

## Abstract

The U.S. Nuclear Regulatory Commission (NRC) considered the environmental effects of renewing nuclear power plant operating licenses for a 20-year period in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, and codified the results in 10 CFR Part 51. The GEIS (and its Addendum 1) identifies 92 environmental issues and reaches generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or to plants with specific design or site characteristics. Additional plant-specific review is required for the remaining issues. These plant-specific reviews are to be included in supplements to the GEIS.

This Supplemental Environmental Impact Statement (SEIS) has been prepared in response to an application submitted to the NRC by Entergy Operations, Inc. (Entergy) to renew the operating license (OL) of Arkansas Nuclear One, Unit 1 (ANO-1) for an additional 20 years under 10 CFR Part 54. This SEIS includes the staff's analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse effects. It also includes the staff's recommendation regarding the proposed action.

Neither Entergy nor the staff has identified significant new information for any of the 69 issues for which the GEIS reached generic conclusions and which apply to ANO-1. Therefore, the staff concludes for these issues that the impacts of renewing the ANO-1 OL will not be greater than the impacts identified in the GEIS for these issues. For each of these issues, the GEIS conclusion is that the impact is of SMALL significance (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and from spent fuel, which were not assigned a single significance level) and that additional mitigation measures are likely not to be sufficiently beneficial to be warranted.

Each of the remaining 23 issues that applies to ANO-1 is addressed in this SEIS. For each applicable issue, the staff concludes that the significance of the potential environmental effects of renewal of the OL is SMALL. The staff has not identified any new issue applicable to ANO-1 that has a significant environmental impact. The staff also concludes that additional mitigation measures are likely not to be sufficiently beneficial to be warranted.

The NRC staff recommends that the Commission determine that the adverse environmental impacts of license renewal for ANO-1 are not so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by Entergy; (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.



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## Executive Summary

By letter dated January 31, 2000, Entergy Operations, Inc. (Entergy) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license for Unit 1 of Arkansas Nuclear One (ANO-1) for an additional 20-year period. If the operating license is renewed, Federal (other than NRC) agencies, State regulatory agencies, and the owners of the plant will ultimately decide whether the plant will continue to operate. This decision will be 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, ANO-1 will be shut down on or before the expiration of the current operating license, which is May 20, 2014.

Under the National Environmental Policy Act of 1969 (NEPA), an environmental impact statement (EIS) is required for major Federal actions significantly affecting the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor operating license; 10 CFR 51.95(c) states that the EIS prepared at the operating license renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437.<sup>(a)</sup>

Upon acceptance of the Entergy application, the NRC staff began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and to conduct scoping. The staff visited the ANO-1 site in April 2000 and held public scoping meetings on April 4, 2000, in Russellville, Arkansas. The staff reviewed the Entergy Environmental Report (ER) and compared it to the GEIS, consulted with Federal, State, and local agencies, conducted an independent review of the issues following the guidance set forth in the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, NUREG-1555, Supplement 1, and considered the public comments received during the scoping process for preparation of the draft Supplemental Environmental Impact Statement (SEIS) for ANO-1 (issued on October 3, 2000). Two public meetings were held in Russellville, Arkansas, on November 14, 2000. During that time, the staff described the preliminary results of the NRC environmental review and were available to answer questions related to it in order to provide members of the public with information to assist them in formulating their comments. This SEIS includes the NRC staff's analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or

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(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

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avoiding adverse effects. It also includes the staff's recommendation regarding the proposed action.

The Commission has adopted the following definition of purpose and need for license renewal from the GEIS:

The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers.

The goal of the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to 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.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether ANO-1 continues to operate beyond the period of the current operating license.

The GEIS contains the results of a systematic evaluation of the consequences of renewing an operating license and operating a nuclear power plant for an additional 20 years. It contains a summary of the evaluation of 92 environmental issues using a three-level standard of significance—SMALL, MODERATE, or LARGE—based on Council on Environmental Quality guidelines. These significance levels are as follows:

**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 69 of the 92 issues considered in the GEIS, the analysis in the GEIS shows the following:

- (1) 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 plant or site characteristics.
- (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).
- (3) Mitigation of adverse impacts associated with the issue 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.

These 69 issues are identified in the GEIS as Category 1 issues. In the absence of significant new information, the staff relied on conclusions as amplified by supporting information in the GEIS for issues designated Category 1 in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

Of the 23 issues not meeting the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, are not categorized. Environmental justice was not evaluated on a generic basis and must also be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This SEIS documents the staff's evaluation of all 92 environmental issues considered in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that are considered include the no-action alternative (not renewing the ANO-1 operating license) and alternative methods of power generation. Among the alternative methods of power generation, coal-fired and gas-fired generation appear the most likely if the power from ANO-1 is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the ANO-1 site or an unspecified "greenfield" site.

Entergy and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither Entergy nor the staff has identified any significant new information related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither Entergy nor the staff

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has identified any new issue applicable to ANO-1 that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all 69 Category 1 issues.

The staff has reviewed the Entergy analysis for each Category 2 issue and has conducted an independent review of each issue. Five Category 2 issues are not applicable to ANO-1 because they are related to plant design features or site characteristics not found at ANO-1. Four Category 2 issues are not discussed in this SEIS because they are specifically related to refurbishment. Five additional Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in relation to operation during the renewal term. Entergy has stated that their evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications necessary to support the continued operation of ANO-1 beyond the end of the existing operating license. In addition, routine replacement of components or additional inspection activities are within the bounds of normal plant component replacement and, therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the *Final Environmental Statement* for ANO-1.

Twelve Category 2 issues, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this SEIS. For all 12 Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff determined that a consensus has not been reached by appropriate Federal health agencies that there are adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Although one cost-beneficial SAMA was identified, further evaluation by Entergy showed that this issue was already adequately addressed in the operations training cycle. Therefore, no further action is necessary as part of license renewal pursuant to 10 CFR Part 54.

Mitigation measures were considered for each Category 2 issue. Current measures to mitigate environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted. In addition, no new issues that were not considered in the GEIS have been identified.

In the event that the ANO-1 operating license is not renewed and the unit ceases to operate on or before the expiration of its current operating license, the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of ANO-1. The impacts may, in fact, be greater in some areas.

| The NRC staff recommends that the Commission determine that the adverse environmental impacts of license renewal for ANO-1 are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the ER submitted by Entergy; (3) consultation with other Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

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## Abbreviations/Acronyms

ac	alternating current
ADEQ	Arkansas Department of Environmental Quality
ADH	Arkansas Department of Health
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
AFW	auxiliary feedwater
AGFC	Arkansas Game and Fish Commission
ALARA	as low as reasonably achievable
ALI	annual limits on intake
ANHC	Arkansas Natural Heritage Commission
ANO	Arkansas Nuclear One
ANO-1	Arkansas Nuclear One, Unit 1
ANO-2	Arkansas Nuclear One, Unit 2
AOC	averted offsite property damage cost
AOE	averted occupational exposure
AOSC	averted onsite cost
APE	averted public exposure
ASHPO	Arkansas State Historic Preservation Office
ASWCC	Arkansas Soil and Water Conservation Commission
ATWS	anticipated transient without scram
AX	accident sequence
Btu	British thermal unit
BWST	borated water storage tank
CD	core damage
CDF	core damage frequency
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cm	centimeter
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
CoE	U.S. Army Corps of Engineers
COE	cost of enhancement
CWA	Clean Water Act

## Abbreviations and Acronyms

DAW	dry active waste
DBA	design basis accident
dc	direct current
DG	diesel generator
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EDG	emergency diesel generator
EFW	emergency feedwater
EIS	environmental impact statement
ELF-EMF	extremely low frequency-electromagnetic field
EOP	emergency operating procedure
EPA	U.S. Environmental Protection Agency
ER	environmental report
ESRP	Environmental Standard Review Plan for License Renewal
FES	final environmental statement
FERC	Federal Energy Regulatory Commission
FR	Federal Register
FSAR	final safety analysis report
ft	feet
FWPCA	Federal Water Pollution Control Act (also known as the Clean Water Act)
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement
gpd	gallons per day
gpm	gallons per minute
GTGs	gas turbine generators
GWPS	gaseous waste processing system
ha	hectare
HEPA	high-efficiency particulate air (filter)
HLW	high-level waste
HSAW	high specific activity waste
HVAC	heating, ventilation, and air conditioning
HX	heat exchanger
IA	instrument air
ICW	intermediate cooling water
in.	inch

## Abbreviations and Acronyms

IPA	integrated plant assessment
IPE	individual plant examination
IPEEE	individual plant examination for external events
ISFSI	independent spent fuel storage installation
ISLOCA	interfacing system loss-of-coolant accident
J	Joule
kg	kilogram
km	kilometer
kV	kilovolt
L	liter
LOCA	loss-of-coolant accident
LOSP	loss of offsite power
LWR	light-water reactor
m	meter
mA	milliampere
mi	mile
mL	milliliter
MT	metric ton (or tonne)
MTU	metric ton-uranium
MWd	megawatt-day
MW(e)	megawatt(electric)
MWh	megawatt-hour
MW(t)	megawatt(thermal)
mGy	milligray
MSIVs	main steam isolation valves
mSv	millisievert
NA	not applicable
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
NIEHS	National Institute of Environmental Health Sciences
NO <sub>x</sub>	oxide(s) of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation

## Abbreviations and Acronyms

ODCM	Offsite Dose Calculation Manual
OL	operating license
person-Sv	person Sievert
PM <sub>2.5</sub>	particulate matter having a diameter of 2.5 microns or less
PM <sub>10</sub>	particulate matter having a diameter of 10 microns or less
PORV	power operated relief valve
PSA	probabilistic safety assessment
PSI	pollutant standards index
RAI	request for additional information
RCP	reactor coolant pump
RCRA	Resource Conservation and Recovery Act of 1976
REMP	radiological environmental monitoring program
RHR	residual heat removal
RRW	risk reduction worth
RW	river water
7Q10	once-in-10-year weekly minimum flow
SCR	selective catalytic reduction
SAMA	severe accident mitigation alternative
SBO	station blackout
SEIS	supplemental environmental impact statement
SGs	steam generators
SGTR	steam generator tube rupture
SO <sub>2</sub>	sulfur dioxide
SO <sub>x</sub>	oxide(s) of sulfur
SRWP	Solid Radioactive Waste Program
TDP	turbine-driven pump
TVA	Tennessee Valley Authority
W	watt
yr	year