

RECORD OF DECISION
U.S. NUCLEAR REGULATORY COMMISSION
DOCKET NO. 50-346
LICENSE RENEWAL APPLICATION FOR THE
DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1

BACKGROUND:

The U.S. Nuclear Regulatory Commission (NRC or Commission) received an application, dated August 27, 2010, from FirstEnergy Nuclear Operating Company (FENOC), filed pursuant to Section 103 of the Atomic Energy Act of 1954, as amended, and Title 10 of the *Code of Federal Regulation* (CFR) Part 54, to renew the operating license for the Davis-Besse Nuclear Power Station (Davis-Besse), Unit 1. Renewal of the license would authorize FENOC to operate for an additional 20 year period beyond that specified in the current operating license.

Davis-Besse is a single-unit nuclear powered steam electric generating facility that began commercial operation on April 22, 1977. The nuclear reactor is a Babcock and Wilcox designed pressurized-water reactor (PWR) producing a reactor core rated thermal power of 2,772 megawatts (MWt). The nominal net electric capacity is 908 megawatts electric (MWe). The current operating license for Davis-Besse, Unit 1 (NPF-3), expires on April 22, 2017.

On October 25, 2010, the NRC published a *Federal Register* Notice of Acceptance and Opportunity for hearing (75 FR 65528) and began the environmental review process. Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA), directs that an environmental impact statement (EIS) be prepared for major Federal actions that have the potential to significantly affect the quality of the human environment. The NRC's Federal action is to decide whether to renew the license for Davis-Besse for an additional 20 years.

Consistent with 10 CFR Part 51, the NRC staff published in the *Federal Register* (FR) a Notice of Intent to prepare an EIS and conduct scoping (75 FR 66399). On November 4, 2010, the NRC held two public meetings at the Camp Perry Conference Center in Port Clinton, Ohio to obtain public input on the scope of the environmental review. The NRC staff reviewed the oral and written comments received during the scoping process and contacted Federal, State, Tribal, regional and local agencies to solicit comments. A Scoping Summary Report was issued in October 2013 (ML11168A197).

The NRC's environmental review involved preparation of an EIS, which is a supplement to the Commission's NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants" (GEIS). See 10 CFR 51.95(c). The GEIS documented the results of the NRC staff's systematic approach to evaluate the environmental consequences of renewing the license of individual nuclear power plants and operating them for an additional 20 years. NRC staff analyzed in detail and resolved those environmental issues that could be resolved generically in the GEIS.

The GEIS identified generic issues (Category 1) and site specific issues (Category 2). For Category 1 issues, no additional site-specific analysis is required in the supplemental EIS (SEIS) unless new and significant information is identified. For Category 2 issues, an additional site-specific review is required, and the results are documented in the SEIS.

FENOC submitted its license renewal application and environmental report under NRC's 1996 rule governing license renewal environmental reviews (61 FR 28467, as amended)¹, as codified in NRC's environmental protection regulations in 10 CFR Part 51. The 1996 GEIS² and Addendum 1³ to the GEIS provided the technical basis for the list of NEPA issues and associated environmental impact findings for license renewal contained in Table B-1 in Appendix B to Subpart A of 10 CFR Part 51. For Davis-Besse, the NRC staff initiated its environmental review in accordance with the 1996 rule and GEIS. Neither FENOC nor the NRC staff identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. This conclusion is supported by the NRC staff's review of FENOC's environmental report and other documentation relevant to FENOC's activities, the public scoping process and substantive comments raised, and the findings from the environmental site audit conducted by the NRC staff.

On June 20, 2013, the NRC published a final rule (78 FR 37282)⁴ revising 10 CFR Part 51, including the list of NEPA issues and findings in Table B-1. A revised GEIS⁵, which updates the 1996 GEIS, provides the technical bases for the final rule. The revised GEIS specifically supports the revised list of NEPA issues and associated environmental impact findings for license renewal contained in Table B-1 in Appendix B to Subpart A of the revised 10 CFR Part 51. The revised GEIS and final rule reflect lessons learned and knowledge gained during previous license renewal environmental reviews. Under NEPA, the NRC must consider and analyze in the SEIS the potential significant impacts described by the final rule's new Category 2 issues. If any new and significant information is identified for the final rule's new Category 1 issues, the potential significant impacts must be described.

Therefore, for the Davis-Besse license renewal, the NRC staff also reviewed information relating to the new issues identified in the final rule and 2013 GEIS, specifically, geology and soils; radionuclides released to the groundwater; effects on terrestrial resources (noncooling system intake); exposure of terrestrial organisms to radionuclides; exposure of aquatic organisms to radionuclides; human health impacts from chemicals; physical occupational hazards; environmental justice; and cumulative impacts. These issues are documented in the Davis-Besse SEIS.

¹61 FR 28467. U.S. Nuclear Regulatory Commission. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register* 61 (109): 28467-28497. June 5, 1996.

²U.S. Nuclear Regulatory Commission. 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Washington, DC. NUREG-1437. May 1996. Agencywide Documents Access & Management System (ADAMS) Accession Nos. ML040690705 and ML040690738.

³U.S. Nuclear Regulatory Commission. 1999. Section 6.3-Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants. In: *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Washington, DC. NRC. NUREG-1437, Volume 1, Addendum 1. August 1999. ADAMS Accession No. ML040690720.

⁴78 FR 37282. U.S. Nuclear Regulatory Commission. "Revisions to Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register* 78 (119): 37282-37324. June 20, 2013.

⁵U.S. Nuclear Regulatory Commission. 2013. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Washington, DC. NUREG-1437, Revision 1, Volumes 1, 2, and 3. June 2013. ADAMS Accession Nos. ML13106A241, ML13106A242, and ML13106A244.

The NRC issued a draft plant-specific SEIS for public comment in support of the Davis-Besse license renewal application on February 26, 2014 (ADAMS Accession No. ML14050A290). A 45-day comment period began on the date of publication of the U.S. Environmental Protection Agency (EPA) Notice of Availability of the filing of the draft SEIS to allow members of the public and agencies to comment on the results of the environmental review. On March 25, 2014, the NRC conducted two public meetings at Camp Perry Conference Center in Port Clinton, Ohio to describe the results of the environmental review, respond to questions, and accept public comments. All comments received during the comment period are included in Appendix A of the final SEIS.

The NRC issued the final plant-specific SEIS in support of the Davis-Besse license renewal application on April 24, 2015 (ADAMS Accession Nos. ML15112A098 (Volume 1) and ML15113A187 (Volume 2)). While preparing the final SEIS, neither FENOC nor the NRC staff identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. In the final SEIS, the NRC staff concluded that the adverse environmental impacts of license renewal for Davis-Besse are not great enough to deny the option of license renewal for energy-planning decision-makers.

Pursuant to 10 CFR 51.102(b) and 51.103(a)(1)(5), the NRC staff has prepared this Record of Decision (ROD) to accompany its action on the Davis-Besse license renewal application. This ROD incorporates by reference materials contained in the FSEIS. See 10 CFR 51.103(c).

DECISION:

The NRC makes the decision to grant or deny the 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. The results of the safety review are documented in the safety evaluation reports (SER) (ADAMS Accession Nos. ML13248A267 and ML15196A429). By letter dated November 12, 2015, the Advisory Committee of Reactor Safeguards (ACRS) notified the Commission of the ACRS's recommendation to approve the application for renewal of Davis-Besse's operating license (ADAMS Accession No. ML15316A125), and by letter dated December 1, 2015, the NRC staff responded to the ACRS (ADAMS Accession No. ML15307A191).

This ROD and the FSEIS document the NRC's decision for the environmental review that the adverse environmental impacts of license renewal for Davis-Besse are not so great that preserving the option of license renewal for energy planning decision-makers would be unreasonable. See 10 CFR 51.103(a)(5). Under its renewed license, FENOC will be able to continue operating Davis-Besse unit 1 for an additional 20 years beyond the expiration of the operating license, as requested in the license renewal application, plus the remaining number of years on the operating license currently in effect.

PURPOSE AND NEED:

As identified in Section 1.2, "Purpose and Need for the Proposed Action," of the FSEIS, 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 energy-planning decision-makers, such as State, utility, and, where authorized, Federal agencies (other than NRC). This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the

Atomic Energy Act or findings in the NEPA environmental analysis that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions as to whether a particular nuclear power plant should continue to operate.

Ultimately, the appropriate energy-planning decision-makers and FENOC will 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.

NRC EVALUATION OF ALTERNATIVES:

Section 102(2)(C)(iii) of NEPA states that an EIS is to include a detailed statement analyzing alternatives to the proposed action. In this case the proposed action is issuance of a renewed license for the Davis-Besse plant, which will allow the plant to operate for 20 years beyond its current license expiration dates. Chapter 8, "Environmental Impacts of Alternatives," of the SEIS presents the NRC staff's evaluation and analysis of alternatives to license renewal. The evaluation of each alternative considered the environmental impacts across several impact categories: air quality, groundwater use and quality, surface water use and quality, terrestrial ecology, aquatic ecology, human health, land use, socioeconomics, transportation, aesthetics, historic and archaeological resources, environmental justice, and waste management. A three level standard of significance was used to indicate the intensity of the environmental effects for each alternative that was considered in-depth. NRC's standard of significance for impacts was established using the Council on Environmental Quality (CEQ) terminology for "significant." The three levels of significance for potential impacts are SMALL, MODERATE, and LARGE, as defined below.

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

MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

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

In evaluating alternatives to license renewal, the NRC considered energy technologies or options currently in commercial operation, as well as some technologies not currently in commercial operation but likely to be commercially available by the time the current Davis-Besse operating license expires. The current operating license for Davis-Besse reactor will expire on April 22, 2017, and reasonable alternatives must be available (constructed, permitted, and connected to the grid) by the time the current Davis-Besse license expires to be considered likely to become available.

In some cases, the NRC considers the environmental effects of locating an alternative at the existing plant site. Selecting the existing plant site allows for the maximum use of existing transmission and cooling system infrastructures and minimizes the overall environmental impact. However, in the case of Davis-Besse, there may not be sufficient land available to site some of the alternatives evaluated while, at the same time, allowing the continued operation of the reactor until its license expiration date.

To ensure that the alternatives analysis is consistent with State or regional energy policies, the NRC staff reviewed energy related statutes, regulations, and policies within the State of Ohio,

including, for example, state renewable portfolio standards (RPS). The State of Ohio has established an RPS that requires electricity providers to obtain a minimum percentage of their power through renewable energy resources or energy efficiency measures or both. The RPS requirement for Ohio was adopted in 2008 and requires at least 12.5 percent of all electricity sold in the State to come from renewable sources by 2027, at least half of which must be generated within the State. Half of the standard (12.5 percent of the electricity sold) must be met using renewable sources such as wind, solar, hydroelectric power, geothermal, and biomass. The other half can be met through alternative energy resources such as third-generation nuclear power plants, fuel cells, energy-efficiency programs, and clean coal technology⁶. As a result, the NRC staff considered a combination alternative that included wind power, solar photovoltaic power, and natural gas-fired combined-cycle (NGCC).

The NRC staff initially considered a number of additional alternatives for analysis as alternatives to the license renewal of Davis-Besse; these were later dismissed because of technical, resource availability, or commercial limitations that currently exist and that the NRC staff believes are likely to continue to exist when the existing Davis-Besse license expires, rendering these alternatives not feasible and commercially viable. The no action alternative (i.e., not renewing the Davis-Besse operating license and the effects it would have was also considered by the NRC staff.

Where possible, the NRC staff evaluated potential environmental impacts for these alternatives located both at the Davis-Besse site and at some other existing power plant site or brownfield site. Alternatives considered, but dismissed, were:

- new nuclear
- wind power;
- wind power with compressed air energy storage
- solar power;
- solar power with compressed air energy storage
- wood waste;
- conventional hydroelectric power;
- ocean wave and current energy;
- geothermal power;
- municipal solid waste;
- biofuels;
- oil-fired power;
- fuel cells;
- coal-fired integrated gasification combined cycle;
- energy conservation and energy efficiency; and
- purchased power.

Each alternative eliminated from detailed study and the basis for its removal is provided in Section 8.4 of the final SEIS.

The alternatives analyzed in detail included not renewing the Davis-Besse operating license (the no-action alternative) and other viable methods of power generation. Impacts of all alternatives considered in detail are summarized in Table 8-6 of the final SEIS. The feasible and commercially viable replacement power alternatives considered in-depth were:

⁶ This information is available on the Public Utilities Commission of Ohio website: <http://www.puco.ohio.gov/puco/index.cfm/industry-information/industry-topics/ohioe28099s-renewable-and-advanced-energy-portfolio-standard/#sthash.aMwukixl.dpbs>.

- NGCC;
- combination of wind, solar, and NGCC; and
- supercritical pulverized coal (SCPC).

ALTERNATIVE EVALUATION:

i. No-Action Alternative

The no-action alternative refers to a scenario in which the NRC denies the renewed operating license for Davis-Besse and the license expires at the end of the current license term. If the NRC denies the renewed operating license, the plant will shut down at or before the end of the current license. After shut down, the plant operators will initiate decommissioning in accordance with 10 CFR 50.82.

Assuming that a need currently exists for the power generated by Davis-Besse, the no-action alternative would require the appropriate energy planning decision-makers (not the NRC) to rely on an alternative to replace the capacity of Davis-Besse, rely on energy conservation or power purchases to offset parts of the Davis-Besse capacity, or rely on some combination of measures to offset and replace the generation provided by the facility. Therefore, the no-action alternative does not satisfy the purpose and need for the FSEIS, as it neither provides power-generation capacity nor meets the needs currently met by Davis-Besse or that the alternatives evaluated in detail would satisfy.

ii. Alternative Energy Sources

NGCC Alternative: The NRC staff evaluated the environmental impacts from construction and operation of a new 910 MW NGCC facility. Typical power-trains for large-scale NGCC power generation would involve one, two, or three combined-cycle units, available in a variety of standard sizes, mated to a heat-recovery steam generator. Appropriately sized units could produce electrical power in amounts equivalent to the Davis-Besse reactor. The combined cycle units are presumed to each be similar in operation to General Electric's (GE's) Advanced F Class design, equipped with dry-low-nitrogen oxide combustors to suppress nitrogen oxide formation and selective catalytic reduction of the exhaust with ammonia for post-combustion control of nitrogen oxide emissions. Installing the NGCC facility on the Davis-Besse site would allow for the fullest use of existing infrastructure, such as transmission lines and cooling systems, and minimize construction impacts. There is only a limited amount of buildable vacant land available on the Davis-Besse site while allowing the reactor to continue operating until license expiration. However, the relatively modest footprint of an NGCC power plant, together with the expectation that the existing cooling tower and substation would be used to support the NGCC alternative, supports the conclusion that an NGCC facility could be installed on the Davis-Besse site. An NGCC alternative would also require a pipeline to deliver natural gas to the site. Depending on the availability of pipeline capacity, the existing pipeline transmission system may require some upgrades to support the new facility.

Combination Alternative: The NRC staff evaluated the alternative that included the combination of solar, wind and NGCC to replace the baseload capacity currently supplied by Davis-Besse. This combination includes 1,500 MW of installed wind capacity spread over multiple sites and 400 MW of installed solar photovoltaic (PV) capacity, with 305 MW of NGCC capacity to provide the balance of capacity needed to replace Davis-Besse. All wind projects would be land-based because there are currently no operating offshore wind projects in the United States.

The feasibility of wind as a baseload power source depends on the availability, accessibility, and constancy of the wind resource within the region of interest. While Davis-Besse can produce electricity constantly, the electricity produced by wind power installations will vary depending upon wind conditions. While 1,500 MW of installed wind capacity will be available across multiple locations, only about 315 MW would be considered available for baseload power, at any given time. The wind component of the combination alternative also assumes 360 MW would be used to power the Norton Energy Storage Project Compressed Air Energy Storage (CAES) facility. Generally, wind power cannot be stored without first being converted to electrical energy. In CAES, an electric motor uses excess electricity to pump air into an underground, pressurized cavity. When electricity is needed, the compressed air is heated and expanded in an expansion turbine which drives a generator to produce electricity. Natural gas provides the heat to increase the pressure and power the turbine. The Norton Energy Storage Project CAES facility would be able supply electricity to the transmission grid system when the wind is not blowing.

The combination alternative included 400 MW of installed solar PV capacity. Solar PV systems use solar panels to absorb and convert sunlight into electricity, a solar inverter to convert the electric current from direct current to alternating current, and then connects to the transmission grid system. Approximately, 400 MW of new solar PV capacity needs to be installed by 2017 to replace part of the baseload provided by Davis-Besse. This projected solar PV capacity exceeds currently planned utility-scale installations in Ohio but this capacity may be achievable due to the short lead times necessary for PV installations. The solar component of this alternative also accounts for 75 MW that would be used to store power at the Norton Energy Storage Project, which would then provide electricity to the grid when the sun is not shining or is less intense.

Finally, this combination alternative contains a 305-MW NGCC unit, built at the Davis-Besse site, capable of within-day cycling to provide the remaining 158 MW of Davis-Besse's capacity and to provide back-up capacity to the wind and solar installations with the remaining capacity. As needed, this alternative also provides additional output to the Norton Energy Storage project during times when the unit would otherwise function in a spinning-reserve or hot-standby mode. The NRC staff notes that this NGCC unit would spend a substantial amount of time either generating electricity to account for variable wind and solar outputs or functioning as spinning reserve.

SCPC Alternative: With the SCPC alternative, the NRC staff assumes that two equal-sized boiler/steam turbine generator power-trains, operating independently and simultaneously, would likely be used to match the power output of Davis-Besse. To complete this analysis, the NRC staff presumed that all powertrains would have the same features, operate at generally the same conditions, have similar impacts on the environment, and be equipped with the same pollution-control devices such that once all parasitic loads are overcome, the net power available would be equal to 908 MWe. Various bituminous coal sources are available to coal-fired power plants in Ohio. In 2008, the State of Ohio produced electricity from coal with heating values of 11,444 British thermal units per pound, sulfur content of 1.96 percent, and ash of 9.42 percent⁷ (EIA 2010b). For the purpose of this evaluation, NRC presumes that coal burned in 2008 will be representative of coal that would be burned in a coal-fired alternative regardless of where it was located. Approximately one-third of the coal burned in Ohio in 2008 came from mines in the Appalachian basin in the eastern part of the State. The remaining coal was brought in primarily by railcar and river barge from West Virginia, Wyoming, Kentucky, and

⁷ U.S. Energy Information Administration. *Cost and Quality of Fuels for Electric Plants 2009 Edition, Table 15A Destination and Origin of Coal to Electric Plants by State: Total (All Sectors), 2010.* November 2010.

Pennsylvania. Air emissions effects will be greater for SCPC due to increased greenhouse gas emissions during operation. Impacts to land use would also be greater due to construction and because additional land may be needed for frequent coal and limestone deliveries by rail or barge. The impacts to socioeconomics would greatly increase due to the loss of high paying jobs at Davis-Besse, with corresponding reduction in purchasing activity and tax contributions to the regional economy. Additionally, transportation impacts related to construction activities would be greater because train deliveries of power plant components and material could cause additional traffic delays at railroad crossings.

iii. Summary

In the April 2015 Davis-Besse FSEIS, the NRC staff considered the environmental impacts associated with license renewal, and alternatives to license renewal, including other methods of power generation and not renewing the Davis-Besse operating license (the no-action alternative). The Davis-Besse FSEIS concluded that the continued operation of Davis-Besse during the license renewal term would have SMALL environmental impacts in all areas, except historical & archaeological resources, where the impact would be SMALL to MODERATE. The Davis-Besse FSEIS concluded that the environmental impacts of renewal of the operating license for Davis-Besse would be smaller than those of the feasible and commercially viable replacement power alternatives considered. The FSEIS concluded that under the no-action alternative, the act of shutting down Davis-Besse on or before its license expiration would have mostly SMALL impacts, although socioeconomic impacts would be SMALL to MODERATE. The NRC staff concluded that environmental impacts of license renewal for Davis-Besse would be smaller than those of replacement power alternatives.

MITIGATION MEASURES:

The NRC has taken all practicable measures within its jurisdiction to avoid or minimize environmental harm from the alternative selected. Continued operation of Davis-Besse would have SMALL environmental impacts in all resources areas except historical & archaeological resources which would be SMALL to MODERATE. FENOC has formal guidelines in place for protecting historic and archaeological resources. FENOC will consult with the Ohio State Historic Preservation Office prior to ground-disturbing activities. Additionally, FENOC has a procedure in place which requires work to be stopped and consultation with the Ohio State Historic Preservation Office is any human remains or archaeological, cultural, or historic resource is encountered.

While NRC is not requiring any mitigation measures for continued operation of Davis-Besse, the National Pollutants Discharge Elimination System (NPDES) permit does impose mitigation measures to ensure that the impacts to water quality are minimal during the continued operation of Davis-Besse. The NRC is not imposing any license conditions in connection with mitigation measures. Additionally the NRC is not requiring any new environmental monitoring programs outside what is required for the NPDES and Delaware River Basin Commission permits.

DETERMINATION:

Based on an independent review, analysis and evaluation contained in the license renewal FSEIS; careful consideration of all the identified social, economic, environmental factors, and

input received from other agencies, organizations and the public; and the factors and mitigation measures outlined above, it is determined that the standards for issuance of a renewed license, as described in 10 CFR 54.29 have been met and the requirements of Section 102 of NEPA have been satisfied.

APPROVED BY:

/RA/

Christopher G. Miller, Director
Division of License Renewal
Office of Nuclear Reactor Regulation

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