USCB 2010-TN8831.

According to the USCB's 2020 census, since 2010, minority populations in the three-county region of influence were estimated to have increased by approximately 339,345 persons, and now compose 56 percent of the population (see Table 3-22). The largest changes occurred in the population of people who identify themselves as Hispanic and Black or African American; these populations grew by more than 140,715 and 96,378 persons, respectively, since 2010.

Table 3-22 Demographic Profile of the Population in the Comanche Peak Three--County Region of Influence, 2020

Demographic	Somervell County	Hood County	Tarrant County	Region of Influence
Total population	**9,205**	**61,598**	**2,110,640**	**2,181,443**
Percent White race	76.2	80.9	42.9	44.1
Percent Black or African American race	0.4	0.8	17.0	16.5
Percent American Indian and Alaska Native race	0.5	0.6	0.3	0.3
Percent Asian race	0.6	0.8	6.1	5.9
Percent Native Hawaiian and other Pacific Islander race	0.0	0.1	0.2	0.2
Percent some other race	0.4	0.3	0.4	0.4
Percent two or more races	3.6	3.7	3.7	3.7
Hispanic, Latino, or Spanish Ethnicity of any race (total population)	**1,687**	**7,958**	**620,907**	**630,552**
Percent Hispanic, Latino, or Spanish Ethnicity of any race of total population	18.3	12.9	29.4	28.9

Source: USCB 2020-TN8832.

3.10.3.1 Transient Population

Hood County, Somervell County, and Tarrant County can experience seasonal transient population growth as a result of local tourism and recreational activities associated with multiple federal, State, and county parks as well as camping areas in the counties. There are eight public use lands within the 6 mi vicinity of Comanche Peak. The closest public use lands to Comanche Peak is CCR. Fishing is allowed by making a reservation for boat access or from the banks of the reservoir. CCR is seasonally open from October through March though it occasionally closes due weather, lake conditions, and other reasons. A transient population creates a demand for temporary housing and services in the area.

Based on the Census Bureau's 2017–2021 American Community Survey 5-Year Estimates (USCB 2021-TN8819), 4,234 seasonal housing units are located in the three-county socioeconomic region of influence.

3.10.3.2 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. 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 minority and low-income workers are under-represented in the decennial Census population counts.

Since 2002, the Census of Agriculture reports the numbers of farms hiring migrant workers defined as a farm worker whose employment required travel that prevented the worker from returning to his or her permanent place of residence the same day (USDA 2017-TN8756). The Census of Agriculture is conducted every 5 years and results in a comprehensive compilation of agricultural production data for every county in the Nation.

Information about both migrant and temporary farm labor (i.e., working fewer than 150 days) can be found in the 2017 Census of Agriculture. Table 3-23 presents information about migrant and temporary farm labor in Hood, Somervell, and Tarrant Counties. According to the 2017 Census of Agriculture, 851 farm workers were hired to work for fewer than 150 days and were employed on 344 farms in the three-county region of influence. Six farms in Hood County and 5 farms in Tarrant County reported hiring migrant workers.

Table 3-23 Migrant Farm Workers and Temporary Farm Labor in Counties Located Within 50 mi (80 km) of Comanche Peak

County	Number of Farms with Hired Farm Labor[a]	Number of Farms Hiring Workers for Less Than 150 Days[a]	Number of Farm Workers Working for Less Than 150 Days[a]	Number of Farms Reporting Migrant Farm Labor[a]
Hood	194	128	254	6
Somervell	69	52	123	N/A
Tarrant	248	164	474	5
Total	511	344	851	11

N/A = not available.
(a) Source: Table 7. Hired farm Labor—Workers and Payroll: 2017 (USDA 2017-TN8756).

3.10.4 Housing and Community Services

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

3.10.4.1 Housing

Table 3-24 lists the total number of occupied and vacant housing units, vacancy rates, and median values in the three-county region of influence. Based on the USCB's 2017–2021 American Community Survey 5-year estimates, there were 829,373 housing units in the region of influence, of which 767,226 were occupied. The median values of owner-occupied housing units in the region of influence range from $219,300 in Hood County to $229,200 in Tarrant County. The homeowner vacancy rate was approximately 1.8 percent in Hood County, 0.2 percent in Somervell County, and 1 percent in Tarrant County (USCB 2021-TN8819).

Table 3-24 Housing in the Comanche Peak Region of Influence

Housing Characteristic	Hood County	Somervell County	Tarrant County	ROI
Total housing units	27,987	3,904	797,482	829,373
Occupied housing units	24,195	3,227	739,804	767,226
Total vacant housing units	3,792	677	57,678	62,147
Percent total vacant	14%	17%	7%	7%
Owner-occupied units	19,402	2,631	442,195	464,228
Median value (dollars)	219,300	224,700	229,200	224,400

Housing Characteristic	Hood County	Somervell County	Tarrant County	ROI
Owner vacancy rate (percent)	1.8	0.2	1	1
Renter-occupied units	4793	596	297609	302998
Median rent (dollars/month)	1,105	858	1,217	1,215
Rental vacancy rate (percent)	9	5.1	7.9	7.9
For seasonal, recreational, or occasional use	705	357	3,172	4,234

ROI = region of influence.
Source: USCB 2021-TN8819.

3.10.4.2 Education

Hood County has three school districts comprising 15 public schools, with a total of 9,031 students in the 2021-2022 school year (NCES 2023-TN8800). These 15 public schools include 8 elementary schools, 3 middle schools, and 4 high schools. Somervell County has one public school district. The Somervell County School District comprises four public schools, with approximately 1,989 students for the 2021-2022 school year (NCES 2023-TN8802). These four public schools include two elementary schools, one middle school, and one high school. Tarrant County has the largest number of school districts and schools. There were 16 school districts, 510 schools, and a student body population of more than 337,000 during the 2021-2022 school year (NCES 2023-TN8801).

3.10.4.3 Public Water Supply

Water service is provided to residents of Hood County by 16 water service providers or from private wells (Luminant 2022-TN8655). The major water source for Hood County is Lake Granbury. The largest water treatment plant is the City of Granbury's water treatment plant. A three-phase plan to increase capacity is under way; the first two phases have been completed and capacity has increased to 5.0 MGD (City of Granbury 2022-TN8719). Phase III will begin at a future date in 20–30 years based on population projections. On peak demand days when demand exceeds the 5.0 MGD capacity, water is drawn from the city's 16 groundwater wells (City of Granbury 2022-TN8719).

Wastewater treatment in Hood County is provided by the City of Granbury Wastewater Treatment Plant. The Granbury Wastewater Treatment Plant has a capacity of 2 MGD and currently 100 percent of the capacity is accounted for. After several years of delays due to public opposition, a permit was issued on October 5, 2022, for the new East Wastewater Treatment Plant (City of Granbury 2022-TN8719).

The Action Municipal Utility District also supplies water and water treatment to Hood County residents from 24 groundwater wells and Lake Granbury. The groundwater wells provide approximately 3.1 MGD capacity, while the treated water purchase contract with the Brazos Regional Public Utility Agency provides up to 5.81 MGD. Action Municipal Utility District operates two wastewater treatment plants with a combined capacity of over 1 MGD.

The SCWD is the main water supplier for Somervell County; it operates the only water treatment facility in the county. It has a capacity of 2.5 MGD with buildout capacity of 3.75 MGD. Current population projections through 2070 indicate that the SCWD has enough capacity to meet future demand. SCWD also provides potable water to Comanche Peak. Comanche Peak demand is approximately 10,750,000 gpy.

3.10.5 Tax Revenues

The Somervell County Appraisal District assesses Comanche Peak property and collects property taxes for five tax jurisdictions: Somervell County, City of Glen Rose, SCWD, Glen Rose Medical (Somervell County Hospital District), and Glen Rose Independent School District (ISD) (Luminant 2022-TN8655). Table 3-25 presents Comanche Peak's annual property tax payments to each tax jurisdiction as well as the annual revenue of each jurisdiction during 2015–2021. Comanche Peak property taxes are a significant source of revenue for the Somervell jurisdictions representing between 58 and 75 percent of total revenue.

Table 3-25 Comanche Peak Property Tax Payments by Somervell County Tax Jurisdiction, 2015–2020

Jurisdiction	2015	2016	2017	2018	2019	2020	2021
Somervell County Water District – Annual Revenue	2,946,663	3,332,094	2,855,614	2,906,962	2,854,875	3,207,275	2,971,801
Somervell County Water District – Comanche Peak Property Tax Paid	2,217,053	1,955,064	2,065,752	1,974,670	1,877,518	2,194,612	2,040,555
Somervell County Water District – % of Annual Revenue	75	59	72	68	66	68	69
Somervell County Hospital District – Annual Revenue	3,084,468	4,622,068	3,343,788	3,309,278	3,510,609	3,778,504	3,816,128
Somervell County Hospital District – Comanche Peak Property Tax Paid	2,320,390	2,194,399	2,351,909	2,248,209	2,309,275	2,585,899	2,620,303
Somervell County Hospital District – % of Annual Revenue	75	47	70	68	66	68	69
Somervell County District – Annual Revenue	10,278,112	12,384,528	10,510,640	11,023,500	11,894,304	12,420,744	11,752,390
Somervell County District – Comanche Peak Property Tax Paid	7,733,193	7,277,726	7,391,710	7,488,928	7,822,992	8,499,203	8,195,128
Somervell County District – % of Annual Revenue	75	59	70	68	66	68	70
Glen Rose ISD –							
Glen Rose ISD – Annual Revenue	22,978,613	25,581,028	22,244,937	22,114,893	22,578,637	23,845,010	23,235,273
Glen Rose ISD – Comanche Peak Property Tax Paid	17,548,537	15,356,713	15,917,502	15,292,212	15,122,026	16,587,181	16,044,684
Glen Rose ISD – % of Annual Revenue	76	60	72	69	67	70	69
Glen Rose, City – Annual Revenue	636,928	655,897	699,011	733,380	775,300	737,194	649,947
Glen Rose, City – Comanche Peak Property Tax Paid	25	24	23	23	23	22	21

Jurisdiction	2015	2016	2017	2018	2019	2020	2021
Glen Rose, City – % of Annual Revenue	0	0	0	0	0	0	0
Total – Annual Revenue	39,924,784	46,575,615	39,653,990	40,088,013	41,613,725	43,988,727	42,425,539
Total – Comanche Peak Property Tax Paid	29,819,198	26,783,926	27,726,896	27,004,042	27,131,834	29,866,917	28,900,691
Total – % of Annual Revenue	75%	58%	70%	67%	65%	68%	68%

Source: Luminant 2022-TN8655.

Comanche Peak property taxes in 2015–2017 were challenged by a taxpayer under Texas code (Luminant 2022-TN8655), and a confidential settlement was reached for those years. Currently, no substantial future tax payment changes are expected. The appraised value of Comanche Peak fluctuates with power price forecasts, costs incurred to produce electricity at Comanche Peak, and output. Other changes in valuation are associated with operation of Comanche Peak in the Electric Reliability Council of Texas, Inc.'s (ERCOT's) competitive market as well as school finance reform that could alter Texas' property tax system (Luminant 2022-TN8655).

Comanche Peak also contributes $220,000 annually in support of emergency planning to Hood County, Somervell County, Glen Rose ISD, Bosque County, and the City of Benbrook.

3.10.6 Local Transportation

The transportation network surrounding the Comanche Peak site comprises interstate and state highways and local roads. Interstate 35 is a major interstate highway east of Comanche Peak that runs north-south through Texas. Interstate 20 is north of Comanche Peak and runs east–west through Texas. US 67, US 377, and SH 144 provide commuter access to the Comanche Peak from Hood and Somervell Counties. FM 56 is a two-lane, north–south road located west of the Comanche Peak site and provides the only direct access to the main facilities at the Comanche Peak site. FM 56 connects to US 377 at the City of Tolar in Hood County and to US 67 at the City of Glen Rose in Somervell County. At FM 56 and the Comanche Peak access road intersection, there are dedicated turn lanes and traffic signals (Luminant 2022-TN8655). As shown in Table 3-26, average annual daily traffic volumes for FM 56 between 2005 and 2019 have remained consistent. Based on those volumes the level-of-service (LOS) rating for FM 56 ranges between LOS "A" to LOS "C" (Luminant 2022-TN8655).

Table 3-26 Total Average Annual Daily Traffic Counts on Farm-to-Market (FM) 56

Roadway and Location	Annual Average Daily Traffic Volume Estimates				
Year	2005	2010	2015	2017	2019
FM 56 (South of Comanche Peak Access Rd)	2,900	2,300	2,695	2,526	3,308
FM 56 (North of Comanche Peak Access Rd)	N/A	N/A	2,539	2,530	2,988

FM = Farm-to-Market, N/A = No count available.
Source: Luminant 2022-TN8655.

Within a 10 mi (16 km) radius of Comanche Peak, there are 12 private airports/heliports and 1 public airport (Luminant 2022-TN8655). The Dallas-Fort Worth International Airport is 60 mi (97 km) northeast of Comanche Peak. Amtrak rail also provides service to the region with the closest station to Comanche Peak located in Cleburne, Texas.

3.10.7 Proposed Action

As described in the LR GEIS (NRC 2013-TN2654), for generic issues related to socioeconomics, the impacts of LR on socioeconomic issues would be SMALL. No new or significant information was identified for these issues. Socioeconomic effects of ongoing reactor operations at Comanche Peak have become well established as regional socioeconomic conditions have adjusted to the presence of the nuclear power plant. Changes in employment and tax revenue could affect the availability of community services and housing, as well as traffic on roads near the nuclear power plant.

Vistra indicated in its ER that it has no plans to add non-outage workers during the LR term and that increased maintenance and inspection activities could be managed using the current workforce (Luminant 2022-TN8655). Consequently, people living near Comanche Peak Units 1 and 2 would not experience any changes in socioeconomic conditions during the LR term beyond what is currently being experienced. Therefore, the impact of continued reactor operations during the renewal term would not exceed the socioeconomic impacts predicted in the 2013 LR GEIS. For these issues, the LR GEIS predicted socioeconomic impacts would be SMALL for all nuclear plants.

3.10.8 No-Action Alternative

3.10.8.1 Socioeconomics

Under the no-action alternative, the NRC would not renew the operating license, and Comanche Peak Units 1 and 2 would shut down on or before the expiration of the current facility operating license. This would have a noticeable impact on socioeconomic conditions in the counties and communities near Comanche Peak. The loss of jobs, income, and tax revenue would have an immediate noticeable socioeconomic impact.

If workers and their families move away, increased vacancies and reduced demand for housing would likely cause property values to fall. The greatest socioeconomic impact would be experienced in the communities located nearest to Comanche Peak in Somervell and Hood Counties. However, the loss of jobs, income, and tax revenue may not be as noticeable in large communities due to the time and steps required to prepare the nuclear plant for decommissioning. Therefore, depending on the jurisdiction, socioeconomic impacts from not renewing the operating license and terminating reactor operations at Comanche Peak Units 1 and 2 could range from SMALL to LARGE, depending on the affected community.

3.10.8.2 Transportation

Traffic volume on roads near Comanche Peak Units 1 and 2 may be noticeably reduced after the termination of reactor operations. Any reduction in traffic volume would coincide with workforce reductions at Comanche Peak. The number of truck deliveries and shipments would also be reduced until active decommissioning. Therefore, due to the time and steps required to prepare the nuclear plant for decommissioning, traffic-related transportation impacts would be SMALL.

3.10.9 Replacement Power Alternatives: Common Impacts

Workforce requirements for replacement power alternatives were evaluated to measure their possible effects on current socioeconomic and transportation conditions. Table 3-27 summarizes socioeconomic and transportation impacts of reasonable replacement power alternatives. The following sections provides a discussion of the common socioeconomic and transportation impacts during construction and operations of replacement power-generating facilities.

Table 3-27 Socioeconomic and Transportation Impacts of Replacement Power Alternatives

Alternative	Resource Requirements	Impacts	Discussion
New Nuclear (small modular reactors [SMRs])	Construction: peak 3,300 workers for several months	MODERATE to LARGE	If all six small modular reactors are constructed/installed at the same time. Same number of operations workers as Comanche Peak.
New Nuclear (SMRs)	Operations: 1,500 workers	SMALL	If all six small modular reactors are constructed/installed at the same time. Same number of operations workers as Comanche Peak.
Natural Gas-fired Combined-Cycle (NGCC)	Construction: peak 800 workers for several months	MODERATE	If all four combined-cycle combustion turbines are constructed/installed at the same time. Some operations workers could transfer from Comanche Peak.
Natural Gas-fired Combined-Cycle (NGCC)	Operations: 150 workers	SMALL	If all four combined-cycle combustion turbines are constructed/installed at the same time. Some operations workers could transfer from Comanche Peak.
Combination, New Nuclear (SMR), Solar PV, and Onshore Wind	Construction: peak 600 (SMR), 2,100 (Solar PV), and 870 (Wind) workers for several months	SMALL to LARGE	Workers would likely be scattered throughout the region and would not have a noticeable effect on local economy.
Combination, New Nuclear (SMR), Solar PV, and Onshore Wind	Operations: 250 (Nuclear), 100 (Solar PV), and 80 (Wind) workers	MODERATE	Workers would likely be scattered throughout the region and would not have a noticeable effect on local economy.

PV = photovoltaic.
Source: BLM 2019-TN8386; DOE 2011-TN8387; NRC 2011-TN6437; Luminant 2013-TN8669; NRC 2019-TN6136; Tegen 2016-TN8826.

3.10.9.1 Socioeconomics

Socioeconomic impacts are defined in terms of changes in the social and economic conditions of a region. For example, the creation of jobs and the purchase of goods and services during the construction and operation of a replacement power plant could affect regional employment, income, and tax revenue. For each alternative, two types of jobs would be created: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts.

While the selection of a replacement power alternative could create opportunities for employment and income and generate tax revenue in the local economy, employment, income, and tax revenue would be greatly reduced or eliminated in communities located near Comanche Peak Units 1 and 2. These impacts are described in the “No-Action Alternative” (Section 3.10.8).

Construction

The relative economic effect of an influx of workers on the local economy and tax revenue would vary and depend on the size of the workforce and construction completion time. The greatest impact would occur in the communities where the majority of construction workers would reside and spend their incomes. While some construction workers would be local, additional workers may be required from outside the immediate area depending on the local availability of appropriate trades and occupational groups. The construction workforce would stimulate spending on goods and services resulting in the creation of indirect jobs. The region of influence could experience a short-term economic boom during construction from increased tax revenue, income generated by expenditures for goods and services, and the increased demand for temporary (rental) housing. After construction, the region of influence would likely experience a return to preconstruction economic conditions. The economic effects of construction would include increased tax revenue, additional wages and benefits, and increased income generated by operational expenditures. Overall, the relative socioeconomic impact from job creation, labor wages and salaries, and additional tax revenue as a result of construction, while beneficial, would depend on the tax structure of the local economy, availability of local workforce and worker migration, and location of major equipment suppliers.

Operation

Before the commencement of startup and operations, local communities could see an influx of operations workers and their families resulting in an increased demand for permanent housing and public services. These communities would also experience the economic benefits from increased income and tax revenue generated by the purchase of goods and services needed to operate a new replacement power plant. Consequently, operations would have a greater potential for effecting permanent, long-term socioeconomic impacts on the region. As would be the case for construction, the impacts from operations on employment and income in the local area and region around a facility would vary depending on the location of major equipment suppliers and the availability of local labor. The economic effects of operating a new facility could include increased tax revenue from property and sales tax, additional wages, increased income generated by operational expenditures, and increased demand for housing. The relative socioeconomic impact would depend on the tax structure of the local economy, availability of local workforce and worker migration, and available housing.

3.10.9.2 Transportation

Transportation impacts are defined in terms of changes in LOS conditions on local roads. Additional vehicles during construction and operations could lead to traffic congestion and LOS impacts on local roadways and delays at intersections. Transportation impacts depend on the size of the workforce and additional vehicles, the capacity of the local road network and infrastructure, and baseline traffic conditions and patterns.

Construction

Transportation impacts would consist of commuting workers and truck deliveries of equipment and material to the construction site. Traffic volumes would increase substantially during shift changes. Trucks would deliver equipment and material to the construction site and remove waste material, thereby increasing the amount of traffic on local roads. The increase in traffic volumes could result in LOS impacts and delays at intersections during certain hours of the day. In some instances, construction material could also be delivered and removed by rail or barge.

Operation

Traffic volumes would be greatly reduced after construction because of the smaller size of the operations workforce. Transportation impacts would consist of commuting operations workers and truck deliveries of equipment and material and removal of waste material. Increased commuter traffic would occur during shift changes and deliveries of materials and equipment to the power plant.

3.10.10 New Nuclear (Small Modular Reactors) Alternative

Potential socioeconomic and transportation impacts during the construction and operation of a new SMR power plant would be similar to the impacts described above in Section 3.10.9 and in Table 3-27.

3.10.11 Natural Gas-fired Combined-Cycle Alternative

Potential socioeconomic and transportation impacts during the construction and operation of a new NGCC power plant would be similar to the impacts described above in Section 3.10.9 and in Table 3-27.

3.10.12 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

Potential socioeconomic and transportation impacts during the construction and operation of a new SMR power plant and the installation of solar PV and onshore wind facilities would be similar to the impacts described above in Section 3.10.9 and Table 3-27.

3.11 Human Health

Comanche Peak is both an industrial facility and a nuclear power plant. Similar to any industrial facility or nuclear power plant, the operation of Comanche Peak during the LR period will produce various human health risks for workers and members of the public. This section describes the human health risks resulting from the operation of Comanche Peak, including those related to radiological exposure, chemical hazards, microbiological hazards, electromagnetic fields, and other hazards. The description of these risks is followed by the NRC staff’s analysis of the potential impacts on human health of the proposed action of LR and the alternatives to the proposed action.

3.11.1 Radiological Exposure and Risk

Operation of a nuclear power plant involves the use of nuclear fuel to generate electricity. Through the fission process, the nuclear reactor splits uranium atoms, resulting very generally in (1) the production of heat, which is then used to produce steam to drive the plant’s turbines and generate electricity; and (2) the creation of radioactive byproducts. As required by NRC regulations at 10 CFR 20.1101 (TN283), “Radiation protection programs,” Vistra designed a radiation protection program to protect onsite personnel (including employees and contractor employees), visitors, and off-site members of the public from radiation and radioactive material at Comanche Peak. The Comanche Peak radiation protection program is extensive and includes, but is not limited to, the following:

- organization and administration (e.g., a radiation protection manager who is responsible for the program and ensures trained and qualified workers for the program)
  - implementing procedures
- an ALARA program to minimize dose to workers and members of the public
- dosimetry program (i.e., measures radiation dose to plant workers)
- radiological controls (e.g., protective clothing, shielding, filters, respiratory equipment, and individual work permits with specific radiological requirements)
- radiation area entry and exit controls (e.g., locked or barricaded doors, interlocks, local and remote alarms, personnel contamination monitoring stations)
- posting of radiation hazards (i.e., signs and notices alerting plant personnel of potential hazards)
- recordkeeping and reporting (e.g., documentation of worker dose and radiation survey data)
- radiation safety training (e.g., classroom training and use of mockups to simulate complex work assignments)
- radioactive effluent monitoring management (i.e., controlling and monitoring radioactive liquid and gaseous effluents released into the environment)
- radioactive environmental monitoring (e.g., sampling and analysis of environmental media, such as direct radiation, air, water, groundwater, milk, food products (corn and pecans), fish, broadleaf vegetation, and shoreline sediment to measure the levels of radioactive material in the environment that may impact human health)
- radiological waste management (i.e., controlling, monitoring, processing, and disposing of radioactive solid waste)

For radiation exposure to Comanche Peak personnel, the NRC staff reviewed the data contained in NUREG-0713, Volume 42, *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and other Facilities 2020: Fifty-First Annual Report* (NRC 2020-TN7292). The 53rd annual report was the most recent annual report available at the time of this environmental review. It summarizes the occupational exposure data in the NRC's Radiation Exposure Information and Reporting System database through 2020. Nuclear power plants are required by 10 CFR 20.2206 (TN283), "Reports of individual monitoring," to report their occupational exposure data to the NRC annually.

The Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2020 (NRC 2022-TN8530) calculates a 3-year average collective dose per reactor for workers at all nuclear power reactors licensed by the NRC. The 3-year average collective dose is one of the metrics that the NRC uses in the Reactor Oversight Process to evaluate the applicant's ALARA program. Collective dose is the sum of the individual doses received by workers at a facility licensed to use radioactive material during a 1-year time period. There are no NRC or EPA standards for collective dose. Based on the data for operating pressurized-water reactors like the ones at Comanche Peak, the average annual collective dose per reactor-year was 31 person-roentgen equivalent man (rem) (NRC 2022-TN8530). In comparison, Comanche Peak had a reported annual collective dose per reactor-year of 24.2 person-rem.

Section 2.1.4, "Radioactive Waste Management Systems," of this SEIS discusses off-site dose to members of the public.

3.11.2 Chemical Hazards

State and Federal environmental agencies regulate the use, storage, and discharge of chemicals, biocides, and sanitary wastes. Such environmental agencies also regulate how facilities like Comanche Peak manage minor chemical spills. Chemical and hazardous wastes can potentially affect workers, members of the public, and the environment.

Vistra currently controls the use, storage, and discharge of chemicals and sanitary wastes at Comanche Peak in accordance with its pollution prevention plan and associated procedures, waste management procedures, and Comanche Peak site-specific chemical accident prevention provisions. Vistra monitors and controls discharges of chemical and sanitary wastes through Comanche Peak's TPDES permit process, discussed in Section 3.5.1.3, "Surface Water Quality and Effluents." These plant procedures, plans, and processes are designed to prevent and minimize the potential for a chemical or hazardous waste release and, in the event of such a release, minimize the impact on workers, members of the public, and the environment.

3.11.3 Microbiological Hazards

Thermal effluents associated with nuclear plants that discharge to a cooling pond or lake, such as Comanche Peak's industrial cooling reservoir, have the potential to promote the growth of certain thermophilic microorganisms linked to adverse human health effects. Microorganisms of particular concern include several types of bacteria (*Legionella* species, *Salmonella* species, *Shigella* species, and *Pseudomonas aeruginosa*) and the free-living amoeba (*Naegleria fowleri)*.

The public can be exposed to the thermophilic micro-organisms *Salmonella*, *Shigella*, *P*. *aeruginosa*, and *N*. *fowleri* during swimming, boating, or other recreational uses of freshwater. If these organisms are naturally occurring and a nuclear plant's thermal effluent enhances their growth, the public could experience an elevated risk of infection when recreating in the affected waters.

Nuclear plant workers can be exposed to *Legionella* when performing cooling system maintenance through inhalation of cooling tower vapors because these vapors are often within the optimum temperature range for *Legionella* growth. Plant personnel most likely to come in contact with aerosolized *Legionella* are workers who clean and maintain cooling towers and condenser tubes. Public exposure to *Legionella* from nuclear plant operation is generally not a concern because exposure risk is confined to cooling towers and related components and equipment, which are typically within the protected area of the site and, therefore, not accessible to the public.

<u>Thermophilic Microorganisms of Concern</u>

Salmonella typhimurium and *S. enteritidis* are two species of enteric bacteria that cause salmonellosis, a disease more common in summer than winter. Salmonellosis is transmitted through contact with contaminated human or animal feces and may be spread through water transmission, contact with infected animals or food, or contamination in laboratory settings

(CDC 2022-TN8513). These bacteria grow at temperatures ranging from 77 °F to 113 °F (25 °C to 45 °C), have an optimal growth temperature around human body temperature (98.6 °F [37 °C]), and can survive extreme temperatures as low as 41 °F (5 °C) and as high as 122 °F (50 °C) (Oscar 2009-TN8514). Research studies examining the persistence of *Salmonella* species outside of a host found that the bacteria can survive for several months in water and in aquatic sediments (Moore et al. 2003-TN8515).

Shigella species causes the infection shigellosis, which can be contracted through contact with contaminated food, water, or feces. When ingested, the bacteria release toxins that irritate the intestines. Like salmonellosis, shigellosis infections are more common in summer than in winter because the bacteria optimally grow at temperatures between 77 °F and 99 °F (25 °C and 37 °C) (PHAC 2010-TN8868). Shigellosis outbreaks related to recreational uses of water are rare; almost all cases are related to food contamination.

Pseudomonas aeruginosa can be found in soil, hospital respirators, water, and sewage, and on the skin of healthy individuals. It is most commonly linked to infections transmitted in healthcare settings. Infections from exposure to *P. aeruginosa* in water can lead to the development of mild respiratory illnesses in healthy people. These bacteria optimally grow at 98.6 °F (37 °C) and can survive in high-temperature environments of up to 107.6 °F (42 °C) (Todar 2004-TN7723).

The free-living amoeba *N. fowleri* prefers warm freshwater habitats and is the causative agent of human primary amoebic meningoencephalitis (PAM). Infections occur when *N. fowleri* penetrate the nasal tissue through direct contact with water in warm lakes, rivers, or hot springs; and migrate to the brain tissues. This free-swimming amoeba species grows best at higher temperatures of up to 115 °F (46 °C) (CDC 2017-TN7853). It is typically not present in waters below 95 °F (35 °C) (Tyndall et al. 1989-TN8598). The *N. fowleri*-caused disease PAM is rare in the United States. From 1962 through 2020, the Centers for Disease Control and Prevention (CDC) reports an average of 2.5 cases of PAM annually nationwide.

Legionella is a genus of common warm-water bacteria that occurs in lakes, ponds, and other surface waters, as well as in some groundwater sources and soils. The bacteria thrive in aquatic environments as intracellular parasites of protozoa and are only pathogenic to humans when aerosolized and inhaled into the lungs. Approximately 2 to 5 percent of those exposed in this way develop an acute bacterial infection of the lungs known as Legionnaires' disease (Madigan et al. 2003-TN3904). *Legionella* optimally grow in stagnant surface waters containing biofilms or slimes that range in temperature from 95 °F to 113 °F (35 °C to 45 °C), although the bacteria can persist in waters from 68 °F to 122 °F (20 °C to 50 °C) (Madigan et al. 2003-TN3904). As such, human infection is often associated with complex water systems within buildings or structures, such as cooling towers (CDC 2016-TN8519). Potential adverse health effects related to *Legionella* would generally not be of concern at Comanche Peak because the plant does not use cooling towers. The CDC issues biannual surveillance summary reports concerning Legionnaires' disease.

<u>Baseline Conditions in Comanche Creek Reservoir</u>

As described in Section 2.1.3, "Cooling and Auxiliary Water Systems," of this SEIS, Comanche Peak uses a once-through cooling system for both units, drawing water from its intake on the north side of the plant in CCR and returning it to CCR on the southeast side of the plant through the discharge point. CCR is classified as an industrial cooling reservoir and is not subject to ambient water quality temperature limits. The current TPDES permit for discharge for

Comanche Peak limits the daily average temperature to 113 °F (45 °C) and daily maximum discharge temperature to 116 °F (46.7 °C).

3.11.4 Electromagnetic Fields

Electromagnetic fields (EMFs) are generated by any electrical equipment. All nuclear power plants have electrical equipment and power transmission systems associated with them. Power transmission systems consist of switching stations (or substations) located on the nuclear power plant site and the transmission lines needed to connect the plant to the regional electrical distribution grid. Transmission lines operate at a frequency of 60 Hz (60 cycles per second), which is low compared to the frequencies of 55 to 890 MHz for television transmitters and 1,000 MHz and greater for microwaves.

Occupational workers or members of the public near transmission lines may be exposed to the EMFs produced by the transmission lines. The EMF varies in time as the current and voltage change, so that the frequency of the EMF is the same (e.g., 60 Hz for standard alternating current, or AC). Electrical fields can be shielded by objects such as trees, buildings, and vehicles. Magnetic fields, however, penetrate most materials, but their strength decreases with increasing distance from the source. The LR GEIS (NRC 2013-TN2654) summarizes NRC-accepted studies of the health effects of EMFs.

3.11.5 Other Hazards

This section addresses two additional human health hazards: (1) physical occupational hazards and (2) occupational electric shock hazards.

Nuclear power plants are industrial facilities that have many of the typical occupational hazards found at any other electric power-generation utility. Nuclear power plant workers may perform electrical work, electric powerline maintenance, repair work, and maintenance activities and may be exposed to potentially hazardous physical conditions. A physical hazard is an action, agent, or condition that can cause harm upon contact. Physical actions could include slips, trips, and falls from height. Physical agents could include noise, vibration, and ionizing radiation. Physical conditions could include high heat, cold, pressure, confined space, or psychosocial issues, such as work-related stress.

The Occupational Safety and Health Administration (OSHA) is responsible for developing and enforcing workplace safety regulations. Congress created OSHA by enacting the Occupational Safety and Health Act of 1970, as amended (Occupational Safety and Health Act of 1970-TN4453.) to safeguard the health of workers. With specific regard to nuclear power plants, plant conditions that result in an occupational risk, but do not affect the safety of licensed radioactive materials, are under the statutory authority of OSHA rather than the NRC, as set forth in a memorandum of understanding (NRC and OSHA 2013-TN8542) between the NRC and OSHA. Occupational hazards are reduced when workers adhere to safety standards and use appropriate protective equipment; however, fatalities and injuries from accidents may still occur. Comanche Peak maintains an occupational safety program for its workers in accordance with OSHA regulations (Luminant 2022-TN8655).

Based on its evaluation in the LR GEIS (NRC 2013-TN2654), the NRC has not found electric shock resulting from direct access to energized conductors or from induced charges in metallic structures to be a problem at most operating plants. Generally, the NRC staff also does not expect electric shock from such sources to be a human health hazard during the LR period.

However, a site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of this SEIS. Transmission lines that are within the scope of the NRC's LR environmental review are limited to (1) those transmission lines that connect the nuclear plant to the substation where electricity is fed into the regional distribution system, and (2) those transmission lines that supply power to the nuclear plant from the grid (NRC 2013-TN2654).

As discussed in Section 2.1.6.4, "Power Transmission Systems," of this SEIS, all in-scope transmission lines are located within the site boundary. Specifically, there are five in-scope transmission lines (Luminant 2022-TN8655). Four lines are connected to the 345 kV switchyard and one line is connected to the 138 kV switchyard. There are no interconnections between the 138 kV switchyard and the 345 kV switchyard at the site. Given that all lines are located completely within Comanche Peak Power Company-owned property and controlled by Vistra. the public does not have access to this area and, therefore, there is no potential shock hazard to off-site members of the public from these onsite transmission lines. The transmission corridors comply with the National Electrical Safety Code clearance standards and therefore the site documents evaluations of changes that would potentially affect the electrical shock hazard of the in-scope transmission lines per their procedures. Comanche Peak maintains an occupational safety program, which includes protection from acute electrical shock and is conducted in accordance with OSHA regulations (Luminant 2022-TN8655).

3.11.6 Proposed Action

According to the LR GEIS (NRC 1996-TN288, 2013-TN2654), the generic issues related to human health as identified in Table 3-1 would have SMALL impacts resulting from LR. The NRC staff identified no new and significant information about these issues. Thus, as concluded in the LR GEIS, the impacts of the generic issues related to human health would be SMALL.

Table 3-2 identifies one uncategorized issue (chronic exposure to EMFs) and two site-specific (Category 2) issues (electric shock hazards and microbiological hazards to the public) related to human health applicable to Comanche Peak LR. These issues are analyzed below.

3.11.6.1 Microbiological Hazards to the Public

In the LR GEIS (NRC 2013-TN2654), the NRC staff determined that the effects of thermophilic micro-organisms on the public from plants using cooling ponds, lakes, or canals or cooling towers that discharge to a river is a Category 2 issue that requires site-specific evaluation during each LR review.

Based on the information presented in Section 3.10.1 of the ER, "Microbiological Hazards" the most likely thermophilic organism in CCR that may pose a public health hazard resulting from nuclear power plant operations is the free-living amoeba *Naegleria fowleri*. The public could be exposed to these microorganisms when swimming, boating, fishing, or engaging in other recreational uses of CCR. Note that CCR is classified as an industrial cooling reservoir and activities are limited to seasonal recreational boating and fishing. Swimming and wading are prohibited, and access is controlled by Comanche Peak.

As explained in Section 3.11.3, "Microbiological Hazards" of this SEIS, all other thermophilic micro-organisms identified in the LR GEIS that may be associated with thermal effluents of nuclear plants pose less of a concern at Comanche Peak or within the CCR. These micro-organisms could include *Salmonella typhimurium, Shigella* species, *Pseudomonas aeruginosa*, and *Legionella* species.

<u>*Naegleria fowleri*</u>

As previously discussed, Comanche Peak's thermal effluent discharge is allowed per the TPDES permit to potentially be within the range of *N. fowleri's* growth temperature (95–106 °F). However, the discharge outlet terminates 35–40 ft below the lake surface, promoting high-velocity mixing of the warmer discharge with cooler water at the lower depths of the lake. The high-velocity mixing rapidly incorporates the heated discharge, bringing the temperature back to ambient conditions. Furthermore, the public is restricted by barriers to coming within 1,800 ft of the discharge point. According to the Texas Department of State Health Services, there are no known reports of outbreaks in the human population of reportable disease caused by thermophilic organisms in the recent past related to Comanche Peak that would prompt investigation by the Department. The proposed action would not result in any operational changes that would affect thermal effluent temperature or otherwise create favorable conditions for *N. fowleri* growth (Luminant 2022-TN8655). During the proposed LR term, the public health risk from *N. fowleri* exposure in CCR remains extremely low.

Conclusion

The thermophilic micro-organisms *N. fowleri* can pose public health concerns in recreational-use waters when these organisms are present in high enough concentrations to cause infection. Based on the NRC staff's preceding analysis, continued thermal effluent discharges from Comanche Peak during the proposed LR term would not contribute to the proliferation in CCR of *N. fowleri*. No infections are known to have occurred from CCR, and none are expected during the proposed LR term.

The NRC staff concludes that the impacts of thermophilic micro-organisms on the public are SMALL for the proposed Comanche Peak LR.

3.11.6.2 Uncategorized Issue Related to Human Health: Chronic Effects of Electromagnetic Fields

The LR GEIS (NRC 2013-TN2654) does not designate the chronic effects of 60 Hz EMFs from powerlines as either a Category 1 or 2 issue. Until a scientific consensus is reached about the health implications of EMFs, the NRC will not include them as Category 1 or 2 issues.

The potential for chronic effects from these fields continues to be studied and is not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the DOE. The NIEHS report (NIEHS 1999-TN78) contains the following conclusion:

> The NIEHS concludes that ELF-EMF (extremely low frequency electromagnetic field) exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or

> noncancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement was not sufficient to cause the NRC to change its position with respect to the chronic effects of EMFs. The NRC staff considers the LR GEIS finding of “UNCERTAIN” still appropriate and will continue to follow developments on this issue.

3.11.6.3 Category 2 Issue Related to Human Health: Electric Shock Hazards

Based on the LR GEIS (NRC 2013-TN2654), the Commission found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been identified as a problem at most operating plants and generally is not expected to be a problem during the LR term. However, a site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of Comanche Peak LR review.

As discussed in Section 3.11.5, “Other Hazards,” there are no off-site transmission lines that are in scope for this SEIS. Therefore, there are no potential impacts on members of the public. The onsite overhead transmission lines with the potential for electric shock to workers through induced currents are depicted in Figure E2.2-2 of the ER. To address this occupational hazard, Vistra adheres to the National Electrical Safety Code for clearances and OSHA compliance requirements for shock hazard avoidance (Luminant 2022-TN8655). As discussed in Section 3.11.5, “Other Hazards,” Comanche Peak maintains an occupational safety program in accordance with OSHA regulations for its workers, which includes protection from acute electric shock. Therefore, the NRC staff concludes that the potential impacts from acute electric shock during the LR term would be SMALL.

3.11.6.4 Environmental Consequences of Postulated Accidents

The LR GEIS (NRC 2013-TN2654) evaluates the following two classes of postulated accidents as they relate to LR:

- design-basis accidents: postulated accidents that a nuclear facility must be designed and built to withstand without loss to the systems, structures, and components necessary to ensure public health and safety
- severe accidents: postulated accidents that are more severe than design-basis accidents because they could result in substantial damage to the reactor core

As shown in Table 3-1, the LR GEIS (NRC 2013-TN2654) addresses design-basis accidents as a Category 1 issue and concludes that the environmental impacts of design-basis accidents are of SMALL significance for all nuclear power plants.

In Table 3-2, the LR GEIS (NRC 2013-TN2654) designates severe accidents as a Category 2 issue requiring site-specific analysis. Based on information in the LR GEIS, the NRC determined in 10 CFR Part 51 (TN250), Subpart A, Appendix B, that for all nuclear power plants, the environmental impacts of severe accidents associated with LR is SMALL, with the following caveat:

> The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, 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 (NRC 2013-TN2654).

The applicant submitted an assessment of severe accident mitigation design alternatives (SAMDAs) as part of its operation license application for Comanche Peak Unit 1 in 1990 and Unit 2 in 1993 (see Appendix F). Because the NRC staff has previously considered SAMDAs (or severe accident mitigation alternatives [SAMAs]) in the Final Environmental Statement (NRC 1981-TN8799) for Comanche Peak, the applicant is not required to perform another SAMA analysis for its LRA (10 CFR 51.53(c)(3)(ii)(L)) (TN250). More specifically, the Commission's statement of considerations for the 1996 Part 51 rulemaking point to the original SAMDA analysis and states the following:

> NRC staff considerations of severe accident mitigation alternatives have already been completed and included in an EIS or supplemental EIS for Limerick, Comanche Peak, and Watts Bar. Therefore, severe accident mitigation alternatives need not be reconsidered for these plants for LR.

Nevertheless, the applicant's ER must contain any new and significant information of which the applicant is aware (10 CFR 51.53(c)(3)(iv)) (TN250).

The NRC staff discusses new information pertaining to SAMAs in APPENDIX F, "Environmental Impacts of Postulated Accidents," in this SEIS. The NRC staff did not find any substantial changes in the proposed action as previously evaluated in the Final Environmental Statement that are relevant to environmental concerns or any significant new circumstances or information relevant to environmental concerns and bearing on the licensing of Comanche Peak Units 1 and 2.

Based on the NRC staff's review and evaluation of applicant's analysis regarding SAMAs and the staff's independent analyses as documented in APPENDIX F, "Environmental Impacts of Postulated Accidents," to this SEIS, the staff finds that there is no new and significant information for Comanche Peak related to SAMAs.

3.11.7 No-Action Alternative

Under the no-action alternative, the NRC would not issue renewed licenses, and Comanche Peak would shut down on or before the expiration of the current licenses. Human health risks would be smaller after plant shutdown. The reactor units, which currently operate within regulatory limits, would emit less radioactive gaseous, liquid, and solid material to the environment. In addition, after 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 Section 3.11.6, "Proposed Action," the NRC staff concluded that the impacts of continued plant operation on human health would be SMALL, except for "Chronic effects of EMFs," for which the impacts are UNCERTAIN. In Section 3.11.6.4, "Environmental Consequences of Postulated Accidents," the NRC staff concluded that the impacts of accidents during operation are SMALL. Therefore, as radioactive emissions to the environment decrease, and as the likelihood and types of accidents decrease after shutdown, the NRC staff concludes that the risk to human health following plant shutdown would be SMALL.

3.11.8 Replacement Power Alternatives: Common Impacts

Impacts on human health from construction of a replacement power station would be similar to the impacts associated with the construction of any major industrial facility. Compliance with worker protection rules, the use of personal protective equipment, training, and placement of engineered barriers would limit the impacts on workers to acceptable levels.

The human health impacts from the operation of a power station include public risk from inhalation of gaseous emissions. Regulatory agencies, including the EPA and State of Texas agencies, base air emission standards and requirements on human health impacts. These agencies also impose site-specific emission limits to protect human health.

3.11.9 New Nuclear (Small Modular Reactors) Alternative

The construction impacts of the new nuclear alternative would include those identified in Section 3.11.8, "Replacement Power Alternatives Common Impacts" above. Because the NRC staff expects that the licensee would limit access to active construction areas to only authorized individuals, the impacts on human health from the construction of two new nuclear units would be SMALL.

The human health effects from the operation of the new nuclear alternative would be similar to those of operating the existing Comanche Peak Units 1, and 2. SMR designs would use the same type of fuel (i.e., form of the fuel, enrichment, burnup, and fuel cladding) as the plants considered in the NRC staff's evaluation in the LR GEIS (NRC 2013-TN2654). As such, their impacts would be similar to those at Comanche Peak. As presented in Section 3.11.6, "Proposed Action," impacts on human health from the operation of Comanche Peak would be SMALL, except for "chronic effects of electromagnetic fields (EMFs)," for which the impacts are UNCERTAIN. Therefore, the NRC staff concludes that the impacts on human health from the operation of the new nuclear alternative would be SMALL.

3.11.10 Natural Gas-fired Combined-Cycle Alternative

The construction impacts of the NGCC alternative would include those identified in Section 3.11.8, "Replacement Power Alternatives: Common Impacts". Because the NRC staff expects that the licensee would limit access to active construction areas to only authorized individuals, the impacts on human health from the construction of an NGCC facility would be SMALL.

The human health effects from the operation of the NGCC alternative would include those identified in Section 3.11.8, "Replacement Power Alternatives: Common Impacts," as common to the operation of all replacement power alternatives. Health risk may be attributable to nitrogen oxide emissions that contribute to ozone formation (NRC 2013-TN2654). Given the regulatory oversight exercised by the EPA and State agencies, the NRC staff concludes that the human health impacts from the NGCC alternative would be SMALL, except for "chronic effects of electromagnetic fields (EMFs)," for which the impacts are UNCERTAIN. Therefore, the NRC staff concludes that the impacts on human health from the operation of the NGCC alternative would be SMALL.

3.11.11 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

Impacts on human health from construction of the combination alternative would include those identified in Section 3.11.8, “Replacement Power Alternatives: Common Impacts,” as common to the construction of all replacement power alternatives. Because the NRC staff expects that the builder will limit access to the active construction area to only authorized individuals, the impacts on human health from the construction of the combination SMR, solar PV, and onshore wind alternative would be SMALL.

The human health effects from the operation of the SMR would be similar to those of operating existing Comanche Peak Units 1 and 2. SMR designs would use the same type of fuel (i.e., form of the fuel, enrichment, burnup, and fuel cladding) as the plants considered in the NRC staff’s evaluation in the LR GEIS (NRC 2013-TN2654). As such, their impacts would be similar to those at Comanche Peak. As presented in Section 3.11.9, “New Nuclear (Small Modular Reactors) Alternative,” the impacts on human health from the operation of new nuclear would be SMALL, except for “chronic effects of electromagnetic fields (EMFs),” for which the impacts are UNCERTAIN. Therefore, the NRC staff concludes that the impacts on human health from the operation of the SMR component would be SMALL.

Solar PV panels are encased in heavy-duty glass or plastic. Therefore, there is little risk that the small amounts of hazardous semiconductor material that they contain would be released into the environment. In the event of a fire, hazardous particulate matter could be released into the atmosphere. Given the short duration of fires and the high melting points of the materials found in the solar PV panels, the impacts from inhalation would be minimal. Also, the risk of fire at ground-mounted solar installations is minimal because of precautions taken during site preparation, such as the removal of fuels and the lack of burnable materials contained in the solar PV panels. Another potential risk associated with PV systems and fire is the potential for shock or electrocution from contact with a high-voltage conductor. Proper procedures and clear marking of system components should be used to provide emergency responders with appropriate warnings to diminish the risk of shock or electrocution (DOT 2011-TN3942). Solar PV panels do not produce EMFs at levels considered harmful to human health, as established by the International Commission on Non-Ionizing Radiation Protection. These small EMFs diminish significantly with distance and are indistinguishable from normal background levels within several yards (DOT 2011-TN3942). Based on this information, the human health impacts from the operation of the solar PV component for the combination alternative would be SMALL.

Operational hazards at a wind facility for the workforce include working at heights, working near rotating mechanical or electrically energized equipment, and working in extreme weather. Adherence to safety standards and the use of appropriate protective equipment through implementation of an OSHA-approved worker safety program would minimize occupational hazards. Potential impacts on workers and the public include broken blades thrown as a result of mechanical failure. Adherence to proper worker safety procedures and limiting public access to wind turbine sites would minimize the impacts from thrown ice and broken rotor blades. Potential impacts also include EMF exposure, aviation safety hazards, and exposure to noise and vibration from the rotating blades. Impacts from EMF exposure would be minimized by adhering to proper worker safety procedures and limiting public access to any components that could create an EMF. Aviation safety hazards would be minimized by proper siting of the wind turbine facilities and maintaining all proper safety warning devices, such as indicator lights, for pilot visibility. The NRC staff has identified no epidemiologic studies of noise and vibration from wind turbines that would suggest any direct human health impact. Based on this information, the

NRC staff concludes that the human health impacts from the operation of the wind portion of the combination alternative would be SMALL.

Therefore, given the expected compliance with worker and environmental protection rules and the use of personal protective equipment, training, and engineered barriers, the NRC staff concludes that the potential human health impacts for the combination alternative would be SMALL.

3.12 Environmental Justice

Under EO 12898 (59 FR 7629-TN1450), Federal agencies are responsible for identifying and addressing, as appropriate, disproportionate and adverse human health and environmental impacts on minority and low-income populations. Independent agencies, such as the NRC, are not bound by the terms of EO 12898 but are "requested to comply with the provisions of [the] order." In 2004, the Commission issued the agency's "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions" (69 FR 52040-TN1009), which states: "The Commission is committed to the general goals set forth in EO 12898, and strives to meet those goals as part of its NEPA review process."

The Council on Environmental Quality (CEQ) provides the following information in Environmental Justice: Guidance Under the National Environmental Policy Act (CEQ 1997-TN452):

> **Disproportionately High and Adverse Human Health Effects**
>
> Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. 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 (as employed by NEPA) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group (CEQ 1997-TN452).
>
> **Disproportionately High and Adverse Environmental Effects**
>
> A disproportionately high environmental impact that is significant (as employed by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as employed by NEPA). In assessing cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered (CEQ 1997-TN452).

This environmental justice analysis assesses the potential for disproportionate and adverse human health or environmental effects on minority and low-income populations that could result from the continued operation of Comanche Peak Units 1 and 2 associated with the proposed action (license renewal) and alternatives to the proposed action. In assessing the impacts, the following definitions of minority individuals, minority populations, and low-income population were used (CEQ 1997-TN452):

Minority Individuals

Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races, meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, White and Asian.

Minority Populations

Minority populations are identified when (1) the minority population of an affected area exceeds 50 percent or (2) 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.

Low-income Population

Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series P60, on Income and Poverty.

In determining the location of minority and/or low-income populations, the NRC uses a 50 mi (80 km) radius from the facility as the geographic area to perform a comparative analysis. The 50 mi (80 km) radius is consistent with the impact analysis conducted for human health impacts. The NRC compares the percentage of minority and/or low-income populations in the 50 mi (80 km) geographic area to the percentage of minority and/or low-income populations in each census block group to determine which block groups exceed the regional percentage (or 50 percent, whichever is lower), thereby identifying the location of these populations (NRC 2020-TN6399).

<u>Minority Population</u>

According to the USCB's 2020 Census data, there are a total of 1,257 block groups within a 50 mile (80 km) radius of the Comanche Peak site and approximately 51 percent of the population residing within a 50 mi (80 km) radius of Comanche Peak identified themselves as minority individuals. The largest minority populations were Black or African American (approximately 14 percent) and Hispanic, Latino, or Spanish origin of any race (approximately 29 percent) (USCB 2020-TN8822).

According to the CEQ definition, a minority population exists if the percentage of the minority population of an area (e.g., census block group) exceeds 50 percent or is meaningfully greater than the minority population percentage in the general population. Because the population within the 50 mile (80 km) radius exceeds 50 percent minority, the 50 percent threshold was used to identify minority populations. Therefore, for the purposes of analysis, census block groups within the 50 mi (80 km) radius of Comanche Peak were identified as minority population block groups if the percentage of the minority population in the block group exceeded 50 percent.

Based on this analysis, there are 565 minority population blocks groups within a 50 mi (80 km) radius of Comanche Peak. Therefore, approximately 45 percent of block groups within a 50 mi (80 km) radius of Comanche Peak are minority population block groups. As shown in Figure 3-7, high population minority block groups (race and ethnicity) are predominantly clustered north and east of the Comanche Peak site. Based on this analysis, Comanche Peak is not located in a minority population block group.

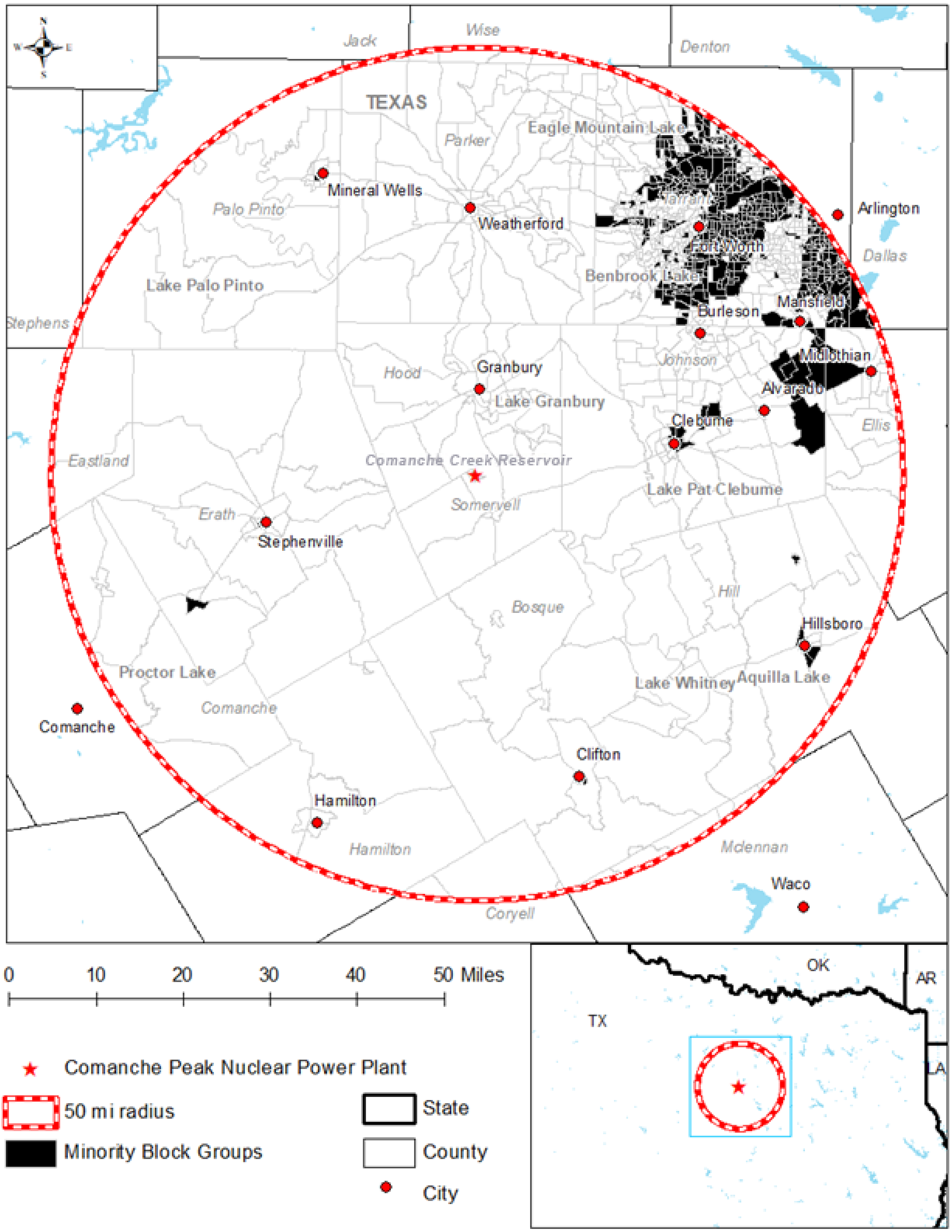


Figure 3-7 Minority Block Groups within a 50-mi (80-km) Radius of Comanche Peak. Adapted from: USCB 2020-TN8822

As presented in Section 3.10.3 and Table 3-21 of this EIS, in 2010, the minority population in the three-county region of influence was approximately 47 percent. Furthermore, as shown in Table 3-22, by 2020, minority populations in the three-county region of influence are estimated to have increased approximately by 339,345 persons.

Low-Income Population

The U.S. Census Bureau’s 2017–2021 American Community Survey data identifies approximately 12 percent of individuals residing within a 50 mi (80 km) radius of the Comanche Peak site as living below the Federal poverty threshold (USCB 2021-TN8824|). The 2020 Federal poverty threshold was $26,200 for a family of four (USCB 2021-TN8833).

Figure 3-8 shows the location of predominantly low-income population block groups within the 50 mi (80 km) radius of Comanche Peak. In accordance with NRC guidance (NRC 2020-TN6399), census block groups were considered low-income population block groups if the percentage of individuals living below the Federal poverty threshold within the block groups exceeded 12 percent—the percent of the individuals living below the Federal poverty threshold within the 50 mi (80 km) radius of the Comanche Peak site.

Based on this analysis, there are 474 low-income population blocks groups within a 50 mi (80 km) radius of the Comanche Peak site. Therefore, for the purposes of analysis, approximately 38 percent of the block groups within a 50 mi (80 km) radius of Comanche Peak are considered low-income population block groups. As shown in Figure 3-8, low-income population block groups are distributed throughout the 50 mi (80 km) radius of the Comanche Peak site. Comanche Peak is located adjacent to low-income population block groups to the south, west, and east.

As discussed in Section 3.10.2.1 of this EIS, according to the USCB’s 2017–2021 American Community Survey 5-Year Estimates (USCB 2021-TN8818), people living in the three-county region of influence had a median household income of more than the State average except for those residing in Hood County which had a lower median household income than the State average. Additionally, the percentage of individuals living below the poverty level in Hood, Somervell, and Tarrant Counties was lower than the percentage of individuals living below the poverty level in the State of Texas.

3.12.1 Proposed Action

The NRC addresses environmental justice matters for license renewal by (1) identifying the location of minority and low-income populations that may be affected by the continued operation of the nuclear power plant during the LR term, (2) determining whether there would be any potential human health or environmental effects to these populations and special pathway receptors (groups or individuals with unique consumption practices and interactions with the environment), and (3) determining whether any of the effects may be disproportionate and adverse.

Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionate 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. Disproportionate environmental effects refer to impacts or risks of impacts on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts.

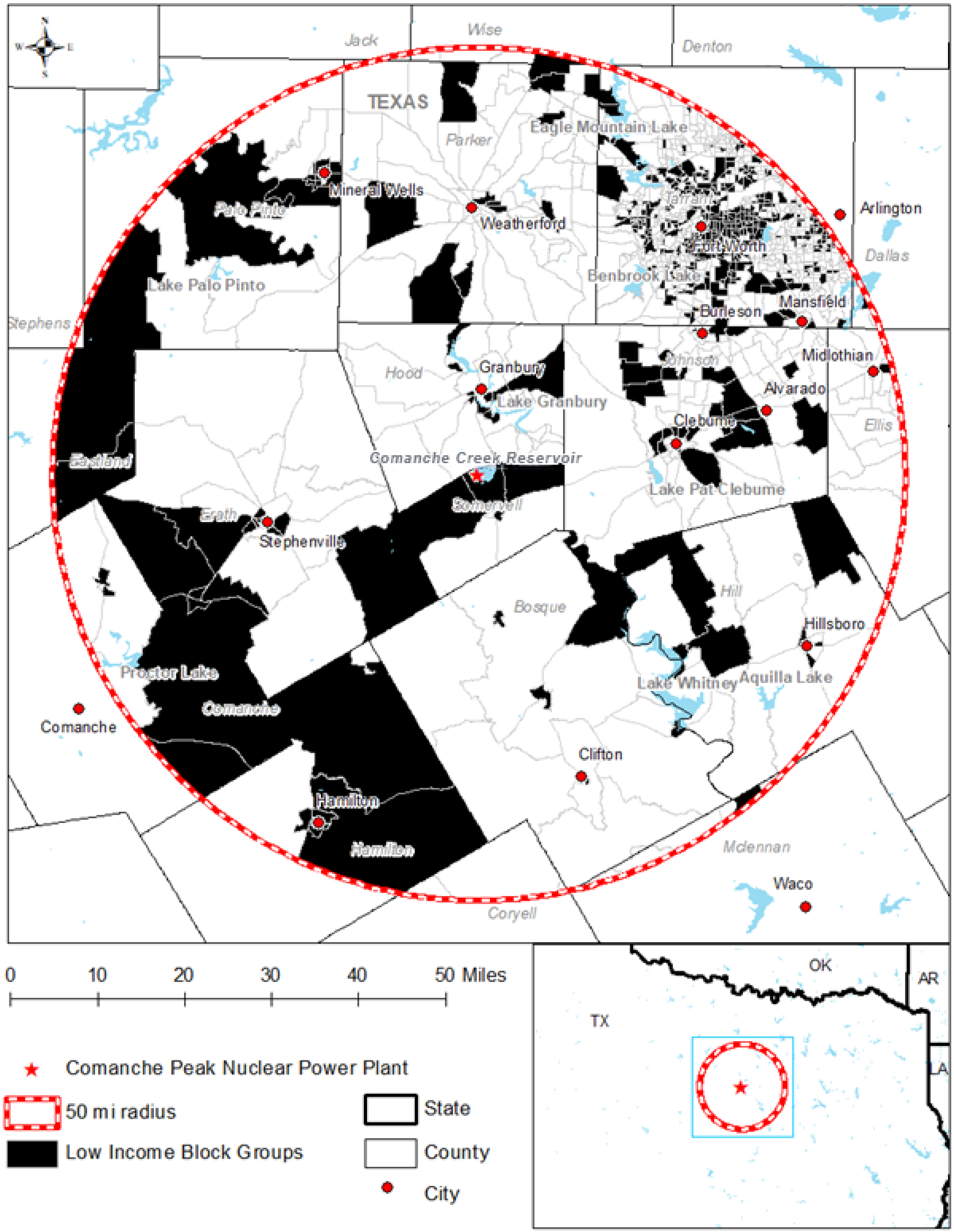


Figure 3-8 **Low-Income Block Groups within a 50-mi (80-km) Radius of Comanche Peak. Adapted from: USCB 2021-TN8824**

Figure 3-7 and Figure 3-8 show the location of predominantly minority and low-income population block groups residing within a 50 mi (80 km) radius of Comanche Peak Units 1 and 2. This area of impact is consistent with the 50 mi (80 km) impact analysis for public and occupational health and safety. This chapter of the SEIS presents the assessment of environmental and human health impacts for each resource area. The analyses of impacts for all environmental resource areas indicated that the impact from LR would be SMALL.

Potential impacts on minority and low-income populations (including migrant workers or Native Americans) would mostly consist of socioeconomic and radiological effects; however, radiation doses from continued operations during the LR term are expected to continue at current levels, and they would remain within regulatory limits. Section 3.11.6.4 discusses the environmental impacts from postulated accidents that might occur during the LR term, which include both design-basis and severe accidents. In both cases, the Commission has generically determined that impacts associated with design-basis accidents are small because nuclear plants are designed and operated to withstand such accidents, and the probability-weighted consequences of severe accidents are small.

Therefore, based on the information and the analysis of human health and environmental impacts, minority and low-income populations would not likely experience any disproportionate and adverse human health and environmental effects from the continued operation of Comanche Peak Units 1 and 2 during the LR term.

Subsistence Consumption of Fish and Wildlife

As part of addressing environmental justice concerns associated with LR, the NRC also assessed the potential radiological risk to special population groups (such as migrant workers or Native Americans) from exposure to radioactive material received through their unique consumption practices and interactions with the environment, including the subsistence consumption of fish and wildlife; native vegetation; contact with surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of airborne radioactive material released from the plant during routine operation. The special pathway receptors analysis is an important part of the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area, such as migrant workers or Native Americans. The results of this analysis are presented here.

Section 4–4 of EO 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (1994) (59 FR 7629-TN1450), directs Federal agencies, whenever practical and appropriate, to collect and analyze information about 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. In this SEIS, the NRC considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts on American Indian, Hispanics, migrant workers, and other traditional lifestyle special pathway receptors.

The assessment of special pathways considered the levels of radiological and nonradiological contaminants in fish, sediments, water, milk, and food products on or near Comanche Peak Units 1 and 2. Radionuclides released to the atmosphere may deposit on soil and vegetation and may therefore eventually be incorporated into the human food chain. To assess the impact of reactor operations on humans from the ingestion pathway, Vistra collects and analyzes samples of air, water, silt, shoreline sediment, aquatic biota, leafy vegetation, and direct exposure for radioactivity as part of its ongoing comprehensive REMP (radiological environmental monitoring program).

To assess the impact of nuclear power plant operations, samples are collected annually from the environment and analyzed for radioactivity. A plant effect would be indicated if the radioactive material detected in a sample was higher than background levels. Two types of samples are collected. The first type, a control sample, is collected from areas beyond the influence of the nuclear power plant or any other nuclear facility. These control samples are used as reference data to determine normal background levels of radiation in the environment. The second type of samples, indicator samples, are collected near the nuclear power plant from areas where any radioactivity contribution from the nuclear power plant will be at its highest concentration. These indicator samples are then compared to the control samples, to evaluate the contribution of nuclear power plant operations to radiation or radioactivity levels in the environment. An effect would be indicated if the radioactivity levels detected in an indicator sample were larger or higher than the control sample or background levels.

Vistra collected samples from the environment in the vicinity of Comanche Peak (Luminant 2022-TN8655). The pathways include air samples, water samples, groundwater samples, milk, food products, fish, broadleaf vegetation and shoreline sediment samples. A 3-year period provides a data set that covers a broad range of activities that occur at a nuclear power plant, such as refueling outages, routine operation, and maintenance that could release radioactive effluents into the environment. The data show that there were no significant radiological impacts on the environment from operations at Comanche Peak.

Based on radiological environmental monitoring data, special pathway receptor populations in the region would not likely experience disproportionate and adverse human health impacts because of subsistence consumption. In addition, the continued operation of Comanche Peak Units 1 and 2 would not have disproportionate and adverse human health and environmental effects on these populations.

3.12.2 No-Action Alternative

Under the no-action alternative, the NRC would not renew the operating licenses, and Comanche Peak Units 1 and 2 would shut down on or before the expiration of the current facility operating license. Impacts on minority and low-income populations would depend on the number of jobs and the amount of tax revenues lost in communities located near the power plant after reactor operations cease. Not renewing the operating licenses and terminating reactor operations could have a noticeable impact on socioeconomic conditions in the communities located near Comanche Peak. The loss of jobs and income could have an immediate socioeconomic impact. Some, but not all, of the approximately 1,159 permanent workers could leave the area. In addition, the plant would generate less tax revenue, which could reduce the availability of public services. This reduction could disproportionately affect minority and low-income populations that may have become dependent on these services.

3.12.3 Replacement Power Alternatives: Common Impacts

The following discussions identify common impacts from the construction and operation of replacement power facilities that could disproportionately affect minority and low-income populations. The NRC cannot determine if any of the replacement power alternatives would result in disproportionate and adverse human health and environmental effects on minority and low-income populations. This determination would depend on the site location, plant design, operational characteristics of the new facility, unique consumption practices and interactions with the environment of nearby populations, and the location of predominantly minority and low-income populations.

Construction

Potential impacts on minority and low-income populations from the construction of a replacement power plant would mostly consist of environmental and socioeconomic effects (e.g., noise, dust, traffic, employment, and housing impacts). The extent of the effects experienced by these populations is difficult to determine because it would depend on the location of the power plant units and transportation routes. Noise and dust impacts from construction would be short term and primarily limited to onsite activities. Minority and low-income populations residing along site access roads would be affected by increased truck and commuter vehicle traffic during construction, especially during shift changes. However, these effects would be temporary, limited to certain hours of the day, and would not likely be high and adverse. Increased demand for rental housing during construction could disproportionately affect low-income populations reliant on low-cost housing.

Operation

Low-income populations living near the new power plant that rely on subsistence consumption of fish and wildlife could be disproportionately affected. Emissions during power plant operations could also disproportionately affect nearby minority and low-income populations, depending on the type of replacement power. However, permitted air emissions are expected to remain within regulatory standards during operations.

3.12.4 New Nuclear (Small Modular Reactors) Alternative

Potential impacts on minority and low-income populations during the construction and operation of new SMR power plant units would be similar to the impacts described above in Section 3.12.3. Potential impacts during nuclear power plant operations would mostly consist of radiological emissions; however, to operate, radiation doses must remain within regulatory limits.

3.12.5 Natural Gas-fired Combined-Cycle Alternative

Potential impacts on minority and low-income populations during the construction and operation of the NGCC would be similar to the impacts described above in Section 3.12.3.

3.12.6 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

Potential impacts on minority and low-income populations from the construction and operation of a new SMR and the installation of solar PV and onshore wind installations would be similar to the impacts described above in Section 3.12.3. Potential impacts during nuclear power plant operations would mostly consist of radiological emissions; however, to operate, radiation doses must remain within regulatory limits.

3.13 <u>Waste Management and Pollution Prevention</u>

Like any operating nuclear power plant, Comanche Peak will produce both radioactive and nonradioactive waste during the licensing period. This section describes waste management and pollution prevention at Comanche Peak. The description of these waste management activities is followed by the staff's analysis of the potential impacts of waste management activities from the proposed action (LR) and alternatives to the proposed action.

3.13.1 Radioactive Waste

As discussed in Section 2.1.4, "Radioactive Waste Management Systems," of this SEIS, Comanche Peak uses liquid, gaseous, and solid waste processing systems to collect and treat, as needed, radioactive materials produced as a byproduct of plant operations. Each of the liquid, solid, and gaseous waste disposal systems is designed to serve both reactor units. Radioactive materials in liquid, gaseous, and solid effluents are reduced prior to being released into the environment so that the resultant dose to members of the public from these effluents is well within the NRC and EPA dose standards. Radionuclides that can be efficiently removed from the liquid and gaseous effluents prior to the effluent releases are converted to a solid waste form for disposal in a licensed disposal facility.

3.13.2 Nonradioactive Waste

Waste minimization and pollution prevention are important elements of operations at all nuclear power plants. Licensees are required to consider pollution prevention measures as dictated by the Pollution Prevention Act (Public Law 101 5084) and the Resource Conservation and Recovery Act of 1976, as amended (RCRA; Public Law 94 580) (TN1281).

RCRA governs the disposal of solid waste. The TCEQ is authorized by the EPA to implement RCRA and regulate solid and hazardous waste in Texas. As described in Section 2.1.5, "Nonradioactive Waste Management System," of this SEIS, Comanche Peak has a nonradioactive waste management program to handle nonradioactive waste in accordance with Federal, State, and corporate regulations and procedures. Comanche Peak maintains a waste minimization program that uses material control, process control, waste management, recycling, and feedback to reduce waste.

The Comanche Peak SWPPP identifies potential sources of pollution that may affect the quality of stormwater discharges from permitted outfalls. The SWPPP also describes BMPs for reducing pollutants in stormwater discharges and assuring compliance with the site's TPDES permit.

Comanche Peak also has an environmental management system (Luminant 2022-TN8655). Procedures are in place to monitor areas within the site that have the potential to discharge oil into or on navigable waters, in accordance with the regulations in 40 CFR 112 (TN1041), "Oil Pollution Prevention." The Pollution Incident/Hazardous Substance Spill Procedure identifies and describes the procedures, materials, equipment, and facilities that Vistra uses to minimize the frequency and severity of oil spills at Comanche Peak.

Comanche Peak is subject to the EPA reporting requirements in 40 CFR 110 (TN8485), "Discharge of Oil," under CWA Section 311(b)(4) (TN662). Under these regulations, Comanche Peak must report to the U.S. Coast Guard (USCG) National Response Center any discharges of oil if the quantity may be harmful to the public health or welfare or to the environment. Based on the NRC staff's review of Section E9.5.3.6 of the ER (Luminant 2022-TN8655) and a review of records from 2016–2020, there have been no inadvertent nonradioactive release that would be classified as an incidental spill. In addition, there has not been any reportable inadvertent nonradioactive release that would trigger a notification requirement from when the ER was published in January 2020 until the audit on February 11, 2023 (Luminant 2023-TN8665).

Comanche Peak is also subject to the reporting provision under Texas Administrative Code, Title 30, Part 1, Chapter 327 (TN8812), and under the site conditions of certification. This reporting provision requires that any release of oil, petroleum product, used oil, hazardous substances, industrial solid waste, or other substances into the environment in a quantity equal to or greater than the reportable quantity listed in Texas Administrative Code, Title 30, Part 1, Chapter 327, Section 327.4 is to be reported within 24 hours to the TCEQ regional office, the State emergency response center, and the State of Texas 24-hour spill reporting hotline, followed by cleanup and remediation. Based on the NRC staff's review of Section E9.5.3.7 of the ER (Luminant 2022-TN8655) and a review of records for the 5-year period of 2016 to 2020, there have been no releases that triggered this notification requirement. The ER states that the licensee did make a courtesy notification to the TCEQ for a mineral oil release from a Unit 2 transformer fire on June 7, 2021. The spill cleanup was completed by June 11, 2021. The ER states that the TCEQ confirmed that the amount of oil spilled was below reportable limits. There have been no releases that have triggered this notification requirement since the ER was written. Based on the NRC staff's review of Section E9.5.13.6 of the ER (Luminant 2022-TN8655) and a review of records from 2016–2020, no reportable spills under the reporting provisions of the Texas Administrative Code, Title 30, Part 1, Chapter 327 (TN8812) occurred. In addition, the applicant confirmed that there have been no reportable spills that would trigger this notification requirement since the ER was written (Luminant 2023-TN8665).

3.13.3 Proposed Action

As described in the LR GEIS (NRC 2013-TN2654) and as cited in Table 3-1 for generic issues related to waste management, the impacts of nuclear power plant LR and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of Comanche Peak on waste management would be SMALL. There are no site-specific (Category 2) waste management issues applicable to Comanche Peak (Table 3-2).

3.13.4 No-Action Alternative

Under the no-action alternative, Comanche Peak would cease operation at the end of the term of the current operating licenses or sooner and enter decommissioning. After entering decommissioning, the plant would generate less spent nuclear fuel, emit fewer gaseous and liquid radioactive effluents into the environment, and generate less low-level radioactive and nonradioactive waste. In addition, after shutdown, the variety of potential accidents at the plant (radiological and industrial) would be reduced to a limited set associated with shutdown events and fuel handling and storage. Therefore, as radioactive emissions to the environment decrease, and the likelihood and variety of accidents decrease after shutdown and decommissioning, the NRC staff concludes that impacts resulting from waste management from implementation of the no-action alternative would be SMALL.

3.13.5 Replacement Power Alternatives: Common Impacts

Impacts from waste management common to all analyzed replacement power alternatives would be from construction-related nonradiological debris generated during construction activities. This waste would be recycled or disposed of in approved landfills.

3.13.6 New Nuclear (Small Modular Reactors) Alternative

Impacts from the waste generated during the construction of the new nuclear alternative would include those identified in Section 3.13.5, "Replacement Power Alternatives: Common Impacts," as being common to all replacement power alternatives.

During normal plant operations, routine plant maintenance and cleaning activities would generate radioactive low-level waste, spent nuclear fuel, high-level waste, and nonradioactive waste. Sections 2.1.4 and 2.1.5 of this SEIS discuss radioactive and nonradioactive waste management at Comanche Peak. SMR designs would use the same type of fuel (i.e., form of the fuel, enrichment, burnup, and fuel cladding) as the plants considered in the NRC staff's evaluation in the LR GEIS (NRC 2013-TN2654), and as such all wastes generated would be similar to those generated at Comanche Peak Units 1 and 2. According to the LR GEIS, the NRC does not expect the generation and management of solid radioactive and nonradioactive waste during the LR term to result in significant environmental impacts. Based on this information, the waste impacts would be SMALL for the new nuclear alternative.

3.13.7 Natural Gas-fired Combined-Cycle Alternative

Impacts from the waste generated during the construction of the NGCC alternative would include those identified in Section 3.13.5, "Replacement Power Alternatives: Common Impacts," of this SEIS as being common to all replacement power alternatives.

Waste generation from natural gas technology would be minimal. The only significant waste generated at a NGCC power plant would be spent selective catalytic reduction catalyst (plants use selective catalytic reduction catalyst to control nitrogen oxide emissions).

The spent catalyst would be regenerated or disposed of off-site. Other than the spent selective catalytic reduction catalyst, waste generation at an operating natural gas-fired plant would be limited largely to typical operations and maintenance of nonhazardous waste. Based on this information, the NRC staff concludes that the waste impacts for the NGCC alternative would be SMALL.

3.13.8 Combination Alternative (Solar Photovoltaic, Onshore Wind, and New Nuclear [SMR])

Impacts from the waste generated during the construction of the combination alternative would include those identified in Section 3.13.5, "Replacement Power Alternatives: Common Impacts," of this SEIS as being common to all replacement power alternatives.

During normal plant operations, routine plant maintenance and cleaning activities would generate radioactive low-level waste, spent nuclear fuel, high-level waste, and nonradioactive waste. Sections 2.1.4 and 2.1.5 of this SEIS discuss radioactive and nonradioactive waste management, respectively, at Comanche Peak. SMR designs would use the same type of fuel (i.e., form of the fuel, enrichment, burnup, and fuel cladding) as the plants considered in the

NRC staff's evaluation in the LR GEIS (NRC 2013-TN2654), and as such, all wastes generated would be similar to those generated at Comanche Peak. According to the LR GEIS, the NRC does not expect the generation and management of solid radioactive and nonradioactive waste during the LR term to result in significant environmental impacts. Based on this information, the NRC staff concludes that the waste impacts for the new nuclear alternative would be SMALL.

The construction of the solar PV facilities would create sanitary and industrial waste, in smaller quantities compared to the SMR. This waste could be recycled or shipped to an off-site waste disposal facility. All the waste would be handled in accordance with appropriate Texas regulations. Impacts on waste management resulting from the construction and operation of the solar PV facilities of the combination alternative would be minimal compared to those of the SMR. In summary, the NRC staff concludes that the waste management impacts resulting from the construction and operation of the PV facilities would be SMALL.

During construction of onshore wind facilities as part of the combination alternative, waste materials or the accidental release of fuels are expected to be negligible because of the very limited amount of traffic and construction activity that might occur with construction, installation, operation, and decommissioning of onshore turbine generators. Therefore, the waste management impacts resulting from the construction and operation of the onshore wind portion would be SMALL.

Based on the above determinations, the NRC staff concludes that the waste impacts of the combination alternative would be SMALL.

3.14 Evaluation of New and Significant Information

As stated in Section 3.1 of this SEIS, for Category 1 (generic) issues, the NRC staff can rely on the analysis in the LR GEIS (NRC 2013-TN2654) unless otherwise noted. Table 3-1 lists the Category 1 issues that apply to Comanche Peak during the proposed LR period. For these issues, the NRC staff did not identify any new and significant information based on its review of the applicant's ER (Luminant 2022-TN8655), the environmental site audits, review of available information as cited in this SEIS, or arising from the environmental scoping process that would change the conclusions presented in the LR GEIS.

New and significant information must be new based on a review of the LR GEIS (NRC 2013-TN2654) as codified in Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 (TN250). Such information must also bear on the proposed action or its impacts, presenting a picture of the impacts that are seriously different from those envisioned in the LR GEIS (i.e., impacts of greater severity than impacts considered in the LR GEIS, considering their intensity and context).

The NRC defines new and significant information in Regulatory Guide (RG) 4.2, Supplement 1, "Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications" (NRC 2013-TN4791), as (1) information that identifies a significant environmental impact issue that was not considered or addressed in the LR GEIS and, consequently, not codified in Table B-1, in Appendix B to Subpart A of 10 CFR Part 51 (TN250); or (2) information not considered in the assessment of impacts evaluated in the LR GEIS leading to a picture of the environmental consequences of the action that is significantly different than previously considered, such as an environmental impact finding different from that codified in Table B-1. Further, a significant environmental issue includes, but is not limited to, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or with an intensity and/or scope (context) not previously recognized.

In accordance with 10 CFR 51.53(c) (TN250), “Operating License Renewal Stage,” the applicant’s ER must analyze the Category 2 (site-specific) issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. Additionally, the applicant’s ER must discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action. In accordance with 10 CFR 51.53(c)(3) (TN250), the applicant’s ER does not need to analyze any Category 1 issue unless there is new and significant information about a specific issue.

NUREG–1555, Supplement 1, Revision 1, “Standard Review Plans for Environmental Reviews for Nuclear Power Plants for Operating License Renewal,” describes the NRC process for identifying new and significant information (NRC 2013-TN3547). The search for new information includes:

- review of an applicant’s ER (Luminant 2020-TN8662) and the process for discovering and evaluating the significance of new information
- review of public comments
- review of environmental quality standards and regulations
- coordination with Federal, State, and local environmental protection and resource agencies
- review of technical literature as documented through this SEIS

New information that the staff discovers is evaluated for significance using the criteria set forth in the LR GEIS. For Category 1 issues in which new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to assessment of the relevant new and significant information; the scope of the assessment does not include other facets of an issue that the new information does not affect.

The NRC staff reviewed the discussion of environmental impacts associated with operation during the LR term in the GEIS and has conducted its own independent review, including a public involvement process (e.g., public meetings and comments) to identify new and significant issues for the Comanche Peak LRA environmental review. The assessment of new and significant information for each resource is addressed in each resource area discussion.

3.15 Impacts Common to All Alternatives

This section describes the impacts that the NRC staff considers common to all alternatives discussed in this SEIS, including the proposed action and replacement power alternatives. In addition, the following sections discuss the termination of operations, the decommissioning of a nuclear power plant and potential replacement power facilities, and GHG emissions.

3.15.1 Fuel Cycle

This section describes the environmental impacts associated with the fuel cycles of both the proposed action and all replacement power alternatives that are analyzed in detail in this SEIS.

3.15.1.1 Uranium Fuel Cycle

The uranium fuel 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. Section 4.12.1.1 of the LR GEIS describes in detail the generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes (NRC 2013-TN2654). The staff incorporates the information in the LR GEIS, Section 4.12.1.1 (NRC 2013-TN2654: 4-183—4-197), here by reference. The LR GEIS does not identify any site-specific (Category 2) uranium fuel cycle issues.

As stated in the LR GEIS (NRC 1996-TN8775, 2013-TN2654), the generic issues related to the uranium fuel cycle as identified in Table 3-1 would not be affected by continued operations associated with LR. The NRC staff identified no new and significant information for these issues. Thus, as concluded in the LR GEIS, the impacts of generic issues related to the uranium fuel cycle would be SMALL.

3.15.1.2 Replacement Power Plant Fuel Cycles

3.15.1.2.1 New Nuclear Energy Alternatives

Uranium fuel cycle impacts for a nuclear plant result from the initial extraction of fuel, transport of fuel to the facility, and management and ultimate disposal of spent fuel. The environmental impacts of the uranium fuel cycle are referenced above in Section 3.15.1.1, “Uranium Fuel Cycle”.

3.15.1.2.2 Fossil Fuel Energy Alternatives

Fuel cycle impacts for a fossil fuel-fired power plant result from the initial extraction of fuel, cleaning and processing of fuel, transport of fuel to the facility, and management and ultimate disposal of any solid wastes from fuel combustion. These impacts are discussed in more detail in Section 4.12.1.2 of the LR GEIS (NRC 2013-TN2654) and can generally include the following:

- significant changes to land use and visual resources
- impacts on air quality, including release of criteria pollutants, fugitive dust, volatile organic compounds, and methane into the atmosphere
- noise impacts
- geology and soil impacts caused by land disturbances and mining
- water resource impacts, including degradation of surface water and groundwater quality
- ecological impacts, including loss of habitat and wildlife disturbances
- historic and cultural resources impacts within the mine or pipeline footprint associated with the extraction of the fuel
- socioeconomic impacts from employment of both the mining workforce and service and support industries
- environmental justice impacts
- health impacts on workers from exposure to airborne dust and methane gases
- generation of industrial wastes

3.15.1.2.3 Renewable Energy Alternatives

For renewable energy technologies that rely on the extraction of a fuel source (e.g., biomass), such alternatives may have fuel cycle impacts with some similarities to those associated with the uranium fuel cycle. However, as stated in Section 4.12.1.2 of the LR GEIS (NRC 2013-TN2654) (under "Renewable Energy Alternatives") the fuel cycle for renewable technologies such as wind, solar, geothermal, and ocean wave and current is difficult to define. This is because the associated natural resources exist regardless of any effort to harvest them for electricity production. Impacts from the presence or absence of these renewable energy technologies are often difficult to determine (NRC 2013-TN2654).

3.15.2 Terminating Power Plant Operations and Decommissioning

This section describes the environmental impacts associated with the termination of operations and the decommissioning of a nuclear power plant and replacement power alternatives. All operating power plants will terminate operations and be decommissioned at some point after the end of their operating life or after a decision is made to cease operations. For the proposed action at Comanche Peak, LR would delay this eventuality for an additional 20 years beyond the current license periods, and the LR terms would end in 2030 (Unit 1) and 2033 (Unit 2).

3.15.2.1 Existing Nuclear Power Plant

Decommissioning would occur whether Comanche Peak is shut down at the end of the current operating license term or at the end of the LR term. NUREG-0586 evaluates the environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license (NRC 2002-TN665). Additionally, Section 4.12.2.1 of the LR GEIS (NRC 2013-TN2654) summarizes the incremental environmental impacts associated with nuclear power plant decommissioning activities. As noted in Table 3-1, there is one Category 1 issue, "Termination of Nuclear Power Plant Operations and Decommissioning," applicable to Comanche Peak decommissioning. The LR GEIS did not identify any site-specific (Category 2) decommissioning issues.

3.15.2.2 Replacement Power Plants

3.15.2.2.1 New Nuclear and Fossil Fuel Alternatives

The environmental impacts from the termination of power plant operations and decommissioning of a power-generating facility are dependent on the facility's decommissioning plan. The decommissioning plan outlines the actions necessary to restore the site to a condition equivalent in character and value to the site on which the facility was first constructed (NRC 2013-TN2654). General elements and requirements for a fossil fuel energy facility decommissioning plan are discussed in Section 4.12.2.2 of the LR GEIS (NRC 2013-TN2654) and can include the removal of structures to at least 3 ft (1 m) below grade, the removal of all accumulated waste materials, the removal of intake and discharge structures, and the cleanup and remediation of incidental spills and leaks at the facility. The environmental consequences of decommissioning can generally include the following:

- short-term impacts on air quality and noise from the deconstruction of facility structures
- short-term impacts on land use and visual resources
- long-term reestablishment of vegetation and wildlife communities
- socioeconomic impacts caused by decommissioning the workforce and long-term loss of jobs
- elimination of health and safety impacts on operating personnel and the general public

The staff considers these impacts to be representative of those associated with decommissioning any thermoelectric power-generating facility. The staff incorporates the information in the LR GEIS, Section 4.12.2.2 (NRC 2013-TN2654: 4-224, 4-225), herein by reference.

Activities that are unique to the termination of operations and decommissioning of a nuclear power-generating facility include the safe removal of the facility from service and the reduction of residual radioactivity to a level that permits release of the property under restricted conditions or unrestricted use and termination of the license.

3.15.2.2.2 Renewable Energy Alternatives

Termination of power plant operation and decommissioning for renewable energy facilities would generally be similar to the activities and impacts discussed for new nuclear and fossil fuel alternatives above. Decommissioning would involve the removal of facility components and any operational wastes and residues to restore sites to a condition equivalent in character and value to the site on which the facility was first constructed. In other circumstances, supporting infrastructure (e.g., buried utilities and pipelines) could be abandoned in place (NRC 2013-TN2654). The range of possible decommissioning considerations and impacts, depending on the renewable energy alternative considered, are discussed in Section 4.12.2.2 of the LR GEIS (under “Renewable Alternatives”) (NRC 2013-TN2654). The staff incorporates the information in the LR GEIS, Section 4.12.2.2 (NRC 2013-TN2654: 4-227, 4-228), herein by reference.

3.15.3 Greenhouse Gas Emissions and Climate Change

The following sections discuss GHG emissions and climate change impacts. Section 3.15.3.1 evaluates the GHG emissions associated with operation of Comanche Peak and replacements power alternatives. Section 3.15.3.3 discusses the observed changes in climate and potential future climate change during the LR term based on climate model simulations under future global GHG emissions scenarios. In Section 3.16 of this SEIS, the NRC staff considers the potential cumulative, or overlapping, impacts of climate change on environmental resources where there are incremental impacts of the proposed action (LR).

3.15.3.1 Greenhouse Gas Emissions from the Proposed Project and Alternatives

Gases found in the Earth’s atmosphere that trap heat and play a role in the Earth’s climate are collectively termed greenhouse gases, or GHGs. These GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), water vapor (H_2O), and fluorinated gases, such as hydrofluorocarbons (HCFs), perfluorocarbons, and sulfur hexafluoride. The Earth’s climate responds to changes in concentrations of GHGs in the atmosphere because these gases affect the amount of energy absorbed and heat trapped by the atmosphere. Increasing concentrations of GHGs in the atmosphere generally increase the Earth’s surface temperature. Atmospheric concentrations of CO_2, CH_4, and N_2O have significantly increased since 1750 (IPCC 2013-TN7434, IPCC 2021-TN7435). In 2019, atmospheric concentrations of CO_2 (measured at 410 ppm) were higher than any time in at least 2 million years (IPCC 2023-TN8557). Long-lived GHGs—CO_2, CH_4, N_2O, and fluorinated gases—are well mixed throughout the Earth’s atmosphere, and their impact on climate is long-lasting and cumulative in nature as a result of their long atmospheric lifetimes (EPA 2016-TN7561). Therefore, the extent and nature of climate change is not specific to where GHGs are emitted. CO_2 is of primary concern for global climate change because it is the primary gas emitted as a result of human activities.

The sixth assessment synthesis report from the Intergovernmental Panel on Climate Change (IPCC) states that "[i]t is unequivocal that human influence has warmed the atmosphere, ocean, and land" (IPCC 2023-TN8557). In 2019, global net GHG emissions were estimated to be 59± 6.6 gigatons of CO_2 equivalents (CO_2eq), with the largest share in gross GHG emissions being CO_2 from fossil fuels combustion and industrial processes (IPCC 2023-TN8557). The EPA has determined that GHGs "may reasonably be anticipated both to endanger public health and to endanger public welfare" (74 FR 66496-TN245).

3.15.3.1.1 Proposed Action

The operation of Comanche Peak results in direct and indirect GHG emissions. Vistra has calculated direct (i.e., stationary and portable combustion sources) and indirect (i.e., workforce commuting) GHG emissions, which are provided in Table 3-28. Vistra does not maintain an inventory of GHG emission resulting from visitors and delivery vehicles. Fluorinated gas emissions from refrigerant sources and from electrical transmission and distribution systems can result from leakage, servicing, repair, or disposal of sources. In addition to being GHGs, chlorofluorocarbons and hydrochlorofluorocarbons are ozone-depleting substances that are regulated by the CAA under Title VI, "Stratospheric Ozone Protection. Chlorofluorocarbons and hydrochlorofluorocarbons are present at Comanche Peak. Comanche Peak PowerCo maintains a program to manage stationary refrigeration appliances at Comanche Peak to recycle, recapture, and reduce emissions of ozone-depleting substances. Therefore, Table 3-28 does not account for any potential emissions from stationary refrigeration sources at Comanche Peak.

Table 3-28 Annual Greenhouse Gas Emissions from Operation at Comanche Peak, Units 1 and 2

Emission Source	Carbon Dioxide Equivalent Emissions (CO_2eq), T[a]
Combustion Sources[b]	5,230
Workforce Commuting[c]	5,650
Total	10,880

(a) Greenhouse gas (GHG) emissions are reported in metric tons and converted to short tons. All reported values are rounded. To convert to metric tons per year, multiply by 0.90718. Expressed in carbon dioxide equivalents (CO_2eq), a metric used to compare the emissions of GHGs based on their global warming potential (GWP). The GWP is a measure used to compare how much heat a GHG traps in the atmosphere. The GWP is the total energy that a gas absorbs over a period of time compared to carbon dioxide. CO_2eq is obtained by multiplying the amount of the GHG by the associated GWP. For example, the GWP of methane is 21; therefore, 1 ton of methane emission is equivalent to 21 tons of carbon dioxide emissions.

(b) Emissions are theoretical maximum emissions based on maximum allowed run times of sources listed in Table 3-5 in this SEIS, No.2 fuel oil or fuel oil, AP 42 emissions factors, and equipment vendor supplied consumption.

(c) Emissions account for 1,866 passenger vehicles per day based on Comanche Peak's permanent full-time employees (1,159 employees total) and a 4.4 percent carpool rate. Greenhouse gas (GHG) emissions are reported in metric tons and converted to short tons. All reported values are rounded. To convert to metric tons per year, multiply by 0.90718. Expressed in carbon dioxide equivalents (CO_2eq), a metric used to compare the emissions of GHGs based on their GWP. The GWP is a measure used to compare how much heat a GHG traps in the atmosphere. The GWP is the total energy that a gas absorbs over a period of time compared to carbon dioxide. CO_2eq is obtained by multiplying the amount of the GHG by the associated GWP. For example, the GWP of methane is 21; therefore, 1 ton of methane emission is equivalent to 21 tons of carbon dioxide emissions.

Source: Luminant 2022-TN8655.

Annual average temperatures are projected to increase by 3.62 and 4.61 °F across the Great Plains South region by midcentury for the representative concentration pathway (RCP) 4.5 and RCP 8.5 (see definition and discussion of RCPs in Section 3.15.3.6.3 below) emission scenarios, respectively. Annual average precipitation is projected to change slightly with overall decreases in average rainfall during winter, spring, and summer. Heavy precipitation events are projected to increase in frequency and intensity in the southern Great Plains. Decreases in average precipitation coupled with increases in extreme precipitation, temperatures, and evapotranspiration can result in increased aridity, more frequent droughts, and reduction in the average flow of rivers and streams. These climate changes may affect water availability and flood characteristics in the region where Comanche Peak is located. However, the NRC staff determined that with continued adherence to water use permit limits and implementation of BMPs for stormwater runoff and spill response, the effects of climate change on water use and quality in the region would be minor during the LR term.

3.15.3.2 No-Action Alternative

Under the no-action alternative, the NRC would not issue renewed licenses, and Comanche Peak would permanently shut down on or before the expiration of the current licenses. At some point, all nuclear plants will terminate operations and undergo decommissioning. The decommissioning GEIS (NRC 2002-TN7254) considers the environmental impacts of decommissioning. Therefore, the scope of impacts considered under the no-action alternative includes the immediate impacts resulting from activities at Comanche Peak that would occur between plant shutdown and the beginning of decommissioning (i.e., activities and actions necessary to cease operation of Comanche Peak). Facility operations would terminate before the expiration of the current licenses. When the facility stops operating, a reduction in GHG emissions from activities related to plant operation, such as the use of generators and employee vehicles would occur. The NRC staff anticipates that GHG emissions for the no-action alternative would be less than those presented in Table 3-29, which shows the estimated direct GHG emissions from operation of Comanche Peak and associated mobile emissions.

Table 3-29 Direct Greenhouse Gas Emissions from Facility Operations Under the Proposed Action and Alternatives

Technology/Alternative	CO_2eq (T/yr)[(a)]
Proposed Action[(b)]	10,880
No-Action Alternative[(c)]	<10,880
New Nuclear Alternative[(d)]	14,970
Natural Gas-fired Combined-Cycle Alternative[(e)]	8 million
Combination Alternative[(f)]	2,495

(a) Carbon dioxide equivalent (CO_2eq) is a metric used to compare the emissions of greenhouse gases (GHGs) based on their global warming potential (GWP). The GWP is a measure used to compare how much heat a GHG traps in the atmosphere. The GWP is the total energy that a gas absorbs over a period of time compared to carbon dioxide. CO_2eq is obtained by multiplying the amount of the GHG by the associated GWP. For example, the GWP of methane is 21; therefore, 1 ton of methane emission is equivalent to 21 tons of carbon dioxide emissions.
(b) GHG emissions include direct emissions from onsite combustion sources.
(c) Emissions resulting from activities at Comanche Peak that would occur between plant shutdown and the beginning of decommissioning and assumed not to be greater than GHG emissions from operation at Comanche Peak.
(d) GHG emissions estimated based on total carbon footprint from two or more small modular reactors with a maximum total electrical output of 800 MWe for 40 years is 199,550 tons of CO2eq (presented in NUREG-2226). Therefore, the NRC staff estimates that operating six 400 MWe small modular reactors would emit up to 14,970 tons of CO2eq annually (13,675 MT).
(e) Emissions from direct combustion of natural gas. GHG emissions estimated using emission factors developed by the DOE’s (NETL 2019-TN7484).
(f) Emissions primarily from the new nuclear portion and scaled from a 400 MWe small modular reactor under the New Nuclear Alternative.

3.15.3.3 New Nuclear Alternative (Small Modular Reactors)

In NUREG-2226, the NRC estimated the total carbon footprint as a result of operating two or more SMRs with a maximum total electrical output of 800 MWe (NRC 2018-TN7244). In Section 5.7.1.2 of NUREG–2226 (page 5-45), the NRC estimated that the carbon footprint for operations for 40 years is 199,500 T of CO_2eq (181,000 MT) or 4,990 T of CO_2eq annually (4,525 MT). Therefore, the NRC staff estimates that operating six 400 MWe SMRs would emit up to 14,970 T (13,575 MT) of CO_2eq annually.

3.15.3.4 Natural Gas-Fired Combined-Cycle Alternative

The LR GEIS (NRC 2013-TN2654) presents life-cycle GHG emissions associated with natural gas power generation. As presented in Table 4.12-5 of the LR GEIS, life-cycle GHG emissions from natural gas can range from 120 to 930 g Ceq/kWh (grams carbon equivalent per kilowatt-hour). The NRC staff estimates that direct emissions from the operation of three megawatt-electric NGCC units would total 8.0 million T (7.25 million MT) of CO_2eq per year.

3.15.3.5 Combination Alternative

For the combination alternative, GHG emissions associated with operation would primarily be from the SMR portion. The NRC staff estimates that direct emissions from the operation of a 400 MWe SMR would emit up to 2,495 T (2,260 MT) of CO_2eq annually. Emissions associated with operation of renewable energy sources (solar PV and wind) would be negligible because no direct fossil fuels are burned to generate electricity.

3.15.3.6 Summary of Greenhouse Gas Emissions from the Proposed Action and Alternatives

Table 3-29 presents the direct GHG emissions from facility operations under the proposed action of LR and alternatives to the proposed action. GHG emissions from the NGCC alternative are several orders of magnitude greater than those from continued operation of Comanche Peak, the new nuclear alternative, or combination alternatives. If Comanche Peak’s generating capacity were to be replaced by the NGCC alternative, there would be an increase in GHG emissions. Therefore, the NRC staff concludes that the continued operation of Comanche Peak (the proposed action) results in GHG emissions avoidance compared to the NGCC alternative. However, the proposed action, the no-action alternative, the new nuclear alternative, and the combination alternative would have similar and comparable GHG emissions. If Comanche Peak’s generating capacity were to be replaced by either the new nuclear alternative or the combination alternative, there would be no significant increase in GHG emissions.

3.15.3.6.1 Climate Change

Climate change is the decades or longer change in climate measurements (e.g., temperature and precipitation) that has been observed on a global, national, and regional level (IPCC 2007-TN7421; EPA 2016-TN7561; USGCRP 2014-TN3472) Climate change research indicates that the cause of the Earth’s warming over the last 50 to 100 years is due to the buildup of GHGs in the atmosphere resulting from human activities (IPCC 2013-TN7434, 2021-TN7435, 2023-TN8557; USGCRP 2014-TN3472, 2017-TN5848, 2018-TN5847). Climate change can vary regionally, spatially, and seasonally, depending on local, regional, and global factors. Just as regional climate differs throughout the world, the impacts of climate change can vary among locations.

3.15.3.6.2 Observed Trends in Climate Change Indicators

Global surface temperature has increased faster since 1970 than in any other 50-year period over at least the last 2,000 years (IPCC 2023-TN8557). On a global level, from 1901 to 2016, the average temperature has increased by 1.8 °F (1.0 °C) (USGCRP 2018-TN5847). Since 1901, precipitation has increased at an average rate of 0.04 in. (0.0.1 cm) per decade on a global level (EPA 2021-TN7420). The United States Global Change Research Program (USGCRP) reports that from 1901 to 2016, average surface temperatures have increased by 1.8 °F (1.0 °C) across the contiguous United States (USGCRP 2018-TN5847). Since 1901, average annual precipitation has increased by 4 percent across the United States (USGCRP 2018-TN5847). Observed climate change indicators across the United States include increases in the frequency and intensity of heavy precipitation, earlier onset of spring snowmelt and runoff, rise of sea level and increased tidal flooding in coastal areas, an increased occurrence of heat waves, and a decrease in the occurrence of cold waves. Since the 1980s, data show an increase in the length of the frost-free season (i.e., the period between the last occurrence of 32 °F [0 °C] in the spring and first occurrence of 32 °F [0 °C] in the fall), across the contiguous United States. Over the period 1991 through 2011, the average frost-free season was 10 days longer (relative to the 1901 through 1960 time period) (USGCRP 2014-TN3472). Over just the past two decades, the number of high-temperature records observed in the United States has far exceeded the number of low-temperature records (USGCRP 2018-TN5847). Since the 1980s, the intensity, frequency, and duration of North Atlantic hurricanes have increased (USGCRP 2014-TN3472).

Climate change and its impacts can vary regionally, spatially, and seasonally, depending on local, regional, and global factors. Observed climate changes and impacts have not been uniform across the United States. Temperature data for the southern Great Plains region (where Comanche Peak is located) between 1986–2016 exhibit an increase of 1.61 °F (0.9 °C) (USGCRP 2017-TN5848). Long-term (1895 to 2012) average annual precipitation data for the southern Great Plains also exhibit an increasing trend. Since 1991, precipitation has increased by 8 percent in the southern Great Plains. Between 1958 and 2016, heavy precipitation events have increased by 12 percent (USGCRP 2014-TN3472, 2018-TN5847). The frost-free season has increased by 7 days across the southern Great Plains during the 1986 to 2015 timeframe relative to the 1901 to 1960 timeframe (USGCRP 2017-TN5848). Sea level rise along the Texas Gulf Coast is twice that of the global average (USGCRP 2018-TN5847). The Gulf Coast of Texas has experienced several record-breaking floods and tropical cyclones, including Hurricane Harvey (USGCRP 2018-TN5847). The southern Great Plains is vulnerable to periods of drought.

The NRC staff used the NOAA’s “Climate at a Glance” tool to analyze temperature and precipitation trends for the 1895–2022 period in Texas’ North Central Climate Division (Climate Division No. 3). A trend analysis shows that the average annual temperature has increased at a rate of 0.05 °C (0.1 °F) per decade, and average precipitation increased at a rate of 0.41 in (1.04 cm) per decade (NOAA 2023-TN8560).

3.15.3.6.3 Climate Change Projections

Future global GHG emission concentrations (emission scenarios) and climate models are commonly used to project possible climate change. Climate models indicate that over the next few decades, temperature increases will continue due to current GHG emission concentrations in the atmosphere (USGCRP 2014-TN3472). If GHG concentrations were to stabilize at current levels, this would still result in at least an additional 1.1 °F (0.6 °C) of warming over this century

(USGCRP 2018-TN5847). Over the longer term, the magnitude of temperature increases and climate change-related effects will depend on future global GHG emissions (IPCC 2021-TN7435; USGCRP 2009-TN18, 2014-TN3472, 2018-TN5847). Climate model simulations often use GHG emission scenarios to represent possible future social, economic, technological, and demographic development that, in turn, drive future emissions. Consequently, the GHG emission scenarios, their supporting assumptions, and the projections of possible climate change effects entail substantial uncertainty.

The IPCC has generated various RCP scenarios commonly used by climate modeling groups to project future climate conditions (IPCC 2000-TN7652, 2013-TN7434; USGCRP 2017-TN5848, 2018-TN5847). In the IPCC Fifth Assessment Report, four RCPs were developed and are based on the predicted changes in radiative forcing (a measure of the influence that a factor, such as GHG emissions, has in changing the global balance of incoming and outgoing energy) in the year 2100, relative to preindustrial conditions. The four RCP scenarios are numbered in accordance with the change in radiative forcing measured in watts per square meter (i.e., +2.6 [very low], +4.5 [lower], +6.0 [mid-high], and +8.5 [higher]) (USGCRP 2018-TN5847). For example, RCP 2.6 is representative of a mitigation scenario aimed at limiting the increase of global mean temperature to 1.1 °F (2 °C) (IPCC 2014-TN7651). The RCP 8.5 reflects a continued increase in global emissions resulting in increased warming by 2100. In the IPCC Working Group contribution to the Sixth Assessment Report, five shared socioeconomic pathways were used along with associated modeling results as the basis for their climate change assessments (IPCC 2021-TN7435). These five socioeconomic pathway scenarios cover a range of GHG pathways and climate change mitigation.

The Fourth National Climate Assessment relies on the four RCPs in the IPCC Fifth Assessment Report and presents projected climate change categorized by U.S. geographic region (see Figure 3-12; USGCRP 2018-TN5847). Climate model projections indicate that changes in climate will not be uniform across the United States. Regional projections for annual mean temperature are available from the Fourth National Climate Assessment based on the RCP 4.5 and RCP 8.5 scenarios for the midcentury (2036–2065) as compared to the annual mean temperature for 1976–2005. The modeling predicts increases of 3.62-4.61 °F (°C) across the Great Plains South region by midcentury, with higher level of GHG emission scenarios leading to greater and faster temperature increases (USGCRP 2017-TN5848, Table 6.4). Specific to the portion encompassing Texas, predicted annual temperature increases range from 2–6 °F (1 °C) under the RCP 4.5 scenario and RCP 8.5 scenario (USGCRP 2017-TN5848). Under the RCP 8.5 scenario, the coldest and warmest daily temperatures of the year are expected to increase by 2–6 °F in Texas by midcentury (USGCRP 2017-TN5848).

As for precipitation, the climate model simulations suggest small changes in average annual precipitation, with overall decreases in average rainfall during winter, spring, and summer (USGCRP 2017-TN5848; EPA 2023-TN8803). The USGCRP, however, predicts continued increases in the frequency and intensity of heavy precipitation events across the United States, including across the southern Great Plains. Generally, extreme precipitation events are observed to increase by 6–7 percent for each degree Celsius of temperature increase (USGCRP 2017-TN5848). Decreases in average precipitation coupled with increases in extreme precipitation, temperatures, and evapotranspiration can result in increased aridity, more frequent droughts, and reduction in the average flow of rivers and streams (USGCRP 2018-TN5847; EPA 2023-TN8803).

The effects of climate change on Comanche Peak SSCs are outside the scope of the NRC staff’s LR environmental review. The environmental review documents the potential effects of continued nuclear power plant operation on the environment. Site-specific environmental conditions are considered when siting nuclear power plants. This includes the consideration of meteorological and hydrologic siting criteria as set forth in 10 CFR Part 100-TN282, “Reactor Site Criteria.” NRC regulations require that plant SSCs important to safety be designed to withstand the effects of natural phenomena, such as flooding, without loss of capability to perform safety functions. Further, nuclear power plants are required to operate within technical safety specifications in accordance with the NRC operating license, including coping with natural phenomena hazards. The NRC conducts safety reviews prior to allowing licensees to make operational changes due to changing environmental conditions. Additionally, the NRC evaluates nuclear power plant operating conditions and physical infrastructure to ensure ongoing safe operations under the plant’s initial and renewed operating licenses through the NRC’s Reactor Oversight Program. If new information about changing environmental conditions (such as rising sea levels that threaten safe operating conditions or challenge compliance with the plant’s technical specifications) becomes available, the NRC will evaluate the new information to determine whether any safety-related changes are needed at licensed nuclear power plants. This is a separate and distinct process from the NRC staff’s LR environmental review that it conducts in accordance with the NEPA.

Nonetheless, changes in climate could have broad implications for certain resource areas. As discussed below, the NRC staff considers the impacts of climate change on environmental resources that are incrementally affected by the proposed.

<u>Air Quality</u>: Climate change can impact air quality as a result of changes in meteorological conditions. Air pollutant concentrations are sensitive to winds, temperature, humidity, and precipitation. Ozone levels have been found to be particularly sensitive to climate change. Sunshine, high temperatures, and air stagnation are favorable meteorological conditions leading to higher levels of ozone. Although surface temperatures are expected to increase, ozone levels will not necessarily increase because ozone formation is also dependent on the relative amounts of precursors available. The combination of higher temperatures, stagnant air masses, sunlight, and emissions of precursors may make it difficult to meet ozone NAAQS. Meteorological conditions conducive to ozone formation occur when high-pressure systems dominate local weather patterns. Clear skies and stagnate air on warm sunny days allow for the highest concentrations of ozone (TCEQ 2023-TN8869). Regional air quality modeling indicates that by mid-century, under both an RCP 4.5 and 8.5 scenario, can experience increases or decreases in ozone concentrations, with central and southeastern portions of Texas will primarily experience decreases in ozone concentrations (USGCRP 2018-TN5847).

<u>Surface Water Resources</u>: Climate change can affect the availability of water resources due to climatic changes such as changes in temperature and precipitation patterns (NRC 2013-TN2654). The availability of water is expected to decline due to warmer temperatures, increased evaporation, and increased transpiration reducing average river flows (EPA 2016-TN7561). However, Comanche Peak withdraws water exclusively from the CCR for operational purposes and uses a once-through cooling system, which reduces demand on water resources. A substantial amount of supplemental water from Lake Granbury and other sources is available under an existing agreement with the BRA (Section 3.5.1.2). As discussed above, Comanche Peak operations do not require significant surface water consumption or any groundwater withdrawals, and Comanche Peak operates in compliance with its permits for water withdrawals and discharges. Because Comanche Peak uses a once-through cooling system and complies with its permitted withdrawals, its contribution to the cumulative impacts on water availability would be SMALL. Warmer water and higher air temperatures can reduce the efficiency of thermal power plant cooling technologies. In addition, discharge permit conditions may limit

operations for some power plants as water temperatures rise (NRC 2013-TN2654). However, the primary function of CCR is to act as a cooling water reservoir for Comanche Peak (Section 2.1.3 and Section 3.5.1.1. Although no changes are reasonably foreseeable, if any changes were to occur, Comanche Peak would continue to operate within permitted conditions.

3.16 Cumulative Effects of the Proposed Action

Actions considered in the cumulative effects (impacts) analysis include the proposed LR action when added to the environmental effects from past, present, and reasonably foreseeable future actions. The analysis considers all actions, however minor, because the effects of individually minor actions may be significant when considered collectively over time. The goal of the cumulative effects analysis is to identify potentially significant impacts. As explained in the LR GEIS (NRC 2013-TN2654), the effects of the proposed LR action combined with the effects of other actions could generate cumulative impacts on a given resource.

The cumulative effects or impacts analysis only considers resources and environmental conditions that could be affected by the proposed license renewal action, including the effects of continued reactor operations during the LR term and any refurbishment activities at a nuclear power plant. In order for there to be a cumulative effect, the proposed action (LR) must have an incremental new, additive, or increased physical impact on the resource or environmental condition beyond what is already occurring.

For the purposes of this analysis, past and present actions include all actions that have occurred since the commencement of reactor operations up to the submittal of the LR request. Older actions are accounted for in baseline assessments presented in the affected environment discussions in Sections 3.2 through 3.13. The time frame for the consideration of reasonably foreseeable future actions is the 20-year LR term. Reasonably foreseeable future actions include current and ongoing planned activities through the end of the period of extended operation.

The incremental effects of the proposed action (LR) when added to the effects from past, present, and reasonably foreseeable future actions and other actions (including trends such as global climate change) result in the overall cumulative effect. A qualitative cumulative effects analysis is conducted in instances where the incremental effects of the proposed action (LR) and past, present, and reasonably foreseeable future actions are uncertain or not well known.

Information from Vistra’s ER (Luminant 2020-TN8662); responses to requests for additional information; information from other Federal, State, and local agencies; scoping comments; and information gathered during the environmental site audit at Comanche Peak were used to identify past, present, and reasonably foreseeable future actions. In 2006, Vistra replaced the Comanche Peak Unit 1 steam generators and reactor pressure vessel closure head. The removed components are housed onsite in a storage facility (Luminant 2022-TN8655). Vistra has subsequently determined that the existing Comanche Peak Unit 2 steam generator and reactor pressure vessel head will not require replacement for the proposed LR operating term. There are currently no plans to construct an expansion to the old steam generator storage facility where the Unit 1 steam generators and reactor pressure vessel head are stored onsite.

Vistra has determined that the current onsite ISFSI pad has enough space for spent nuclear fuel canister storage to support the current licenses. The possible need to expand the size of the ISFSI pad, and the scope of any such potential expansion, is speculative and not reasonably foreseeable at this time because it would depend on the status of DOE’s future performance of its obligation to accept spent nuclear fuel or the availability of other interim storage options. If the ISFSI pad needs to be expanded, previously disturbed land near the ISFSI is likely to be sufficient for the expansion with no significant environmental impact. No other major changes to Comanche Peak Units 1 and 2 or plant infrastructure are anticipated during the LR term.

A combined license application for two U.S. Advanced Pressurized Water Reactors, designated as Comanche Peak Units 3 and 4, was prepared by Luminant and submitted to the NRC for approval in 2008. Subsequently, the Comanche Peak combined license application project was put on hold in 2013, and the licensing application review remains suspended (Luminant 2022-TN8655).

Additional Federal or non-Federal projects taking place in the Comanche Peak region include ongoing Texas Department of Transportation road maintenance and construction projects. Additionally, the SCWD has been adding new water lines to the county distribution network. More water lines are anticipated to be installed during the LR term, but no schedule has been announced.

Three proposed pipeline projects near Comanche Peak are in various stages of development. Each pipeline, if constructed, is anticipated to cross a portion of the Comanche Peak site. These pipeline projects include:

- Wolf Hollow Pipeline Project – The Wolf Hollow Pipeline Project is a proposed 10.5 mi long, 24 in. pipeline that would be routed under a portion of the Comanche Peak site and the CCR. Installation of the pipeline would require temporary disturbance associated with access, construction, and equipment staging. Ecological, cultural resources, and land use impacts are expected to be SMALL and temporary. Other resources are not present, will be avoided, or will not be affected by the construction or operation of the proposed pipeline.
- Targa Pipeline – Currently undergoing impacts analysis; impacts are expected to be similar to those of the Wolf Hollow Pipeline Project.
- Warrior Pipeline – Currently undergoing impacts analysis; impacts are expected to be similar to those of the Wolf Hollow Pipeline Project.

Hood County is currently considering whether to construct a $169M solar farm (Yellow Viking Solar Project Two) near Pecan Plantation in the southeastern portion of the county, which could result in 400–600 new jobs associated with construction and operation (HCN 2022-TN8806).

Texas Department of Transportation has identified a number of transportation improvement projects (TXDOT 2023-TN8804) in the vicinity of the Comanche Peak, including:

- improvements to US 377 in Hood County east of Granbury
- preventive maintenance on FM 200 (southwest of Comanche Peak), FM 56 (west of Comanche Peak) and FM 51 (northwest of Comanche Peak)
- intersection improvements on SH 144 (east of Comanche Peak)
- preventive maintenance on FM 200 (southwest of Comanche Peak), FM 56 (west of Comanche Peak) and FM 51 (northwest of Comanche Peak)
- intersection improvements on SH 144 (east of Comanche Peak)

A new water line extension project in Somervell County is close to completion; 96 of 97 planned extensions have been completed (SCWD 2023-TN8805).

The following sections discuss the cumulative effects on the environmental near Comanche Peak —when the incremental environmental effects of the proposed LR action are compounded by the effects of past, present, and reasonably foreseeable future actions. For the most part, environmental conditions near Comanche Peak are not expected to change appreciably during the LR term beyond what is already being experienced. Consequently, no cumulative impacts analysis was performed for the following resource areas: land use, noise, geology and soils, terrestrial resources, aquatic resources, and historic and cultural resources.

3.16.1 Air Quality

The region of influence in the cumulative air quality analysis consists of Somervell County. Vistra has not proposed any refurbishment-related activities during the LR term. As a result, air emissions from the plant during the LR term would be similar to those described in Section 3.3. Current air emission sources operating in Somervell County have not resulted in long-term NAAQSs violations, given the designated in attainment status for all criteria pollutants. Consequently, cumulative changes to air quality in Somervell County would be the result of off-site future actions that would change present-day emissions within the counties.

Development and construction activities (e.g., solar farm, pipeline projects) could increase air emissions during their respective construction periods, but the air emissions would be temporary and localized. Air emissions associated with the operation of the future solar farm would be negligible because fossil fuels would not be burned to generate electricity. Therefore, there would be no cumulative effect from the proposed action caused by continued operations at Comanche Peak in the LR term beyond what is already being experienced.

3.16.2 Water Resources

3.16.2.1 Surface Water Resources

The description of the affected environment in Section 3.5.1, “Surface Water Resources,” serves as the baseline for the cumulative impacts assessment for surface water resources. The Comanche Peak condenser cooling system withdraws water from the CCR. Heated water from the once-through cooling system is discharged to the CCR. Evaporative losses from the CCR are replaced by makeup water withdrawn from Lake Granbury. Comanche Creek downstream of the Comanche Creek Dam, flows into Paluxy River. The Paluxy River flows into the Brazos River a short distance downstream of its confluence with Comanche Creek. As such, this cumulative impact review focuses on the projects and activities that would withdraw water from, or discharge effluents to, the CCR, Lake Granbury, Paluxy River, and Brazos River (see Figure 3-2).

The CCR was created to provide a source of cooling water for the Comanche Peak units. As discussed in Section 3.5.1.2, with the exception of a small fraction of water being lost to evaporation, surface water withdrawn by Comanche Peak is returned to the CCR. Vistra has not proposed to increase Comanche Peak surface water withdrawals or consumptive water use during the LR term. In addition, as referenced in Section 3.5.1.1, under an agreement with the BRA and additional water from the closed DeCordova Plant’s contract, Comanche Peak has access to 49,350 ac-ft of water per year (39,350 ac-ft per year through August 31, 2066 and 10,000 ac-ft per year through December 31, 2030, respectively). As stated in Section 3.5.1.2, two irrigation water withdrawals from CCR have been proposed. The Texas Water Rights Commission is reviewing these proposals and their water withdrawal needs would be determined during the review. The NRC expects the proposed withdrawals to be consistent with current Comanche Peak water withdrawals and with water availability in the Brazos River Basin. The proposed pipeline projects are not expected to affect surface water use from the CCR.

Discharges from Comanche Peak are regulated by TPDES Permit No. WQ0001854000 (Luminant 2022-TN8655). As stated in Section 3.5.1.3, Comanche Peak's CWA Section 401 Water Quality Certification remains valid (see Attachment B in Luminant 2022-TN8655). To meet instream flow requirements, a minimum discharge of 1.5 cfs to Comanche Creek downstream of the dam is maintained. Comanche Peak will continue operating under the current and future renewed TPDES permits during the LR period. Comanche Peak will also continue to implement its SWPPP and SPCC plan. Vistra does not anticipate any dredge-and-fill activities during the LR term. Therefore, the proposed action would have no cumulative effect beyond what is already being experienced.

3.16.2.2 Groundwater Resources

As presented in Section 3.5.2.3, the quality of groundwater at the site is unsuitable for irrigation due to local soil conditions and the sodium content of the water. As stated in Section 3.5.2.3, groundwater use from the Glen Rose and Paluxy Aquifers in the vicinity of Comanche Peak is not expected to increase significantly because the aquifers are variable in their hydraulic characteristics and quality. Potable water is supplied by the SCWD and all water supply wells have been deactivated as of August 2021. Minor amounts of groundwater are withdrawn as part of plant operations. Groundwater withdrawal for operations are not anticipated to significantly increase from the current low rate during the proposed LR operating term. As discussed above, land development (beyond that which has already been disturbed) in the Comanche Peak vicinity is not anticipated. Comanche Peak will continue to maintain and implement its site-specific spill prevention plans to prevent spills that would contaminate soils, groundwater, and surface water during the proposed LR operating term. Based on this information, the proposed action would have no cumulative effect beyond what is currently being experienced.

3.16.3 Socioeconomics

As discussed in Section 3.10.7, continued operation of Comanche Peak during the LR term would have no impact on socioeconomic conditions in the region beyond what is already being experienced. Vistra has no planned activities at Comanche Peak beyond continued reactor operations and maintenance.

Because Vistra has no plans to hire additional workers during the LR term, overall expenditures and employment levels at Comanche Peak would remain unchanged and there would be no new or increased demand for housing and public services. Therefore, the only contributory effects would come from reasonably foreseeable future planned operational activities at Comanche Peak unrelated to the proposed action (LR), and other planned off-site activities. When combined with other past, present, and reasonably foreseeable future activities, the contributory effects of reactor operations and maintenance at Comanche Peak would have no new or increased socioeconomic impact in the region beyond what is currently being experienced.

3.16.4 Human Health

The NRC and EPA have established radiological dose limits to protect the public and workers from both acute and long-term exposure to radiation and radioactive materials. These dose limits are specified in 10 CFR Part 20 (TN283) and 40 CFR Part 190 (TN739), “Environmental Radiation Protection Standards for Nuclear Power Operations.” As discussed in Section 3.11.6 et seq., “Human Health,” of this SEIS, the impacts on human health from continued plant operations during the LR term would be SMALL.

For the purposes of this cumulative impact analysis, the geographical area considered is the area within a 50 mi (80 km) radius of Comanche Peak. There are no other operational nuclear power plants within this 50 mi (80 km) radius. As discussed in Section 2.1.4.4, “Radioactive Waste Storage,” of this SEIS, Vistra stores spent nuclear fuel from Comanche Peak in a storage pool and in an onsite ISFSI. As discussed during the February audit with Vistra, Vistra can add additional storage capacity as needed in accordance with their general license (Luminant 2023-TN8665).

The EPA regulations at 40 CFR Part 190 (TN739) limit the dose to members of the public from all sources in the nuclear fuel cycle, including nuclear power plants, fuel fabrication facilities, waste disposal facilities, and transportation of fuel and waste. As discussed in Section 2.1.4.5 in this SEIS, Comanche Peak has a REMP that measures radiation and radioactive materials in the environment from Comanche Peak operations, its ISFSI, and all other sources. The NRC staff reviewed the radiological environmental monitoring results for the 5-year period from 2018 through 2022 as part of this cumulative impacts assessment (Luminant 2019-TN8661, 2020-TN8662, 2021-TN8663, 2022-TN8664, 2023-TN8660). The review of Vistra’s data showed no indication of an adverse trend in radioactivity levels in the environment from either Comanche Peak or the ISFSI. The data showed that there was no measurable impact on the environment from operations at Comanche Peak.

In summary, the NRC staff concludes that there would be no cumulative effect on human health resulting from the proposed LR action beyond what is already being experienced, in combination with the cumulative effects from other sources. The NRC staff bases this conclusion on its review of REMP data, radioactive effluent release data, and worker dose data; the expectation that Comanche Peak would continue to comply with Federal radiation protection standards during the period of extended operation; and the continued regulation of any future development or actions in the vicinity of the Comanche Peak site by the NRC and the State of Texas.

3.16.5 Environmental Justice

This cumulative impact analysis evaluates the potential for disproportionate and adverse human health and environmental effects on minority and low-income populations that could result from past, present, and reasonably foreseeable future actions, including the continued operational effects of Comanche Peak Units 1 and 2 during the LR term. As discussed in Section 3.12, there would be no disproportionate and adverse impacts on minority and low-income populations from the continued operation of Comanche Peak Units 1 and 2 during the LR term.

Everyone living near Comanche Peak, including minority and low-income populations, currently experiences its operational effects. The NRC addresses environmental justice by identifying the location of minority and low-income populations, determining whether there would be any potential human health or environmental effects, and whether any of the effects may be disproportionate and adverse to these populations.

Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionate and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionate environmental effects refer to impacts or risks of impacts in the natural or physical environment in a minority or low-income community that appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts. Some of these potential effects have been identified in resource areas presented in preceding sections of this chapter of the SEIS. As previously discussed in this chapter, LR impacts for all resource areas (e.g., land, air, water, and human health) would be SMALL.

As discussed in Section 3.12, there would be no disproportionate and adverse impacts on minority and low-income populations from the continued operation of Comanche Peak Units 1 and 2 during the LR term. Because Vistra has no plans to hire additional workers during the LR term, employment levels at Comanche Peak would remain unchanged, and there would be no additional demand for housing or increase in traffic. Based on this information and the analysis of human health and environmental impacts, it is not likely that there would be any disproportionate and adverse contributory effects on minority and low-income populations from the continued operation of Comanche Peak Units 1 and 2 during the LR term.

Vistra has no planned activities at Comanche Peak beyond continued reactor operations and maintenance. When combined with other past, present, and reasonably foreseeable future actions, the contributory effects of continuing reactor operations and maintenance at Comanche Peak would not likely cause disproportionate and adverse human health and environmental effects on minority and low-income populations residing near Comanche Peak beyond what those populations have already experienced. Therefore, the only contributory effects would come from reasonably foreseeable future off-site activities, unrelated to the proposed action (LR).

3.16.6 Waste Management and Pollution Prevention

This section considers the incremental waste management impacts of the LR term when added to the contributory effects of other past, present, and reasonably foreseeable future actions. As discussed in Section 3.13.3, “Proposed Action,” of this SEIS, the potential waste management impacts from continued operations at Comanche Peak during the LR term would be SMALL.

As discussed in Sections 2.1.4 and 2.1.5 of this SEIS, Vistra maintains waste management programs for radioactive and nonradioactive waste generated at Comanche Peak and is required to comply with Federal and State permits and other regulatory waste management requirements. All industrial facilities, including nuclear power plants and other facilities within a 50 mi (80 km) radius of Comanche Peak, are also required to comply with appropriate NRC, EPA, and State requirements for the management of radioactive and nonradioactive waste. Current waste management activities at Comanche Peak would likely remain unchanged during the LR term, and continued compliance with Federal and State requirements for radioactive and nonradioactive waste is expected.

Therefore, there would be no cumulative effect from the proposed action caused by continued radioactive and nonradioactive waste generation. This is based on Comanche Peak's continued compliance with Federal and State of Texas requirements for radioactive and nonradioactive waste management and the regulatory compliance of other waste producers in the area.

3.17 Resource Commitments Associated with the Proposed Action

This section describes the NRC's consideration of potentially unavoidable adverse environmental impacts that could result from implementation of the proposed action and alternatives; the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity; and the irreversible and irretrievable commitments of resources.

3.17.1 Unavoidable Adverse Environmental Impacts

Unavoidable adverse environmental impacts are impacts that would occur after implementation of all workable mitigation measures. Carrying out any of the replacement 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 Federal EPA and State emissions standards. 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 low levels of radiation as well as 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 regulatory 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, for workers and the public.

The generation of spent nuclear fuel and waste material, including low-level radioactive waste, hazardous waste, and nonhazardous waste, would be unavoidable. Hazardous and nonhazardous wastes would be generated at some 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, the NRC staff expects that power plant operators would optimize all waste management activities and operations in a way that generates the smallest possible amount of waste.

3.17.2 Relationship Between Short-Term Use of the Environment and Long-Term Productivity

The operation of power-generating facilities would result in short-term uses of the environment, as described in Sections 3.2 through 3.13 (see sections titled, "Proposed Action," "No Action," and "Replacement Power Alternatives: Common Impacts"). 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 (e.g., land and energy), indefinitely or permanently. Certain short-term resource commitments are substantially greater under most energy alternatives, including LR, 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 entail similar relationships between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

Air emissions from nuclear power plant operations introduce small amounts of radiological and nonradiological emissions to the region around the plant site. Over time, these emissions would result in increased concentrations and exposure, but the NRC staff does not expect that these emissions would affect air quality or radiation exposure to the extent that they would impair public health and long-term productivity of the environment.

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 require an increase in energy and consume 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.

3.17.3 Irreversible and Irretrievable Commitment of Resources

Resource commitments are irreversible when primary or secondary impacts limit the future options for use of a resource. For example, the consumption or loss of nonrenewable resources is irreversible. An irretrievable commitment refers to the use or consumption of resources for a period of time (e.g., for the duration of the action under consideration) that are neither renewable nor recoverable for future use. Irreversible and irretrievable commitments of resources for electrical power generation include the commitment of land, water, energy, raw materials, and other natural and human-made resources required for power plant operations. In general, the commitments of capital, energy, labor, and material resources are also irreversible.

The implementation of any of the replacement energy alternatives considered in this SEIS would entail the irreversible and irretrievable commitments of energy, water, chemicals, and—in some cases—fossil fuels. These resources would be committed during the LR term and over the entire life cycle of the power plant, and they 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 off-site commercial sources. Water would be obtained from existing water supply systems or withdrawn from surface water or groundwater. These resources are readily available, and the NRC staff does not expect that the amounts required would deplete available supplies or exceed available system capacities.

4 CONCLUSIONS

4.1 Environmental Impacts of License Renewal

This draft SEIS contains the environmental review of the application for renewed operating licenses for Comanche Peak Nuclear Power Plant (Comanche Peak), Units 1 and 2. After reviewing the site-specific (Category 2) environmental issues in this draft SEIS, the NRC staff concluded that issuing renewed licenses for Comanche Peak would have SMALL impacts for the Category 2 issues applicable to the LR at Comanche Peak. The NRC staff considered mitigation measures for each Category 2 issue, as applicable. The NRC staff concluded that no additional mitigation measure is warranted.

4.2 Comparison of Alternatives

In Chapter 3 of this draft SEIS, the NRC staff considered the following alternatives to issuing renewed operating licenses to Comanche Peak:

- no-action alternative
- new nuclear (small modular reactor) alternative
- natural gas-fired combined-cycle
- combination alternative

Based on the review presented in this draft SEIS, the NRC staff concludes that the environmentally preferred alternative is the proposed action. The NRC staff recommends that renewed Comanche Peak operating licenses be issued. As shown in Table 2-2, all other power-generation alternatives have impacts in more than one resource area that are greater than LR, in addition to the environmental impacts inherent to new construction projects. To make up the lost power generation if the NRC does not issue renewed licenses for Comanche Peak (i.e., the no-action alternative), energy decisionmakers may implement one of the replacement power alternatives discussed in Chapter 3, or a comparable alternative capable of replacing the power generated by Comanche Peak Units 1 and 2.

4.3 Recommendation

The NRC staff's preliminary recommendation is that the adverse environmental impacts of LR for Comanche Peak are not so great that preserving the option of LR for energy-planning decisionmakers would be unreasonable. This preliminary recommendation is based on the following:

- the analysis and findings in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
- the environmental report submitted by the applicant
- the NRC staff's consultation with Federal, State, Tribal, and local agencies
- the NRC staff's independent environmental review
- the NRC staff's consideration of public comments

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10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” TN250.

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40 CFR Part 131. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 131, “Water Quality Standards.” TN4814.

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50 CFR Part 10. *Code of Federal Regulations*, Title 50, *Wildlife and Fisheries*, Part 10, “National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce.” TN5490.

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6 LIST OF PREPARERS

Members of the U.S. Nuclear Regulatory Commission's (NRC's) Office of Nuclear Material Safety and Safeguards prepared this draft supplemental environmental impact statement with assistance from other NRC organizations and Pacific Northwest National Laboratory (PNNL). Table 6-1 identifies each contributor's name, professional background, and function or expertise.

Table 6-1 List of Preparers

Name	Education and Experience	Function or Expertise
Beth Alferink, NRC	MS Environmental Engineering; MS Nuclear Engineering; BS Nuclear Engineering; 25 years of national laboratory, industry, and government experience including radiation detection and measurements, nuclear power plant emergency response, operations, health physics, decommissioning, shielding and criticality	Human Health, Waste Management, Uranium Fuel Cycle, Spent Nuclear Fuel, Termination of Operations and Decommissioning
Briana Arlene, NRC	Masters Certification, National Environmental Policy Act (NEPA); BS Conservation Biology; 15 years of experience in ecological impact analysis, Endangered Species Act (ESA) Section 7 consultations, and essential fish habitat (EFH) consultations	Aquatic Resources, Federally Protected Ecological Resources
Lloyd Desotell, NRC	MS Civil Engineering; MS Water Resources Management; BA Environmental Studies; Over 20 years of experience conducting surface and subsurface hydrologic analyses	Surface Water Resources, Groundwater Resources
Jerry Dozier, NRC	MS Reliability Engineering; MBA Business Administration; BS Mechanical Engineering; 30 years of experience including operations, reliability engineering, technical reviews, and NRC branch management	Postulated Accidents
Lifeng Guo, NRC	PhD, MS Hydrogeology; BS Hydrogeology and Engineering Geology; Registered Professional Geologist; Over 30 years of combined experience in hydrogeologic investigation, hydrogeochemical analysis, and remediation	Surface Water Resources, Geologic Environment, Groundwater Resources
Robert Hoffman, NRC	BS Environmental Resource Management; 35 years of experience in NEPA compliance, environmental impact assessment, alternatives identification and development, and energy facility siting	Replacement Power Alternatives
Caroline Hsu, NRC	BS in Molecular Biology; BA in English Literature; 12 years of government experience; 3 years of management experience	Terrestrial Ecology, Land Use and Visual Resources, Socioeconomics, Environmental Justice

Name	Education and Experience	Function or Expertise
Nancy Martinez, NRC	BS Earth and Environmental Science; AM Earth and Planetary Science; 7 years of experience in environmental impact analysis	Air Quality, Meteorology and Climatology, Noise, Greenhouse Gases, Climate Change
Donald Palmrose, NRC	PhD Nuclear Engineering; MS Nuclear Engineering; BS Nuclear Engineering; 34 years of experience including operations on U.S. Navy nuclear powered surface ships, technical and NEPA analyses, nuclear authorization basis support for U.S. Department of Energy (DOE), and NRC project management	Waste Management
Leah Parks, NRC	PhD Environmental Management; MS Environmental Engineering; BS System Engineering; 17 years of experience in nuclear waste, Spent Nuclear Fuel, and reactor termination and decommissioning	Waste Management, Spent Nuclear Fuel
Jeffrey Rikhoff, NRC	MRP Regional Environmental Planning; MS Development Economics; BA English; 43 years of combined industry and Government experience in NEPA compliance for DOE Defense Programs/National Nuclear Security Administration and Nuclear Energy, U.S. Department of Defense, and the U.S. Department of the Interior; project management; socioeconomics and environmental justice impact analysis, historic and cultural resource impact assessments, consultation with American Indian tribes, and comprehensive land-use and development planning studies	Historic and Cultural Resources, Cumulative Impacts, Surface Water Resources, Environmental Justice, Replacement Power Alternatives
Ted Smith, NRC	MS Environmental Engineering; BS Electrical Engineering; 38 years of experience, including DOE Power Administration support of site environmental management programs and spent fuel management; oversight of U.S. Navy nuclear ships design, construction, and operation; and NRC project management	Management Oversight
Tam Tran, NRC	MBA Management; MS Environmental Science; MS Nuclear Engineering; Over 30 years of Federal project and program management experience	Project Management
Rebecka Bence, PNNL	MS Hydrogeology and Water Resource Management; BS Earth and Environmental Science 5+ years in groundwater resource assessment and environmental impact evaluation, contaminated land risk assessment and remediation, and natural resource management and monitoring	Groundwater Resources, Geologic Environment
Teresa Carlon, PNNL	BS Information Technology; 30 years of experience as SharePoint administrator, project coordinator, and database manager	Reference Coordinator
Kirsten Chojnicki, PNNL	PhD Geological Sciences; MS Geological Sciences; BS Earth and Space Science; 7 years management experience	Deputy Project Management

Name	Education and Experience	Function or Expertise
Caitlin Condon, PNNL	PhD Radiation Health Physics; BS Environmental Health; 6 years of experience in health physics, NEPA environmental impact assessments, waste management, radionuclide dispersion, and dosimetry modeling	Project Management
Susan Ennor, PNNL	BJ Journalism; 40 years of experience in document planning, editing, and production	Production Editor
Tracy Fuentes, PNNL	PhD Urban Design and Planning; MS Plant Biology; BS Botany; Over 15 years of experience in NEPA, ecological impact analysis, natural resource management and monitoring, data analysis, and research	Terrestrial Resources, Federally Protected Ecological Resources
Dave Goodman, PNNL	JD Law; BS Economics; 12 years of experience including NEPA environmental impact assessments, ecological restoration, ESA, land use and visual resources, and environmental law and policy	Land Use, Visual Resources, Cumulative Impacts, NEPA Regulatory Analyst
Philip Meyer, PNNL	PhD Civil Engineering; MS Civil Engineering; BA Physics; 30+ years of experience in applied groundwater and unsaturated zone research; 15+ years of experience in groundwater resource assessment and environmental impact evaluation	Groundwater Resources, Geologic Environment
Ann Miracle, PNNL	PhD Molecular Immunology; MS Molecular Genetics; BA Biology; Over 15 years of experience in ecological impact analysis, NEPA, ESA Section 7 consultations, and EFH consultations	Aquatic Resources, Terrestrial Resources, Federally Protected Ecological Resources
Patrick Mirick, PNNL	MS Fisheries; BA Biology and Economics; 15 years leading fishery policy development and environmental compliance reviews (e.g., NEPA, ESA, EFH, rulemakings)	Aquatic Resources
Michelle Niemeyer, PNNL	MS Agricultural Economics; BS Agricultural Economics; 15+ years of experience including NEPA environmental impact assessments, project management, economics, and stakeholder engagement	Environmental Justice, Socioeconomics
Mike Parker, PNNL	BA English Literature; 25 years of experience copyediting, document design, and formatting and 20 years of experience in technical editing	Production
Rajiv Prasad, PNNL	PhD Civil and Environmental Engineering; M.Tech. Civil Engineering; BE Civil Engineering; 25 years of experience in applying hydrologic principles to water resources engineering, hydrologic design, flooding assessments, environmental engineering, and impacts assessment including 15 years of experience in NEPA environmental assessments of surface water resources	Surface Water Resources
Adrienne Rackley, PNNL	MS Economics; BA Business Administration; AA General Studies	Environmental Justice, Socioeconomics

Name	Education and Experience	Function or Expertise
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Kazi Tamaddun, PNNL	PhD Civil and Environmental Engineering; MS Civil and Environmental Engineering; MBA Marketing; PGC Artificial Intelligence and Machine Learning; BS Civil Engineering; 9 years of experience in hydrologic, hydraulic, ecosystem, and water systems modeling; hydro-climatology; and climate change modeling and analysis	Surface Water Resources

7 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT ARE SENT

Table 7-1 List of Agencies, Organizations, and Persons to Whom Copies of the Statement are Sent (10 CFR 51, "Appendix A to Subpart A—Format for Presentation of Material in Environmental Impact Statements")

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Scoping Participant[(a)] (10 CFR 51.29(b))	**Scoping Participant[(a)] (10 CFR 51.29(b))**
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(a) Provided address of email and requested to be on the mailing list.
This Draft SEIS was also provided to additional individual scoping participants who requested a copy of it and listed in the Scoping Summary (ML23289A201) or Tribal Consultation (ML23097A128) in Appendix C of this SEIS.

APPENDIX A

COMMENTS RECEIVED ON THE COMANCHE PEAK NUCLEAR POWER PLANT UNITS 1 AND 2 ENVIRONMENTAL REVIEW

A.1 Comments Received During the Scoping Period

The scoping process began on December 13, 2022, with the publication of the U.S. Nuclear Regulatory Commission's (NRC's) notice of intent to conduct scoping in the *Federal Register* (87 FR 76220). The scoping process originally included two in-person public meetings to be held at the Somervell County Expo Center, 202 Bo Gibbs Blvd., W Hwy. 67, Glen Rose, TX 76043, on January 10, 2023. Because of local high COVID-19 level, the NRC staff canceled these public meetings and held a public scoping webinar on January 17, 2023 (ML23031A096) that was transcribed by a certified court reporter. On February 22, 2023, the NRC staff published an additional notice of intent to conduct scoping in the *Federal Register* (88 FR 10940) to extend the comment period to March 13, 2023, and to announce a public meeting that was held at the Somervell County Expo Center on February 23, 2023.

This in-person meeting consisted of prepared statements by NRC staff and a public comment session. Attendees provided oral statements that were recorded and transcribed by a certified court reporter. Written statements submitted at the public meeting are captured in Agencywide Documents Access and Management System.

The transcript of the meeting is an attachment of the scoping meeting summary, dated April 17, 2023 Agencywide Documents Access and Management System No. ML23081A523). In addition to the comments received during the public meeting, comments were also received electronically, via Regulations.gov and email.

At the conclusion of the scoping process, the staff issued the Comanche Peak Nuclear Power Plant Scoping Summary Report (ADAMS Accession No. ML23289A201). The report contains comments received during the public meeting and electronically during the scoping period as well as the NRC staff's consideration of these comments.

APPENDIX B

APPLICABLE LAWS, REGULATIONS, AND OTHER REQUIREMENTS

Several Federal laws and regulations affect environmental protection, health, safety, compliance, and consultation at every U.S. Nuclear Regulatory Commission (NRC) licensed nuclear power plant. Some of them require permits by or consultation with other Federal agencies or State, Tribal, or local governments. Certain Federal environmental requirements have been delegated to State authorities for enforcement and implementation. Furthermore, States have also enacted laws to protect public health and safety and the environment. It is the NRC's policy to make sure nuclear power plants are operated in a manner that provides adequate protection of public health and safety and protection of the environment through compliance with applicable Federal and State laws, regulations, and other requirements, as appropriate.

The Atomic Energy Act of 1954, as amended (AEA) (42 U.S.C. 2011 et seq.), and the Energy Reorganization Act of 1974 (42 U.S.C. 5801 et seq.) give the NRC the licensing and regulatory authority for commercial nuclear energy use. They allow the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under the AEA through regulations set forth in Title 10, "Energy," of the *Code of Federal Regulations* (CFR). The AEA also authorizes the NRC to enter into an agreement with any State that allows the State to assume regulatory authority for certain activities (see 42 U.S.C. 2021). Texas has been an NRC Agreement State since 1967, and the Radiation Section of the Consumer Protection Division of the Texas Department of State Health Services and the Radioactive Materials Division of the Texas Commission on Environmental Quality have regulatory responsibility over certain byproducts, sources, and quantities of special nuclear materials not sufficient to form a critical mass. In addition, the Texas County Judges have the authority for Emergency Planning and Response Program to provide response capabilities to emergencies for Texas.

In addition to carrying out some Federal programs, State legislatures develop their own laws. State statutes can supplement, as well as implement, Federal laws for the protection of air, surface water, and groundwater. State legislation may address solid waste management programs, locally rare or endangered species, and historic and cultural resources.

The U.S. Environmental Protection Agency (EPA) has the primary responsibility to administer the Clean Water Act (33 U.S.C. 1251 et seq., herein referred to as CWA). The National Pollutant Discharge Elimination System (NPDES) program addresses water pollution by regulating the discharge of potential pollutants to waters of the United States. The EPA allows for primary enforcement and administration through State agencies if the state program is at least as stringent as the Federal program.

EPA has delegated the authority to issue NPDES permits to the State of Texas. The Texas Commission on Environmental Quality (TCEQ) provides oversight for public water supplies and issues permits to regulate the discharge of industrial and municipal wastewaters—including discharges to groundwater—and monitors State water resources for water quality. The Department issues Texas Pollutant Discharge Elimination System (TPDES) permits to regulate and control water pollutants.

B.1 Federal and State Requirements

Comanche Peak Nuclear Power Plant (Comanche Peak) is subject to various Federal and State requirements. The applicant may prepare and submit for several regulatory approvals or permits prior to the NRC license renewal approval. As a convenient source of references of environmental requirements, Table B-1 lists principal Federal, State, and local approvals applicable to license renewal.

Table B-1 Federal and State Requirements

	Law/Regulation	Requirements
Current operating license and license renewal	Atomic Energy Act, 42 U.S.C. 2011 et seq.	The Atomic Energy Act (AEA) of 1954, as amended, and the Energy Reorganization Act of 1974 (42 U.S.C. 5801 et seq.) give the NRC the licensing and regulatory authority for commercial nuclear energy use. They allow the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under the AEA through regulations set forth in Title 10, “Energy,” of CFR.
Current operating license and license renewal	National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq.	The National Environmental Policy Act (NEPA), as amended, requires Federal agencies to integrate environmental values into their process by considering the environmental impacts of proposed Federal actions and reasonable alternatives to those actions. NEPA establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out the policy. NEPA Section 102(2) contains action-forcing provisions to ensure that Federal agencies follow the letter and spirit of the Act. For major Federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of NEPA requires Federal agencies to prepare a detailed statement that includes the environmental impacts of the proposed action and other specified information.
Current operating license and license renewal	10 CFR Part 20	Regulations in 10 CFR Part 20, “Standards for Protection Against Radiation,” establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC. These regulations are issued under the AEA of 1954, as amended, and the Energy Reorganization Act of 1974, as amended. The purpose of these regulations is to control the receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual (including doses resulting from licensed and unlicensed radioactive material and from radiation sources other than background radiation) does not exceed the standards for protection against radiation prescribed in the regulations in this Part.
Current operating license and license renewal	10 CFR Part 51	Regulations in 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,” contain the NRC’s regulations that implement NEPA.

	Law/Regulation	Requirements
Current operating license and license renewal	10 CFR Part 50	Regulations in 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," are NRC regulations issued under the AEA, as amended (68 Stat. 919), and Title II of the Energy Reorganization Act of 1974 (88 Stat. 1242), to provide for the licensing of production and utilization facilities, including power reactors.
Current operating license and license renewal	10 CFR Part 54	NRC regulations in 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," govern the issuance of renewed operating licenses and renewed combined licenses for nuclear power plants licensed under Sections 103 or 104b of the AEA, as amended, and Title II of the Energy Reorganization Act of 1974 (88 Stat. 1242). The regulations focus on managing adverse effects of aging. The rule is intended to ensure that important systems, structures, and components will continue to perform their intended functions during the period of extended operation.
Air quality protection	Clean Air Act, 42 U.S.C. 7401 et seq.	The Clean Air Act (CAA) is intended to "protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population." The CAA establishes regulations to ensure maintenance of air quality standards and authorizes individual States to manage permits. Section 118 of the CAA requires each Federal agency with jurisdiction over properties or facilities engaged in any activity that might result in the discharge of air pollutants, to comply with all Federal, State, inter-State, and local requirements with regard to the control and abatement of air pollution. Section 109 of the CAA directs the EPA to set National Ambient Air Quality Standards for criteria pollutants. The EPA has identified and set National Ambient Air Quality Standards for the following criteria pollutants: particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. Section 111 of the CAA requires the establishment of national performance standards for new or modified stationary sources of atmospheric pollutants. Section 160 of the CAA requires that specific emission increases must be evaluated before permit approval to prevent significant deterioration of air quality. Section 112 requires specific standards for release of hazardous air pollutants (including radionuclides). These standards are implemented through plans developed by each State and approved by the EPA. The CAA requires sources to meet standards and obtain permits to satisfy those standards. Nuclear power plants may be required to comply with the CAA Title V, Sections 501–507, for sources subject to new source performance standards or sources subject to National Emission Standards for Hazardous Air Pollutants. The EPA regulates the emissions of air pollutants using 40 CFR Parts 50 to 99.

	Law/Regulation	Requirements
Water resources protection	Clean Water Act, 33 U.S.C. 1251 et seq., and the NPDES (40 CFR 122)	The CWA was enacted to "restore and maintain the chemical, physical, and biological integrity of the Nation's water." The Act requires all branches of the Federal Government with jurisdiction over properties or facilities engaged in any activity that might result in a discharge or runoff of pollutants to surface waters, to comply with Federal, State, inter-State, and local requirements. As authorized by the CWA, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The NPDES program requires all facilities that discharge pollutants from any point source into waters of the United States to obtain an NPDES permit. A nuclear power plant may also participate in the NPDES General Permit for Industrial Stormwater due to stormwater runoff from industrial or commercial facilities to waters of the United States. The EPA is authorized under the CWA to directly implement the NPDES program; however, the EPA has authorized many States to implement all or parts of the national program. Section 401 of the CWA requires States to certify that the permitted discharge would comply with all limitations necessary to meet established State water quality standards, treatment standards, or schedule of compliance. The U.S. Army Corps of Engineers is the lead agency for enforcement of CWA wetland requirements (33 CFR Part 320, "General Regulatory Policies"). Under Section 401 of the CWA, the EPA or a delegated State agency has the authority to review and approve, condition, or deny all permits or licenses that might result in a discharge to waters of the State, including wetlands.
Water resources protection	Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et seq.)	Congress enacted the Coastal Zone Management Act (CZMA) in 1972 to address the increasing pressures of over-development upon the Nation's coastal resources. The National Oceanic and Atmospheric Administration administers the Act. The CZMA encourages States to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Participation by States is voluntary. To encourage States to participate, the CZMA makes Federal financial assistance available to any coastal State or territory, including those on the Great Lakes, as long as the State or territory is willing to develop and implement a comprehensive coastal management program.
Water resources protection	Wild and Scenic Rivers Act, 16 U.S.C. 1271 et seq.	The Wild and Scenic River Act created the National Wild and Scenic Rivers System, which was established to protect the environmental values of free-flowing streams from degradation by impacting activities, including water resources projects.

	Law/Regulation	Requirements
Water resources protection	*Texas Administrative Code* (TAC), Title 30, “Environmental Quality”: Part 1, “Texas Commission on Environmental Quality”	Establishes the State of Texas’s rules and regulations related to environmental quality including Surface Water Quality Standard.
Waste management and pollution prevention	Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq.	The Resource Conservation and Recovery Act requires the EPA to define and identify hazardous waste; establish standards for its transportation, treatment, storage, and disposal; and require permits for persons engaged in hazardous waste activities. Section 3006, “Authorized State Hazardous Waste Programs” (42 U.S.C. 6926), allows States to establish and administer these permit programs with EPA approval. EPA regulations implementing the Resource Conservation and Recovery Act are found in 40 CFR Parts 260 through 283. Regulations imposed on a generator or on a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated, stored, and/or disposed. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements.
Waste management and pollution prevention	Pollution Prevention Act, 42 U.S.C. 13101 et seq.	The Pollution Prevention Act establishes a national policy for waste management and pollution control that focuses first on source reduction, then on environmental issues, safe recycling, treatment, and disposal.
Waste management and pollution prevention	TAC 30: Part 1, Chapter 205	Title 30, “Environmental Quality” of the *Texas Administrative Code*, Part 1, Chapter 205, “General Permits for Waste Discharges,” establishes regulations for waste discharges.
Waste management and pollution prevention	TAC 30: Part 1, Chapter 335	TAC 30: Part 1, Chapter 335, “Industrial Solid Waste and Municipal Hazardous Waste.”
Waste management and pollution prevention	TAC 30: Part 1, Chapter 334	TAC 30: Part 1, Chapter 334, “Underground and Aboveground Storage Tanks.”
Protected species	Bald and Golden Eagle Protection Act, 16 U.S.C. 668-668d et seq.	The Bald and Golden Eagle Protection Act prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald or golden eagles, including their parts (including feathers), nests, or eggs. The Act defines “take” as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. Regulations further define “disturb” as “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.”

	Law/Regulation	Requirements
Protected species	Endangered Species Act, 16 U.S.C. 1531 et seq.	The Endangered Species Act was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7, "Interagency Cooperation," of the Act requires Federal agencies to consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service (NMFS) on Federal actions that may affect listed species or designated critical habitats.
Protected species	Magnuson–Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801-1884	The Magnuson–Stevens Fishery Conservation and Management Act, as amended, governs marine fisheries management in U.S. Federal waters. The Act created eight regional fishery management councils and includes measures to rebuild overfished fisheries, protect essential fish habitat, and reduce bycatch. Under Section 305 of the Act, Federal agencies are required to consult with the NMFS for any Federal actions that may adversely affect essential fish habitat.
Protected species	Migratory Bird Treaty Act, 16 U.S.C. 703-712 et seq.	The Migratory Bird Treaty Act (MBTA) implements four international conservation treaties that the U.S. entered with Canada (1916), Mexico (1936), Japan (1972), and Russia (1976). The MBTA has been amended with signing of each treaty, as well as when any of the treaties were subsequently amended. To ensure that populations of all protected migratory birds are sustained, the MBTA prohibits the take of protected migratory bird species without prior authorization from U.S. Fish and Wildlife Service. Under the MBTA, "take" includes killing, capturing, selling, trading, and transport of protected migratory bird species.
Protected species	TAC 31: Part 2, Chapter 65, Subchapter G	TAC 31: Part 2, Chapter 65, Subchapter G, "Threatened and Endangered Nongame Species."
Protected species	TAC 31: Part 2, Chapter 69, Subchapter A	TAC 31: Part 2, Chapter 69, Subchapter A, "Endangered, Threatened, and Protected Native Plants."
Historic preservation and cultural resources	National Historic Preservation Act, 16 U.S.C. 470 et seq.	The National Historic Preservation Act was enacted to create a national historic preservation program, including the National Register of Historic Places and the Advisory Council on Historic Preservation. Section 106 of the Act requires Federal agencies to consider the effects of their undertakings on historic properties. The Advisory Council on Historic Preservation regulations implementing Section 106 of the Act are found in 36 CFR Part 800, "Protection of Historic Properties." The regulations call for public involvement in the Section 106 consultation process, including involvement from Indian Tribes and other interested members of the public, as applicable.

B.2 Operating Permits and Other Requirements

Table B-2 lists the permits and licenses issued by Federal, State, and local authorities for activities at Comanche Peak, as identified in Chapter 9 of the Environmental Report.

Table B-2 Operating Permits and Other Requirements

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Certification of water quality standards	EPA/TCEQ	Certification of water quality standards	N/A (Valid through the period of extended operation)	Discharge of wastewaters to waters of the State.
Air quality permit/Stationary Source permit to operate	TCEQ	19225	Issued: 9/26/2014 Expires: 9/26/2024	Operation of emergency diesel generators, auxiliary boiler, and diesel fire water pumps.
Hazardous waste generator number	EPA	TXD020332078	N/A	Hazardous waste generator registration is managed under TCEQ Solid Waste Registration #: 33306 Permit #: 50356.
Consistency determination with the TX Coastal Management Program	Texas General Land Office	N/A	N/A	N/A (Comanche Peak is not in a coastal zone).
Industrial and hazardous solid waste generators registration	TCEQ	Solid Waste Registration #: 33306 Permit #: 50356	Initial Registration: 2/14/1986 Last Amendment: 11/29/2022	Industrial waste and hazardous waste generators State registration.
Industrial stormwater permit	TCEQ	TXR05DA67	Issued: 11/10/2016 Expires: 8/14/2026	Stormwater discharge permit associated with industrial activity.
TPDES general permit	TCEQ	TXR050000	Effective: 8/14/2021 Expires: 8/14/2026	Multisector industrial general permit for stormwater.
Construction stormwater general permit	TCEQ	TXR150000	Effective: 3/5/2023 Expires: 3/5/2028	Stormwater discharge general permit under the TPDES associated with construction.
Underground storage tank registration	TCEQ	No registration numbers required	N/A – Exempt under TAC 334.3(a)(9)	Operation of underground storage tanks.
Aboveground storage tank registration	TCEQ	No registration numbers required	N/A – Exempt under TAC 334.123(a)(9)	Operation of aboveground storage tanks.

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Industrial and hazardous waste permit	TCEQ	50356	Originally issued: 2/14/1997 Renewal/Minor Amendment: 9/25/2019 10-year permit renewal date: 9/25/2029	Post-closure care of onsite hazardous or industrial waste landfills.
Certificate of adjudication of water rights	Texas Water Commission	12-4097	Issued: 2/28/1986	Authority to appropriate waters of the State of Texas in the Brazos II River basin.
Contract	Contract water	-	Renewal Agreement 08-26-2016 (Term 9-1-2016 through 8-31-2066)	Brazos River Authority (BRA) Renewal Agreement.
Industrial wastewater facility permit (TPDES)	TCEQ	WQ0001854000	Issued: 10/7/2019 Expires: 10/7/2024	Wastewater treatment and effluent disposal. State implementation of NPDES.
Operating license	NRC	NPF-87	Issued: 4/17/1990 Expires: 2/8/2030	Operation of Comanche Peak.
Operating license	NRC	NPF-89	Issued: 4/6/1993 Expires: 2/2/2033	Operation of Comanche Peak.
General license for storage of spent fuel at power reactor sites	NRC	General Permit	N/A	Storage of reactor spent fuel and other associated radioactive materials in an independent spent fuel storage installation (ISFSI).
Hazardous materials certificate of registration	U.S. Department of Transportation	060923550304F US DOT #: 2051403	Issued: 7/3/2023 Expires: 6/30/2024. Updated annually	Hazardous material shipments.

Source: Vistra 2022 Environmental Report (Luminant 2022-TN8655) (see Appendix D that serves as the project docket).

APPENDIX C

CONSULTATION CORRESPONDENCE

C.1 Endangered Species Act Section 7 Consultation

As a Federal agency, the U.S. Nuclear Regulatory Commission (NRC) must comply with the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.; TN1010), as part of any action authorized, funded, or carried out by the agency. In this case, the proposed agency action is whether to issue renewed facility operating licenses for the continued operation of Comanche Peak Nuclear Power Plant (Comanche Peak), Units 1 and 2. The proposed action would authorize Vistra Operations Company LLC (Vistra) to operate Comanche Peak for an additional 20 years beyond the current operating license term. Under Section 7 of the ESA, the NRC must consult with the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) ("the Services" [collectively] or "Service" [individually]), as appropriate, to ensure that the proposed action is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

C.2 Federal Agency Obligations Under Section 7 of the Endangered Species Act

The ESA and the regulations that implement ESA Section 7 at Title 50 of the *Code of Federal Regulations* (50 CFR) Part 402 (TN4312) describe the consultation process that Federal agencies must follow in support of agency actions. As part of this process, the Federal agency shall either request that the Services (1) provide a list of any listed or proposed species or designated or proposed critical habitats that may be present in the action area, or (2) request that the Services concur with a list of species and critical habitats that the Federal agency has created (50 CFR 402.12(c) - TN4312). If any such species or critical habitats may be present, the Federal agency prepares a biological assessment to evaluate the potential effects of the action and determine whether the species or critical habitats are likely to be adversely affected by the action (50 CFR 402.12(a) -TN4312; 16 U.S.C. 1536(c) - TN4459).

Biological assessments are required for any agency action that is a "major construction activity" (50 CFR 402.12(b) - TN4312). A major construction activity is a construction project or other undertaking having construction-type impacts that is a major Federal action that significantly affects the quality of the human environment under the National Environmental Policy Act of 1969, as amended (NEPA; 42 U.S.C. § 4321, et seq-TN8608; 51 FR 19926-TN7600). Federal agencies may fulfill their obligations to consult with the Services under ESA Section 7 and to prepare a biological assessment, if required, in conjunction with the interagency cooperation procedures required by other statutes, including NEPA (50 CFR 402.06(a) - TN4312). In such cases, the Federal agency should include the results of ESA Section 7 consultation(s) in the NEPA document (50 CFR 402.06(b); TN4312).

C.3 Biological Evaluation

License renewal (LR) does not require the preparation of a biological assessment because it is not a major construction activity. Nonetheless, the NRC staff must consider the impacts of its actions on federally listed species and designated critical habitats. In cases where the staff finds that LR "may affect" ESA-protected species or habitats, ESA Section 7 requires the NRC to consult with the relevant Service(s).

To support such consultations, the NRC staff has incorporated its analysis of the potential impacts of the proposed LR into Section 3.8 of this draft supplemental environmental impact statement (SEIS). The NRC staff refers to its ESA analysis as a "biological evaluation."

The NRC staff structured its evaluation in accordance with the Services' suggested biological assessment contents described at 50 CFR 402.12(f) (TN4312). Section 3.8.1 of this SEIS describes the action area as well as the ESA-protected species and habitats potentially present in the action area. Section 3.8.2 assesses the potential effects of the proposed Comanche Peak LR on the ESA-protected species and habitats present in the action area and contains the NRC's effect determinations for each of those species and habitat. This section also addresses cumulative effects. Finally, Sections 3.8.5 through 3.8.9 address the potential effects of the no-action alternative power replacement alternatives. The results of the NRC staff's analysis are summarized below in Table C-1.

Table C-1 Effect Determinations for Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction

Species	Federal Status[(a)]	Potentially Present in the Action Area?	NRC Effect Determination[(b)]	FWS Concurrence Date[(c)]
golden-cheeked warbler	FE	Yes	NLAA	3/8/2023
piping plover	FT	No	NE	N/A
red knot	FT	No	NE	N/A
whooping crane	FE	No	NE	N/A
tricolored bat	FPE	Yes	NLAA	TBD
Texas fawnsfoot	FPT	No	NE	N/A
monarch butterfly	FC	Yes	NLAA	TBD

FE = federally endangered; NLAA = may affect but is not likely to adversely affect; FT = federally threatened; NE = no effect; N/A = not applicable; FPE = proposed for Federal listing as endangered; TBD = to be determined; FPT = proposed for Federal listing as endangered; FC = candidate for Federal listing.

(a) Indicates protection status under the Endangered Species Act. FE = federally endangered; FT = federally threatened; FPE = proposed for Federal listing as endangered; FPT = proposed for Federal listing as endangered; and FC = candidate for Federal listing.

(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and NMFS Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031).

(c) N/A = not applicable; the ESA does not require Federal agencies to seek FWS concurrence for "no effect" determinations. TBD = to be determined; the NRC will seek the FWS's concurrence following the issuance of this draft SEIS.

C.3.1 Chronology of Endangered Species Act Section 7 Consultation

Endangered Species Act Section 7 Consultation with the U.S. Fish and Wildlife Service

On March 8, 2023, the FWS concurred with the NRC's determination that Comanche Peak LR may affect but is not likely to adversely affect (NLAA) the golden-cheeked warbler. Following issuance of this draft SEIS, the NRC staff will seek the FWS's concurrence for the two additional species for which the NRC determined that the Comanche Peak LR is NLAA (see Table C-1) in accordance with 50 CFR 402.13(c) (TN4312). Table C-2 lists the correspondence between the NRC and the FWS pursuant to ESA Section 7 that has transpired to date.

Table C-2 Endangered Species Act Section 7 Consultation Correspondence with the U.S. Fish and Wildlife Service

Date	Description	ADAMS Accession No.[(a)]
Mar 8, 2023	Arlington Ecological Services Field Office (FWS) to NRC, Concurrence letter for Comanche Peak license renewal for specified federally threatened and endangered species and designated critical habitat that may occur in your proposed project area consistent with the Arlington Ecological Services Field Office (ESFO) Determination Key (DKey) for project review and guidance for federally listed species	ML23068A045

(a) Access these documents through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://adams.nrc.gov/wba/.

Endangered Species Act Section 7 Consultation with the National Marine Fisheries Service

As discussed in Section 3.8.1, no federally listed species or critical habitats under NMFS 's jurisdiction occur within the action area. Therefore, the NRC staff did not engage the NMFS pursuant to ESA Section 7 for the proposed Comanche Peak LR.

C.4 Magnuson-Stevens Act Essential Fish Habitat Consultation

The NRC must comply with the Magnuson-Stevens Fishery Conservation and Management Act of 1996, as amended (MSA; 16 U.S.C. 1801 et seq.-TN1061), for any actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may adversely affect any essential fish habitat (EFH) identified under the MSA.

In Section 3.8.2 and 3.8.4.4 of this SEIS, the NRC staff concludes that the NMFS has not designated any EFH under the MSA near Comanche Peak and that the proposed Comanche Peak LR would have no effect on EFH. Thus, the MSA does not require the NRC to consult with the NMFS for the proposed action.

C.5 National Marine Sanctuaries Act Consultation

The National Marine Sanctuaries Act of 1966, as amended (NMSA; 16 U.S.C. 1431 et seq.-TN4482), authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or aesthetic qualities as national marine sanctuaries. Under Section 304(d) of the Act, Federal agencies must consult with the National Oceanic and Atmospheric Administration's (NOAA's) Office of National Marine Sanctuaries if a Federal action is likely to destroy, cause the loss of, or injure any sanctuary resources.

In Sections 3.8.3 and 3.8.4.5 of this SEIS, the NRC staff concludes that no coastal or marine waters or Great Lakes occur near Comanche Peak site and that the Comanche Peak LR would have no effect on sanctuary resources. Thus, the NMSA does not require the NRC to consult with NOAA for the proposed action.

C.6 National Historic Preservation Act of 1966

The National Historic Preservation Act of 1966, as amended (54 U.S.C. 100101 et seq.) (NHPA), requires Federal agencies to consider the effects of their undertakings on historic properties and consult with applicable state and Federal agencies, Tribal groups, individuals, and organizations with a demonstrated interest in the undertaking before taking action. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places. The NHPA Section 106 review process is outlined in regulations issued by the Advisory Council on Historic Preservation in 36 CFR Part 800, “Protection of Historic Properties” (TN513). In accordance with 36 CFR 800.8(c), “Use of the NEPA Process for Section 106 Purposes,” the NRC has elected to use the NEPA process to comply with its obligations under Section 106 of the NHPA.

Table D-1Table D-1 in Appendix D lists the chronology of correspondence including correspondence related to the NRC’s NHPA Section 106 review of the Comanche Peak LR.

C.7 References

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, “Protection of Historic Properties.” TN513.

50 CFR Part 402. *Code of Federal Regulations,* Title 50, *Wildlife and Fisheries*, Part 402, “Interagency Cooperation—Endangered Species Act of 1973, as amended.” TN4312.

51 FR 19926. 1986. “Interagency Cooperation - Endangered Species Act of 1973, as amended.” Final Rule, *Federal Register*, Fish and Wildlife Service, Interior; National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Commerce. TN7600.

16 U.S.C. § 1536. Endangered Species Act, Section 7, “Interagency Cooperation.” TN4459.

42 U.S.C. § 4321 et seq. U.S. Code Title 41, The Public Health and Welfare, Section 4321 “Congressional Declaration of Purpose.” TN8608.

Endangered Species Act of 1973. 16 U.S.C. § 1531 *et seq.* TN1010.

FWS and NMFS (U.S. Fish and Wildlife Service and National Marine Fisheries Service). 1998. *Endangered Species Act Consultation Handbook, Procedures for Conducting Section 7 Consultation and Conference*. Washington, D.C. ADAMS Accession No. ML14171A801. TN1031.

Magnuson-Stevens Fishery Conservation and Management Act. 16 U.S.C. § 1801 *et seq.* TN1061.

National Marine Sanctuaries Act, as amended. 16 U.S.C. § 1431 *et seq*. TN4482.

APPENDIX D

CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

D.1 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 the Comanche Peak Nuclear Power Plant (Comanche Peak), Units 1 and 2. All documents, with the exception of those containing proprietary information, are available electronically from the NRC's Public Electronic Reading Room at http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents. Table D-1 includes the ADAMS accession number for each included document.

D.2 Environmental Review Correspondence

Table D-1 lists the environmental review correspondence in date order beginning with the request by Vistra Generation Company, LLC (Vistra), to renew the operating licenses for Comanche Peak.

Table D-1 Environmental Review Correspondence

Date	Correspondence Description	ADAMS No.
10/3/2022	Comanche Peak Nuclear Power Plant, Units 1 and 2 – Facility Operating License Numbers NPF-87 and NPF-89 – License Renewal Application	ML22276A082
10/3/2022	Comanche Peak Nuclear Power Plant, Units 1 and 2 – Facility Operating License Numbers NPF-87 and NPF-89 – License Renewal Application – Appendix E, Environmental Report	ML22297A246
10/21/2022	News Release-22-043: NRC Makes Available Comanche Peak Nuclear Plant License Renewal Application	ML22305A546
10/24/2022	Comanche Peak LRA – Receipt and Availability Letter	ML22285A075
10/26/2022	Comanche Peak LRA – Receipt and Availability FRN	ML22285A074
11/23/2022	Comanche Peak Nuclear Power Plant, Units 1 and 2 – Notice of Acceptance and Opportunity for Hearing Letter	ML22297A007
11/28/2022	Comanche Peak Nuclear Power Plant, Units 1 and 2 – Notice of Acceptance and Opportunity for Federal Register Notice	ML22297A006
12/1/2022	Comanche Peak Nuclear Power Plant, Units 1 and 2 – License Renewal Application Online Reference Portal	ML22298A016
12/1/2022	News Release-22-050: NRC Announces Hearing Opportunity for Comanche Peak License Renewal; Public Meetings in January 2023 to Discuss Environmental Review	ML22346A048
12/8/2022	FRN – Comanche Peak Notice of Intent to Prepare EIS and to Conduct EIS Scoping	ML22299A179

Date	Correspondence Description	ADAMS No.
1/9/2023	01/17/2023 Environmental Scoping Meeting Related to the Comanche Peak Nuclear Power Plant, Units 1 and 2, License Renewal Application	ML23009A036
1/10/2023	License Renewal Scoping Meeting, Comanche Peak Nuclear Power Plant, Units 1 and 2 – Meeting Slides	ML23011A087
1/17/2023	Transcript of January 17, 2023 Environmental Scoping Meeting Related to the Comanche Peak Nuclear Power Plant, Units 1 and 2, License Renewal Application	ML23031A096
1/30/2023	Declaration of Anita Smith in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23030B933
1/30/2023	Declaration of Anita Smith in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A500
1/30/2023	Declaration of Authorized Officer of Citizens for Fair Utility Regulation in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 & 2 License Renewal Application Proceeding	ML23060A495
1/30/2023	Declaration Of Authorized Officer Of Citizens For Fair Utility Regulation In Support Of Leave To Intervene In Comanche Peak Nuclear Power Plant, Units 1 And 2 License Renewal Application Proceeding	ML23030B932
1/30/2023	Declaration of Janet Mattern in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23030B918
1/30/2023	Declaration of Janet Mattern in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23030B934
1/30/2023	Declaration of Janet Mattern in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A498
1/30/2023	Declaration of Karen Hadden in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23030B930
1/30/2023	Declaration of Karen Hadden in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A489
1/30/2023	Declaration of Lon Burnam Mattern in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23030B938
1/30/2023	Declaration of Margaret DeMoss in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 & 2 License Renewal Application Proceeding	ML23030B935
1/30/2023	Declaration of Margaret DeMoss in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A488
1/30/2023	Declaration of Suzanne Mabe in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23030B936

Date	Correspondence Description	ADAMS No.
1/30/2023	Declaration of Suzanne Mabe in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A499
1/30/2023	Declaration of Terry McIntire in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 & 2 License Renewal Application Proceeding	ML23030B937
1/30/2023	Declaration of Terry McIntire in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A497
1/30/2023	Declarations In Support Of The Petition Of Citizens For Fair Utility Regulation For Leave To Intervene	ML23030B931
1/30/2023	Exhibit A, Closest Earthquakes to Comanche Peak Reactor Site	ML23030B928
1/30/2023	Exhibit B, Projected Zone of Karst Collapsed Features (Caves) in the Ellenburger Group	ML23030B929
1/30/2023	Order (Granting Requests for Extension of Time to Request for Hearing)	ML23030B901
1/30/2023	Petition For Leave To Intervene And Request For Hearing Of Citizens For Fair Utility Regulation	ML23030B927
2/1/2023	Comanche Peak LRA On-Site Audit Needs List	ML23032A384
2/1/2023	License Renewal Severe Accident Mitigation Alternatives Audit Plan regarding the Comanche Peak Nuclear Power Plant, Unit Nos. 1 & 2, Licenses Renewal Application (EPID No. L-2022-LNE-0004) (Docket Nos 50-445 and 50-446)	ML23019A219
2/2/2023	Comanche Peak Nuclear Power Plant, Unit Nos. 1 and 2 – Request for Withholding Information from Public Disclosure (EPID L-2022-LLA-0171)	ML23023A001
2/6/2023	Order (Granting Request for Extension of Time to Request for Hearing)	ML23037A791
2/6/2023	Referral of Petition for Leave to Intervene and Request for Hearing	ML23037A877
2/7/2023	Establishment of Atomic Safety and Licensing Board	ML23038A210
2/8/2023	Memorandum and Order (Initial Prehearing Order)	ML23039A158
2/10/2023	Joint Unopposed Motion of Vistra Operations Company LLC and Citizens for Fair Utility Regulation to Adjust Briefing Schedule	ML23041A024
2/10/2023	Notices of Appearance for Lighty, Bessette and Matthews	ML23041A020
2/13/2023	MEMORANDUM AND ORDER (Granting in Part and Denying in Part Joint Motion to Adjust Briefing Schedule)	ML23044A481
2/13/2023	Notice of Appearance for Marcia Carpentier	ML23044A346
2/13/2023	Notice of Appearance of Ethan Licon	ML23044A347
2/13/2023	Notice of Appearance of William David Griggs	ML23044A622
2/14/2023	Comanche Peak Public Meeting February 23, 2023 – Presentation Slides	ML23045A155
2/14/2023	License Renewal Environmental Site Audit Plan regarding the Comanche Peak Nuclear Power Plant, Units 1 and 2, License Renewal Application	ML23044A326

Date	Correspondence Description	ADAMS No.
2/14/2023	News Release-23-009: NRC Announces Additional Public Meeting, New Comment Deadline for Environmental Review of Comanche Peak License Renewal Application	ML23052A100
2/15/2023	02/23/2023 Environmental Scoping Meeting Related to the Comanche Peak Nuclear Power Plant, Units 1 and 2, License Renewal Application	ML23046A080
2/16/2023	FRN – Comanche Peak Second Notice of Intent to Prepare EIS and to Conduct EIS Scoping	ML23039A053
2/23/2023	Transcript of Environmental Scoping Meeting Related to the Comanche Peak Nuclear Power Plant, Units 1 and 2, License Renewal Application	ML23081A508
2/27/2023	Declaration of Linda Hanratty in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A490
3/1/2023	Amended Petition For Leave to Intervene and Request For Hearing of Citizens for Fair Utility Regulation	ML23060A486
3/1/2023	Attachment A – Closest Earthquakes to Comanche Peak Reactor Site	ML23060A487
3/1/2023	Attachment B – Project Zone of Karst Collapsed Features (caves) in the Ellenburger Group	ML23060A493
3/1/2023	Declaration of John MacFarlane in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A492
3/1/2023	Declaration of Lon Burnam in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A496
3/1/2023	Declaration of Reed Bilz in Support of Leave to Intervene in Comanche Peak Nuclear Power Plant, Units 1 and 2 License Renewal Application Proceeding	ML23060A491
3/1/2023	Declarations in Support of the Petition of Citizens for Fair Utility Regulation for Leave to Intervene	ML23060A494
3/2/2023	E-mail from David Griggs Regarding Submission to NRC Electronic Information Exchange on 03/01/2023 for Citizens for Fair Utility Regulation in Comanche Peak Proceeding	ML23061A161
3/8/2023	FWS to NRC, Endangered Species Act concurrence letter for certain species that are not likely to be adversely affected by Comanche Peak license renewal	ML23068A045
3/27/2023	NRC Staff's Answer Opposing CFUR Hearing Request	ML23086C101
3/27/2023	Vistra Operations Company LLC's Answer Opposing the Petition for Leave to Intervene and Request for Hearing of Citizens for Fair Utility Regulation	ML23086C086
3/30/2023	Comanche Peak Nuclear Power Plant (CPNPP) – Decommissioning Report	ML23089A250
4/3/2023	Citizens for Fair Utility Regulation's Reply in Support of Petition for Leave to Intervene and Request for Adjudicatory Hearing	ML23093A223
4/6/2023	Comanche Peak Nuclear Power Plant, Units 1 and 2 – License Renewal Application Revision 0 – Supplement 1	ML23096A302

Date	Correspondence Description	ADAMS No.
4/6/2023	Memorandum and Order (Scheduling Initial Prehearing Conference)	ML23096A178
4/10/2023	Ltr. to Bobby Gonzalez, Chairman, Caddo Nation, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A151
4/10/2023	Ltr. to Brian Givens, Mekko, Kialegee Tribal Town, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A146
4/10/2023	Ltr. to Chuck Hoskins, Principal Chief, Cherokee Nation, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A150
4/10/2023	Ltr. to Darwin Kaskaske, Chairperson, Kickapoo Tribe of Oklahoma, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A155
4/10/2023	Ltr. to Deborah Dotson, President, Delaware Nation, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A147
4/10/2023	Ltr. to Durcel Cooper, Chairman, Apache Tribe of Oklahoma, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A152
4/10/2023	Ltr. to Eddie Martinez, President, Mescalero Apache Tribe, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A143
4/10/2023	Ltr. to Joe Bunch, Chief, United Keetoowah Band of Cherokee Indians, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A138
4/10/2023	Ltr. to Jonathan Cernek, Chairman, Coushatta Tribe of Louisiana, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A148
4/10/2023	Ltr. to Juan Garza, Jr., Chairman, Kickapoo Tribe of Oklahoma, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A145
4/10/2023	Ltr. to Lawrence SpottedBird, Chairman, Kiowa Indian Tribe, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A144
4/10/2023	Ltr. to Lewis Johnson, Chief, Seminole Nation of Oklahoma, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A142
4/10/2023	Ltr. to Mark Woommavovah, Chairman, Comanche Nation, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A149
4/10/2023	Ltr. to Marshall Pierite, Chairman, Tunica-Biloxi Tribe of Louisiana, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A139
4/10/2023	Ltr. to Russell Martin, President, Tonkawa Tribe of Oklahoma, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A140

Date	Correspondence Description	ADAMS No.
4/10/2023	Ltr. to Ryan Morrow, Town King, Thlopthlocco Tribal Town, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A141
4/10/2023	Ltr. to Terri Parton, President, Wichita and Affiliated Tribes, Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A137
4/10/2023	Ltr. to Wilson Yargee, Chief, Alabama-Quassarte Tribal Town Re., Request for Comments Concerning the Environmental Review of Comanche Peak, Units 1 and 2, License Renewal	ML23097A153
4/10/2023	Ltrs to Donnis Battise, Mikko Choba, and Millie Thompson William, Mikko Istimatokia, Alabama-Coushatta Tribe of TX, Re, Request for Comments Concerning the ER of CPNPP, Units 1, 2, License Renewal	ML23088A185
4/10/2023	Memorandum (Information Regarding Telephone Listen-Only Access for the Public to the Initial Prehearing Conference)	ML23100A188
4/12/2023	Public Scoping Meeting for Environmental Review of Comanche Peak Nuclear Power Plant (CPNPP), Unit Nos. 1 and 2 License Renewal Application	ML23081A523
4/13/2023	Requests For Confirmation of Information for the Environmental Review of the Comanche Peak Nuclear Power Plant, Units 1 and 2, Licensed Renewal Application (EPID Number: L-2022-LNE-0004) (Docket Numbers 50-445 and 50-446)	ML23068A073
4/14/2023	Citizens for Fair Utility Regulation's Notice of Supplemental References for Initial Prehearing Conference	ML23104A447
4/14/2023	NRC Staff Additional Sources Filing	ML23104A443
4/14/2023	Vistra Operations Company LLC Advisement of Supplemental References for Initial Prehearing Conference	ML23104A313
4/17/2023	Comanche Peak Nuclear Power Plant, Units 1 and 2 – Summary of the License Renewal Severe Accident Mitigation Alternatives Audit (EPID Number: L-2022-LNE-0004) (Docket Numbers: 50-445 and 50-446)	ML23082A120
4/18/2023	Ltr to Mark Wolfe, SHPO, Re, Initiate Section 106 Consultation and Request for Comments on Scope of the Comanche Peak NPP, Units 1, 2 License Renewal Environmental Review	ML23083B373
4/19/2023	Initiate Section 106 Consultation, Request For Comments On Scope Of The Comanche Peak Nuclear Power Plant, Units 1, 2 License Renewal Environmental Review	ML23083B976
4/19/2023	Transcript of April 19, 2023 Hearing for Vistra Operations Company, LLC, Pages 1-79	ML23111A175
4/24/2023	Comanche Peak Nuclear Power Plant, Units 1 and 2 – License Renewal Application Revision 0 – Supplement 2	ML23114A377
5/8/2023	Comanche Peak Nuclear Power Plant, Units 1 and 2 - Response to Requests for Confirmation of Information regarding the Environmental Review of the License Renewal Application	ML23128A11
5/18/2023	Comanche Peak Nuclear Power Plant, Units 1 and 2, Summary of the License Renewal Environmental Audit (EPID Number: L-2022-LNE-004) (Docket Numbers 50-445 and 50-446)	ML23132A157

Date	Correspondence Description	ADAMS No.
6/6/2023	Comanche Peak Nuclear Power Plant Units 1 and 2 - Response to Request for Additional Information - License Renewal Application Environmental Review	ML23157A333

APPENDIX E

PROJECTS AND ACTIONS CONSIDERED IN THE CUMULATIVE IMPACTS ANALYSIS

All information previously provided in Appendix E has been incorporated into Section 3.16 of this environmental impact statement (see Section 3.16, “Cumulative Effects of the Proposed Action”).

APPENDIX F

ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS

This appendix describes the environmental impacts of the postulated accidents that may occur at Comanche Peak Nuclear Power Plant Units 1 and 2 (Comanche Peak or CPNPP) during the license renewal (LR) period. The term “accident” refers to any unintentional event outside the normal plant operational envelope that could result in either (1) an unplanned release of radioactive materials into the environment or (2) the potential for an unplanned release of radioactive materials into the environment.

NUREG–1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996-TN288, NRC 2013-TN2654), evaluates in detail the two classes of postulated accidents listed below as they relate to LR. The GEIS conclusions are codified in Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51)(TN250), “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions”:

- Design-basis accidents: Postulated accidents that a nuclear facility must be designed and built to withstand without loss to the systems, structures, and components necessary to ensure public health and safety.
- Severe accidents: Postulated accidents that are more severe than design-basis accidents because they could result in substantial damage to the reactor core, with or without serious offsite consequences.

This appendix first describes the U.S. Nuclear Regulatory Commission (NRC) staff’s evaluation of new and significant information related to design-basis accidents at Comanche Peak, followed by an evaluation of new and significant information for postulated severe accidents at Comanche Peak.

F.1 Background

Although this supplemental environmental impact statement (SEIS) documents the NRC staff’s review of an LR application, it is helpful to keep in mind that long before any LR actions occur, an operating reactor has already completed the NRC licensing process for the original 40-year operating license (OL). To receive a license to operate a nuclear power reactor, an applicant must submit to the NRC an OL application that includes, among many other requirements, a safety analysis report. The applicant’s safety analysis report presents the design criteria and design information for the proposed reactor and includes comprehensive data about the proposed site. The applicant’s safety analysis report also describes various design-basis accidents and the safety features designed to prevent or mitigate their impacts. The NRC staff reviews the OL application to determine whether the plant’s design—including designs for preventing or mitigating accidents—meets the NRC’s regulations and requirements. At the conclusion of that review, an OL would be issued only if the NRC finds, in part, reasonable assurance that the activities authorized by the license can be conducted without endangering the health and safety of the public and that the activities will be conducted in accordance with the NRC’s regulations.

F.1.1 Design-Basis Accidents

Design-basis accidents are postulated accidents that a nuclear facility must be designed and built to withstand without loss to the systems, structures, and components necessary to ensure public health and safety. Planning for design-basis accidents ensures that the proposed plant can withstand normal transients (e.g., rapid changes in the reactor coolant system temperature or pressure, or rapid changes in reactor power), as well as a broad spectrum of postulated accidents without undue hazard to the health and safety of the public. Many of these design-basis accidents may occur but are unlikely to occur even once during the life of the plant; nevertheless, carefully evaluating each design-basis accident is crucial to establishing the design basis for the preventive and mitigative safety systems of the proposed nuclear power plant. 10 CFR Part 50-TN249, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 100-TN282, "Reactor Site Criteria," describe the NRC's acceptance criteria for design-basis accidents.

Before the NRC will issue an OL for a new nuclear power plant, the applicant must demonstrate the ability of its proposed reactor to withstand all design-basis accidents. The applicant and the NRC staff evaluate the environmental impacts of design-basis accidents for the hypothetical individual exposed to the maximum postulated amount of radiation (maximum exposed individual member of the public). The results of these evaluations of design-basis accidents are found in the reactor's original licensing documents, such as the applicant's final safety analysis report, the NRC staff's safety evaluation report, and the final environmental statement (FES). Once the NRC issues the OL for the new reactor, the licensee is required to maintain the acceptable design and performance criteria (which includes withstanding design-basis accidents) throughout the operating life of the nuclear power plant, including any LR periods of extended operation. The consequences of design-basis accidents are evaluated for the hypothetical maximum exposed individual; as such, changes in the plant environment over time will not affect these evaluations.

The NRC regulation at 10 CFR 54.29(a) (TN4878), "Standards for Issuance of a renewed license," requires LR applicants to demonstrate that identified actions have been or will be taken to manage the effects of aging and perform any required time-limited aging analyses (as further described in the regulation), such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the plant's current licensing basis (CLB) (10 CFR 54.3(a), "Definitions", TN4878). Furthermore, the applicant must show that any changes made to the plant's CLB comply with paragraph (a) of 10 CFR 54.29 (TN4878) and are in accordance with the Atomic Energy Act of 1954, as amended, and the NRC's regulations. Because of the requirements that the plant's existing design basis and aging-management programs be in effect for LR, the environmental impacts of design-basis accidents as calculated for the original OL application should not differ significantly from the environmental impacts of design-basis accidents at any other time during plant operations, including during the initial LR period. Accordingly, the design of the nuclear power plant, relative to design-basis accidents during the period of extended operation, is considered to remain acceptable.

F.1.2 Design-Basis Accidents and License Renewal

Consistent with Regulatory Issue Summary RIS-2014-006, "Consideration of Current Operating Issues and Licensing Actions in License Renewal" (NRC 2014-TN7851), the early and adequate identification of design-basis accidents makes these design-basis accidents and associated structures, systems, and components a part of the CLB of the plant as defined at

10 CFR 54.3(a) (TN4878). The NRC requires licensees to maintain the CLB of the plant under the current OL, as well as during any LR period. Therefore, under the provisions of 10 CFR 54.30, "Matters not subject to a renewal review," design-basis accidents are not subject to review under LR.

As stated in Section 5.3.2 of the 1996 GEIS, the NRC staff assessed the environmental impacts of design-basis accidents in individual plant-specific environmental impact statements (EISs) at the time of the initial license application review. Consistent with the NRC Reactor Oversight Program/Process, a licensee is required to maintain the plant within acceptable design and performance criteria, including during any LR term. As such, the NRC staff would not expect the environmental impacts of continued plant operation to change significantly, and accordingly, an additional assessment of the environmental impacts of design-basis accidents is not necessary (10 CFR Part 51-TN250, Appendix B to Subpart A, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant"). The 1996 GEIS concluded that the environmental impacts of design-basis accidents are of SMALL significance for all nuclear power plants, because the plants were designed to withstand these accidents. For the purposes of initial or subsequent LR, the NRC designates design-basis accidents as a Category 1 generic issue—applicable to all nuclear power plants (see 10 CFR Part 51-TN250, Appendix B to Subpart A). During the LR review process, the NRC staff adopts the applicable Category 1 issue conclusions from the GEIS (unless new and significant information about the issue has been identified). Hence, the NRC staff need not address Category 1 issues (like design-basis accidents) in the site-specific SEIS for LR, unless new and significant information has been identified for those issues. The 2013 GEIS confirmed this decision.

In its environmental report (ER) for the Comanche Peak LR application, Vistra OpCo did not identify any new and significant information related to design-basis accidents at Comanche Peak (Luminant 2022-TN8655). The NRC staff also did not identify any new and significant information related to design-basis accidents during its independent review of Vistra OpCo 's ER, through the scoping process, or in its evaluation of other available information. Therefore, the NRC staff concludes that there are no environmental impacts related to design-basis accidents at Comanche Peak during the LR period beyond those already discussed generically for all nuclear power plants in the GEIS.

F.1.3 Severe Accidents

Severe accidents are postulated accidents that are more severe than design-basis accidents because severe accidents can result in substantial damage to the reactor core, with or without serious offsite consequences. Severe accidents can entail multiple failures of equipment or functions.

F.1.4 Severe Accidents and License Renewal

Chapter 5 of the 1996 GEIS (NRC 1996-TN288) conservatively predicts the environmental impacts of postulated severe accidents that may occur during the period of extended operations at nuclear power plants. In the 2013 GEIS, the staff updated the NRC's 1996 plant-by-plant severe accident environmental impact assessments (NRC 2013-TN2654, Appendix E). In the GEIS, the NRC considered impacts of severe accidents including:

- dose and health effects of accidents,
- economic impacts of accidents, and
- effect of uncertainties on the results

The NRC staff calculated these estimated impacts by studying the risk analysis of severe accidents as reported in the EISs and/or FESs that the NRC staff had prepared in support of each plant's original reactor OL review. When the NRC staff prepared the 1996 GEIS, 28 nuclear power plant sites (44 units) had EISs or FESs that contained a severe accident analysis. Not all original operating reactor licenses contained a severe accident analysis because the NRC had not always required such analyses. The 1996 GEIS assessed the environmental impacts of severe accidents during the LR period for all plants by using the results of existing analyses and site-specific information to make conservative predictions. With few exceptions, the severe accident analyses evaluated in the 1996 GEIS were limited to consideration of reactor accidents caused by internal events. The 1996 GEIS addressed the impacts of external events (e.g., earthquakes and flooding) qualitatively.

For its severe accident environmental impact analysis for each plant, the 1996 GEIS used very conservative 95th-percentile upper-confidence bound estimates for environmental impact whenever available. This approach provides conservatism to cover uncertainties, as described in Section 5.3.3.2.2 of the 1996 GEIS. The 1996 GEIS concluded that the probability-weighted consequences of severe accidents related to LR are SMALL compared to other risks to which the populations surrounding nuclear power plants are routinely exposed. Since issuing the 1996 GEIS, the NRC's understanding of severe accident risk has continued to evolve. The updated 2013 GEIS assesses more recent information and developments in severe accident analyses and how they might affect the conclusions in Chapter 5 of the 1996 GEIS. The 2013 GEIS also provides comparative data where appropriate. Based on information in the 2013 GEIS, the NRC staff determined that for all nuclear power plants, the probability-weighted consequences of severe accidents are SMALL. However, the GEIS determined that alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives, as a Category 2 issue. See Table B-1, "Summary of Findings on NEPA [National Environmental Policy Act] Issues for License Renewal of Nuclear Power Plants," of Appendix B to Subpart A of 10 CFR Part 51-TN250, which states:

> The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, 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.

CPNPP submitted an application for an OL which was approved in 1990 for Unit 1 (NRC 2003-TN8607) and in 1993 for Unit 2 (NRC 2003-TN8607). In its application, the applicant performed a severe accident mitigation design alternative (SAMDA) evaluation to support the NRC's review (TU Electric 1989-TN8982). NUREG–0775, "Final Environmental Statement related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2" (NRC 1989-TN7822), documents the NRC's evaluation of the alternative of facility operation with the installation of severe accident mitigation design features. NUREG-0775 concluded that "the risks of acute fatality from potential accidents at the site are small in comparison with the risks of acute fatality from other human activities in a comparably sized population" and that "there are no special or unique features about the CPNPP site and environs that would warrant special or additional engineered safety features for CPNPP" (NRC 1989-TN7822).

The NRC subsequently prepared a supplement to NUREG-0775, as described in Section F.2.1 of this appendix. As provided in the NUREG-0775 supplement, a set of SAMDAs was developed for CPNPP to address the accident sequences or sequence groups identified in the FES as well as risk contributors identified in more recent studies that could be applicable to

CPNPP. None of the nine SAMDAs that were evaluated were found to be cost-effective. This conclusion was due in large part to the low population around the CPNPP site and low residual risk. In light of these insights, the NRC concluded that there was no basis for requiring modifications to the plant for the purpose of further mitigating environmental concerns. In summary, the NRC did not discover any substantial changes in the proposed action as previously evaluated in the CPNPP FES (NRC 1989-TN7822) that are relevant to environmental concerns or any significant new circumstances or information relevant to environmental concerns and bearing on the licensing of CPNPP Units 1 and 2.

A LR applicant for a plant that has already had a severe accident mitigation alternative (SAMA) or SAMDA analysis considered by the NRC as part of an EIS, supplement to an EIS, or environmental assessment (EA), does not need to provide another SAMA analysis in the LR ER. In the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses (61 FR 28467-TN4491), the 1996 Part 51 Final Rule determined that the original Comanche Peak SAMDA analysis was a SAMA analysis for the purposes of this Part 51 rule. More specifically, the Commission’s statement of considerations for the 1996 Part 51 rulemaking point to the original SAMDA analysis and states the followings:

> NRC staff considerations of severe accident mitigation alternatives have already been completed and included in an EIS or supplemental EIS for Limerick, Comanche Peak, and Watts Bar. Therefore, severe accident mitigation alternatives need not be reconsidered for these plants for license renewal.

In forming its basis for determining which plants needed to submit SAMA analyses at LR, the Commission noted that all licensees had undergone, or were in the process of undergoing, more detailed site-specific severe accident mitigation analyses through processes separate from LR, specifically the containment performance improvement, individual plant examination, and individual plant examination of external events (IPEEE) programs. Considering these studies, the Commission stated that it did not expect future SAMA analyses to uncover “major plant design changes or modifications that will prove to be cost beneficial.” As stated in the 2013 GEIS (NRC 2013-TN2654), the NRC’s experience in completed LR proceedings has confirmed this prediction. Nevertheless, the applicant’s ER must contain any new and significant information of which the applicant is aware (10 CFR 51.53(c)(3)(iv) TN250).

Nuclear Energy Institute (NEI) 17-04, Revision 1 (NEI 2019-TN6815) provides a model approach for assessing the significance of new information of which the applicant for renewal of a nuclear power reactor OL is aware that relates to either (1) the SAMDA analysis or SAMA analysis documented in the NRC’s final environmental statement (FES, FSEIS, or EA) that supported issuance pursuant to 10 CFR Part 50-TN249 (or 10 CFR Part 54-TN4878) of the reactor’s initial (or renewed) OL, or (2) the SAMDA analysis documented in the NRC’s final environmental statement (FES, FSEIS, or EA) that supported issuance pursuant to 10 CFR Part 52 (TN251) of the reactor’s combined license and the design certification incorporated therein by reference, if any. The NRC staff endorsed NEI 17-04, Revision 1, as one acceptable way for evaluating new and significant information as it relates to SAMA analysis on December 11, 2019 (NRC 2019-TN7805). The purpose of NEI 17-04 is to provide a model approach for assessing the significance of new information of which the applicant for renewal of a nuclear power reactor operating license or extension of a combined license is aware that relates to either (1) the severe accident mitigation design alternatives (SAMDA) analysis or SAMA analysis documented in the NRC’s final environmental statement (FES, FSEIS, or EA) that supported issuance pursuant to 10 CFR Part 50-TN249 (or 10 CFR Part 54-TN4878) of the reactor’s initial (or renewed) operating license or (2) the SAMDA analysis documented in the NRC’s final environmental statement (FES, FSEIS, or EA) that supported issuance pursuant to 10 CFR Part 52 (TN251) of the reactor's combined license and the design certification incorporated therein by reference, if any.

An analysis of SAMAs was performed for Comanche Peak at the time of the initial OL application. NUREG–0775, "Final Environmental Statement related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2" (NRC 1989-TN7822), documents the NRC's evaluation of the alternative of facility operation with the installation of severe accident mitigation design features. Therefore, for the Comanche Peak LR SAMA analysis, the NRC staff is only considering any new and significant information that might alter the conclusions of that analysis, as discussed below.

The NRC's regulations in 10 CFR Part 51-TN250, which implement Section 102(2) of NEPA, require that all LR applicants must submit an ER to the NRC, in which they identify any "new and significant information regarding the environmental impacts of license renewal of which the applicant is aware'' (10 CFR 51.53(c)(3)(iv) TN250). This includes new and significant information that could affect the environmental impacts related to postulated severe accidents or that could affect the results of a previous SAMA analysis. Accordingly, in its LR application ER, Vistra OpCo evaluates areas of new and significant information that could affect the environmental impact of postulated severe accidents during the LR period of extended operation and possible new and significant information as it relates to SAMAs.

F.2 Severe Accident Mitigation Alternatives

In a SAMA analysis, the NRC requires LR applicants to consider the environmental impacts of severe accidents, their probability of occurrence, and potential means of mitigating those accidents. As quoted above, 10 CFR Part 51-TN250, Table B-1 states, "Alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives." This NRC requirement to consider alternatives to mitigate severe accidents can be fulfilled by a SAMA analysis. The purpose of the SAMA analysis is to identify design alternatives, procedural modifications, or training activities that may further reduce the risks of severe accidents at nuclear power plants and that are also potentially cost beneficial to implement. The SAMA analysis includes the identification and evaluation of SAMAs that may reduce the radiological risk from a severe accident by preventing substantial core damage (i.e., preventing a severe accident) or by limiting releases from containment if substantial core damage occurs (i.e., mitigating the impacts of a severe accident) (NRC 2013-TN2654). The regulation at 10 CFR 51.53(c)(3)(ii)(L) (TN250), states that each LR applicant must submit an ER that considers alternatives for mitigating severe accidents "[i]f the staff has not previously considered severe accident migration alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment."

F.2.1 Comanche Peak 1989 SAMDA Analysis

In an enclosure to an NRC memorandum dated 10/23/1989, the staff provided a supplement to NUREG–0775 "Final Environmental Statement related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2" (NRC 1989-TN7822), that presented the staff's assessment of the alternative of facility operation with the installation of further SAMDAs for Comanche Peak. The NRC did not discover any substantial changes in the proposed action as previously evaluated in NUREG–0775 that are relevant to environmental concerns or any significant new circumstances or information relevant to environmental concerns and bearing on the licensing of CPNPP Units 1 and 2.

In the NUREG-0775 assessment, a set of SAMDAs was developed for CPNPP to address the accident sequences or sequence groups identified in the FES as well as risk contributors identified in more recent studies that could be applicable to CPNPP. This was done on a generic basis because a plant-specific probabilistic risk assessment for CPNPP was not available at the time of the NRC review. In assessing the risk reduction potential, each SAMDA was conservatively assumed to avert all the residual risk estimated in NUREG–0775. This risk reduction was compared to the estimated costs associated with each SAMDA. None of the nine SAMDAs were found to be cost-effective. This conclusion was due in large part to the low population around the CPNPP site and low residual risk. Considering these insights, the NRC concluded that there was no basis to require modifications to the plant for the purpose of further mitigating environmental concerns (NRC 1989-TN7822). Given the low level of residual risk and the large cost of physical enhancements necessary to substantially reduce risk, the NRC concluded that cost-beneficial enhancements that can significantly reduce risk were unlikely. The margins in the analysis were considered ample to cover uncertainties in risk and cost estimates given that, in general, estimates for these factors were conservatively evaluated (NRC 1989-TN7822).

F.2.2 License Renewal Application and New and Significant Information as It Relates to the Probability-Weighted Consequences of Severe Accidents

As mentioned above, an LR application must include an ER that describes SAMAs if the NRC staff has not previously evaluated SAMAs for that plant in an EIS, in a related supplement to an EIS, or in an EA. As also discussed above, the NRC staff performed a site-specific analysis of Comanche Peak SAMAs and documented it in an enclosure to an NRC memorandum dated 10/23/1989 (NRC 1989-TN7822), and the staff provided a supplement to NUREG–0775, "Final Environmental Statement related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2," that presented the staff's assessment of the alternative of facility operation with the installation of further SAMDAs for Comanche Peak. Therefore, in accordance with 10 CFR 51.53(c)(3)(ii)(L) and Table B-1 in Appendix B of Subpart A of 10 CFR Part 51-TN250, Vistra OpCo is not required to provide another SAMA analysis in its ER for the Comanche Peak LR application.

In Vistra OpCo's assessment of new and significant information related to SAMAs in its LR application, Vistra OpCo used the NEI guidance document, NEI 17-04, Revision 1, "Model SLR New and Significant Assessment Approach for SAMA" (NEI 2019-TN6815), which the NRC staff has endorsed (NRC 2019-TN7805). As discussed in Section F.5 below, NEI developed a model approach for LR applicants to use for assessing the significance of new information, of which the applicant is aware, that relates to a prior SAMA analysis that was performed in support of the issuance of an initial license, renewed license, or combined license.

NEI 17-04 provides a tiered approach that entails a three-stage screening process for the evaluation of new information. In this screening process, new information is deemed to be "potentially significant" to the extent that it results in the identification in Stage 1 (involving the use of PRA risk insights and/or risk model quantifications) of an unimplemented SAMA that reduces the maximum benefit by 50 percent or more. Maximum benefit is defined in Section 4.5 of NEI 05-01, Revision A, "Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document" (NEI 2005-TN1978), as the benefit a SAMA could achieve if it eliminated all risk. The total offsite dose and total economic impact are the baseline risk measures from which the maximum benefit is calculated.

Vistra OpCo ’s assessment of new and significant information related to its SAMA cost-benefit analysis is discussed in Section F.5 of this appendix.

Below, the NRC staff summarizes possible areas of new and significant information and assesses Vistra OpCo ’s conclusions.

F.3 Evaluation of New Information Concerning Severe Accident Consequences for Comanche Peak as It Relates to the GEIS

The 2013 GEIS considers developments in plant operation and accident analysis that could have changed the assumptions made in the 1996 GEIS concerning severe accident consequences. The 2013 GEIS confirmed the determination in the 1996 GEIS that the probability-weighted consequences of severe accidents are SMALL for all plants. In the 2013 GEIS, Appendix E provides the NRC staff’s evaluation of the environmental impacts of postulated accidents. Table E-19, “Summary of Conclusions,” of the 2013 GEIS shows the developments that the NRC staff considered, as well as the staff’s conclusions. Consideration of the items listed in Table E-19 was the basis for the NRC staff's overall determination in the 2013 GEIS that the probability-weighted consequences of severe accidents remain SMALL for all plants.

For LR for Comanche Peak, the staff confirmed that there is no new and significant information that would change the 2013 GEIS conclusions on the probability-weighted consequences of severe accidents. The NRC staff evaluated Vistra OpCo ’s information related to the 2013 GEIS, Table E-19, “Summary of Conclusions,” during the Comanche Peak audit (NRC 2023-TN8981), during the scoping process, and through the evaluation of other available information. The results of that review are discussed below.

F.3.1 New Internal Events Information (Section E.3.1 of the 2013 GEIS)

Since the CPNPP licensing application and SAMDA evaluation (TU Electric 1989-TN8982), there have been many improvements to the plant’s risk profile. CPNPP did not use a PRA model quantification to evaluate its noted SAMDAs in the original OL but performed evaluations of core damage frequency (CDF) in its IPEEE that was completed in 1995 (5.72×10^{-5}). Vistra OpCo stated that the current CPNPP PRA (Revision 5) has an updated internal events model as well as an updated internal fire study and internal flooding study; other external events have not been explicitly incorporated into the CPNPP PRA model of record. The current internal events including internal flooding CDF is 1.22×10^{-6} and 1.25×10^{-6} per year for Unit 1 and Unit 2, respectively. These PRA model refinements represent an approximately 98 percent reduction in CDF from the IPEEE CDF (about a factor of 46 or $5.72 \times 10^{-5}/1.25 \times 10^{-6}$) and an approximately 88 percent reduction in internal events (i.e., excluding internal flooding) CDF from the Revision 3 CDF (about a factor of 7 or $9.3 \times 10^{-6}/1.25 \times 10^{-6}$) for each unit for the internal events PRA. Therefore, no new and significant information exists for CPNPP concerning offsite consequences of severe accidents initiated by internal events.

Revision 4 of the CPNPP PRA was peer reviewed in March 2011 following the NEI process. The Facts and Observations generated by the peer review were addressed in 2015 and 2016 and subsequently reviewed by CPNPP in November 2019 as having closed all peer review findings. Revision 5 of the CPNPP PRA maintains those resolutions.

Therefore, considering the CDF reduction in Comanche Peak’s risk profile, the NRC staff concludes that the offsite consequences of severe accidents initiated by internal events during the LR term at Comanche Peak would not exceed the impacts predicted in the 1996 GEIS. For these issues, the GEIS predicted that the probability-weighted consequences of severe accidents would be SMALL for all nuclear plants. The NRC staff identified no new and significant information regarding internal events during its review of Vistra OpCo's ER, during the SAMA audit, through the scoping process, or through the evaluation of other available information. Thus, the NRC staff finds Vistra OpCo's conclusion acceptable that no new and significant information exists for Comanche Peak concerning offsite consequences of severe accidents initiated by internal events that would alter the conclusions reached in the 1996 GEIS.

F.3.2 External Events (Section E.3.2 of the 2013 GEIS)

The 1996 GEIS concluded that severe accidents initiated by external events (such as earthquakes) could have potentially high consequences, but also found that the risks from these external events are adequately addressed through a consideration of severe accidents initiated by internal events (such as a loss of cooling water). Therefore, the 1996 GEIS concluded that an LR applicant need only analyze the environmental impacts of an internal event to characterize the environmental impacts of either internal or external events.

The 2013 GEIS expanded the scope of the evaluation in the 1996 GEIS and used more recent technical information that included both internally and externally initiated event CDFs. Section E.3.2.3 of the 2013 GEIS concludes that the CDFs of severe accidents initiated by external events, as quantified in NUREG–1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants" (NRC 1990-TN525), and other sources documented in the GEIS, are comparable to the CDFs from accidents initiated by internal events, but lower than the CDFs that formed the basis for the 1996 GEIS.

On March 12, 2012, the NRC issued a request under 10 CFR 50.54(f) (TN249), as part of implementing lessons learned from the accident at Fukushima, that, among other things, requested licensees to reevaluate the seismic hazards at their sites using present-day methodologies and guidance to develop a ground motion response spectrum (GMRS) (SNL 1982-TN7749).

For seismic risk, CPNPP indicated that the plant is in an area of low seismic activity. According to the CPNPP IPEEE, the CPNPP-specific seismic screening program was approved by the NRC based on a walkdown of structures, systems, and components rather than having a full seismic margin assessment calculation (TU Electric 1995-TN8984). In its response to post-Fukushima Near-Term Task Force recommendation 2.1, CPNPP reevaluated its seismic risk by comparing its updated plant-specific GMRS developed by the Electric Power Research Institute against the 1.3 times the site's safe shutdown earthquake level as defined in Appendix S to 10 CFR Part 50-TN249, and concluded that the updated GMRS was lower than the site's safe shutdown earthquake at a range of 1 Hz to 100 Hz, indicating that the seismic hazard at CPNPP is low and bounded by the design-basis value of 0.10g peak ground acceleration. NRC staff confirmed that the GMRS developed by the NRC staff is bounded by the CPNPP safe shutdown earthquake over the same range. Therefore, a seismic risk evaluation, spent fuel pool (SPF) evaluation, and a high-frequency confirmation were not merited for CPNPP (NRC 2016-TN8980).

A high winds PRA has not been developed for CPNPP. Section 5.1.4 and Table 5.1.6 of the IPEEE (TU Electric 1995-TN8984) indicates that the overall CDF for tornadoes at CPNPP is estimated to be approximately 3.7E-06. Station blackout is the principal contributor to the overall CDF for tornadoes. The dominant contributor to the station blackout sequences is the random failure of both diesel generators following a tornado strike. Based on the qualitative evaluation documented on Table 2-1 of Appendix A of the ER (Luminant 2022-TN8655), no potential cost-effective SAMAs were identified for high winds and tornadoes at CPNPP. Therefore, a quantitative high-wind evaluation is not merited for CPNPP.

Because the CPNPP internal fire PRA model has been developed since the time of the SAMDA analysis, it is considered new information and is used in the quantitative PRA calculation to evaluate SAMAs for the potential for significance, as demonstrated in Table 4.15-2 of the ER and reviewed below.

Vistra OpCo provided the base case CDF values used to evaluate SAMAs in the ER. The sum of the external events CDF (6.2×10^{-5}), fire, high winds, and external flooding CDFs (4.2×10^{-5} per reactor-year, 3.7×10^{-6} per reactor-year 1.59×10^{-5} per reactor-year, respectively) is greater than the Comanche Peak internal event CDF(1.1×10^{-6} per reactor-year), but is within the range of pressurized water reactor (PWR) CDFs (4.4×10^{-5} to 3.5×10^{-4} per reactor-year) and only slightly above 5.9×10^{-5} per reactor-year, which is the internal events mean value CDF for PWRs that the 2013 GEIS used to estimate probability-weighted, offsite consequences from airborne, surface water, and groundwater pathways, as well as the resulting economic impacts from such pathways.

Vistra OpCo indicated these PRA models reflected the most up-to-date understanding of plant risk at the time of the analysis. The staff determined that this approach is sufficient to evaluate new and significant information related to SAMAs because use of the models reflected the most up-to-date understanding of plant risk at the time of the analysis, consistent with NEI 17-04.

In conclusion, there was an approximately 98 percent reduction in CDF from the original IPEEE CDF (about a factor of 46) events CDF. As predicted in the 2013 GEIS, the sum of the Comanche Peak external events CDFs was within the range of PWR CDFs that formed the basis for the 1996 GEIS. Therefore, the NRC staff concludes that the probability-weighted offsite consequences of severe accidents initiated by external events during the LR term would not exceed the consequences predicted in the 1996 GEIS. For these issues, the GEIS predicts that the probability-weighted consequences would be SMALL for all nuclear plants. The NRC staff identified no new and significant information regarding external events during its review of Vistra OpCo's ER, through the SAMA audit, during the scoping process, or through the evaluation of other available information. Thus, the NRC staff concludes that no new and significant information exists for Comanche Peak concerning offsite consequences of severe accidents initiated by external events that would alter the conclusions reached in the 1996 or 2013 GEIS.

F.3.3 New Source Term Information (Section E.3.3 of the 2013 GEIS)

Based on a comparison of NRC studies from 1982 (NUREG–0773, NRC 1982-TN7746) and 1997 (NUREG/CR-6295, NRC 1997-TN7777), which included data for CPNPP, the 2013 GEIS concluded that the 1997 source term information indicated that the timing from dominant severe accident sequences is comparable to that in the analysis forming the basis of the 1996 GEIS. Generally, the release frequencies and release fractions estimated in the 1997 study were significantly lower than previously estimated. Thus, the environmental impacts used as the basis for the 1996 GEIS (i.e., the frequency-weighted consequences) were higher than impacts that would be estimated using the 1997 source term information. Therefore, the updated estimates of offsite consequences remained within the bounds of the 1996 GEIS evaluation.

The source term refers to the magnitude and mix of the radionuclides released from the fuel (expressed as fractions of the fission product inventory in the fuel), as well as their physical and chemical form, and the timing of their release following an accident. The 2013 GEIS concludes that, in most cases, more recent estimates give significantly lower release frequencies and release fractions than were assumed in the 1996 GEIS. Thus, the environmental impacts of radioactive materials released during severe accidents, used as the basis for the 1996 GEIS (i.e., the frequency-weighted release consequences), are higher than the environmental impacts using more recent source term information. The predicted early and latent fatalities and dose estimates per reactor-year for Comanche Peak are provided in Table 5.6 of the 1996 GEIS. The very conservatively predicted latent total fatalities/reactor-year (95 percent upper-confidence bound (UCB)) were determined to be 2.3E-03 in the 1996 GEIS. In the Comanche Peak ER, the total CDF (a surrogate for the individual latent cancer fatality risk) was calculated to be 4.30E-05 (more than a factor of 50 improvement).

Although not a physical change to Comanche Peak or to the explicit PRA modeling, Volume 2 of NUREG–7110, State-of-the-Art Reactor Consequence Analysis (SOARCA), was published in August 2013. The analysis updated the NRC's severe accident studies of the Surry Power Station (e.g., NUREG–1150), incorporating state-of-the-art analyses to evaluate offsite risk. The conclusions of the SOARCA were that the calculated risks of public health consequences from severe accidents modeled in SOARCA are “very small.” The unmitigated versions of the scenarios analyzed in SOARCA have lower risk of early fatalities than calculated in the 1982 Siting Study SST 1 case. SOARCA's analyses show essentially zero risk of early fatalities. As stated in SOARCA, “The actual risk of a prompt fatality (cf., Table 7-13), using current best-estimate practices for calculating source terms, is about five orders of magnitude lower than using the SST1 source term would imply (cf., Table 7-13 and Table 7-18).” Included in the state-of-the-art SOARCA are evaluations of steam generator tube ruptures, demonstrating that their offsite consequences are less than previously modeled. The SOARCA was not a complete analysis of all scenarios in the PRA, but it supports the conclusion that the offsite effects of a severe accident would be small. Comanche Peak is a very similar design to Surry (both are Westinghouse PWRs with large, dry containments), and the general conclusions of lower offsite consequences from the SOARCA apply to Comanche Peak as well.

For the reasons described above, the more recent source term (timing and magnitude) at Comanche Peak has significantly smaller effects than had been quantified in the 1996 GEIS. For the Comanche Peak SAMA new and significant evaluation (described in ER Section 4.15.3 and evaluated in Section F.5 below), SAMAs were evaluated for their impact on CDF and source term category group frequencies if they were implemented. None of the SAMAs evaluated were found to reduce a significant source term category group frequency by at least 50 percent. Therefore, the offsite consequences of severe accidents initiated by the new source term during the LR term would not exceed the impacts predicted in the GEIS. For these issues, the GEIS predicts that the probability-weighted consequences of severe accidents would be SMALL for all nuclear plants. The NRC staff identified no new and significant information regarding the source term during its review of Vistra OpCo’s ER, through the SAMA audit, during the scoping process, or through the evaluation of other available information. Thus, the NRC staff concludes that no new and significant information exists for Comanche Peak concerning the source term that would alter the conclusions reached in the 1996 or 2013 GEIS.

F.3.4 Power Uprate Information (Section E.3.4 of the 2013 GEIS)

Operating at a higher reactor power level results in a larger fission product radionuclide inventory in the core than if the reactor were operating at a lower power level. In the event of an accident, the larger radionuclide inventory in the core would result in a larger source term. If the accident is severe, the release of radioactive materials from this larger source term could result in higher doses to offsite populations.

Large early release frequency (LERF) represents the frequency of event sequences that could result in early fatalities. The impact of a power uprate on early fatalities can be measured by considering the impact of the uprate on the LERF calculated value. To this end, Table E-14 of the 2013 GEIS presents the change in LERF calculated by each licensee that has been granted a power uprate of more than 10 percent. Table E-14 shows that the increase in LERF ranges from a minimal impact to an increase of about 30 percent (with a mean of 10.5 percent). The 2013 GEIS, Section E.3.4.3, “Conclusion,” determines that a power uprate will result in a small to (in some cases) moderate increase in the environmental impacts from a postulated accident. However, taken in combination with the other information presented in the GEIS, the increases would be bounded by the 95th-percent UCB values in Table 5.10 and Table 5.11 of the 1996 GEIS. Taken in combination with the other information presented in the 2013 GEIS, the NRC concluded that effects of such increases on risk and environmental impacts of severe accidents would be bounded by the 1996 GEIS, which used the 95-percent UCB values as the basis for estimating offsite consequences.

The NRC approved an approximate 4.8 percent power uprate for CPNPP from a reactor core power of 3,458 MWt to 3,612 MWt (NRC 2008-TN8978). Texas Utilities indicated that the PRA model was updated with a small change to model results, which is included in their current CDF and LERF values. The Unit 1 LERF changed from 4.87E-07 to 4.91E-07 and Unit 2 LERF changed from 6.11E-07 to 6.32E-07 (approximately 3.5 percent increase). This small 3.5 percent increase is less than the mean value of the 10.5 percent increase calculated in the 2013 GEIS. Based on this evaluation, the conclusion is that the risk increases due to the impacts of the power uprate conditions for internal events, external events, and shutdown operations are very small and within the acceptance criteria of Regulatory Guide (RG) 1.174. Since the PRA was previously updated, the effects of the power uprate are also included in the quantitative SAMA evaluations for the CPNPP LR.

Therefore, the NRC staff finds that the offsite consequences from the power uprate would not exceed the consequences predicted in the 2013 GEIS. The NRC staff has identified no new and significant information regarding power uprates during its review of Vistra OpCo’s ER, through the SAMA audit, during the scoping process, or through the evaluation of other available information. Thus, the NRC staff concludes that no new and significant information exists for Comanche Peak concerning offsite consequences due to power uprates that would alter the conclusions reached in the 2013 GEIS.

F.3.5 Higher Fuel Burnup Information (Section E.3.5 of the 2013 GEIS)

The 2013 GEIS evaluates updated information from NUREG/CR-6703 (Ramsdell et al. 2001-TN4545) to account for the effect of future increased fuel burnup on consequences of postulated accidents as predicted in the 1996 GEIS. There has been continued movement toward higher fuel burnup to allow for more efficient utilization of the fuel and longer operating cycles. The purpose of Section E.3.5 of the 2013 GEIS was to account for the effect of current and possible future increased fuel burnup on postulated accidents. Future peak burnups considered were 62 gigawatt days per metric ton uranium (GWd/MTU) for PWRs and 70 GWd/MTU for boiling water reactors.

Vistra OpCo indicated in the ER that average peak rod fuel burnup limit for each CPNPP unit during the terms of the extended licenses will not exceed 62,000 MWd/MTU. Taken in combination with the other information presented in the 2013 GEIS, the NRC concluded that increased peak fuel burnup from 42 to 75 GWd/MTU for PWRs would have effects on risk and environmental impacts of severe accidents that are bounded by the 1996 GEIS. Because CPNPP peak fuel burnup is within the range considered by the NRC in the 2013 GEIS for PWRs, the staff concludes that no new and significant information exists for CPNPP concerning the effect of peak fuel burnup on risk and environmental impacts of severe accidents. Therefore, the offsite consequences from higher fuel burnup would not exceed the consequences predicted in the 1996 GEIS. For these issues, the GEIS predicted that the probability-weighted consequences would be small for all nuclear plants. The NRC staff identified no new and significant information regarding higher fuel burnup during its review of Vistra OpCo's ER, through the SAMA audit, during the scoping process, or through the evaluation of other available information. Thus, the staff concludes that no new and significant information exists for Comanche Peak concerning offsite consequences due to higher fuel burnup that would alter the conclusions reached in the 1996 or 2013 GEIS.

F.3.6 Low Power and Reactor Shutdown Event Information (Section E.3.6 of the 2013 GEIS)

The 2013 GEIS states the environmental impacts of accidents at low power and shutdown conditions are generally comparable to those of accidents at full power when comparing the values in NUREG/CR-6143, "Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Grand Gulf, Unit 1" (NRC 1995-TN8976), and NUREG/CR-6144, "Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Surry, Unit 1" (BNL 1995-TN7776), with the values in NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants" (NRC 1990-TN525). The 2013 GEIS further indicates that although the impacts for low power and shutdown conditions could be somewhat greater than for full power conditions (for certain metrics), the 1996 GEIS's very conservative estimates of the environmental impact of severe accidents (using 95th UCBs) bound the potential impacts of accidents at low power and shutdown with margin.

Surry was evaluated in NUREG–1150 and NUREG/CR-6144 for low power and reactor shutdown event information, and Comanche Peak is a similarly designed plant (i.e., Westinghouse PWRs with large containments); thus, the NRC staff concludes that there are likely to be no significant plant configurations under low power and shutdown conditions likely to distinguish Comanche Peak from the evaluated plants such that the assumptions in the 2013 and 1996 GEISs would not apply.

Additionally, as discussed in SECY-97-168, "Issuance for Public Comment of Proposed Rulemaking Package for Shutdown and Fuel Storage Pool Operation" (NRC 1997-TN7621), industry initiatives taken during the early 1990s have also contributed to the improved safety of low power and shutdown operations for all plants. Therefore, the offsite consequences of severe accidents, considering low power and reactor shutdown events, are in line with the conclusions in the 1996 or 2013 GEIS. For these issues, the GEIS predicts that the probability-weighted consequences of severe accidents would be small for all nuclear plants. The NRC staff identified no new and significant information regarding low power and reactor shutdown events during its review of Vistra OpCo's ER, through the NRC staff's SAMA audit, during the scoping process, or through the evaluation of other available information. Thus, the staff concludes that no new and significant information exists for Comanche Peak concerning low power and reactor shutdown events that would alter the conclusions reached in the 2013 GEIS.

F.3.7 Spent Fuel Pool Accident Information (Section E.3.7 of the 2013 GEIS)

The 2013 GEIS concludes that the environmental impacts of accidents involving SPFs (as quantified in NUREG–1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants" (NRC 2001-TN5235)), can be comparable to those from reactor accidents at full power (as estimated in NUREG–1150 (NRC 1990-TN525)). The 2013 GEIS further indicates that subsequent analyses performed, and mitigative measures employed since 2001, have further lowered the risk of accidents involving SPFs. In addition, the GEIS notes that even the conservative estimates from NUREG–1738 (published in 2001) are much lower than the impacts from full power reactor accidents estimated in the 1996 GEIS. Therefore, the GEIS concludes the environmental impacts stated in the 1996 GEIS bound the impact from SPF accidents for all plants. For these issues, the GEIS predicts that the impacts would be SMALL for all nuclear plants. There are no spent fuel configurations that would distinguish Comanche Peak from the evaluated plants such that the assumptions in the 2013 and 1996 GEISs would not apply. Consistent with NUREG–1738, the impacts of accidents in spent fuel pools at Comanche Peak is comparable to or lower than those from reactor accidents and are bounded by the 1996 GEIS. In addition, two orders were issued by the NRC in March 2012, Mitigating Strategies (EA-12-049) and Spent Fuel Pool Instrumentation (EA-12-051). Comanche Peak implemented both of these orders in 2016, respectively (NRC 2016-TN8980). Mitigation strategies implemented after September 11, 2001, and diverse and flexible coping strategies, provide additional resources for maintaining spent fuel pool water inventory and risk reduction. The NRC staff identified no new and significant information regarding Spent Fuel Pool accidents during its review of Vistra OpCo's ER, through the SAMA audit, during the scoping process, or through the evaluation of other available information. Thus, the NRC staff concludes that no new and significant information exists for Comanche Peak concerning Spent Fuel Pool accidents that would alter the conclusions reached in the 2013 GEIS.

F.3.8 Use of Biological Effects of Ionizing Radiation (BEIR) VII Risk Coefficients (Section E.3.8 of the 2013 GEIS)

In 2005, the NRC staff completed a review of the National Academy of Sciences report, "Health Risks from Exposure to Low Levels of Ionizing Radiation: Biological Effects of Ionizing Radiation (BEIR) VII, Phase 2." The staff documented its findings in SECY-05-0202, "Staff Review of the National Academies Study of the Health Risks from Exposure to Low Levels of Ionizing Radiation (BEIR VII)" (NRC 2005-TN4513). The SECY paper states that the NRC staff agrees with the BEIR VII report's major conclusion—namely, the current scientific evidence is consistent with the hypothesis that there is a linear, no-threshold, dose-response relationship between exposure to ionizing radiation and the development of cancer in humans. The BEIR VII conclusion is consistent with the hypothesis on radiation exposure and human cancer that the NRC uses to develop its standards of radiological protection. Therefore, the NRC staff has determined that the conclusions of the BEIR VII report do not warrant any change in the NRC's radiation protection standards and regulations, because the NRC's standards are adequately protective of public health and safety and will continue to apply during Comanche Peak's LR term. This general topic is discussed further in the NRC's 2007 denial of Petition for Rulemaking (PRM)-51-11 (72 FR 71083-TN7789), in which the NRC stated that it finds no need to modify the 1996 GEIS, considering the BEIR VII report. For these issues, the GEIS predicts that the impacts of using the BEIR VII risk coefficients would be SMALL for all nuclear plants.

The NRC staff identified no new and significant information regarding the risk coefficient used in the BEIR VII report during its review of Vistra OpCo's ER, through the SAMA audit, during the scoping process, or through the evaluation of other available information. Thus, the staff concludes that no new and significant information exists for Comanche Peak concerning the biological effects of ionizing radiation that would alter the conclusions reached in the 1996 or 2013 GEIS.

F.3.9 Uncertainties (Section E.3.9 of the 2013 GEIS)

Section 5.3.3 of the 1996 GEIS provides a discussion of the uncertainties associated with the analysis in the GEIS and in the individual plant EISs used to estimate the environmental impacts of severe accidents. The 1996 GEIS used 95^{th}-percentile UCB estimates whenever available for its estimates of the environmental impacts of severe accidents. This approach provides conservatism to cover uncertainties, as described in Section 5.3.3.2.2 of the 1996 GEIS. Many of these same uncertainties also apply to the analysis used in the 2013 GEIS update. As discussed in Sections E.3.1 through E.3.8 of the 2013 GEIS, the GEIS update used more recent information to supplement the estimate of environmental impacts contained in the 1996 GEIS. In effect, the assessments contained in Sections E.3.1 through E.3.8 of the 2013 GEIS provided additional information and insights into certain areas of uncertainty associated with the 1996 GEIS. However, as provided in the 2013 GEIS, the impact and magnitude of uncertainties, as estimated in the 1996 GEIS, bound the uncertainties introduced by the new information and considerations addressed in the 2013 GEIS. Accordingly, in the 2013 GEIS, the NRC staff concluded that the reduction in environmental impacts resulting from the use of new information (since the 1996 GEIS analysis) outweighs any increases in impact resulting from the new information. As a result, the findings in the 1996 GEIS remain valid. The NRC staff identified no new and significant information regarding uncertainties during its review of Vistra OpCo's ER, the SAMA audit, the scoping process, or the evaluation of other available information. Accordingly, the NRC staff concludes that no new and significant information exists for Comanche Peak concerning uncertainties that would alter the conclusions reached in the 2013 GEIS.

As a sensitivity analysis, Section E.3.9.2 of Appendix E to the 2013 GEIS discusses the impact of population increases on offsite dose and economic consequences. The 2013 GEIS, in Section E.3.9.2, states the following:

> The 1996 GEIS estimated impacts at the mid-year of each plant's license renewal period (i.e., 2030 to 2050). To adjust the impacts estimated in the NUREGs and NUREG/CRs to the mid-year of the assessed plant's license renewal period, the information (i.e., exposure indexes [EIs]) in the 1996 GEIS can be used. The EIs adjust a plant's airborne and economic impacts from the year 2001 to its mid-year license renewal period based on population increases. These adjustments result in anywhere from a five to a 30 percent increase in impacts, depending upon the plant being assessed. Given the range of uncertainty in these types of analyses, a 5 to 30 percent change is not considered significant. Therefore, the effect of increased population around the plant does not generally result in significant increases in impacts.

The 2020 population used in the Comanche Peak initial LR ER (Luminant 2022-TN8655) was extrapolated by staff to the year 2030 and found to be 6,987,542. In the ER, Vistra OpCo extrapolated the population within the 50 mi radius to the year 2054. Vistra OpCo projected the total population for the year 2054 to be 9,465,735. This is an increase of 35 percent (factor of 1.35), which is only slightly above the GEIS range of 5 to 30 percent change that the GEIS concludes does not generally result in significant increases in impacts. The effect of the reduction in risk cited above far exceeds the effect of a population increase. The staff concludes that the overall effect of increased population around the plant during the LR period of extended operation does not result in significant increases in impacts. Thus, the staff concludes that no new and significant information exists for Comanche Peak concerning population increases that would alter the conclusions reached in the 2013 GEIS.

F.3.10 Summary and Conclusion (Section E.5 of the 2013 GEIS)

The 2013 GEIS categorizes "sources of new information" by their potential effect on the best-estimate environmental impacts associated with postulated severe accidents. These effects can (1) decrease the environmental impact associated with severe accidents, (2) not affect the environmental impact associated with severe accidents, or (3) increase the environmental impact associated with severe accidents.

New information regarding Comanche Peak was evaluated in Sections F.3.1 through F.3.9 above. No new and significant information regarding Comanche Peak was identified that was above the values previously evaluated in the GEIS. Thus, there was no new and significant information that would significantly increase the environmental impact associated with severe accidents. However, for Comanche Peak, just the reduction in risk due to a better understanding of the Comanche Peak source term provided a substantial decrease in the calculated environmental impact (consequences) by several orders of magnitude that was calculated in the 1996 GEIS. Given the new and updated information, the reduction in estimated environmental impacts from the use of new internal event and source term information outweighs any increases from the consideration of external events, future power uprates, higher fuel burnup, low power and shutdown risk, and SPF risk. Therefore, the conclusion in the 1996 GEIS and 2013 GEIS that "the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are "small" is considered appropriate for the Comanche Peak LR period.

Other areas of new information related to the Comanche Peak severe accident risk, severe accident environmental impact assessment, and cost-beneficial SAMAs are described below. These areas of new information demonstrate additional conservatism in the evaluations in the GEIS and Vistra OpCo's ER, because they result in further reductions in the impact of a severe accident.

F.4 <u>Other New Information Related to NRC Efforts to Reduce Severe Accident Risk Following Publication of the 1996 GEIS</u>

The Commission considers ways to mitigate severe accidents at a given site in more than just a one-time SAMA or SAMDA analysis. The Commission has considered and adopted various regulatory requirements for mitigating severe accident risks at reactor sites through a variety of NRC programs. For example, in 1996, when it promulgated Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants," in Appendix B of Subpart A in 10 CFR Part 51-TN250, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," the Commission explained the following in a *Federal Register* notice:

> The Commission has considered containment improvements for all plants pursuant to its Containment Performance Improvement program…and the Commission has additional ongoing regulatory programs whereby licensees search for individual plant vulnerabilities to severe accidents and consider cost-beneficial improvements (Final rule, "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 FR 28467 (June 5, 1996)).

These “additional ongoing regulatory programs” that the Commission mentioned include the individual plant examination (IPE) and the IPEEE program, which consider “potential improvements to reduce the frequency or consequences of severe accidents on a plant-specific basis and essentially constitute a broad search for severe accident mitigation alternatives.” Further, in the same rule, the Commission observed that the IPEs “resulted in a number of plant procedural or programmatic improvements and some plant modifications that will further reduce the risk of severe accidents” (61 FR 28481-TN8474; *Federal Register* notices are accessible and searchable at https://www.federalregister.gov). Based on these and other considerations, the Commission stated its belief that it is “unlikely that any site-specific consideration of SAMAs for LR will identify major plant design changes or modifications that will prove to be cost-beneficial for reducing severe accident frequency or consequences.” The Commission noted that it may review and possibly reclassify the issue of severe accident mitigation as a Category 1 issue upon the conclusion of its IPE/IPEEE program but deemed it appropriate to consider SAMAs for plants for which it had not done so previously, pending further rulemaking on this issue.

The Commission reaffirmed its SAMA-related conclusions in Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 and 10 CFR 51.53(c)(3)(ii)(L) (TN250), “Postconstruction environmental reports,” in *Exelon Generation Co., LLC* (Limerick Generating Station, Units 1 and 2), CLI-13-07, October 31, 2013. In addition, the Commission observed that it had promulgated the regulations because it had “determined that one SAMA analysis would uncover most cost-beneficial measures to mitigate both the risk and the effects of severe accidents, thus satisfying our obligations under NEPA” (NRC 2013-TN7766).

The NRC has continued to address severe accident-related issues since the agency published the GEIS in 1996. Combined NRC and licensee efforts have reduced risks from accidents beyond those accidents that were considered in the 1996 GEIS. The 2013 GEIS describes many of those efforts (NRC 2013-TN2654). In the remainder of Section F.4 of this SEIS, the NRC staff describes several efforts to reduce severe accident risk (i.e., CDF and LERF) following publication of the 1996 GEIS. Each of these initiatives applies to all reactors, including Comanche Peak. Section F.4.1 describes requirements adopted after the terrorist attacks of September 11, 2001, to address the loss of large areas of a plant caused by fire or explosions. Section F.4.2 describes the SOARCA project, which indicates that source term timing and magnitude values are significantly lower than source term values quantified in previous studies using other analysis methods. Section F.4.3 describes measures adopted after the Fukushima earthquake and tsunami events of 2013. Section F.4.4 discusses efforts that have been made to use plant operating experience to improve plant performance and design features. These are areas of new information that reinforce the conclusion that the probability-weighted consequences of severe accidents are SMALL for all plants, as stated in the 2013 GEIS, and further reduce the likelihood of finding a cost-beneficial SAMA that would substantially reduce the severe accident risk at Comanche Peak.

F.4.1 10 CFR 50.54(hh)(2) Requirements Regarding Loss of Large Areas of the Plant Caused by Fire or Explosions

As discussed on page E-7 of the 2013 GEIS, after the terrorist attacks of September 11, 2001, the NRC conducted a comprehensive review of the agency’s security program and made further enhancements to security at a wide range of NRC-regulated facilities. These enhancements included significant reinforcement of the defense capabilities for nuclear facilities, better control of sensitive information, enhancements in emergency preparedness, and implementation of mitigating strategies to deal with postulated events potentially causing loss of large areas of the plant due to explosions or fires, including those that an aircraft impact might create. For example, the Commission issued Order EA-02-026, “Order for interim safeguards and security compensatory measures” (NRC 2002-TN7825) to provide interim safeguards and security compensatory measures, which ultimately led to the promulgation of a new regulation in 10 CFR 50.54(hh) (TN249). This regulation requires commercial power reactor licensees to prepare for a loss of large areas of the facility due to large fires and explosions from any cause, including beyond-design-basis aircraft impacts. In accordance with 10 CFR 50.54(hh)(2) (TN249), licensees must adopt guidance and strategies to maintain or restore core cooling, containment, and SPF cooling capabilities under circumstances associated with the loss of large areas of the plant due to explosion or fire (NRC 2013-TN2654).

NRC requirements pertaining to plant security are subject to NRC oversight on an ongoing basis under a plant’s current OL and are beyond the scope of LR. As discussed in Section 5.3.3.1 of the 1996 GEIS, the NRC addresses security-related events using deterministic criteria in 10 CFR Part 73-TN423, “Physical Protection of Plants and Materials,” rather than by risk assessments or SAMAs. However, the implementation of measures that reduce the risk of severe accidents, including measures adopted to comply with 10 CFR 50.54(hh) (TN249), “Conditions of licenses,” also have a beneficial impact on the level of risk evaluated in a SAMA analysis, the purpose of which is to identify potentially cost-beneficial design alternatives, procedural modifications, or training activities that may further reduce the risks of severe accidents. Vistra OpCo has updated Comanche Peak’s guidelines, strategies, and procedures to meet the requirements of 10 CFR 50.54(hh) (TN249); therefore, those efforts have contributed to mitigation of the risk of a beyond-design-basis event. Accordingly, actions taken by Vistra OpCo to comply with those regulatory requirements have further contributed to the reduction of risk at Comanche Peak.

In summary, the new information regarding actions that Vistra OpCo has taken to prepare for potential loss of large areas of the plant due to fire or explosions has further contributed to the reduction of severe accident risk at Comanche Peak. Thus, this information does not alter the conclusions reached in the 2013 GEIS regarding the probability-weighted consequences of severe accidents.

F.4.2 State-of-the-Art Reactor Consequence Analysis

The 2013 GEIS notes that a significant NRC effort is ongoing to requantify realistic, severe accident source terms under the SOARCA project. Results indicate that source term timing and magnitude values quantified using SOARCA are significantly lower than source term values quantified in previous studies using other analysis methods. The NRC staff plans to incorporate this new information regarding source term timing and magnitude using SOARCA in future revisions of the GEIS (NRC 2013-TN2654).

The NRC has completed a SOARCA study for Surry; like Comanche Peak, Surry is a PWR with a large dry containment (NRC 2013-TN4593). The Surry SOARCAs indicate that successful implementation of existing mitigation measures can prevent reactor core damage or delay or reduce offsite releases of radioactive material. All SOARCA scenarios, even when unmitigated, progress more slowly and release much less radioactive material than the potential releases cited in the 1982 Siting Study, NUREG/CR-2239, “Technical Guidance for Siting Criteria Development” (SNL 1982-TN7749). As a result, the calculated risks of public health consequences of severe accidents modeled in SOARCA are very small.

This new information regarding the SOARCA project's findings has further contributed to the likelihood of a reduction of the calculated severe accident risk at Comanche Peak, compared to the 1996 GEIS and the previous Comanche Peak SAMA evaluation. Thus, the NRC staff finds there is no new and significant information related to the SOARCA project that would alter the conclusions reached in the 2013 GEIS or Comanche Peak's previous SAMA analysis.

F.4.3 Fukushima-Related Activities

As discussed in Section E.2.1 of the 2013 GEIS, on March 11, 2011, a massive earthquake off the east coast of the main island of Honshu, Japan, produced a tsunami that struck the coastal town of Okuma in Fukushima Prefecture. The resulting flooding damaged the six-unit Fukushima Dai-ichi nuclear power plant, causing the failure of safety systems needed to maintain cooling water flow to the reactors. Due to the loss of cooling, the fuel overheated, and there was a partial meltdown of fuel in three of the reactors. Damage to the systems and structures containing reactor fuel resulted in the release of radioactive material to the surrounding environment (NRC 2013-TN2654).

As further discussed in Section E.2.1 of the 2013 GEIS, in response to the earthquake, tsunami, and resulting reactor accidents at Fukushima Dai-ichi (hereafter referred to as the Fukushima events), the Commission directed the NRC staff to convene an agency task force of senior leaders and experts to conduct a methodical and systematic review of NRC regulatory requirements, programs, and processes (and their implementation) relevant to the Fukushima events. After thorough evaluation, the NRC required significant enhancements of U.S. commercial nuclear power plants. The enhancements included adding capabilities to maintain key plant safety functions after a large-scale natural disaster; updating evaluations of the potential impact of seismic and flooding events; adding new equipment to better handle potential reactor core damage events; and strengthening emergency coping capabilities. Additional discussion specific to the Comanche Peak response to earthquakes, including Vistra OpCo's performance of a seismic PRA, is available in Section F.3.2 and Section 3.4.4 of this SEIS.

In summary, the Commission has imposed additional safety requirements on operating reactors, including Comanche Peak, after the Fukushima accident (as described in the preceding paragraphs). The new regulatory requirements have further contributed to the reduction of severe accident risk at Comanche Peak. Therefore, the NRC staff concludes that there is no new and significant information related to the Fukushima events that would alter the conclusions reached in the 2013 GEIS or Comanche Peak's previous SAMA analysis.

F.4.4 Operating Experience

Section E.2 of the 2013 GEIS mentions the considerable operating experience that supports the safety of U.S. nuclear power plants. As with the use of any technology, greater user experience generally leads to improved performance and improved safety. Additional operating experience at nuclear power plants has contributed to improved plant performance (e.g., as measured by trends in plant-specific performance indicators), a reduction in adverse operating events, and new lessons learned that improve the safety of all operating nuclear power plants (NRC 2013-TN2654).

F.4.5 Conclusion

In summary, the new information related to NRC efforts to reduce severe accident risk described above contribute to improved safety, as do safety improvements not related to LR, including the NRC and industry response to generic safety issues (NRC 2011-TN7816). Thus, the performance and safety record of nuclear power plants operating in the United States, including Comanche Peak, continue to improve. This improvement is also confirmed by analysis, which indicates that, in many cases, improved plant performance and design features have resulted in reductions in initiating event frequency, CDF, and containment failure frequency (NRC 2013-TN2654).

As discussed above, the NRC and the nuclear industry have addressed and continue to address numerous severe accident-related issues since the publication of the 1996 GEIS and the 1989 Comanche Peak SAMA analysis. These actions reinforce the conclusion that the probability-weighted consequences of severe accidents are SMALL for all plants, as stated in the 2013 GEIS, and further reduce the likelihood of finding a cost-beneficial SAMA that would substantially reduce the severe accident risk at Comanche Peak.

F.5 Evaluation of New and Significant Information Pertaining to SAMAs Using NEI 17-04, "Model SLR New and Significant Assessment Approach for SAMA"

As discussed earlier in Section F.2.2, Vistra OpCo stated in its ER, that it used the methodology in NEI 17-04 Revision 1, "Model SLR New and Significant Assessment Approach for SAMA" (NEI 2019-TN6815) to evaluate new and significant information as it relates to the Comanche Peak LR SAMDAs. By letter dated December 11, 2019, the staff reviewed NEI 17-04 and found it acceptable for interim use, pending formal NRC endorsement of NEI 17-04 by incorporation in RG 4.2, Supplement 1, "Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications" (NRC 2019-TN7805). In general, as discussed earlier, the NEI 17-04 methodology (NEI 2017) does not consider a potential SAMA to be significant unless it reduces by at least 50 percent the maximum benefit as defined in Section 4.5, "Total Cost of Severe Accident Risk/Maximum Benefit," of NEI 05-01, Revision A, "Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document." NEI 05-01 is endorsed in NRC RG 4.2, Supplement 1 (NRC 2013-TN2654).

NEI 17-04 Revision 1 provides a model approach for assessing the significance of new information of which the applicant for renewal of a nuclear power reactor OL is aware that relates to either (1) the SAMDA analysis or SAMA analysis documented in the NRC's final environmental statement (FES, FSEIS, or EA) that supported issuance pursuant to 10 CFR Part 50-TN249 (or 10 CFR Part 54-TN4878) of the reactor's initial (or renewed) OL, or (2) the SAMDA analysis documented in the NRC's final environmental statement (FES, FSEIS, or EA) that supported issuance pursuant to 10 CFR Part 52 (TN251) of the reactor's combined license and the design certification incorporated therein by reference, if any.NEI 17-04 (Revision 1) (NEI 2019-TN6815) describes a three-stage process for determining whether there is any "new and significant" information relevant to a previous SAMA analysis. In Stage 1, the applicant uses PRA risk insights and/or risk model quantifications to estimate the percent reduction in the maximum benefit associated with (1) all unimplemented "final plant-specific" SAMAs for the analyzed plant and (2) those SAMAs identified as potentially cost-beneficial for other U.S. nuclear power plants and determined to be applicable to but not already implemented at the analyzed plant. Consistent with the NRC's rulings that new and significant information is that which "presents a 'seriously different picture' of the environmental impacts compared to the previously issued final environmental impact statement (FEIS)," the first stage examines whether these potentially cost-beneficial SAMAs might reduce severe accident risk substantially. If it can be demonstrated that none of the SAMAs being evaluated can reduce the maximum benefit by 50 percent or more, then the applicant may document the conclusion that there is no new and significant information relevant to the previous SAMA analysis. If one or more of the SAMAs are shown to have the potential to reduce the maximum benefit by 50 percent or more, then the applicant must complete Stage 2 by developing updated averted cost-risk estimates for implementing those SAMAs. If the Stage 2 assessment confirms that one or more SAMAs reduce the maximum benefit by 50 percent or more, then the applicant must complete Stage 3 by performing a cost-benefit analysis for the "potentially significant" SAMAs identified in Stage 2. Applicants that can demonstrate through the Stage 1 screening process that there is no potentially significant new information are not required to perform the Stage 2 or Stage 3 evaluations.

The NEI methodology described in NEI 17-04 uses "maximum benefit" to determine whether SAMA-related information is new and significant. Maximum benefit is defined in Section 4.5 of NEI 05-01, Revision A, "Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document" (NEI 2005-TN1978), as the benefit a SAMA could achieve if it eliminated all risk. The total offsite dose and total economic impact are the baseline risk measures from which the maximum benefit is calculated. The methodology in NEI 17-04 considers a cost-beneficial SAMA to be potentially significant if it reduces the maximum benefit by at least 50 percent. The NRC staff finds the criterion of exceeding a 50 percent reduction in the maximum benefit a reasonable significance value because it correlates with significance determinations in the American Society of Mechanical Engineers and American Nuclear Society PRA standard (cited in RG 1.200) ([ASME/ANS 2009-TN6220; NRC 2009-TN6211), NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants" (NRC endorsed in RG 1.160) (NEI 2018-TN7758; NRC 2018-TN7799) and NEI 00-04, "10 CFR 50.69 SSC Categorization Guideline" (endorsed in RG 1.201) (NEI 2005-TN8340; NRC 2006-TN6279), which the NRC has cited or endorsed. It is also a reasonable quantification of the qualitative criteria that new information is significant if it presents a seriously different picture of the impacts of the Federal action under consideration, requiring a supplement (NUREG–0386, "United States Nuclear Regulatory Commission Staff Practice and Procedure Digest: Commission, Appeal Board, and Licensing Board Decisions" [NRC 2009-TN8377]). Furthermore, it is consistent with the criteria that the NRC staff accepted in the Limerick Generating Station LR final SEIS (NRC 2014-TN7328). The NRC staff finds the approach in NEI 17-04 to be reasonable because, with respect to SAMAs, new information may be significant if it indicates a potentially cost-beneficial SAMA could substantially reduce the probability or consequences (risk) of a severe accident occurring. The implication of this statement is that "significance" is not solely related to whether a SAMA is cost beneficial (which may be affected by economic factors, increases in population, etc.), but it also depends on a SAMA's potential to significantly reduce risk to the public.

Upon completion of the Stage 1 screening process, Vistra OpCo determined that there is no potentially significant new information affecting its Comanche Peak SAMA analysis; thus, Vistra OpCo did not perform the Stage 2 or Stage 3 assessments. The following sections summarize Vistra OpCo's application of the NEI 17-04 methodology to Comanche Peak SAMAs.

F.5.1 Data Collection

NEI 17-04 Section 3.1, "Data Collection," explains that the initial step of the assessment process is to identify the "new information" relevant to the SAMA analysis and to collect and develop those elements of information that will be used to support the assessment. The guidance document states that each applicant should collect, develop, and document the information elements corresponding to the stage or stages of the SAMA analysis performed for the site. For Comanche Peak LR, the NRC staff reviewed the onsite information during an audit at NRC headquarters and determined that Vistra OpCo had considered the appropriate information (NRC 2023-TN8981).

F.5.2 Stage 1 Assessment

Section E4.15.4, "Analysis of New and Significant SAMAs," of Vistra OpCo's ER describes the process it used to identify any potentially new and significant SAMAs. For the CPNPP LR application, new and significant changes since the issuance of the OL were considered. The list of candidate SAMAs for the CPNPP LR application was developed from plant-specific and industry sources. For the plant-specific portion, the CPNPP PRA are examined for insights. The purpose is to determine whether there is any new and significant information regarding the SAMDA analyses that would affect the decision to renew the OL. Over the course of plant operation, changes are made to the plant design, operation, and maintenance practices.

Periodic updates of the CPNPP PRA have ensured that the PRA includes the relevant changes and continues to reflect the current plant design and operation. PRA updates also include updates of the plant-specific initiating event and equipment data used, and improvements in state-of-the-art analysis of severe accidents. Therefore, the PRA provides valuable insights into the risk significance of the plant changes over time.

For evaluation of the industry sources, the supplements of NUREG–1437, Revision 1 were examined for SAMAs found to be cost-effective at plants similar to CPNPP. Any such items found to be cost-effective at similar plants were considered for their significance at CPNPP. Industry SAMAs from Table 14 of NEI 05-01 were also reviewed to identify potential cost-effective SAMAs.

The list of SAMAs collected was evaluated qualitatively to screen any that are not applicable to CPNPP or already exist at CPNPP (including plant modifications since issuance of the OL). In addition, two other screening criteria were applied to eliminate SAMAs that have excessive cost. These SAMAs were screened if they were not found to reduce the CPNPP maximum benefit by >50 percent. The remaining SAMAs were then grouped (if similar) based on similarities in mitigation equipment or risk reduction benefits, and all were evaluated for the impact they would have on the CPNPP CDF and significant source term category (STC) grouped frequencies (i.e., Small Early Release Frequency [SERF], Large Late Release Frequency [LLRF], and Large Early Release Frequency [LERF]) if implemented. If any of the SAMAs reduced the total CDF, SERF, LLRF or LERF by at least 50 percent, then the SAMA would be retained for a full Level 3 PRA evaluation of the reduction in maximum benefit. As seen in ER Sections 2.2 and Section 3.0, all SAMAs were screened as being not significant and without the need to perform a Level 3 PRA.

A total of 283 industry SAMAs, 2 SAMAs from Table 14 of NEI 05-01 (NEI 2005-TN1978), nine SAMDAs from the initial OL (TU Electric 1989-TN8982), and five plant-specific SAMAs, were considered in the LR application, yielding a total of 301 SAMAs considered. A total of 24 were retained after the qualitative screening evaluation. This list of 24 SAMAs was then further edited into nine cases for bounding SAMA evaluation. This grouping is presented in Table 4.15-2 of the ER.

This section presents the quantitative screening of the CPNPP SAMAs. The NEI 17-04 (NEI 2019-TN6815) methodology considers a potential SAMA to not be significant unless it reduces the maximum benefit by at least 50 percent. The Stage 1 quantitative screening process evaluates this using the criteria of total CDF and no STC frequency being reduced by at least 50 percent. Because the maximum benefit is the sum total of the contribution of each STC, if no STC decreases by at least 50 percent, then the total maximum benefit reduction cannot exceed 50 percent. However, the approach of evaluating every STC is not necessary to ensure the maximum benefit reduction is less than 50 percent. Many individual STCs have a frequency that is insignificant, and while an insignificant STC could in theory be reduced by >50 percent, its impact on maximum benefit would be negligible. Additionally, many STCs have conditional offsite consequences that are negligible compared to the dominant STC groups (i.e., SERF, LLRF and LERF).

For this analysis, the significant STC groups (i.e., SERF, LLRF and LERF) are summed to calculate percentage reduction. If the total CDF and total STC group is not reduced by 50 percent or more, then the maximum benefit is also not reduced by 50 percent or more and the SAMA is screened. SAMAs screened in this manner are not considered “significant” and are screened as part of the Stage 1 assessment.

The evaluations were selected conservatively to provide assurance that they are bounding. As seen in Table 4.15-2, none of the bounding quantitative screening evaluations resulted in a reduction of total CDF or total LERF greater than 50 percent. Therefore, a Stage 2 assessment is not required and was not performed.

The NRC staff reviewed Comanche Peak’s onsite information and its SAMA Stage 1 process during an in-office audit at NRC headquarters (NRC 2023-TN8981). The staff found that Vistra OpCo had used a methodical and reasonable approach to identifying any SAMAs that might reduce the maximum benefit by at least 50 percent and therefore could be considered potentially significant. Therefore, the NRC staff finds that Vistra OpCo properly concluded, in accordance with the NEI 17-04 guidance, that it did not need to conduct a Stage 2 assessment.

F.5.3 Other New Information Related to SAMA

As discussed in Vistra OpCo s LR application ER and in NEI 17-04, some inputs to the SAMA analysis are expected to change or to potentially change for all plants. Examples of these inputs include the following:

- Updated Level 3 PRA model consequence results, which may be affected by multiple inputs, including, but not limited to, the following:
  - population, as projected within a 50 mi (80 km) radius of the plant
  - value of farm and nonfarm wealth
  - core inventory (e.g., due to power uprate)
  - evacuation timing and speed
  - Level 3 PRA methodology updates
  - cost-benefit methodology updates

In addition, other changes that could be considered new information may be dependent on plant activities or site-specific changes. These types of changes (listed in NEI 17-04) include the following:

- Identification of a new hazard (e.g., a fault that was not previously analyzed in the seismic analysis)

- Updated plant risk model (e.g., a fire PRA that replaces the IPEEE analysis)

- Impacts of plant changes that are included in the plant risk models will be reflected in the model results and do not need to be assessed separately.
- Nonmodeled modifications to the plant
    - Modifications determined to have no risk impact need not be included (e.g., replacement of the condenser vacuum pumps), unless they affect a specific input to SAMA (e.g., new low-pressure turbine in the power conversion system that results in a greater net electrical output).

F.5.4 Conclusion

The NRC staff reviewed Vistra OpCo’s new and significant information analysis for severe accidents and SAMAs at Comanche Peak during the LR period and finds Vistra OpCo’s analysis and methods to be reasonable. As described above, Vistra OpCo evaluated a total of 301 SAMAs for Comanche Peak LR and did not find any SAMAs that would reduce the maximum benefit by 50 percent or more. The NRC staff reviewed Vistra OpCo’s evaluation and concludes that Vistra OpCo’s methods and results were reasonable. Based on Comanche Peak’s Stage 1 qualitative and quantitative screening results, Vistra OpCo demonstrated that none of the plant-specific and industry SAMAs that it considered constitutes new and significant information in that none of them changed the conclusion of Comanche Peak’s previous SAMA analysis. Further, the NRC staff did not otherwise identify any new and significant information that would alter the conclusions reached in the previous SAMA analysis for Comanche Peak. Therefore, the NRC staff concludes that there is no new and significant information that would alter the conclusions of the SAMA analysis performed for Comanche Peak’s initial LR.

In addition, given the low residual risk at Comanche Peak, the decrease in internal event CDF at Comanche Peak from the previous SAMA analysis, and the fact that no potentially cost-beneficial SAMAs were identified during Comanche Peak’s initial SAMDA review, the staff considers it unlikely that Vistra OpCo would have found any potentially cost-beneficial SAMAs for LR. Further, Vistra OpCo’s implementation of actions to satisfy the NRC’s orders and regulatory requirements regarding beyond-design-basis events after the September 2001 terrorist attacks and the March 2011 Fukushima events, as well as the conservative assumptions used in earlier severe accident studies and SAMA analyses, also make it unlikely that Vistra OpCo would have found any potentially significant cost-beneficial SAMAs during its LR review. For all the reasons stated above, the NRC staff concludes that Vistra OpCo reached reasonable SAMA conclusions in its LR ER and that there is no new and significant information regarding any potentially cost-beneficial SAMA that would substantially reduce the risks of a severe accident at Comanche Peak.

F.6 <u>References</u>

Note, all NUREG reports listed in Appendix F are available electronically from the NRC’s public website found at: https://www.nrc.gov/reading-rm/doc-collections/nuregs/index.html. From this site, the public can gain access to NRC’s collection of technical reports by using the technical report numbers (e.g., NUREG-xxxx or NUREG/CR-xxxx).

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APPENDIX G

ENVIRONMENTAL ISSUES AND IMPACT FINDINGS CONTAINED IN THE PROPOSED RULE, 10 CFR PART 51, "ENVIRONMENTAL PROTECTION REGULATIONS FOR DOMESTIC LICENSING AND RELATED REGULATORY FUNCTIONS"

The U.S. Nuclear Regulatory Commission (NRC, the Commission) staff prepared this supplemental environmental impact statement (SEIS) in accordance with the NRC's environmental protection regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," implement the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.) to evaluate the environmental impacts of license renewal (LR) of Comanche Peak Nuclear Power Plant, Units 1 and 2 by Vistra Operations Company LLC (Vistra). This SEIS supplements NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (NRC 1996-TN288, 1999-TN289, 2013-TN2654).

On March 3, 2023, the NRC published a draft rule (88 FR 13329-TN8601) proposing to amend its environmental protection regulations in 10 CFR Part 51. Specifically, the proposed rule would update the NRC's 2013 findings concerning the environmental impacts of renewing the operating license of a nuclear power plant. The technical basis for the proposed rule would be provided by Revision 2 to NUREG–1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (the 2023 LR GEIS; NRC 2023-TN7802), which would update NUREG–1437, Revision 1 (the 2013 LR GEIS; NRC 2013-TN2654), which, in turn, was an update of NUREG–1437, Revision 0 (1996 LR GEIS; NRC 1996-TN288). The 2023 Generic Environmental Impact Statement for License Renewal of Nuclear Plants (LR GEIS) would specifically support the proposed revised list of NEPA (42 U.S.C. § 4321, et seq-TN8608) issues and associated environmental impact findings for LR to be contained in Table B-1 in Appendix B to Subpart A of 10 CFR Part 51. The 2023 LR GEIS and proposed rule reflect lessons learned and knowledge gained from the NRC's conducting of environmental reviews for initial LR and subsequent license renewal (SLR) since 2013.

The proposed rule would redefine the number and scope of the environmental issues that must be addressed by the NRC during LR environmental reviews. The proposed rule identifies 80 environmental impact issues, 20 of which would require plant-specific analysis. The proposed rule would reclassify some previously site-specific (Category 2) issues as generic (Category 1) issues and would consolidate other issues. It would also add new Category 1 and Category 2 issues to Table B-1. These proposed changes are summarized as follows.

- One Category 2 issue, "Groundwater quality degradation (cooling ponds at inland sites)," and a related Category 1 issue, "Groundwater quality degradation (cooling ponds in salt marshes)," would be consolidated into a single Category 2 issue, "Groundwater quality degradation (plants with cooling ponds)."

- Two related Category 1 issues, "Infrequently reported thermal impacts (all plants)" and "Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication," and the thermal effluent component of the Category 1 issue, "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses," would be consolidated into a single Category 1 issue, "Infrequently reported effects of thermal effluents."

- One Category 2 issue, “Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds),” and the impingement component of the Category 1 issue, “Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses,” would be consolidated into a single Category 2 issue, “Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds).”
- One Category 1 issue, “Impingement and entrainment of aquatic organisms (plants with cooling towers),” and the impingement component of the Category 1 issue, “Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses,” would be consolidated into a single Category 1 issue, “Impingement mortality and entrainment of aquatic organisms (plants with cooling towers).”
- One Category 2 issue, “Threatened, endangered, and protected species and essential fish habitat,” would be divided into three Category 2 issues: (1) “Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife jurisdiction,” (2) “Endangered Species Act: federally listed species and critical habitats under National Marine Fisheries Service jurisdiction,” and (3) “Magnuson-Stevens Act: essential fish habitat.”
- Two new Category 2 issues, “National Marine Sanctuaries Act: sanctuary resources” and “Climate change impacts on environmental resources,” would be added.
- One Category 2 issue, “Severe accidents,” would be changed to a Category 1 issue.
- One new Category 1 issue, “Greenhouse gas impacts on climate change,” would be added.
- Several issue titles and findings would be revised to clarify their intended meanings.

The final versions of the 2023 LR GEIS and the proposed rule are expected to be published in August 2024 and, upon being finalized, under the NRC’s environmental protection regulations, the NRC would have to consider and analyze in its LR environmental reviews the potential significant impacts associated with the new Category 2 issues and, to the extent that there is any new and significant information, the potential significant impacts associated with the new Category 1 issues. To account for the proposed rule and 2023 LR GEIS and the possibility of their finalization in 2024, the NRC staff analyzes in this appendix their new and revised environmental issues as they may apply to the LR of Comanche Peak. Table G-1 lists the new and revised environmental issues that would apply to Comanche Peak LR. The sections that follow discuss how the NRC staff addressed each of these new and revised issues in this SEIS and explains how this SEIS covers all the issues in the proposed rule and 2023 LR GEIS.

Table G-1 New and Revised 10 CFR Part 51 License Renewal Environmental Issues

Issue	2023 LR GEIS Section	Category
Infrequently reported effects of thermal effluents	4.6.1.2	1
Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	4.6.1.2	2
Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife jurisdiction	4.6.1.3.1	2
Endangered Species Act: federally listed species and critical habitats under National Marine Fisheries Service jurisdiction	4.6.1.3.2	2
Magnuson-Stevens Act: essential fish habitat	4.6.1.3.3	2
National Marine Sanctuaries Act: sanctuary resources	4.6.1.3.4	2

Issue	2023 LR GEIS Section	Category
Severe accidents	4.9.1.2.1	1
Greenhouse gas impacts on climate change	4.12.1	1
Climate change impacts on environmental resources	4.12.3	2

G.1 Infrequently Reported Effects of Thermal Effluents

The draft rule proposes to combine two Category 1 issues, "Infrequently reported thermal impacts (all plants)" and "Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication," and the thermal effluent component of the Category 1 issue, "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses," into one Category 1 issue, "Infrequently reported effects of thermal effluents." This issue pertains to interrelated and infrequently reported effects of thermal effluents, including cold shock, thermal migration barriers, accelerated maturation of aquatic insects, and proliferated growth of aquatic nuisance species, as well as the effects of thermal effluents on dissolved oxygen, gas supersaturation, and eutrophication. This issue also considers sublethal stresses associated with thermal effluents that can increase the susceptibility of exposed organisms to predation, parasitism, or disease. These changes do not introduce any new environmental issues; rather, the proposed rule would reorganize existing issues. The changes are fully summarized and explained in Section 4.6.1.2 of the 2023 LR GEIS and in the proposed rule.

Section 3.7.3 of this SEIS analyze infrequently reported effects of thermal effluents for Comanche Peak LR and conclude that the impacts would be SMALL. Therefore, the environmental issue of infrequently reported effects of thermal effluents is addressed in the SEIS.

G.2 Impingement Mortality and Entrainment of Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

The draft rule proposes to combine the Category 2 issue, "Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)," and the impingement component of the Category 1 issue, "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses," into one Category 2 issue, "Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)." This issue pertains to impingement mortality and entrainment of finfish and shellfish at nuclear power plants with once-through cooling systems and cooling ponds during the LR term (either initial LR or SLR). This includes plants with helper cooling towers that are seasonally operated to reduce thermal load to the receiving water body, reduce entrainment during peak spawning periods, or reduce consumptive water use during periods of low river flow.

In the 2023 LR GEIS, the NRC renamed this issue to specify impingement mortality, rather than simply impingement. This change is consistent with the U.S. Environmental Protection Agency (EPA) 2014 Clean Water Act Section 316(b) (79 FR 48300-TN4488) regulations and the EPA's assessment that impingement reduction technology is available, feasible, and has been demonstrated to be effective. Additionally, the EPA 2014 Clean Water Act Section 316(b) regulations establish best technology available standards for impingement mortality based on the fact that survival is a more appropriate metric for determining environmental impact rather than simply looking at total impingement. Therefore, the 2023 LR GEIS also consolidates the impingement component of the "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses" issue for plants with once-through cooling systems or cooling ponds into this issue.

Section 3.7.3.1 of this SEIS analyzes the impacts of impingement and entrainment for Comanche Peak LR. The analysis considers the components of the proposed revision to this issue, impingement mortality, and the impingement component of losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. In this section, the NRC staff concludes that impingement and entrainment during the LR term would be of SMALL significance on the aquatic organisms in Comanche Creek Reservoir. Therefore, the environmental issue of impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) is addressed in the SEIS.

G.3 Endangered Species Act: Federally Listed Species and Critical Habitats Under U.S. Fish and Wildlife Jurisdiction

The draft rule proposes to divide the Category 2 issue, "Threatened, endangered, and protected species and essential fish habitat," into three separate Category 2 issues for clarity and consistency with the separate Federal statues and interagency consultation requirements that the NRC must consider with respect to federally protected ecological resources. When combined, however, the scope of the three issues is the same as the scope of the former "Threatened, endangered, and protected species and essential fish habitat" issue discussed in the 2013 LR GEIS.

The first of the three issues, "Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife jurisdiction," concerns the potential effects of continued nuclear power plant operation and any refurbishment during the LR term on federally listed species and critical habitats protected under the Endangered Species Act (ESA) and under the jurisdiction of the U.S. Fish and Wildlife Service (FWS).

Sections 3.8.1 and 3.8.4 of this SEIS address the impacts of Comanche Peak LR on federally listed species and critical habitats under FWS jurisdiction. The NRC staff determined that Comanche Peak LR may affect but is not likely to adversely affect the golden-cheeked warbler, tricolored bat, and monarch butterfly. Appendix C.1 describes the staff's ESA consultation with the FWS. Therefore, the environmental issue of "Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife Service jurisdiction" is addressed in the SEIS.

G.4 Endangered Species Act: Federally Listed Species and Critical Habitats Under National Marine Fisheries Service Jurisdiction

As explained in the previous section, the draft rule proposes to divide the Category 2 issue, "Threatened, endangered, and protected species and essential fish habitat," into three separate Category 2 issues. The second of the three issues, "Endangered Species Act: federally listed species and critical habitats under National Marine Fisheries Service jurisdiction," concerns the potential effects of continued nuclear power plant operation and any refurbishment during the LR term on federally listed species and critical habitats protected under the ESA and under the jurisdiction of the National Marine Fisheries Service (NMFS).

Sections 3.8.1 and 3.8.4 of this SEIS find that no federally listed species or critical habitats under NMFS jurisdiction occur within the action area. Accordingly, the NRC staff concluded that the proposed action would have no effect on federally listed species or habitats under this agency's jurisdiction. Therefore, the environmental issue of "Endangered Species Act: federally listed species and critical habitats under National Marine Fisheries Service jurisdiction" is addressed in the SEIS.

G.5 Magnuson-Stevens Act: Essential Fish Habitat

As explained above, the draft rule proposes to divide the Category 2 issue, "Threatened, endangered, and protected species and essential fish habitat," into three separate Category 2 issues. The third of the three issues, "Magnuson-Stevens Act: essential fish habitat," concerns the potential effects of continued nuclear power plant operation and any refurbishment during the LR term on essential fish habitat protected under the Magnuson-Stevens Act (MSA - TN1061).

Sections 3.8.2 and 3.8.4.4 of this SEIS find that no Essential Fish Habitat occurs within the affected area. Accordingly, the NRC staff concluded that the proposed action would have no effect on Essential Fish Habitat. Therefore, the environmental issue of "Magnuson-Stevens Act: essential fish habitat" is addressed in the SEIS.

G.6 National Marine Sanctuaries Act: Sanctuary Resources

The draft rule proposes to add a new Category 2 issue, "National Marine Sanctuaries Act: sanctuary resources," to evaluate the potential effects of continued nuclear power plant operation and any refurbishment during the LR term on sanctuary resources protected under the National Marine Sanctuaries Act (NMSA -TN4482).

Under the NMSA, the National Oceanic and Atmospheric Administration Office of National Marine Sanctuaries designates and manages the National Marine Sanctuary System. Marine sanctuaries may occur near nuclear power plants located on or near marine waters as well as the Great Lakes.

Sections 3.8.3 and 3.8.4.5 of this SEIS find that no national marine sanctuaries occur within the affected area. Accordingly, the NRC staff concluded that the proposed action would have no effect on sanctuary resources. Therefore, the environmental issue of "National Marine Sanctuaries Act: sanctuary resources" is addressed in the SEIS.

G.7 Severe Accidents

With respect to postulated accidents, the draft rule proposes to amend Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 (TN250) by reclassifying the Category 2 "Severe accidents" issue as a Category 1 issue. In the 2013 LR GEIS, the issue of severe accidents was classified as a Category 2 issue to the extent that only alternatives to mitigate severe accidents must be considered for all nuclear power plants where the licensee had not previously performed a severe accident mitigation alternatives (SAMA) analysis for the plant. In the 2023 LR GEIS, the NRC notes that this issue will be resolved generically for the vast majority, if not all, expected LR applicants because the applicants who will likely reference the 2023 LR GEIS have previously completed a SAMA analysis.

Severe accidents are addressed in Section 3.11.6.4 and Appendix F of this SEIS. Therefore, the environmental issue of severe accidents is addressed in the SEIS.

G.8 Greenhouse Gas Impacts on Climate Change

With respect to greenhouse gas (GHG) emissions and climate change, the draft rule proposes to amend Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 (TN250) by adding a new Category 1 issue "Greenhouse gas impacts on climate change." This new issue has an impact level of SMALL. This new issue considers GHG impacts on climate change from routine operations of nuclear power plants and construction vehicles and other motorized equipment for refurbishment activities. GHG emissions from routine operations of nuclear power plants are typically very minor because such plants, by their very nature, do not normally combust fossil fuels to generate electricity. However, nuclear power plant operations do have some GHG emission sources, including diesel generators, pumps, diesel engines, boilers, refrigeration systems, and electrical transmission and distribution systems, as well as mobile sources (e.g., worker vehicles and delivery vehicles). GHG emissions from construction vehicles and other motorized equipment for refurbishment activities would be intermittent and temporary, restricted to the refurbishment period. GHG emissions from continued operations and refurbishment activities are minor.

The issue of GHG impacts on climate change associated with nuclear power plant operations was not identified as either a generic or plant-specific issue in the 1996 LR GEIS and the 2013 LR GEIS. In the 2013 LR GEIS, however, the NRC staff presented GHG emission factors associated with the nuclear power life cycle. Following the issuance of CLI-09-21 (NRC 2009-TN6406), the NRC began to evaluate the effects of GHG emissions in plant-specific environmental reviews for LR applications. Accordingly, Section 3.15.3.1 of this EIS evaluates GHG emissions associated with the operation of Comanche Peak during the LR term. Table 3-28 of this SEIS presents quantified annual GHG emissions from sources at Comanche Peak. Comanche Peak's direct GHG emissions result from onsite stationary and portable combustion. Indirect emission sources include those from workforce commuting.

Vistra has no plans to conduct refurbishment during the Comanche Peak LR term and, therefore, no GHG emissions from refurbishment or increases in GHG emissions from routine operations at Comanche Peak are anticipated. The NRC staff concludes that there would be no impacts on climate change beyond the impacts discussed in the 2023 LR GEIS and in Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 (TN250) of the proposed rule (88 FR 13329-TN8601). Based on this information, the NRC staff concludes that GHG impacts on climate change for the Comanche Peach LR term would be SMALL. Therefore, the environmental issue of GHG impacts on climate change are addressed.

G.9 Climate Change Impacts on Environmental Resources

With respect to climate change, the draft rule proposes to amend Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 by adding the new Category 2 issue "Climate change impacts on environmental resources." This new issue considers the additive effects of climate change on environmental resources that may also be directly affected by continued operations and refurbishment during the LR term. The effects of climate change can vary regionally and climate change information at the regional and local scale is necessary to assess trends and the impacts on the human environment for a specific location. The impacts of climate change on environmental resources during the LR term are location-specific and cannot be evaluated generically.

The issue of climate change impacts was not identified as either a generic or plant-specific issue in the 1996 LR GEIS and the 2013 LR GEIS. However, the 2013 LR GEIS described the environmental impacts that could occur on resource areas (land use, air quality, water resources, etc.) that may also be affected by LR. In plant-specific initial LR and SLR environmental reviews prepared since the development of the 2013 LR GEIS, the NRC staff has considered projected differences in climate changes in the United States and climate change impacts on the resource areas that could be incrementally affected by the proposed action as part of its cumulative impacts analysis. Accordingly, Section 3.15.3.6.1 of this SEIS) discusses the observed changes in climate and the potential future climate change across the southern Great Plains region of the United States during the Comanche Peak LR term based on climate model simulations under future global GHG emissions scenarios. The NRC staff considered regional projected climate changes from numerous climate assessment reports, including the U.S. Global Change Research Program, the Intergovernmental Panel on Climate Change, and the EPA. Furthermore, in Section 3.15.3.6 of this SEIS the NRC staff evaluated the impacts of climate change on environmental resources (air quality, and water resources.) where there are incremental impacts due to Comanche Peak LR.

G.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." TN250.

79 FR 48300. August 15, 2014. "National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities." *Federal Register*, Environmental Protection Agency. TN4488.

88 FR 13329. March 3, 2023. "Renewing Nuclear Power Plant Operating Licenses-Environmental Review." *Federal Register*, Nuclear Regulatory Commission. TN8601.

42 U.S.C. § 4321 et seq. U.S. Code Title 41, The Public Health and Welfare, Section 4321 "Congressional Declaration of Purpose." TN8608.

Magnuson-Stevens Fishery Conservation and Management Act. 16 U.S.C. § 1801 *et seq.* TN1061.

National Marine Sanctuaries Act, as amended. 16 U.S.C. § 1431 *et seq*. TN4482.

NRC (U.S. Nuclear Regulatory Commission). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Volumes 1 and 2, NUREG-1437, Washington, D.C. ADAMS Accession Nos. ML040690705, ML040690738. TN288.

NRC (U.S. Nuclear Regulatory Commission). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Addendum to Main Report, NUREG–1437, Volume 1, Addendum 1.* Washington, D.C. ADAMS Accession No. ML040690720. TN289.

NRC (U.S. Nuclear Regulatory Commission). 2009. "Memorandum and Order in the Matter of Duke Energy Carolinas, LLC (Combined License Application for William States Lee III Nuclear Station, Units 1 and 2) and Tennessee Valley Authority (Bellefonte Nuclear Power Plant, Units 3 and 4)." CLI-09-21, Rockville, Maryland. ADAMS Accession No. ML093070690. TN6406.

NRC (U.S. Nuclear Regulatory Commission). 2013. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Revision 1, Washington, D.C. ADAMS Package Accession No. ML13107A023. TN2654.

NRC (U.S. Nuclear Regulatory Commission). 2023. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Draft Report for Comment*. NUREG–1437, Revision 2, Washington, D.C. ADAMS Package Accession No. ML23011A063. TN7802.

NRC FORM 335 (12-2010) NRCMD 3.7 U.S. NUCLEAR REGULATORY COMMISSION **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*	1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) NUREG-1437 Supplement 60
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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

The U.S. Nuclear Regulatory Commission staff prepared this supplemental environmental impact statement (SEIS) as part of its environmental review of Vistra Generation Company, LLC application to renew the operating licenses for Comanche Peak Nuclear Power Plant, Units 1 and 2 (CPNPP) for an additional 20 years. This SEIS includes the NRC staff's evaluation of the environmental impacts of the license renewal and alternatives to license renewal.

Alternatives considered include:

(1) new small modular reactors
(2) natural gas-fired combined-cycle (NGCC) facility
(3) combination of solar photovoltaic, onshore wind, and new small modular reactor

The NRC staff's recommendation is that the adverse environmental impacts of license renewal for CPNPP are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)	13. AVAILABILITY STATEMENT
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Regarding License Renewal of Comanche Peak Nuclear Power Plant

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