Environmental Reviews for Nth-of-a-Kind Microreactors

This enclosure describes the NRC staff's strategy for the most efficient environmental review processes in support of licensing and deployment of nth-of-a-kind (NOAK) microreactors.

Background

As a Federal agency, the U.S. Nuclear Regulatory Commission (NRC) must assess the environmental effects of its proposed major actions, including licensing actions, before making decisions.[1] The NRC complies with the National Environmental Policy Act (NEPA) through its regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," as noted in 10 CFR 51.10, "Purpose and scope of subpart; application of regulations of Council on Environmental Quality." There are three environmental review alternatives under 10 CFR Part 51, depending on whether an action significantly affects the environment. These three alternatives are categorical exclusion (CATX), environmental assessment (EA), and environmental impact statement (EIS):

- **CATX**: CATXs are certain NRC licensing, regulatory, and administrative actions specified in 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," that the NRC has determined do not individually or cumulatively have a significant environmental impact.

- **EA**: EAs are prepared for all licensing and regulatory actions except those identified as requiring an EIS under 10 CFR 51.20, "Criteria for and identification of licensing and regulatory actions requiring environmental impact statements"; those that do not meet the CATX criteria at 10 CFR 51.22(c); and those identified in 10 CFR 51.22(d) as other actions not requiring environmental review. Based on the EA, the NRC determines one of two ways to proceed:

    - Prepare a "finding of no significant impact" (FONSI), which indicates that the NRC determined the action will not have a significant impact on the environment.

    - Prepare an EIS, which indicates that the NRC determined that the proposed action has the potential to significantly impact the environment.

- **EIS**: EISs are prepared for "major Federal actions significantly affecting the quality of the human environment" or for proposed actions that the Commission, as a matter of discretion, determines should be covered by an EIS. The NRC's regulations at 10 CFR 51.20(b) identify categories of actions requiring preparation of an EIS.

---

[1] The information in this enclosure focuses on the environmental aspects of licensing. The vote topic on standardized operational programs in the main paper, supporting information in Enclosure 1, "Standardization of Operational Programs for Nth-of-a-Kind Microreactors," and several information topics in Enclosure 3, "Technical, Licensing, and Policy Considerations for Nth-of-a-Kind Microreactors," focus on the safety aspects of license applications and related NRC staff reviews. Although this paper treats the safety and environmental aspects of licensing separately, NRC safety and environmental reviews would likely be performed in parallel in a coordinated manner.

The NRC staff has prioritized the development of strategies for more predictable and efficient licensing and regulation of smaller power reactors, such as small modular reactors and microreactors. An example of recent policy development work is COL-ISG-029, “Environmental Considerations Associated with Micro-reactors,” dated October 20, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20252A076), which lays out a strategy for tailoring environmental reviews to microreactors.

The NRC staff has developed alternatives to current NRC approaches to satisfying NEPA to prepare for the environmental evaluation of microreactor applications. The alternatives are not mutually exclusive, and the NRC staff may combine elements of multiple alternatives to meet emerging conditions as plans for microreactor development progress through, for example, design finalization, creation of a supply chain, or manufacturing plans. Certain environmental review alternatives might be best suited either to specific microreactor designs or to a large number of microreactor designs that can be considered generically because of their common features, such as size and power levels. Furthermore, the NRC staff envisions implementing elements of multiple alternatives sequentially to apply lessons learned over time, as the agency gains experience reviewing microreactor applications.

In keeping with NEPA, each of the environmental review alternatives would involve participation from interested and affected parties, including members of the public. The EIS and generic environmental impact statement (GEIS) processes, relied upon in Alternatives E1 and E2, represent the most in-depth level of environmental review and public participation, including a scoping period and a public comment period on the draft EIS. An EA (under Alternative E2 or E3) would involve less public participation, because the public may only have the opportunity to comment on a draft FONSI unless a public scoping process is utilized. Alternative E4 would involve public participation in the potential 10 CFR 51.22(c) rulemaking that would codify a CATX for a specific reactor or set of reactors but would not involve public participation on the environmental effects of individual actions for which the application meets the criteria for categorical exclusion. As explained below, other requirements, e.g., for consultation, may still apply to such actions.

Some of the environmental alternatives presented below apply the concepts of a plant parameter envelope (PPE) and site parameter envelope (SPE) as defined and developed in NUREG -2249, “Generic Environmental Impact Statement for Licensing of New Nuclear Reactors, Draft Report for Comment” (NR GEIS), issued September 2024 (NRC, 2024a). A PPE consists of parameters for specific reactor design features independent of the site. Examples include the footprint of disturbance, building height, water use, air emissions, employment levels, and noise generation levels. For each PPE parameter, the NR GEIS presents a set of bounding values and assumptions underlying the associated analysis of environmental impacts. The NR GEIS introduces the SPE as a set of site-related parameters such as site size, size of water bodies supplying water to the reactor, and regional demographics. As for the PPE, the NR GEIS presents a set of bounding values and assumptions for each SPE parameter that underlies the associated analysis of environmental impacts. Additionally, the National Reactor Innovation Center (NRIC) at Idaho National Laboratory developed a report on advanced nuclear reactor PPEs to facilitate environmental reviews of potential future advanced reactor demonstration projects at Idaho National Laboratory and elsewhere in the United States (PNNL, 2021). The NRIC report developed PPEs for two size ranges: (1) a microreactor, which is defined for this PPE as a single unit with a power output of 60 megawatts thermal (MWt) power or less, and (2) a small- to medium-sized advanced reactor with a power output above 60 MWt and up to 1,000 MWt. The NRIC report may help NRC staff in developing PPE and SPE for some microreactor designs.

Alternatives

This enclosure explores alternatives the staff is considering for tailoring the NRC environmental evaluation processes to provide the simplicity, efficiency, and timeliness appropriate to the unique needs of microreactors, which are expected to be substantially smaller projects with less potential for significant environmental impact than the reactors typically licensed by NRC. In further developing or implementing these options, the staff would seek Commission direction should the staff identify a significant policy issue. To help support preparation of this enclosure, the NRC staff directed a contractor to prepare a paper summarizing the efforts of other Federal and State agencies to streamline environmental review processes for repetitive licensing and permitting actions (PNNL, 2024). Following its review of NRC environmental review processes and those of other agencies, the NRC staff developed the following four alternatives:

Alternative E1: Ongoing environmental streamlining

Alternative E2: Design-specific generic environmental impact statement

Alternative E3: Generic microreactor online portal with a streamlined NEPA process

Alternative E4: Design-specific categorical exclusions

The NRC staff is considering whether it would be appropriate to select and implement one or more of the alternatives in the near term and implement other alternative(s) in the long term. Figure 2 provides the initial thoughts by the NRC staff on the potential environmental process timeframes for Alternatives 2 through 4 in relation to when a microreactor could complete manufacturing. The data, outreach, and time needed to complete environmental requirements other than NEPA (e.g., consultations) can add schedule risk. However, the NRC is also considering and implementing several ways to effectively minimize the additional risk, such as using alternative approaches for conducting the consultations. This is discussed in more detail below in the section “Considerations with Respect to Other Environmental Requirements and Consultations.”

Alternative E1—Ongoing Environmental Streamlining

Alternative E1 represents the application to microreactors of ongoing efforts by the NRC staff to streamline environmental reviews. The NRC staff will continue to modernize environmental reviews in its fulfillment of the agency’s NEPA obligations as discussed in public meetings and on the NRC’s Environmental Center of Expertise’s public website (https://www.nrc.gov/about-nrc/regulatory/licensing/ecoe.html).

Implementation

Under this alternative, the NRC staff would apply the existing NRC NEPA review process to microreactors. The existing NRC process requires preparation of an EIS for each power reactor license application (such as an application for a construction permit (CP), operating license, combined license, or early site permit). The EIS process represents the most in-depth level of environmental review and public participation. The NRC staff would retain the ability to consider exemptions from parts of 10 CFR Part 51 requiring an EIS, thereby allowing use of an EA instead of an EIS if it appears that an EA may be able to support a FONSI. The existing regulations at 10 CFR 51.20 require an EIS for the issuance of a full-power or design-capacity

license to operate a nuclear power plant (which would include microreactors). However, an EIS could tier from the NR GEIS, once finalized, which is expected to reduce the time and resources required for environmental reviews. As an example, the NRC staff developed an EA for the review of the application for the two Kairos Hermes 2 test reactors using exemptions, which the NRC granted in November 2024. The NRC staff could typically prepare an EA in about a year, while an EIS could take up to 2 years. (Preparation of an EA for the Hermes 2 reactors would not have saved any time if the EA had not provided a basis for a FONSI.)

The NRC staff is also implementing Congressional direction in the Fiscal Responsibility Act of 2023 (FRA). The FRA requires specific changes to Federal agencies' NEPA practices. Implementation of the FRA will continue to result in a more streamlined NEPA process than the one existing under current NRC regulations in 10 CFR Part 51. For example, for all environmental reviews, the NRC staff plans to consider exemptions from 10 CFR 51.20(b) on a case-by-case basis with appropriate communication to the Commission. In addition, NRC staff proposed a rulemaking in SECY-24-0046, "Implementation of the Fiscal Responsibility Act of 2023 National Environmental Policy Act Amendments," which would provide more flexibility in the type of environmental document that is developed.

Implementation Considerations

- Under this alternative, the NRC staff would continue to use existing practices, which are well established and would not require rulemaking or substantial changes in NRC staff processes.

- EISs provide a high level of public involvement and transparency.

- This alternative would not typically involve higher effort level for first-of-a-kind licensing, and FRA implementation should improve upon the existing process.

- Although some efficiencies could be gained in repeating the environmental review process for each NOAK application, such repetition for each application would result in redundancy, schedule impacts, and greater long-term costs.

Alternative E2—Design-Specific Generic Environmental Impact Statement

Under this alternative, the NRC staff would develop a design-specific GEIS for each new standard microreactor design to generically analyze additional environmental topics or resource impacts beyond those analyzed in the NR GEIS. Each design-specific GEIS could tier from the NR GEIS and incorporate by reference other relevant information and analyses from other past EISs whenever possible, allowing each to focus only on environmental impacts from design features unique to the specific design at a specific site. The environmental review associated with an application for a NOAK microreactor at a specific site would follow the existing NEPA process in 10 CFR Part 51 and analyze those issues not considered in the design-specific GEIS. The NRC staff would consider whether a rulemaking to codify the design-specific GEIS is appropriate at the time a specific licensing action is being considered for that design.

The design-specific GEIS could be developed using a specific microreactor design's PPE and SPE values to define bounding assumptions applicable to a range of potential microreactor sites. Thus, a design-specific GEIS could be useful to support the rapid deployment of factory-fabricated microreactors. Specifically, under Appendices N for 10 CFR Part 50 and

10 CFR Part 52, the NRC might be requested to approve microreactor construction and operation of multiple microreactors of essentially the same design at different sites. The design-specific GEIS could then describe environmental impacts for all of the proposed sites that fit within the PPE and SPE values of the design-specific GEIS. Further, even subsequent applicants referencing a microreactor design could choose sites or locations on a site that would fall within the design-specific PPE and SPE in the design-specific GEIS, which would not only speed the schedule for the environmental review but would also minimize the environmental effects of the licensing action, a prime goal of NEPA.

Implementation

Implementation would consist of developing a design-specific GEIS (or other generic NEPA documentation) upon receipt of a first-of-a-kind license application referencing a specific design. The NRC staff would tier the design-specific GEIS from the NR GEIS. Development of a design-specific GEIS would follow procedures already used by the NRC staff for other GEIS development. The goal of a design-specific GEIS would be to develop more extensive generic analyses that would apply to more resource areas compared to the NR GEIS, which was prepared before specific microreactor designs were proposed. Use of the design-specific GEIS in tandem with the NR GEIS would reduce the amount of project-specific environmental analysis needed for an Nth-of-a-Kind application than would use of the NR GEIS by itself.

It might be possible (with exemptions) to instead develop a generic EA (GEA) with a FONSI if each generic issue addressed lacks potentially significant impacts and if the GEA establishes thresholds to ensure there are no potentially significant site-related impacts. Because a GEA or the design-specific GEIS could itself be tiered from the NR GEIS, the GEA or design-specific GEIS would only have to address those generic issues not also addressed in the NR GEIS. The design-specific GEIS or GEA may therefore be very short for some designs, depending on how closely the preparers of the NR GEIS anticipated elements of the design.

A design-specific GEIS could go far to reduce the need for most detailed site-specific reviews for NOAK licensing applications if (1) all material issues are adequately analyzed generically, (2) site-specific analysis is sufficient to ensure the conditions at the site are bounded by the GEIS, and (3) any site-specific impacts are not significant. Then the site environmental review could be documented using a brief supplement to the first-of-a-kind GEIS, as needed, to resolve any remaining site-specific aspects. Such site-specific aspects could include approvals or consultations required by Federal laws, executive orders, and permits, such as Coastal Zone Management Act, National Historic Preservation Act (NHPA) section 106 consultation with State Historic Preservation Officers and Tribes, Endangered Species Act (ESA) section 7 consultation with the U.S. Fish and Wildlife Service, and Clean Water Act (CWA) permits from the U.S. Army Corps of Engineers. State permit requirements may also have to be met. The site-specific NOAK standard microreactor assessment could follow the existing NEPA process of 10 CFR Part 51 through an EA with a FONSI or EIS as decided by the NRC staff to address unique site conditions that are bounded or not bounded by the design-specific first-of-a-kind GEIS. If the approach uses an EA with a FONSI in lieu of an EIS, then there would potentially be fewer opportunities for public participation.

Upon receipt of a NOAK microreactor licensing application, the NRC staff would then have to prepare supplemental NEPA documentation covering site-specific issues not adequately addressed in either the NR GEIS or the corresponding design-specific GEIS (or GEA). Whether a supplemental EIS or a supplemental EA with a FONSI, the supplemental NEPA documentation could be very short if only a few site-specific issues need to be addressed. The

NRC staff could consider developing an environmental review checklist to accompany the design-specific GEIS (or GEA). Applicants for each NOAK project could then supply necessary project-related information through the checklist, and the NRC staff could use the checklist to ease the effort needed to prepare supplemental NEPA documentation. An applicant completing the checklist would have to provide only that information needed to determine whether impacts from its NOAK project would be bounded by the assumptions underlying the generic analyses.

Alternative E2 could be implemented under existing regulations, although development of a design-specific GEA or use of EA-type NOAK supplemental NEPA documents with FONSIs would require exemptions from the requirement in 10 CFR 51.20(b) to prepare an EIS for a power reactor application. The need for exemptions could be eliminated if a rulemaking removed blanket EIS requirements from 10 CFR Part 51 for licensing power reactors. If applicants seeking review of a standard design desire increased regulatory certainty regarding issues addressed in the design-specific GEIS or GEA, the NRC staff could pursue a rulemaking to adopt the generic documentation in the same way it has for NUREG-1437, Revision 2, "Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants," issued August 2024 (NRC, 2024b). This same approach is being pursued for the NR GEIS.

Implementation Considerations

- A design-specific GEIS would enable the NRC staff to evaluate more issues generically, so that upon review of a NOAK application using that specific design, the environmental documentation could be more focused, with increased regulatory certainty.

- The development of a design-specific GEIS could substantially reduce time and costs when reviewing a NOAK application (beyond the reductions made possible by the NR GEIS).

- Alternative E2 may lead to development of checklists allowing applicants to submit information supporting NOAK applications more efficiently, thereby reducing application preparation costs and staff review effort. A checklist could consist of a list of assumptions used in a design-specific GEIS, with space next to each for the applicant to explain how its project meets the assumption.

- A license applicant could tailor its site selection to conform to assumptions underlying analyses in the design-specific GEIS and thereby avoid the need for application-specific evaluations.

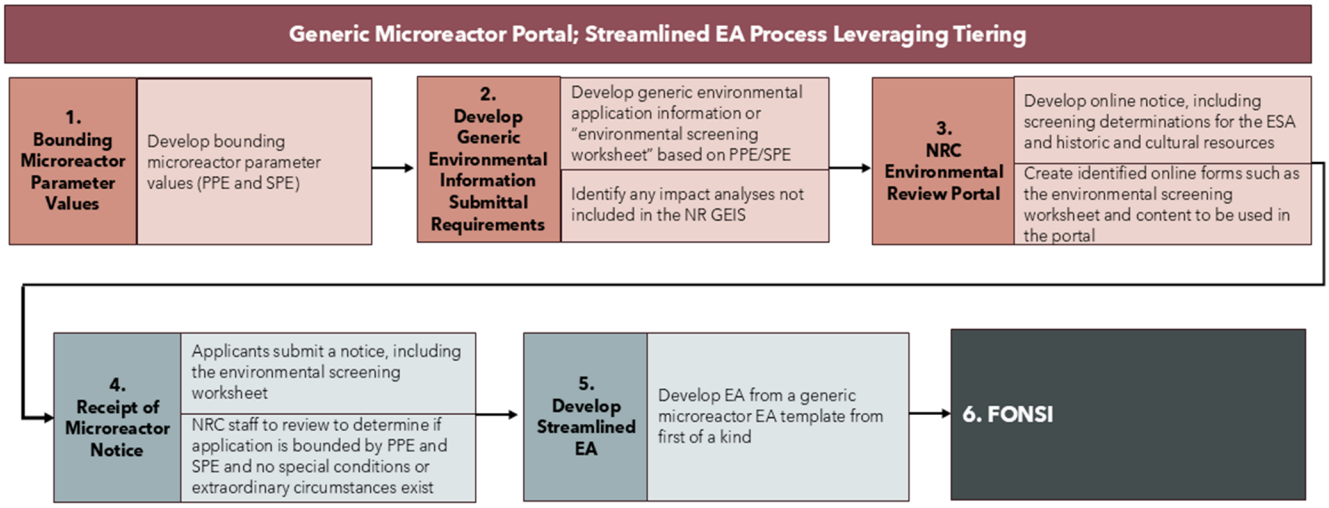
- Development of the expanded generic environmental analysis would require additional resources and time.

- Alternative E2 would be advantageous only if a large number of NOAK applications were subsequently received for one or more designs.

Alternative E3—Generic Microreactor Portal; Streamlined Environmental Assessment Process with Tiering

Alternative E3 represents a streamlined approach that largely uses the current NEPA review process. Unique aspects of this alternative are modeled after the "general permit" process used by several regulatory agencies (e.g., the U.S. Army Corps of Engineers (USACE)). Under this

alternative, the NRC staff would conduct its environmental review in a manner similar to the USACE process for reviewing use of general permits under the CWA in relation to a specific site. This concept is not related to the NRC's authority to issue general licenses and should not be equated to or confused with the agency's provisions for general licenses. Figure 1 provides an "initial sketch" of the process, including the upfront steps necessary.



(Note: At any step under the process, if the staff determines a FONSI cannot be reached, the process would proceed to an EIS.)

Figure 1 Process steps for environmental Alternative E3

Step 1 of this process involves the development of bounding microreactor PPE and SPE values. The bounding microreactor PPE and SPE values could be a subset of the PPE and SPE values generated in the NR GEIS. That is, the NR GEIS would be leveraged during development to narrow its PPE and SPE values to be more reflective of the microreactor designs. One approach for accomplishing this task could be for the NRC to hold publicly open workshops to consider industry and other stakeholder input, e.g., from the American Nuclear Society standards process, and prior studies by the U.S Department of Energy's national laboratories, e.g., PNNL, 2021. The workshops could also involve experts from academia and national laboratories and international entities (e.g., Canada). In view of the information obtained from the workshops, the NRC staff could propose microreactor bounding PPE and SPE values that would accommodate a broad range of microreactor siting possibilities as a subset of the PPE and SPE values developed for advanced reactors in the NR GEIS. That is, in the case of a microreactor site, which would have a much smaller footprint, a greater number of environmental impacts common to microreactors can be addressed generically, eliminating the need to repeat the same analyses for the review of each licensing application. The main difference between Alternatives E2 and E3 is that the development of the bounding microreactor PPE and SPE values would not be tied to a specific design, and, therefore, could begin immediately without having to wait for the submittal of an application for a specific design. In addition, some, if not all NR GEIS Category 2 issues could be dispositioned as Category 1 issues for microreactors based, in part, on information obtained through the workshops.

Step 2 of the process could involve identifying instances in which the NR GEIS does not analyze an environmental effect for the microreactor, but because of the smaller footprint or other circumstances, an initial analysis could be presented and documented in an EA at the

FOAK stage on which subsequent EAs could tier if the analysis in the first-of-a-kind were bounding and shows no significant impact. This would allow applicants and the NRC staff to focus NOAK environmental review efforts on issues that can be resolved only once a site is identified, while ensuring that the site falls within the bounding SPE values.

Once the bounding microreactor PPE and SPE values are established, the NRC staff would then develop guidance documenting these values along with the information an applicant would need to submit in order for the NRC system to populate the online forms, continuing step 2 of this process, shown in figure 1. The set of information identified in the guidance would serve as the "generic environmental application information or environmental screening worksheet," analogous to an environmental report on a much smaller scale. The set of information would be developed to allow the applicant to document, and the NRC to verify, that the site falls within the established bounding microreactor PPE and SPE values that correlate to impacts already analyzed in the NR GEIS or as part of a first-of-a-kind EA or EIS.

In step 3 of the process, the NRC staff then would develop an online review portal (the NRC Environmental Review Portal).[2] Several Federal and State agencies have established online permitting portals (see PNNL, 2024). For example, the Maryland Department of the Environment (MDE, 2024) has an online permitting portal through which an applicant can submit data and other information needed for a permit. The NRC application information could be similar to that required under the U.S. Environmental Protection Agency's (EPA's) general construction permit process (EPA, 2024). The NRC could employ a screening process to help expedite section 106 (NHPA) and section 7 (ESA) consultations. The portal could also contain a notification for the applicant (step 4) to state its intent to use this process and fill out the information needed for the NRC staff to make a preliminary estimate as to whether a FONSI may be possible. This process would reduce the work needed from applicants and the NRC staff while still allowing for a public process in keeping with the purpose of NEPA.

After review and verification of information submitted through the portal, the NRC staff could then develop a streamlined EA based on a generic microreactor EA template (step 5). The NRC staff could populate the template by incorporating by reference or tiering off the upfront analysis used to form the bounding microreactor PPE and SPE values or other previous NEPA analysis along with the applicant submittals. A FONSI could then be issued (step 6), provided the site or sites are bounded by the PPE and SPE values and there are no extraordinary or special circumstances indicative of a significant environmental impact. Extraordinary or special circumstances are unique situations, such as characteristics of the geographic area found not to be bounded by the SPE or PPE, or significant uncertainty about the environmental effects of the proposal. Throughout an environmental review using this process, the NRC staff will develop and use a procedure to rapidly determine whether extraordinary or special circumstances reveal a significant environmental effect, which would require an EIS instead of a streamlined EA.

[2] The development of a portal to support environmental reviews could support the Commission's compliance with the congressional direction in section 506(b)(2)(K) of the Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy (ADVANCE) Act.

Implementation

Before FOAK review for a new design, the following objectives could be completed:

- development of a set of bounding microreactor PPE and SPE values derived from the NR GEIS
- documentation of the bounding microreactor PPE and SPE values in a guidance document (e.g., interim staff guidance)
- development of the applicant's necessary submittal information or environmental screening worksheet (i.e., GEIS standards)
- development of screening processes for consultations (e.g., NHPA section 106 and ESA section 7)
- implementation of the NRC Environmental Review Portal with the developed environmental screening worksheet containing the necessary generic environmental information

Upon receipt of a first-of-a-kind microreactor licensing application, the analysis could be presented in an EIS or EA. Upon receipt of a NOAK microreactor application, if the environmental information does not indicate a potential for significant environmental impacts that would require an EIS, the NRC staff would use the information provided in the portal to prepare a streamlined EA and FONSI.

Implementation Considerations

- This alternative could lead to significant time savings compared to the current EA/FONSI timeline. The NRC staff anticipates that if it used an online permitting portal, it could issue an EA supporting a FONSI in under 6 months for a microreactor application meeting the bounding conditions in the environmental screening worksheet.
- The upfront work of developing the bounding microreactor PPE and SPE values, the associated guidance document, NHPA section 106 and ESA section 7 screening guidance, and the online portal could begin immediately.
- The bounding sets of microreactor PPE and SPE values would be developed to encompass the environmental impacts of all or most microreactor designs (with cooperation from multiple microreactor developers, potentially through an American Nuclear Society standards committee standards process).
- The initiation of this streamlined process would not require rulemaking, although under current rules an exemption would be required to prepare an EA and FONSI instead of an EIS.
- The bounding microreactor PPE and SPE values established for the portal could be used by applicants in their site selection processes.

- The use of an online portal would be in alignment with Council on Environmental Quality goals and the direction in the Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy (ADVANCE) Act for timeliness and efficiency. The portal could provide a blueprint for other efforts to streamline environmental reviews.

- This alternative would call for coordination with stakeholders, Tribes, and other interested and affected persons to develop aspects of these alternatives, such as the bounding microreactor PPE and SPE values and associated guidance.

Alternative E4—Design-Specific Categorical Exclusions

Alternative E4 would be based on the premise that objective, comparatively easily measured parameters demonstrate that the NOAK deployment of a microreactor would have no significant environmental impacts on the human environment (with no special circumstances applicable). Alternative E4 could leverage the completion of environmental reviews under alternatives E2 and E3. The first step under this alternative would be to develop a comprehensive environmental evaluation of the design with potentially site specific EAs. If these environmental evaluations result in FONSIs involving the design, an environmental checklist would be developed based on site conditions. Establishment of design-specific CATXs would require rulemaking to modify 10 CFR 51.22. Any subsequent licensing applications bounded by the conditions of the EIS or EA for the specific standard microreactor design would then meet the criteria for a CATX. The NRC staff would need to determine whether one or more proposed new CATXs in 10 CFR 51.22 would apply only to a specific standard microreactor design or more broadly to other microreactors. Based on experience with this alternative, if implemented, future refinements under a long-term development plan could be pursued based on experience.

Implementation

The NRC staff would implement this alternative by building upon the experiences from first-of-a-kind and other related microreactor environmental reviews. The first review of a new, standard, microreactor design would include a complete environmental evaluation under the current NEPA process. If the environmental evaluation demonstrates that the specific design or the bounding microreactor PPE and SPE values would not (individually or cumulatively) have a significant effect on the human environment, an environmental checklist would be developed based on NRC guidance. Environmental evaluation of issues that rely on information presented in the safety analysis (e.g., radiological effluent releases and postulated accidents) may call for special attention in developing this approach. Rulemaking for either a specific standard microreactor design or a generic set of conditions based on the environmental checklist would codify a new CATX in 10 CFR 51.22(c). NOAK licensing would then rely on a CATX finding, which the NRC staff would determine by applying the environmental checklist for the specific site.

Implementation Considerations

- The NRC staff would establish an efficient NOAK environmental review process allowing for a quick determination (within a few months) that a NOAK licensing application meets a CATX, once the rulemaking amending 10 CFR 51.22(c) has been completed.

- CATXs would provide regulatory stability and increased reliability once established.

- There could be just one implementation process for a generic set of conditions representative of and bounding of multiple microreactor designs, leading to one rulemaking rather than multiple design-specific rulemakings. This would increase regulatory efficiency.

- Potential applicants could use the assumptions in the CATX as a site selection tool.

- It may take several years to develop the requisite experience to propose a CATX, perform the necessary FOAK environmental evaluation, develop the environmental checklist, and complete rulemaking.

- The regulatory process might not be efficient if a bounding CATX for multiple microreactors is not attainable and each standard microreactor design requires a separate rulemaking process. Timeline challenges would arise if multiple microreactor designs are being considered at the same time.

- Most of the opportunity for public participation would take place when a CATX is being established by rulemaking, rather than at the NOAK deployment stage. Public interest may be greater at the time a specific microreactor project is proposed for a specific site.

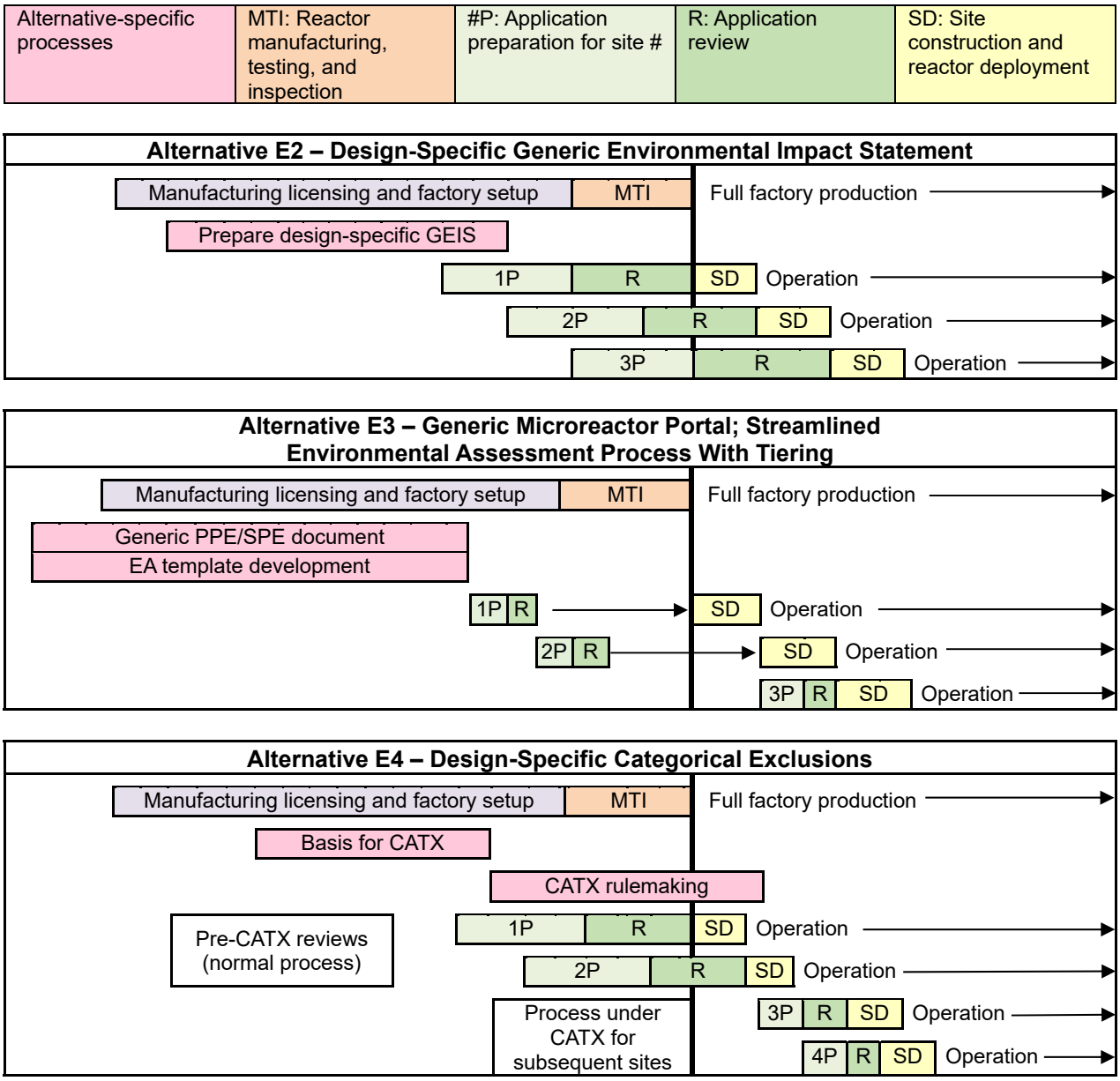


Figure 2 Illustrative timelines for the proposed environmental alternatives (for informational purposes only)

CATX, categorical exclusion; EA, environmental assessment; GEIS, generic environmental impact statement; PPE, plant parameter envelope; SPE, site parameter envelope.

Considerations with Respect to Other Environmental Requirements and Consultations

In addition to NEPA, Federal agency actions are subject to additional environmental requirements, including consultation requirements that can impact review timelines. These requirements and consultations may necessitate additional data from the applicant and more focused outreach to other Federal and State agencies and Tribes than that required for NEPA reviews. Currently, the NRC uses the NEPA process to perform these consultations. The NRC

does not have the statutory authority to change requirements for NRC consultation with Federal and State agencies and Tribes. The time to complete consultations could vary from a few months to years, depending on the complexity of the project, level of effort, and other challenges. Such time challenges could occur for even simple projects with limited land disturbance. The following subsections describe initiatives the NRC staff is taking to reduce these schedule risks.

Endangered Species Act

Under section 7 of the ESA, Federal agencies must consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service (collectively, "the Services") for agency actions that may affect federally listed species or designated critical habitats. For each licensing action, the NRC staff must consider whether ESA consultation is necessary and, if required, engage in consultation. The ESA regulations at 50 CFR Part 402, "Interagency Cooperation—Endangered Species Act of 1973, as Amended," prescribe timelines for consultation that range from 60 days to 135 days, depending on the level of impact. The NRC staff has historically conducted ESA consultation concurrently with its NEPA review and summarized the results of the consultation in the NEPA document. The NRC staff is currently examining alternative approaches for conducting these consultations. For example, using the non-Federal representative process, pursuant to 50 CFR 402.08, would allow a licensee to initiate ESA consultation prior to submitting an application to the NRC, and would significantly reduce staff time and schedule risks.

The NRC staff has experienced delays in completing ESA consultation for various reasons, such as inadequate data received in applications or resource constraints among the Services. The NRC staff currently reduces potential delays by working with applicants during the preapplication phase to help ensure high-quality applications and to get a head start on the ESA portion of the environmental review. The NRC staff anticipates that most microreactor licensing actions (whether first-of-a-kind or NOAK) would not likely result in adverse effects on ESA-protected resources and therefore not require formal consultation and a biological opinion, as outlined in 50 CFR 402.14. Instead, the NRC expects that most ESA consultation requirements for microreactor licensing actions could be met through the early or informal consultation processes outlined in 50 CFR 402.11 and 50 CFR 402.13. Avoiding the need for formal ESA consultation, which can take as long as 135 days, would greatly reduce the NRC staff's workload and the potential for delays.

National Historic Preservation Act

Section 106 of the NHPA requires Federal agencies to take into account the effect of undertakings under their direct or indirect jurisdiction, including licensing, permitting, funding, or other Federal assistance or approvals (54 U.S.C. § 306108). The NHPA established the Advisory Council on Historic Preservation as the Federal agency responsible for creating regulations to implement section 106 (54 U.S.C. § 304108(a)). Regulations in 36 CFR Part 800, "Protection of Historic Properties," call for Federal agencies to identify historic properties; assess effects on historic properties; and avoid, minimize, or mitigate any adverse effects on historic properties. Throughout the process, Federal agencies are required to conduct consultations with the State Historic Preservation Officer or Tribal Historic Preservation Officer, Indian Tribes, Native Hawaiian organizations, local governments, applicants or licensees, and others.

The NRC staff has experienced delays in completing section 106 consultations due to insufficient or incomplete data from applicants or the need for enhanced outreach efforts with Tribes as part of the need to conduct a reasonable and good-faith effort to identify historic properties pursuant to 36 CFR 800.4(b)(1). This effort may include background research, field surveys, or other efforts, which can take weeks or months to complete depending on the availability of qualified staff or consultants, project location, and time of year. While 36 CFR Part 800 requires 30-day consultations for all findings and determinations, this review period is for consulting parties to raise objections and there is no prescribed duration for resolving objections. Therefore, it is possible for the consultation process to take several months or years to complete for complex undertakings under certain conditions.

To streamline section 106 compliance for projects with a small footprint, such as microreactors, the NRC could pursue program alternatives as allowed by 36 CFR 800.14, "Federal agency program alternatives." A program alternative can provide advanced consultations and enable exemptions or alternative processes for section 106 review for certain types of undertakings under specific conditions. The NRC staff is currently working with the Advisory Council on Historic Preservation to determine whether any program alternatives would be appropriate for microreactors. While not all microreactor undertakings may be reviewable under a program alternative, those with no or minimal impacts would benefit from an expedited process. Additionally, pursuant to 36 CFR 800.2(c)(4), the NRC may authorize an applicant for an NRC license to conduct consultations with the State Historic Preservation Officer and other parties (other than Tribes). Finally, the NRC could encourage NRC and applicant coordination before an applicant seeks a license from the NRC to expedite consultations. This would have benefits similar to those mentioned above for non-Federal representative process during informal Endangered Species Act coordination.

Clean Water Act Section 401 Water Quality Certification

A Federal agency may not issue a license or permit to conduct any activity, including construction or operation of facilities, that may result in any discharge into navigable waters (i.e., "waters of the United States") unless the State or authorized Tribe where the discharge would originate issues either a CWA section 401 water quality certification or a waiver. Water quality certification is intended to ensure that the discharge will comply with applicable effluent limitations and water quality requirements under the CWA and with any appropriate requirement of State law. Section 401 applies to any Federal license or permit that may result in a discharge into waters of the United States. Procedural requirements for implementing CWA section 401 are contained in 40 CFR Part 121, "State Certification of Activities Requiring a Federal License or Permit." The EPA issued a final rule (88 FR 66558, September 27, 2023), "Clean Water Act Section 401 Water Quality Certification Improvement Rule," which revised the 2020 rule.[3]

[3] Other requirements include the potential need for a National Pollutant Discharge Elimination System permit under Section 402 of the CWA and State approval of an applicant's certification of consistency with the State Coastal Management Plan under the Coastal Zone Management Act.

Integration with the NEPA Alternatives Presented Above

Methods for streamlining consultations may depend upon the alternative implemented. For example, under Alternative E3 or E4, one criterion may be that one or more consultations are not required. If one of the alternative consultation approaches are implemented, applicants may be able to complete all or most of the section 7 and section 106 consultations along with any CWA permitting process, if applicable, before (or soon after) submitting the application. The NRC staff could also work with consulting parties to take advantage of the NRC Environmental Review Portal (Alternative E3) to more efficiently conduct consultations. Under all scenarios, encouraging applicants to engage in preapplication communications with the NRC and consulting parties, when applicable, would help minimize schedule risks.

Summary of Other Agency Strategies for Streamlining Environmental Review

PNNL (2024) identified several streamlining strategies used by other Federal and State agencies that resemble those outlined above:

- use of CATXs where appropriate (similar to alternative E4)

- use of programmatic environmental NEPA documentation as a tiering tool to reduce redundancies with subsequent site-specific analyses or the need for additional site-specific analysis through the use of environmental checklists to confirm the applicability to the programmatic reviews (combining elements of Alternatives E2 and E3)

- some portion of the NEPA or consultation process, or both, conducted by the applicant (could be applied under any of the alternatives and the NRC staff would independently evaluate and be responsible for the reliability of any information it uses if such a process is pursued by the NRC) (consistent with NEPA section 107(f), enacted in the Fiscal Responsibility Act of 2023, Section 321, the Builder Act, Pub. L. 118-5, 137 Stat. 39 (June 3, 2023))

- streamlining of the consultation processes by working with the Advisory Council on Historic Preservation and other consulting agencies to establish criteria to eliminate the need for repetitive formal consultations (could be applied under any of the alternatives)

- use of web portals or online databases and tools to streamline application submittals and facilitate communication with the agencies and consulting parties (similar to alternative E3)

Conclusions

Alternatives E2, E3, and E4 all offer potential savings in the costs and time needed to complete environmental reviews for licensing microreactors, relative to use of the traditional new reactor environmental review process (Alternative E1). As mentioned earlier, figure 2 provides illustrative timelines for the various alternatives described in this enclosure. The figure gives an indication of the potential application and review processes that would occur in each environmental alternative and their potential timing with respect to the manufacturing process. One example of such a timing issue is the planning and implementation of the siting process timelines (i.e., site application, application review, and site construction) to coincide with the

manufacturing of a microreactor. The timeframe lengths in figure 2 serve only as examples to demonstrate the relative timeline relationships within an environmental alternative. Figure 2 should not be considered as an established absolute schedule for any review.

The NRC is taking a systematic phased approach that ultimately could employ elements of Alternatives E2, E3, and E4 in a series that progresses incrementally as the NRC staff gains experience with licensing microreactors. Figure 3 provides a conceptual overview of the implementation of the phased approach. The systematic phased approach is based on a "time-phased approach" dependent on the stage of a design and allows applicants the flexibility to utilize the alternative that best meets their needs. That is, as industry develops or advances a design, the procedures could subsequently initiate elements of other alternatives to provide additional streamlining. As illustrated in Figure 3, possible deployment to support a specific design could look like the following:

Present:

- Continue to employ the existing approach (E1) with ongoing environmental streamlining until other alternatives are deployable.

Before the First-of-a-Kind Reactor Licensing Review:

- Begin implementation of alternative E3, which tiers off the NR GEIS to develop a set of microreactor parameter values that would be bounding for one or more designs.

First-of-a-Kind Phase:

- Apply a design-specific GEIS (alternative E2) on a case-by-case basis based on a microreactor developer's progress.

- Begin the process to develop bounding microreactor parameter values under alternative E3. Apply the design-specific GEIS (alternative E2).

- Develop the Environmental Review Portal.

NOAK Phase:

- Applicants would utilize the Environmental Review Portal for either alternative E2 or E3.

Potential Later-NOAK Phase:

- If there is a sufficient history of EAs arriving at FONSIs for a specific design, the NRC staff may then consider whether establishing a CATX through rulemaking, as outlined under alternative E4, would be appropriate.

Implementation of alternative E2 along with the parallel development of alternative E3 would allow for the flexibility of design changes and the necessary data collection and time required for deployment of alternative E4. As part of alternative E3, the NRC staff is pursuing the development of an Environmental Review Portal that can be employed with any other alternative to streamline the NRC NEPA process. The Environmental Review Portal for digital submissions could serve to facilitate submission of environmental reports in other licensing actions.

The NRC staff plans to begin the development process to implement alternative E2 as soon as a first-of-a-kind reactor licensing application is submitted to the NRC. Development of alternative E3 and implementing elements of the Environmental Review Portal could also begin immediately to complement future efforts while implementing alternative E2 or even while following the traditional new reactor environmental review process. The NRC staff would need to allocate the appropriate NRC resources for development of alternative E3, whose development is intended and can be expanded for use in many of NRC's NEPA actions (e.g., fuel cycle facility licensing actions).

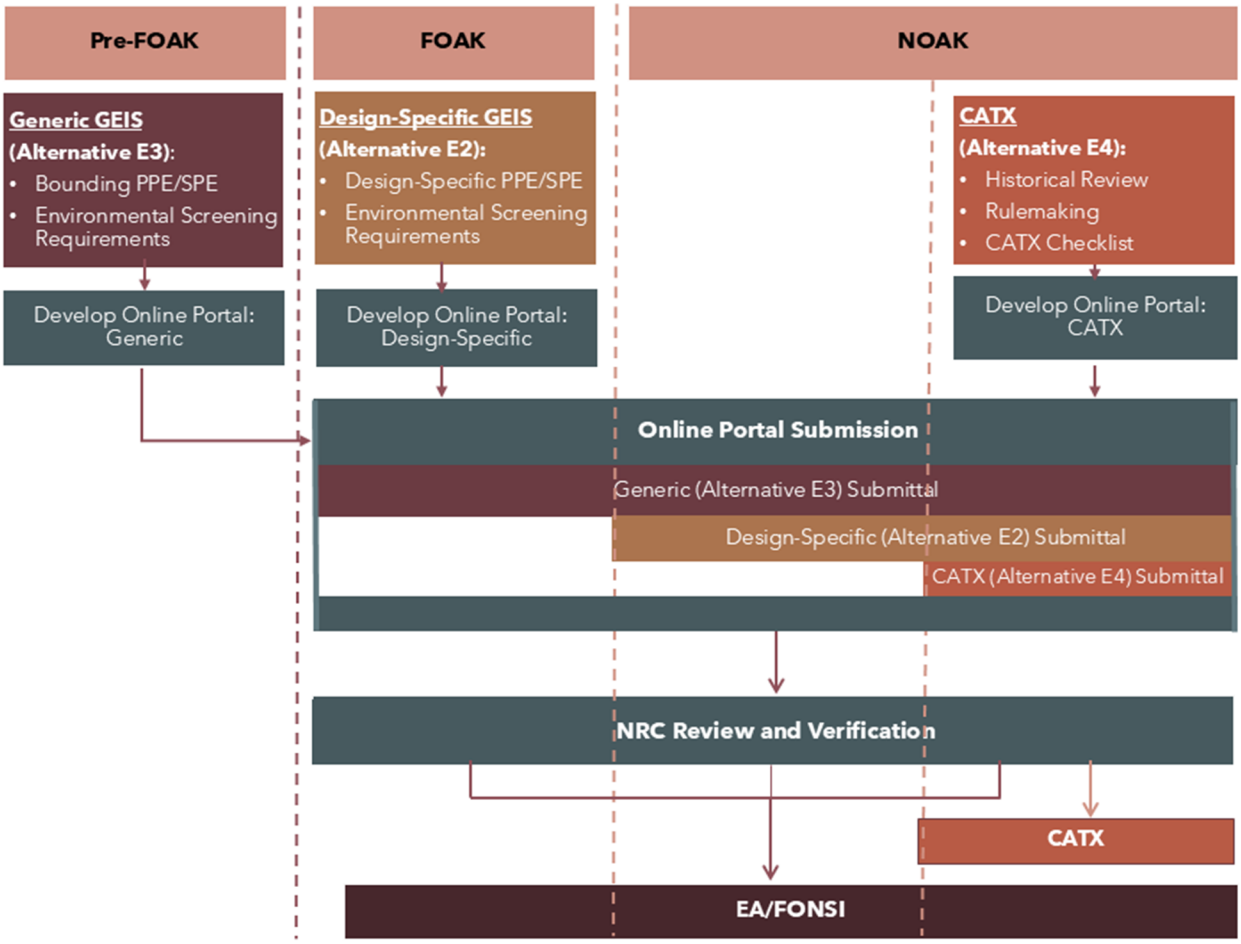


Figure 3 Conceptual overview of the implementation of the phased approach

CATX, categorical exclusion; EA, environmental assessment; FOAK, first-of-a-kind; FONSI, finding of no significant impact; GEIS, generic environmental impact statement; NOAK, nth-of-its-kind; PPE, plant parameter envelope; SPE, site parameter envelope.

Note: If the EA identifies a significant environmental impact, the NRC will not make a FONSI but will prepare an EIS. Similarly, if a site cannot meet any requisites in the CATX checklist, the NRC will either prepare a FONSI or an EIS.

References

EPA, 2024. U.S. Environmental Protection Agency (EPA), 2022 Construction General Permit (CGP), EPA National Pollutant Discharge Elimination System, accessed August 6, 2024, from https://www.epa.gov/npdes/2022-construction-general-permit-cgp

MDE, 2024a. Maryland Department of the Environment (MDE), Industrial Wastewater General Discharge Permit example, accessed August 6, 2024, from https://onestop.md.gov/licenses/industrial-wastewater-general-discharge-5d1540bc54f24d03e9998678

MDE, 2024b. MDE, Maryland OneStop Licenses and Permits Portal, accessed August 6, 2024, from https://onestop.md.gov/tags/5d1538807ccc6701ed6141cd

NRC, 2024a. NRC, "Generic Environmental Impact Statement for Licensing of New Nuclear Reactors, Draft Report for Public Comment," NUREG-2249, September 2024 (ML24176A220).

NRC, 2024b. U.S. Nuclear Regulatory Commission (NRC), "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, Volume 1, Revision 2, August 2024 (ML24086A526).

PNNL, 2021. Pacific Northwest National Laboratory (PNNL), "Advanced Nuclear Reactor Plant Parameter Envelope and Guidance," NRIC-21-ENG-0001, PNNL-30992, February 18, 2021 (ML21145A416).

PNNL, 2024. PNNL, "PNNL Review of Federal and State Agency Regulatory Streamlining Practices," PNNL-36490, August 2024 (ML24257A176).