

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.^(a)

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

(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 ₂ | 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 _x | 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 _{2.5} | particulate matter having a diameter of 2.5 microns or less |
| PM ₁₀ | 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 ₂ | sulfur dioxide |
| SO _x | oxide(s) of sulfur |
| SRWP | Solid Radioactive Waste Program |
| TDP | turbine-driven pump |
| TVA | Tennessee Valley Authority |
| W | watt |
| yr | year |