Regulatory Analysis for the Final Rule Amending 10 CFR Part 171 "Annual Fees for Reactor Licenses and Fuel Cycle Licenses and Materials Licenses, Including Holders of Certificates of Compliance, Registrations, and Quality Assurance Program Approvals and Government Agencies Licensed by the NRC"

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ABBREVIATIONS AND ACRONYMS

ADAMS	Agencywide Documents Access and Management System
ANPR	advance notice of proposed rulemaking
ANS	American Nuclear Society
CFR	*Code of Federal Regulations*
COL	combined license
FR	*Federal Register*
MWe	megawatt(s) electric
MWt	megawatt(s) thermal
NEI	Nuclear Energy Institute
NRC	U.S. Nuclear Regulatory Commission
NUREG	NRC technical report designation
OBRA-90	Omnibus Budget Reconciliation Act of 1990
SMR	small modular reactor
SRM	staff requirements memorandum

ABSTRACT

The U.S. Nuclear Regulatory Commission's (NRC's) fee structure is based on the Omnibus Budget Reconciliation Act of 1990, as amended (OBRA-90), which requires the NRC to recover approximately 90 percent of its budget authority each year. A portion of this budget recovery is accomplished through annual fee collections from licensees under part 171 of Title 10 of the *Code of Federal Regulations* (10 CFR), "Annual Fees for Reactor Licenses and Fuel Cycle Licenses and Materials Licenses, Including Holders of Certificates of Compliance, Registrations, and Quality Assurance Program Approvals and Government Agencies Licensed by the NRC."

In late 2008, the NRC staff recognized that there could be potential inequities in fairness when applying the existing annual fee methodology under 10 CFR part 171 to future small modular reactors (SMR) because of anticipated design features such as limited thermal/electrical power production capacity and modularity. Beginning in 2009, the staff conducted a comprehensive review and evaluation of potential alternatives for modifying the existing annual fee structure to maintain the fairness and equity required by OBRA-90 for all current and potential licensees, including future SMRs. Industry and public stakeholders were engaged throughout the review process. The Commission was informed of the staff's planned approach for SMR fees in 2011, and then the SMR fee work was placed on hold while awaiting more certainty of potential SMR applications. Once that level of certainty was established in 2014, the NRC reconstituted the working group, and the staff's review culminated with a final recommendation to the Commission in 2015. The Commission accepted the staff's recommendation and directed the staff to commence rulemaking on the topic. This final rule amends 10 CFR part 171 to provide a methodology for fair and equitable SMR participation in the payment of part 171 annual fees and provide future SMR stakeholders with regulatory certainty for the computation of annual fees.

This regulatory analysis has been prepared to assist NRC staff, external stakeholders, and the Commission in understanding the analytical bases of the final rule responding to Commission direction in the staff requirements memorandum to SECY-15-0044, "Proposed Variable Annual Fee Structure for Small Modular Reactors."

EXECUTIVE SUMMARY

In late 2008, the U.S. Nuclear Regulatory Commission (NRC) staff recognized that there could be potential inequities in fairness when applying the existing annual fee methodology under Title 10 of the *Code of Federal Regulations* (10 CFR) part 171, "Annual Fees for Reactor Licenses and Fuel Cycle Licenses and Materials Licenses, Including Holders of Certificates of Compliance, Registrations, and Quality Assurance Program Approvals and Government Agencies Licensed by the NRC." These inequities related to future small modular reactors (SMRs) because of anticipated design characteristics such as limited thermal and electrical power production capacity and modularity. In March 2009, the NRC issued an advance notice of proposed rulemaking (ANPR) in the *Federal Register* (74 FR 12735) seeking input from the public on potential changes to the annual fee structure to account for the possibility of licensing SMRs in the future. The NRC received a total of 16 public comments from licensees, industry groups, and private individuals, providing a wide range of input for agency consideration. The NRC staff reviewed the public comments and provided the Commission with recommendations in SECY-09-0137, "Next Steps for Advance Notice of Proposed Rulemaking on Variable Annual Fee Structure for Power Reactors" (NRC, 2009).

In October 2009, in a staff requirements memorandum (SRM) to SECY-09-0137, "Next Steps for Advance Notice of Proposed Rulemaking on Variable Annual Fee Structure for Power Reactors," (Vietti-Cook, 2009), the Commission accepted the NRC staff's recommendation and directed the staff to form a working group to analyze suggested methodologies for a variable annual fee structure for power reactors. The analysis was used to recommend changes to 10 CFR part 171. This final rule amends the current process for assessing 10 CFR part 171 annual fees to accommodate SMRs. These reactors have thermal power ratings of 1,000 megawatts thermal (MWt) (approximately 300 megawatts electric (MWe) if used for electricity production) or less per reactor; and may potentially offer safety, design, and modularity innovations. For the purposes of this final rule, SMRs are defined as light-water reactors.

Under the NRC's current fee structure, SMRs would be required to pay the same 10 CFR part 171 annual fee as existing operating fleet reactors, notwithstanding their smaller size. Concern arose that applying the current fee structure to SMRs without alteration could be contrary to the Agency's charge under OBRA-90. OBRA-90 instructs the NRC to "establish, by rule, a schedule of charges fairly and equitably allocating" various generic agency regulatory costs "among licensees" (OBRA-90 Section 1601, 42 U.S.C. § 2214). The statute goes on to provide that, "[t]o the maximum extent practicable, the charges shall have a reasonable relationship to the cost of providing regulatory services and may be based on the allocation of the Commission's resources among licensees or classes of licensees" (OBRA-90 Section 1601, 42 U.S.C. § 2214). The potential that an SMR could be assessed the same annual fee as a large light-water reactor raised significant fairness and equity concerns.

Additionally, under the current fee structure, multi-module nuclear plants would be allocated 10 CFR part 171 annual fees on a per-licensed-module basis. For example, a multi-module nuclear plant with 12 licensed NuScale SMR reactor modules (approximately 1,920 MWt

cumulative)[1] would have to pay 12 times the annual fee paid by Duane Arnold Energy Center (a currently operating single unit large light-water reactor licensed for a thermal power rating of 1,912 MWt). Therefore, even though the two facilities would be licensed to generate approximately equivalent amounts of power—with, presumably, comparable ability to generate revenue and absorb the expense of NRC annual fees—the annual fees paid to the NRC by the SMR would be drastically higher than the annual fees paid by the operating power reactor.

To further evaluate the potential impacts of this inconsistency, the NRC staff examined potential changes to the fee methodology for operating power reactors as directed by the Commission. Using public comments from the ANPR, position papers received from the Nuclear Energy Institute (NEI) and American Nuclear Society (ANS) (NEI, 2010, ANS, 2010), and internal evaluations, the working group distilled a range of methodologies into alternatives to be considered for future rulemaking. These alternatives were then considered in light of their impact on the reactor licensees, alignment with the NRC Principles of Good Regulation (Independence, Openness, Efficiency, Clarity and Reliability), and compliance with OBRA-90 requirements.

Four possible alternatives emerged from the working group's analysis that, in the staff's opinion, warranted further consideration:

(1) Continue the existing annual fee structure, but define a modular site of up to 12 reactors or 4,000 MWt licensed power as a single unit for annual fee purposes.

(2) Create fee classes for groups of reactor licensees and distribute the annual fee costs attributed to each fee class equally among the licensees in that class.

(3) Calculate the annual fee for each licensed power reactor as a function of potential risk to public health and safety using a risk matrix.

(4) Calculate the annual fee for each licensed power reactor as a function of its licensed thermal power rating (MWt).

The staff concluded that Alternative 3 would be "…costly to implement and maintain as probabilistic risk assessment (PRA) technology evolves. Additionally, the uncertainty of existing PRA modeling capabilities might not produce adequate differentiation between specific licensees or provide adequate consideration of SMRs" (Dyer, 2011). Therefore, the staff ceased analysis of this alternative.

Based on the assessment of the three remaining alternatives, the NRC staff informed the Commission of its planned approach for developing a variable annual fee structure for SMRs using the fourth alternative (Dyer, 2011). The staff placed a hold on this work from 2011–2014 while awaiting more certainty of potential SMR applications. Once the required level of certainty was established in 2014, the staff finalized its recommendations and presented a formal request for Commission approval to draft a proposed rule to amend 10 CFR part 171 to include a variable annual fee structure for SMRs (Wylie, 2015). This request was approved by the Commission in May 2015 (Vietti-Cook, 2015).

[1] The NuScale SMR design is used for illustrative purposes throughout this analysis. However, the analysis applies to any SMR design.

Subsequently, the working group further refined the original alternatives to adapt them for the rulemaking process and included a no action alternative in its analysis, resulting in the following final set of alternatives:

(1) No action.

(2) Continue the existing annual fee structure for all reactors but allow for "bundling" of SMR reactor modules up to a total of 4,500 MWt as a single "bundled unit."

(3) Continue the existing annual fee structure for the current fleet of operating power reactors but establish a third fee class for SMRs with fees commensurate with the budgetary resources allocated to SMRs.

(4) Continue the existing annual fee structure for the current fleet of operating power reactors but calculate the annual fee for each SMR site as a multipart fee. This alternative bundles the licensed thermal power ratings from all SMRs on a single site up to 4,500 MWt as a "bundled unit." Under this alternative, the SMR fee would contain a Minimum Fee for the first 250 MWt applied to each SMR site regardless of the cumulative thermal power ratings or number of reactor modules present, and:

- A Variable Fee applied on a dollars-per-MWt basis for bundled units with a total MWt rating greater than 250 MWt and less than or equal to 2,000 MWt

  OR:

- A Maximum Fee equal to that paid by the existing operating power reactor fleet for bundled units with a cumulative MWt greater than 2,000 MWt and less than or equal to 4,500 MWt. The Maximum Fee supersedes the Minimum and Variable Fees for sites with bundled units in this power range.

Once an SMR reactor site exceeds a cumulative 4,500 MWt (and for each subsequent increment of 4,500 MWt), any additional MWt are considered part of a second bundled unit. This resets the fee process without a second Minimum Fee, but includes a variable fee for a licensed thermal power rating less than or equal to 2,000 MWt, after which another Maximum Fee would apply.

The results of analyzing and comparing these four refined alternatives are as follows:

(1) The NRC staff finds the no action alternative unacceptable. The NRC does not consider it necessary or appropriate at this time to change its longstanding flat-fee approach to allocating fees among the current fleet of operating power reactors. Based on the information currently available to the NRC, the staff has no sound basis to conclude that charging SMRs significantly higher annual fees per licensed MWt than are charged to large light-water reactors would be justifiable in relation to the regulatory costs per reactor. Some adjustment to the annual fee structure to account for the potentially significant capacity disparities between SMRs and large power reactors, therefore, appears necessary to comply with OBRA-90, rather than the no action alternative which would leave the current fee structure unchanged.

(2) Continuing the existing annual fee structure for the current fleet of large operating power reactors but treating SMRs at the same site as a single unit for annual fee purposes (up to 4,500 MWt total for each single unit) would address the fairness and equity concerns regarding SMR facilities that utilize a number of reactors to achieve generating capacity similar to large light-water reactors. However, this approach would still impose relatively severe fee burdens on small-output SMR facilities relative to their ability to benefit economically from their NRC licenses. Therefore, the NRC staff finds that this alternative only partly addresses the fairness and equity problem presented by applying the current fee structure to SMRs, while leaving the remaining fairness concerns unaddressed. Accordingly, the NRC staff finds that Alternative 2 does not sufficiently resolve the fairness and equity concerns that prompted this rulemaking.

(3) Creating a third reactor fee class for SMRs with fees commensurate with the budgetary resources allocated to SMRs would provide consistency in methodology across all reactor fee classes. All SMRs would pay the same flat fee within the class. However, establishing a one-size-fits-all fee for an SMR class would not account for the potential differences in licensed thermal power ratings within the SMR class, as a 1,000-MWt SMR (for example) would be licensed to generate more than 30 times the power of a 30-MWt SMR. Therefore, two SMR licensees would obtain dramatically different amounts of economic benefit from holding their NRC licenses, while paying the same annual fees. In contrast, among large light-water reactors (which currently pay a class-wide flat fee and would continue to do so under this alternative), while some disparity is certainly present, the highest licensed thermal power reactor (Grand Gulf) is licensed to produce only 3 times more power than the lowest licensed thermal power reactor (Fort Calhoun). Therefore, the NRC staff finds that Alternative 3, while having some merit, does not sufficiently resolve the fairness and equity concerns that prompted this rulemaking.

(4) Alternative 4 is the NRC staff's preferred alternative. It provides an analytically simple basis for applying an annual fee to SMRs that is tailored to address the particular fairness and equity concerns presented by this potential new category of reactor. It would not be particularly hard to administer, yet it takes into account the economic benefits each SMR licensee stands to gain from each NRC license (a factor which may also tend to correlate with the licensee's ability to absorb NRC regulatory costs through annual fees). Alternative 4 addresses the revenue limitations of small SMR projects while reflecting that, as an SMR site's licensed thermal power rating increases, its revenue-generating potential (and therefore its ability to cover the costs of NRC annual fees) should become increasingly comparable to, and eventually equal, that of large light-water reactors. Alternative 4 also provides a reasonable method for charging fees to larger SMR facilities that exceed the licensed thermal power rating of large light-water reactors. Additionally, the flat minimum fee under Alternative 4 that would apply to SMR facilities licensed at 250 MWt or below is consistent with other low-fee reactor classes of NRC licensees, which also are charged a flat annual fee by the NRC. In sum, Alternative 4 accounts for the novel issues presented by SMRs while maintaining a level of fairness and equity across all reactor fee classes.

For these reasons, the NRC staff finds Alternative 4 to provide the most fair and equitable distribution of annual fees, when compared to the other alternatives.

REGULATORY ANALYSIS - VARIABLE ANNUAL FEE STRUCTURE FOR SMALL MODULAR REACTORS

PURPOSE

The existing annual fee process applies to all operating power reactors but, if applied to small modular reactors (SMR), it may not align with the requirements of the Omnibus Budget Reconciliation Act of 1990, as amended (OBRA-90) (Pub. L. 101-508, 42 U.S.C. § 2214) to allocate fees fairly and equitably. The Commission approved the U.S. Nuclear Regulatory Commission (NRC) staff's request to proceed with a rulemaking that would amend Title 10 of the *Code of Federal Regulations* (10 CFR) part 171, "Annual Fees for Reactor Licenses and Fuel Cycle Licenses and Materials Licenses, Including Holders of Certificates of Compliance, Registrations, and Quality Assurance Program Approvals and Government Agencies Licensed by the NRC" (hereinafter "part 171" for brevity), to address these fairness and equity concerns (Vietti-Cook, 2015).

1. STATEMENT OF PROBLEM AND OBJECTIVE

Statement of the Problem

OBRA-90 requires that the NRC recover approximately 90 percent of its budget authority each year prior to the end of the fiscal year. To meet the requirements of OBRA-90, each year the NRC publishes a rule that establishes two types of fees:

(1) hourly fees and flat fees to recover NRC costs for specific services provided to identifiable applicants and licensees under 10 CFR part 170, "Fees for Facilities, Materials, Import and Export Licenses, and Other Regulatory Services under the Atomic Energy Act of 1954, as Amended"

(2) annual fees under 10 CFR part 171 to recover generic and other regulatory costs not otherwise recovered under 10 CFR part 170

In 2015, the NRC revised its annual part 170 and part 171 fees based on the fiscal year 2015 appropriations. The NRC calculated the total 10 CFR part 170 user fee at $268 per hour and computed $497.9 million in total operating reactor annual fees to be assessed evenly among the existing fleet. In other words, each reactor pays an equal share of the part 171 fee, regardless of reactor size or design. Currently, the existing operating reactor fleet consists of 99 licensed power reactors with thermal capacities between 1,500 and 4,408 MWt. Fort Calhoun, the nuclear reactor with the lowest thermal power rating (licensed at 1,500 MWt) must pay the same $5.03 million annual fee as the largest reactor, Grand Gulf, Unit 1, which is licensed at 4,408 MWt. The NRC considers the current annual fee methodology to be consistent with the requirements under OBRA-90. While there is some disparity among the licensed thermal power rating of current plants relative to the annual fees they pay, the flat-fee approach has been in place for 2 decades. The NRC considers this method to be a fair and equitable distribution of fees as it relates to OBRA-90. Previously, agency efforts to manage cost and fee allocations at a more granular level proved labor intensive and resulted in minimal additional benefits to

licensees when compared to the flat-fee approach (see 60 FR 32230). Furthermore, there could be an element of unfairness to the current reactor fleet generally if the NRC were to substantially change its fee methodology, long considered as a factor in the fleet's business planning decisions and projections, simply because of the introduction of a new type of reactor.

Based on the information currently available to the NRC, the staff has no quantitative basis to conclude that the NRC would provide more or less regulatory services for SMRs compared to services provided for current power reactors. However, based on a qualitative assessment of SMR design features described in the paragraphs below, the NRC staff finds that the regulatory oversight process for SMRs may be simplified relative to current power reactors.

At the same time, with applications for SMR licenses on the horizon, the NRC considers it important to give prospective SMR licensees regulatory certainty regarding fees that would likely apply to them. Because SMR thermal power ratings could be as low (for example) as 30 MWt per module, applying the current flat-fee power reactor fee structure to SMRs without alteration could potentially result in a 30 MWt SMR paying the same annual fee as Grand Gulf, Unit 1, despite Grand Gulf 1 being licensed to generate nearly *150 times more* thermal energy than the SMR.[2] Because of the presumed differences in scale between SMRs and large light-water reactors, simply applying the current fee structure to SMRs raises significant fairness concerns.

Beyond size, proposed light-water SMR designs differ in other important ways from the current fleet of operating reactors.[3] "Modular" refers to the fabrication of major components in a factory environment to be shipped to the site for assembly, thereby reducing the time it takes to build the unit. Fabricating major components in a factory and assembling them on site may result in: (1) cheaper reactors, because factories provide economies of scale in production, (2) faster construction, because modular assembly means significant construction is completed prior to the arrival of the components on site, and (3) cheaper construction, because faster factory fabrication and faster site construction may also reduce cost of construction capital.

Reactor designers are optimistic about the advantages of SMR designs relative to large light-water reactors.[4] Recent proposed designs anticipate inherent safety features that may not be found in larger operating power reactors. For example, SMRs may feature passive safety methods, such as natural circulation of the coolant in emergency modes and for cooling of the core during normal operation (NuScale Power, 2015). Some manufacturers expect lower inventories of low enriched uranium-based fuels, combined with longer intervals between refueling, will reduce the amount of radioactivity released in an accident, and smaller spent fuel inventories and less frequent transportation of fuel could also improve fuel safety (Westinghouse, 2015). And, an SMR's smaller size means the size of piping would be reduced,

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2 In contrast, within the current operating reactor fleet, the largest disparity in licensed thermal power rating—between Grand Gulf, Unit 1, and Fort Calhoun—is slightly below a factor of 3 (4,408 MWt for Grand Gulf 1 versus 1,500 MWt for Fort Calhoun).

3 Gas-cooled and liquid metal–cooled reactors represent an even greater departure from current designs and, consequently, greater challenges to the application of current regulatory guidance. However, for this rulemaking, an SMR is defined as a light-water reactor with a thermal power rating of 1,000 megawatts thermal (MWt) or less per reactor.

4 Note that the claimed SMR design advantages and operational enhancements cited in this analysis are based on manufacturer/vendor claims and have not yet been submitted for formal evaluation by the NRC. While it may be too soon for the NRC to take a firm stand on the relative safety of SMRs and how easy they will be to regulate compared to the existing operating fleet, the basic *theory* behind SMRs is the basis for the discussion of SMR merits that follows.

eliminating the potential for a large pipe break loss-of-coolant accident (Generation mPower, 2012).

Reactor designers believe that SMRs will provide a flexible alternative to providing power to the electrical grid. Being smaller and less expensive to construct, SMRs will provide power generating companies with the ability to have more siting alternatives, allowing for placement of reactors closer to their source of demand, and have less uncertainty in financing by allowing for licensees to incrementally add capacity as it is needed at a more affordable cost rather than having to commit to the current "all-in" cost and capacity of a large operating power reactor. To facilitate the flexibility of SMRs, several designs are "scalable," allowing the incremental addition of more reactor modules within a "plant" that allows for sharing of common components and/or structures as demand for energy increases.[5]

While the NRC anticipates the first group of SMRs to be licensed for the generation of commercial electricity (Vietti-Cook, 2015), flexibility in the purpose of the reactor is a significant difference for SMRs. Unlike large operating power reactors, an SMR's smaller size may facilitate its use in other applications beyond power production, such as process steam generation, desalinization, and hydrogen production.

Finally, SMR designs may enhance reactor security through the use of security-by-design. This design approach may result in attributes such as: (1) better controlled access points to limit ingress/egress to adversaries within the plant buildings, (2) designs that eliminate security camera blind spots, and (3) designs that limit the ability of adversaries to gain access to the protected area from the outside. Security-by-design potentially allows for the use of fewer security staff to protect the facility, creates a diminished target size for potential aircraft impact events, uses simplified plant systems that harden the plant against natural or manmade disasters (Holtec, 2015), and allows major safety-related structures to be deeply embedded underground.

If the design features discussed above materialize in the future operation of SMRs, these improvements may simplify the NRC's reactor oversight process. Therefore, it is not unreasonable to consider at this early stage that the anticipated SMR design-driven benefits weigh in favor of a fee approach that would involve calculating SMR annual fees differently from large light-water reactor annual fees, with SMRs tending to pay lower fees per reactor. Simplicity, improved safety performance, and greater security, all speak to a potentially lower regulatory oversight burden, which, per OBRA-90, should be reflected in the size of the reactor's fee because OBRA-90 requires the NRC to tie its annual fees to its regulatory costs to the maximum extent practicable. However, under the NRC's current fee structure, SMRs would be required to pay the same annual fee as the existing operating fleet, notwithstanding their smaller size, innovative safety and design concepts, and potentially reduced NRC regulatory oversight requirements.

Currently, with no SMR licensees, it may be premature for the NRC staff to draw definitive conclusions on how to allocate fees based on SMR safety or security characteristics. However, it is apparent from the preliminary analysis that adding SMR licensees to the reactor fleet could introduce very large differences in licensed thermal power ratings within the fleet, both within the

[5] For clarity, this regulatory analysis defines the building that houses co-located SMR reactor modules sharing common systems as a "plant," and the geographically bounded area that houses single or multiple plants as a "site."

SMR class itself and when comparing SMRs to the reactors currently in operation. As a result, extending the current one-size-fits-all flat fee approach to SMR licensees could result in licensees undertaking operations vastly different in scale from one another but paying identical fees to the NRC for the ability to undertake these operations. Furthermore, licensees could end up paying drastically different annual fees for the same level of licensed output. For example, a NuScale multi-module nuclear plant with 12 licensed SMR modules (160 MWt per reactor) would have to pay 12 times the annual fee paid by a single operating power reactor even though its 12 modules would have only 1,920 MWt—less than half the licensed thermal power rating of the largest reactor in the current fleet, Grand Gulf, Unit 1 (4,408 MWt), and slightly more thermal power than the smallest, Fort Calhoun (1,500 MWt) (NRC, 2014). Such a fee methodology, given the potentially dramatic disparities from a licensee's standpoint in costs relative to benefits, potentially raises fairness and equity concerns under OBRA-90.

Again, OBRA-90 requires the NRC to tie annual fees to the costs of regulatory services, to the maximum extent practicable. Applying the current fee approach to SMRs without change *could* still potentially comply with OBRA-90. Yet, as previously noted, the NRC's most recent experience with attempting to calculate fees based on detailed analysis of the relationship of specific generic regulatory activities to specific types of light-water reactors did not reveal the process to be worthwhile, particularly given the level of effort required to administer the process. See 60 FR 32230. Accordingly, the NRC revised its fee approach in 1995 in favor of the current flat-fee approach to operating power reactor fees. The current approach still satisfies the OBRA-90 "reasonable relationship" requirement by charging fees associated with regulating operating power reactors to the fleet of operating power reactors. OBRA-90 specifically permits the NRC to assess fees by looking at licensee classes, and OBRA-90 does not restrict how narrowly or broadly the NRC would define each licensee class for this purpose. Considering these factors, basing an SMR annual fee approach upon analysis of which generic regulatory services benefit which types of plants does not appear likely to be viable, at least based on the current state of information.[6] Developing some other approach to calculating SMR annual fees, therefore, appears necessary.

Consideration of Backfit Provisions

Backfitting as defined at 10 CFR 50.109(a)(1) applies to production facilities or utilization facilities licensed under 10 CFR part 50 (NRC, 1990). A backfit analysis is not required for the rulemaking, because these final rule changes do not require the modification of, or addition to, systems, structures, components, or the design of a facility.

Objective

The objective of the rulemaking is to provide an equitable method to assess part 171 annual fees to the current fleet of operating power reactors and the possible future fleet of SMRs.

[6] Certainly, if and when there are licensed SMRs in operation, and therefore generic regulatory activities taking place in connection with regulating them, the NRC would be able to re-evaluate this proposition.

2. IDENTIFICATION AND PRELIMINARY ANALYSIS OF ALTERNATIVE APPROACHES

Background

In early 2009, the NRC published an ANPR for the variable annual fee structure for power reactors in the *Federal Register* (74 FR 12735) (NRC, 2009a). While the ANPR addressed the fee methodology used for all power reactors, its principal focus was on how to best adapt the existing fee methodology for future SMRs. In September 2009, the NRC staff submitted to the Commission SECY-09-0137, "Next Steps for Advance Notice of Proposed Rulemaking on Variable Annual Fee Structure for Power Reactors" (NRC, 2009b) which summarized the ANPR comments and requested Commission approval to form a working group to evaluate the computation of annual fees for power reactors by various fee methodologies. The Commission approved the NRC staff's recommendation in the October 13, 2009, SRM to SECY-09-0137 (Vietti-Cook, 2009).

Four possible alternatives emerged from the working group's analysis that, in the NRC staff's opinion, warranted further consideration:

(1) Continue the existing annual fee structure, but define a modular site of up to 12 reactors or 4,000 MWt licensed power as a single unit for annual fee purposes.

(2) Create fee classes for groups of reactor licensees and distribute the annual fee costs attributed to each fee class equally among the licensees in that class.

(3) Calculate the annual fee for each licensed power reactor as a function of potential risk to public health and safety using a risk matrix.

(4) Calculate the annual fee for each licensed power reactor as a function of its licensed thermal power rating (MWt).

The staff concluded that Alternative 3 would be "…costly to implement and maintain as PRA technology evolves. Additionally, the uncertainty of existing PRA modeling capabilities might not produce adequate differentiation between specific licensees or provide adequate consideration of SMRs" (Dyer, 2011).

Based on the assessment of the remaining alternatives, the NRC staff informed the Commission of its planned approach for developing a variable annual fee structure for SMRs using the fourth alternative (NRC 2011). The NRC staff followed this memo with a formal request for Commission approval to draft a proposed rule to amend 10 CFR part 171 to include a variable annual fee structure for SMRs (Wylie, 2015). This request was approved by the Commission in May 2015 (Vietti-Cook, 2015).

The changes to be in this rulemaking would apply only to future light-water SMRs. The current annual fee structure would remain unchanged for the existing fleet of operating power reactors consistent with the Commission's 1995 determination that a uniform annual fee for all reactors was the optimal approach because it simplified the fee assessment process and provided a predictable, reliable, and equitable allocation of cost recovery fees. Consequently, this regulatory analysis looks principally at the SMR annual fees in comparison to the fees that

would be charged to current operating power reactors, and in relation to the overall fairness and equity of the variable annual fee structure if implemented for SMRs.

The NRC's guidance for the development of regulatory analyses, NUREG/BR-0058, "Regulatory Analysis Technical Evaluation Handbook," states: "Taking no action should be considered an alternative except in cases where action has been mandated by legislation or a court decision" (NRC, 2004, p. 34). The no action alternative serves as the baseline against which all other alternatives, including the rulemaking, are compared. The NRC staff assessed the no action alternative first, followed by a set of refined alternatives developed by the NRC staff during preparation of the final SMR variable fee rule, as follows:

(1) **No action.** Under this alternative, no separate fee structure would be created for SMRs, requiring each SMR reactor to pay the same fee as each reactor in the existing operating power reactor fleet.

(2) **Continue the existing annual fee structure for all reactors but allow for "bundling" of SMR reactors up to a total of 4,500 MWt as a single unit.**[7] This alternative was originally Alternative 1 from the working group. Under this alternative, all SMRs at a site with a cumulative licensed thermal power rating of up to 4,500 MWt would be treated as a single reactor (hereinafter a "bundled unit") and pay a single fee equal to that paid by the existing operating power reactor fleet.[8] Additional units that take the SMR site beyond the 4,500-MWt threshold would be treated as a second bundled unit, subject to its own single annual fee, up until the SMR site reaches 9,000 MWt, and so on.

(3) **Continue the existing annual fee structure for the current fleet of operating power reactors but establish a third fee class for SMRs with fees commensurate with the budgetary resources allocated to SMRs.** This was originally Alternative 2 from the working group. Under this alternative, the NRC staff would maintain a separate fee that would apply equally to all SMR reactors in the same manner that the current annual fee applies to all large light-water reactors.

(4) **Continue the existing annual fee structure for the current fleet of operating power reactors but calculate the annual fee for each SMR site as a multipart fee.** This alternative combines features of the working group's original Alternatives 2 and 4, and bundles the licensed thermal power ratings from all SMRs on a single site in 4,500-MWt increments as bundled units. Under this alternative, the SMR fee would contain a Minimum Fee for the first 250 MWt applied to each SMR site regardless of the cumulative thermal power ratings or number of reactor modules present, and:

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[7] The working group initially established an upper threshold of 4,000 MWt for multi-module power plants so the upper bound of a bundled unit would be roughly comparable to the largest operating reactor units when the 2011 working group developed the alternative. That maximum was based on the largest operating reactors at the time: Palo Verde Nuclear Generating Station, Units 1, 2, and 3, which were each rated at 3,990 MWt. Since then, Grand Gulf Nuclear Station, Unit 1, performed a power uprate that raised the maximum licensed thermal power rating to 4,408 MWt. Therefore, the working group determined the threshold for a bundled unit should be 4,500 MWt.

[8] Currently few SMR designs have a thermal power rating such that they would exactly meet the 4,500-MWt threshold with a discrete number of units. Consequently, it is possible for the addition of a single new SMR reactor to a bundled unit to complete that bundled unit (i.e., reach the 4,500 MWt threshold) and start a new bundled unit.

- A Variable Fee applied on a dollars-per-MWt basis for bundled units with a total MWt rating greater than 250 MWt and less than or equal to 2,000 MWt.

  OR:

- A Maximum Fee equal to that paid by the existing operating power reactor fleet for bundled units with a cumulative MWt greater than 2,000 MWt and less than or equal to 4,500 MWt. The Maximum Fee supersedes the Minimum and Variable fees for sites with bundled units in this power range."

Once an SMR reactor site exceeds a cumulative 4,500 MWt (and for each subsequent increment of 4,500 MWt), any additional units are considered a second "reactor." This resets the fee process without a second Minimum Fee, but includes a variable fee for a licensed thermal power rating less than or equal to 2,000 MWt, after which another Maximum Fee would apply.

The NRC staff did not assess the original Alternative 3 in this regulatory analysis because of the technical complexities and potential costs of developing the probabilistic risk assessments necessary to implement this alternative. These complexities were first identified and described by the working group in 2011 (Dyer, 2011).

Assessment of Alternatives

This analysis evaluated the effect of each alternative on industry implementation, industry operation, regulatory efficiency, NRC implementation, and NRC operation. Attributes that are not expected to be affected by the alternatives evaluated include other government agencies, security and safeguards considerations, public health (accident and routine); occupational health (accident and routine); offsite property; onsite property; general public; improvements in knowledge; antitrust considerations; environmental considerations; and other considerations.

The total fees collected annually from NRC licensees (including operating power reactors) are calculated to recover approximately 90 percent of the NRC's budget authority. This total fee collection is unaffected by the particular methodology chosen for future SMR annual fee determinations, which means there is no net gain or loss to the NRC for implementation of any of the SMR alternative fee structures described herein.

Similarly, because the total fee to be collected is currently evenly distributed over 99 operating reactors, adding a single reactor to the fee structure will not materially change the total part 171 annual fee collected.[9] However, the annual fee paid by each power reactor would decline slightly, because of the increased number of reactors contributing to the total fee recovery. Based on the current number of operating power reactors, the individual fee decreases under all of the alternatives with the exception of the no action alternative, amounting to about one percent or less of the annual fee assessed before the inclusion of a single additional

[9] This statement implies there is a high degree of independence between the "generic and other regulatory costs" of Part 171's annual fee and the costs imposed by reactors. While not entirely true, this simplifying assumption is necessary as a *ceteris paribus* condition of this analysis. For instance, when managers attend site visits to better understand issues related to their work, their time is not billed to the specific licensee, but instead is entered as a management cost—part of the NRC's overhead. However, staff finds no benefit in the false precision of attempting to estimate the small increase in Part 171 annual fees that would be attributable to a new SMR.

operating reactor. Therefore, the NRC staff finds there would be only minimal marginal impacts on the current fleet of power reactor licensees from the alternative SMR fee structures considered here.

As for part 170 user fees, SMRs would pay the same hourly rate as the current fleet of operating reactors for site-specific regulatory activities performed by the NRC. However, the NRC expects that the addition of an SMR licensee to the current fleet of operating reactors would result in a direct increase in new billable hours, which would expand the cost of NRC oversight of such activities in a linear fashion. Consequently, the only costs and benefits that need to be determined in this regulatory analysis are the relative merits of each alternative SMR fee structure: issues of equity among SMRs and, potentially, between SMRs and the current fleet.

In assessing these alternatives, the NRC is attempting to identify the best SMR fee approach possible based on the staff's current understanding of the unique characteristics of SMRs. The alternative ultimately selected for implementation must demonstrate a balance between administrative complexity and the cost effectiveness while satisfying the requirements of OBRA-90. Past experience with fee approaches for operating power reactors prior to 1995, described previously, has been incorporated into the decision process.

Consequently, the NRC favors approaches to assessing part 171 fees among its licensees that would be relatively simple to administer. To assess the relative merits of each alternative identified by the working group as meeting these "simple and equitable" criteria, the NRC staff applied 2015 fees established by the June 30, 2015 final rule (80 FR 37432), and made several simplifying assumptions:

(1) The Minimum Fee for each SMR site under Alternative 4 is $153,250 (Wylie, 2015 for methodology).

(2) When an SMR joins the licensed fleet, the total part 171 fee remains the same for that year. For the purposes of this analysis, the NRC staff used the 2015 part 171 total annual fees of $497,970,000.

(3) Where appropriate for illustrative purposes, evaluation of the following alternatives will consider NuScale SMR reactor modules rated at 160 MWt (50 MWe) each.

Alternative 1: No action.

The no action alternative entails maintaining the status quo. The current approach has proven to be a fair, equitable, and stable approach for the current reactor fleet since the NRC adopted this approach in 1995. Furthermore, there could be an element of unfairness to the current reactor fleet generally if the NRC were to substantially change NRC fee practices that have long governed them, and that have been factored into business planning decisions and projections, simply because the fee approach might not be as fair if applied to a *different* type of reactor that does not yet exist.

However, the NRC does see value in giving prospective SMR licensees reasonable advance notice of the annual fee approach that would likely apply to them if and when SMRs are licensed. Doing so—and doing so through rulemaking, rather than through some less formal process like case-by-case exemptions—should help prospective SMR licensees make better informed business decisions, as they will better understand the likely costs that would be associated with projects they are considering.

In this approach, the NRC staff examined how the no action alternative would operate if applied to SMRs. The staff concluded that Alternative 1 would not address the potential disparities between fees paid and economic benefits derived from each NRC reactor license that could potentially result from applying the existing operating power reactor fee structure to SMR licensees. For instance, under the 2015 fee structure, a NuScale plant with the full licensed design capacity of 12 reactor modules would have to pay total annual fees of almost $54 million (12 reactor modules times $4,486,216)[10] for an electrical power output of about 600 MWe—slightly more than the electrical capacity of Fort Calhoun, the smallest operating power reactor in the existing fleet, which pays a single fee of $4,486,216 (i.e., one-twelfth of the fee that would be charged for the NuScale SMR site).

The economic benefits that can be derived from operating a reactor typically correlate with the thermal rating of the reactor. The higher the thermal rating of the reactor, the greater its ability to provide the licensee with economic benefits. Therefore, a small reactor with a relatively low thermal rating is not likely to be able to generate nearly as much revenue as a large reactor with a much higher thermal rating.[11] The economic benefits a power reactor licensee in the existing fleet receives from its NRC license are much greater than the economic benefits a small SMR licensee would receive from its NRC license. Consequently, there is a fairness and equity basis for developing a system that would assess lower fees for lower-output SMR facilities than are assessed to the existing operating fleet.

Without a different fee for SMRs, licensees would still be eligible to apply each year for a fee exemption for each reactor under 10 CFR 171.11(c). The fee exemption criteria allow for consideration of the age of the reactor, the number of customers in the licensee's rate base,

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[10] Part 171 divides the fee equally among all licensed power reactors. In other words, the 12 NuScale reactors would bring the total number to 111 licensed reactors, which would drop the fee per reactor from $5,030,000 (for the current fleet of 99 operating reactors) to $4,486,216 per reactor, or $53,834,595 for the NuScale 12 reactor plant.

[11] Megawatts thermal (MWt) and megawatts electric (MWe) are both valid measures of the size of a nuclear reactor. This regulatory analysis primarily uses MWt as its metric because the conversion from MWt to MWe—even across different reactor designs—is fairly constant (about three MWt equal one MWe), and discussions in terms of MWt allows considerations of reactor usage for purposes other than electricity generation.

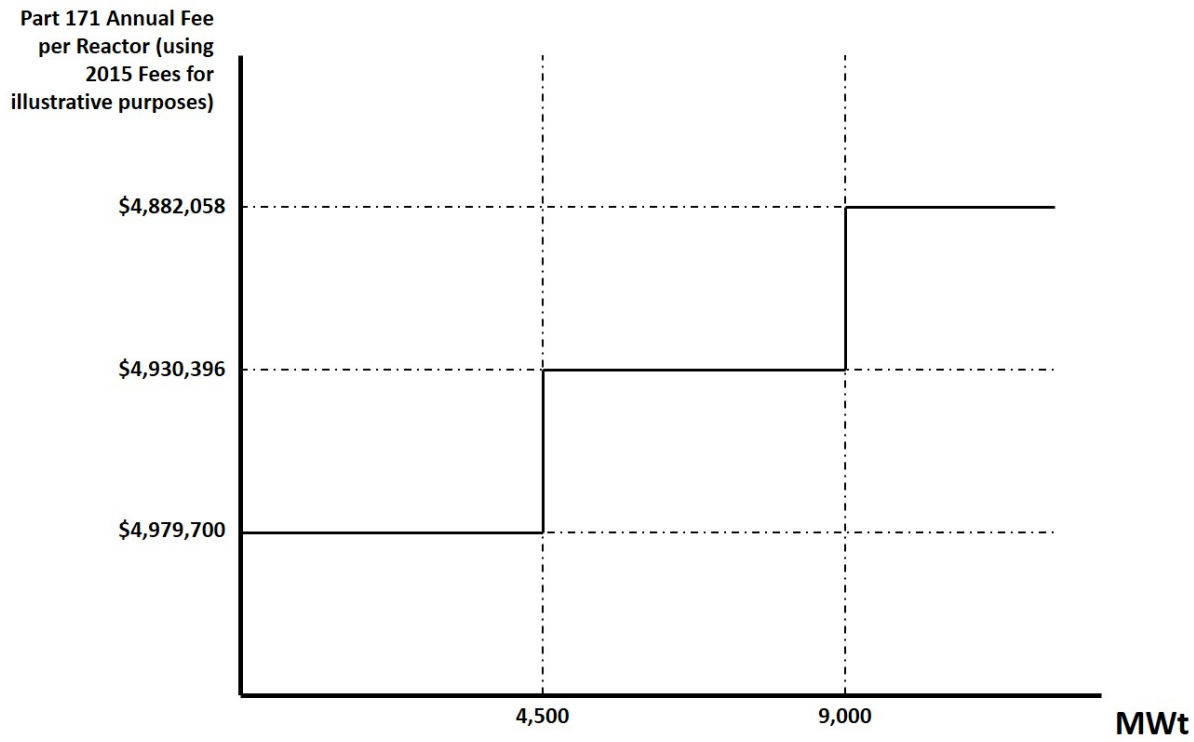
how much the annual fee would add to the per kilowatt-hour (kWh) cost of electricity, and other relevant issues. But as described in SECY-15-0044, there are no guarantees that an exemption will be approved, decreasing regulatory certainty. The NRC staff's anticipated outcome of the no action alternative would be that SMR licensees would seek annual exemptions, which would have an impact on the regulatory efficiency attribute. Under the no action alternative, annual exemptions represent a cost to both the NRC and licensees. However, the impact is not quantified under this alternative and is instead discussed as a qualitative benefit under the other alternatives considered in this analysis. Furthermore, under OBRA-90, the schedule of charges established is supposed to be fair and equitable. If many, and perhaps all, members of a class of reactors could find it necessary to apply for exemptions from the fee schedules established by rule to achieve fair and equitable annual fee results, then that would indicate the fee assessment methodology in the NRC's rules is not fair and equitable. While the right to apply for an exemption remains an option for unexpected situations, relying on exemptions as a routine matter to ensure fairness and equity is not consistent with the requirements of OBRA-90.

Therefore, the NRC staff finds the no action alternative unacceptable because it would not address the substantial fairness and equity concerns posed by the NRC's charging small SMRs and large light-water reactors identical fees despite the potentially large differences in scale, ability to pay, or charging dramatically more in fees to multi-module SMR facilities than are charged to large light-water reactors of comparable scale and ability to pay.

Alternative 2: Continue the existing annual fee structure for all reactors but allow for "bundling" of SMR reactors up to a total of 4,500 MWt as a single unit.

In essence, Alternative 2 treats up to 4,500 MWt of combined MWt at an SMR site as a "bundled unit" that for fee purposes is considered the same as a single reactor paying the current operating power reactor fee. For an SMR site that has a combined thermal power rating similar to that of a current large light-water reactor (approximately 2,000 to 4,500 MWt), this approach does not appear unreasonable, as it would charge facilities with comparable revenue-generating potential from their NRC-licensed activities identical fees. Figure 1 provides a graphical representation of the Alternative 2 SMR fee.

Figure 1: Alternative 2 SMR Fee



When considering smaller SMR facilities, however, Alternative 2 would allow for great disparities among facilities in terms of the annual fees they pay relative to the economic benefits they stand to gain from their NRC licenses. Consider an SMR site with only one NuScale reactor module. The licensee would pay the full annual fee but could spread the fee over only 160 MWt—about $31,123 per MWt. In contrast, an SMR site featuring 12 NuScale reactor modules would pay $2,594 per MWt in annual fees. Additionally, once an SMR site has reached (or nearly reached) the 4,500-MWt threshold for bundled units, it would face a *doubling* of its NRC annual fee if it adds only a slight amount of additional generating capacity. For example, it takes 29 NuScale units to exceed the 4,500-MWt threshold. For 28 NuScale units under Alternative 2, the licensee pays one fee of $4,979,700 for 4,480 MWt ($1,112 per MWt). If the same licensee adds a 29th reactor, the cumulative licensed thermal power rating would exceed 4,500 MWt and the fee under Alternative 2 would double because the total MWt above 4,500 would be considered a second bundled unit. The licensee would then pay $9,860,792 in fees ($497,970,000 total part 171 fee divided by 101 reactors—$4,930,396 each—times 2), and the fee per MWt would be $2,125, a 91-percent increase in the per-MWt cost and twice the annual fee paid by Grand Gulf, Unit 1, for an additional 140 MWt.

Similar to Alternative 1, SMR licensees would still be eligible to apply each year for a fee exemption for each reactor under 10 CFR 171.11(c). But as described in SECY-15-0044, there are no guarantees that an exemption will be approved, decreasing regulatory certainty. The NRC staff's anticipated outcome of Alternative 2 would be that some SMR licensees would seek annual exemptions, which again relates to the regulatory efficiency attribute for this analysis. As

a result, Alternative 2 does not represent a qualitative benefit with respect to regulatory efficiency.

As these examples illustrate, Alternative 2 would go only part of the way toward addressing the fairness and equity concerns that prompted this rulemaking, while leaving significant potential for disparities, from one reactor licensee to another, in terms of the economic benefits the licensee would be able to receive from its NRC license(s) relative to the annual fees assessed. For these reasons, the NRC staff finds Alternative 2 unacceptable.

Alternative 3: Continue the existing annual fee structure for the current fleet of operating power reactors but establish a third fee class for SMRs with fees commensurate with the budgetary resources allocated to SMRs.

Alternative 3 would establish a flat (equal) fee for each SMR reactor in a manner analogous to the way the current fee is allocated across the operating power reactor fleet. In other words, this alternative would create a new fee class of reactors—SMRs—that would be treated as a separate fee class, similar to other fee classes. Examples of these classes include the operating power reactor class, the research and test reactors class, and the spent fuel storage/reactor-in-decommissioning class. An advantage of this approach is that it provides methodological consistency across the various fee classes of reactor licensees, with each reactor licensee being charged the same flat fee as the other licensees in the same fee class. Additionally, the fees charged would be based on the NRC support requirements specific to the fee class, providing alignment with OBRA-90 requirements. If data show the cost of regulatory support differs from one class of SMRs to another, these differences would be reflected by differences in the fees assessed to each SMR reactor class. Yet, similar to the current fee structure's disproportionate impact on SMR licensees with extremely different levels of licensed thermal power ratings, a single per-reactor fee could prove burdensome to SMRs with low thermal power ratings (such as 160 MWt for a single NuScale SMR) when compared to SMRs with higher rated capacities (such as 800 MWt for a single Westinghouse SMR). It is the NRC's intent to select an SMR fee alternative that is fair and equitable for the broadest possible range of SMR designs. Flat-rate alternatives such as this one are inconsistent with the "fair and equitable" requirements of OBRA-90 when applied to a fee class with the wide range of SMR thermal power capacities, and resulting economic benefits, described by reactor designers to date.

Additionally, Alternative 3 is similar to the no action alternative in that fees are based on a licensed reactor or module rather than on the cumulative licensed thermal power rating. This alternative also fails to address the fee disparity created for SMRs using multiple small modules rather than fewer, larger reactors with similar cumulative licensed thermal power ratings, as previously described.

Again, SMR owners would retain the option of applying for an annual fee exemption under this alternative. But as described in SECY-15-0044, there are no guarantees that an exemption will be approved, decreasing regulatory certainty. The NRC staff's anticipated outcome of Alternative 3 would be that some SMR licensees would seek annual exemptions, which relates to the regulatory efficiency attribute. As a result, Alternative 3 does not represent a qualitative benefit with respect to regulatory efficiency.

In summary, the NRC staff finds Alternative 3 to be an unacceptable alternative for addressing the particular fairness and equity concerns regarding annual fee assessments posed by the potential addition of SMRs to the reactor fleet.

Alternative 4: Continue the existing annual fee structure for the current fleet of operating power reactors but calculate the annual fee for each SMR as a multipart fee.

Alternative 4 is the NRC's preferred approach, and it is based upon the original Alternative 4 identified by the working group. In essence, Alternative 4 considers up to 4,500 MWt of combined MWt at a single SMR site to be a "bundled unit" that, for fee purposes, is considered the same as a single reactor paying the current operating power reactor fee—similar, in that respect, to Alternative 2 discussed above. Unlike Alternative 2, however, Alternative 4 would not treat all bundled units the same. Instead, for bundled units below the Variable Fee threshold of 2,000 MWt, Alternative 4 would charge lower fees to bundled units with a lower licensed thermal power rating and higher fees to bundled units with a higher licensed thermal power rating. For bundled units above 2,000 MWt, but at or below 4,500 MWt, Alternative 4 would treat each bundled unit the same as a single reactor in the current operating fleet, regardless of its licensed thermal rating.

To promote fairness and equity across the entirety of the NRC's fee structure for assessing annual fees to reactor licensees, though, the gradual increase in annual fees corresponding to increasing licensed thermal power ratings would occur only until the bundled units reached a licensed thermal power rating comparable to that of a current large light-water reactor. First, very small-capacity SMR sites—those with a bundled total licensed thermal power rating at or below 250 MWt for all SMRs—would pay a flat **minimum fee**. The goal of this minimum-fee approach is to create consistency with reactor-related licensees in existing low-fee reactor classes. While the licensed activities covered by these existing classes may differ from the uses for SMRs, the NRC recognizes that all reactors licensed by the NRC derive some benefits from the NRC's generic licensing work and support activities. Therefore, bundled units with very small thermal ratings, like other low-fee reactor classes, should pay more than just a *de minimis* share of the associated costs. To promote fairness across the NRC annual fee structure, the NRC staff proposes an annual minimum fee for all SMR sites at or below 250 MWt in cumulative licensed thermal power rating.

Second, for an SMR site where the total licensed thermal power rating is greater than 250 MWt and less than or equal to 2,000 MWt, the licensee would pay the minimum fee plus a **variable fee** based on the licensed thermal power rating above 250 MWt at the SMR site. The purpose of this variable fee is to increase the fee paid by a bundled unit as its total thermal rating increases through the addition of more SMR units until the total thermal rating of the SMR site reaches a level roughly comparable with the current operating fleet—2,000 MWt. The increasing variable fee should generally correlate with the economic benefits the licensee is able to derive from its NRC license. The NRC staff views this correlation between licensee benefits and annual fees paid as a reasonable basis to address fairness and equity concerns under OBRA-90 in the SMR context, given the wide variations of scale and uses that SMR technology could potentially support.

Finally, for bundled units that reach the cumulative licensed thermal power rating of typical large light-water reactors (greater than 2,000 MWt and less than or equal to 4,500 MWt), Alternative 4 would charge the same flat fee (hereinafter, the **maximum fee**) that is charged to the current

operating fleet of large light-water reactors. This would ensure comparable fee treatment of facilities that stand to derive comparable economic benefits from their NRC-licensed activities. Beyond the 4,500 MWt level, the NRC staff considers it not unreasonable to treat the SMR site as having begun a new bundled unit on the SMR site.

Under Alternative 4, the effects on fees of a marginal increase in licensed thermal power rating above the upper threshold are addressed as follows. Charging a second maximum fee as soon as the site rating exceeds 4,500 MWt by a minimal amount, such as by the addition of a single reactor module with, say, a 100 MWt rating, would bear little relationship to the increased benefits the licensee is receiving from its additional SMR licenses. In that case, the SMR site would then have *two* flat-rate fees instead of just one, doubling the SMR site's annual fee even though the site has added only a small fraction of additional thermal capacity. This result is contrary to the "fair and equitable" requirements of OBRA-90. Therefore, the NRC staff finds it reasonable to "reset" the fee process once that upper threshold has been crossed by the SMR site.

Because bundled units under the final rule, by definition, have a maximum rating of 4,500 MWt, Alternative 4 would gradually increase variable fees as the SMR site continues to add licensed thermal power rating beyond the 4,500-MWt level (i.e., once the SMR site has created a second bundled unit). With the SMR site by that point already paying considerable annual fees for its first bundled unit, there is no reason to assess a second "minimum fee" at the commencement of a second bundled unit. Instead, the variable fees would begin to increase linearly, as the licensed thermal power rating exceeds 4,500 MWt.

With further additions to the SMR site, the second bundled unit would eventually reach the flat-fee range (at 2,000 MWt for the second bundled unit—6,500 MWt for the SMR site), and be assessed the same maximum fee as a large light-water reactor. Figure 2, below, illustrates this example. This would remain the case until enough licensed thermal power is added to commence a third bundled unit (once the SMR site as a whole exceeds 9,000-MWt licensed thermal power rating), at which point the same approach would apply to the third bundled unit as applied to the second, and so on, alternating between ranges of gradually increasing fees and flat fees, as still more bundled units are added to the SMR site.

Alternative 4, therefore, provides an avenue by which an SMR site can start small and pay a variable fee that grows along with its licensed thermal rating and is, therefore, roughly commensurate with the economic benefits the site's NRC licenses would provide and with the licensee's corresponding ability to absorb annual fee costs. Additionally, the minimum fee at 250 MWt and below and the flat fee for bundled units greater than 2,000 MWt and less than or equal to 4,500 MWt would ensure fairness and equity across the NRC fee structure as it pertains to all reactor fee classes. The staff accordingly views Alternative 4 as meeting the fairness and equity requirements of OBRA-90.

With respect to the specific values chosen to represent the MWt range for typical large light-water reactors for purposes of this alternative, the NRC staff selected values (2,000 MWt and 4,500 MWt) that cover most, although not all, of the current fleet of power reactors. While no reactor generates more than 4,500 MWt (with Grand Gulf, Unit 1, at 4,408 MWt, being the highest licensed thermal power rating reactor in the fleet), there are nine that generate less than 2,000 MWt, with Fort Calhoun listed as the smallest reactor (1,500 MWt). Of the 9 reactors in the current operating fleet with less than 2,000 MWt, 5 are among the 10 oldest reactors in the operating fleet. For the current operating fleet, the average thermal rating among all reactors is 3,094 MWt, with a median reactor rating of 3,216 MWt, which indicates the current fleet is

composed of more large reactors than small ones. The mean thermal rating for all reactors is 3,411 MWt, with six reactors licensed for that capacity. These data indicate the lower bound of the maximum fee is a reasonable starting point for establishing parity between bundled units and the operating reactors in the current fleet.

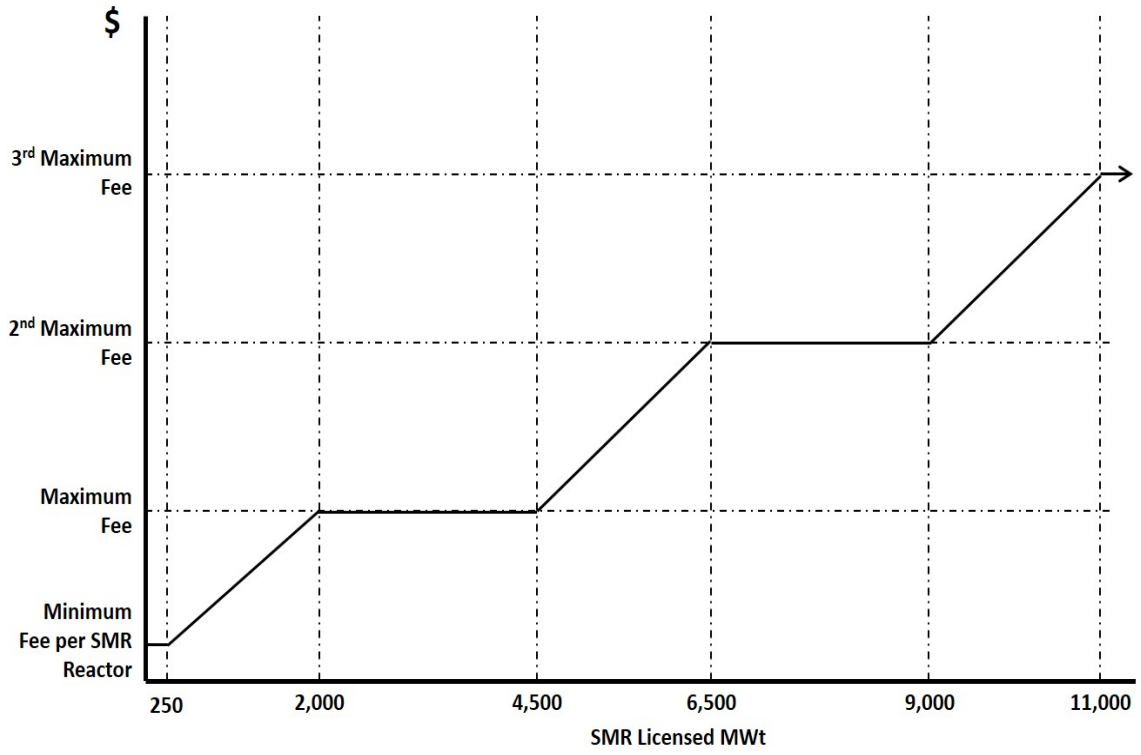
It should be noted that thermal power is not the only conceivable measure of the scale of a reactor. In the case of electricity-generating reactors, the reactor's electricity-generating capacity, rather than its thermal capacity, could provide an adequate measure of the SMR site's scale and its resulting ability to benefit economically from its NRC license and afford NRC annual fees. Although current planning indicates the first SMRs installed in the United States will most likely be used to produce electricity for sale, basing the per-unit portion of the fee on thermal power rather than electrical output accommodates different end uses (e.g., process heat, desalinization, hydrogen production) to which SMRs could potentially be put. Additionally, the use of MWt as a fee basis eliminates potential inequities associated with differences in energy conversion efficiency among different reactor designs.

This alternative represents the greatest benefit to regulatory efficiency compared to the no action alternative. SMR licensees would still be eligible to apply each year for a fee exemption for each reactor under 10 CFR 171.11(c). However, the NRC staff's anticipated outcome of Alternative 4 would be that fewer SMR licensees would seek annual exemptions because Alternative 4 promotes fair and equitable fee distribution compared to the other alternatives. As a result, Alternative 4 represents a qualitative benefit with respect to regulatory efficiency.

3. A QUANTITATIVE ASSESSMENT OF PREFERRED ALTERNATIVE 4

Figure 2 displays a graphical representation of the NRC staff's preferred fee structure.

Figure 2: Alternative 4 SMR Fee



The preferred SMR annual fee has three parts. These parts are described conceptually below.[12]

(1) **Minimum Fee** is a fee paid by each SMR site, regardless of how many bundled units are present, so long as the cumulative licensed thermal power does not exceed 2,000 MWt.[13] This is intended to be comparable to fees paid by other low-fee reactor classes. Accordingly, it is determined by calculating the average of the individual fees for the research and test reactor fee class and the spent fuel storage/reactor decommissioning fee class (Wylie, 2015).

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12 Note that the determination of the variable and the maximum fee values requires an iterative calculation because of the effect on the annual fee values when an additional fee payer (an SMR, in this case) is added to the fee base. For a step-by-step example of how the variable and maximum fee values are calculated using this iterative process, see Attachment A.

13 The 2,000 MWt value is based on a maximum of 250 MWt for the minimum fee plus a maximum of 1,750 MWt for the variable fee. Once the cumulative licensed thermal power exceeds 2,000 MWt on a site, the maximum fee supersedes both the minimum fee and the variable fee.

(2a) **Variable Fee (first bundled unit):** For the first bundled unit on a site, in addition to the Minimum Fee, a Variable Fee is applied for cumulative licensed thermal power ratings greater than 250 MWt, and less than or equal to 2,000 MWt. The Variable Fee increases as licensed thermal power increases. This fee is represented by the sloped portion of the fee curve in Figure 2, in the region between 250 MWt and 2,000 MWt.

(2b) **Variable Fee (additional bundled units):** For additional bundled units on a site, no additional Minimum Fee is charged. Therefore, the variable fee for additional bundled units is applied for cumulative licensed thermal power ratings less than or equal to 2,000 MWt. The Variable Fee increases as licensed thermal power increases. This fee is represented by the sloped portion of the fee curve in Figure 2, in the region between 4,500 MWt and 6,500 MWt, and similarly for additional bundled units.

(3) **Maximum Fee** is a fee equal to the flat fee assessed to the current operating power reactors under the new structure. This fee replaces the Minimum and Variable Fees and applies to all bundled units with a cumulative licensed thermal power rating greater than 2,000 MWt and less than or equal to 4,500 MWt.

Once the SMR site contains enough reactors in the first bundled unit to cross the 4,500 MWt threshold, the methodology would consider the thermal power above 4,500 MWt to be a "second" bundled unit (see Figure 2), and the fee assessment process for that second bundled unit would start over again. A new Variable Fee (but without a Minimum Fee for the first 250 MWt) would be applied until the site contains more than 6,500 MWt (4,500 MWt from the first bundled unit plus the 2,000-MWt Variable Fee threshold for the second bundled unit).

When the second (and all subsequent) bundled units on the same site surpasses 2,000 MWt, the Maximum Fee replaces the Variable Fee, until the second (or subsequent) bundled unit reaches a total of 4,500 MWt, at which point the fee system is reset for another bundled unit.

For fee purposes, a single SMR reactor can be part of one or more bundled units by completing the capacity of one bundled unit and beginning the capacity of an additional bundled unit. For a given site, the use of the bundled unit concept is independent of the number of SMR plants, the number of SMR licenses issued, or the sequencing of the SMR licenses that have been issued.

Conceptually, the part 171 fee can be thought of in terms of a pie chart. Figure 3 displays a conceptual fee composition for several SMR sites and the existing operating fleet. Note, this figure is illustrative only and the apportionment of the segments is not intended to indicate a forecast of licensed SMR size distribution. The area of the circle represents the total part 171 annual fees (in 2015 dollars, $497,970,000).

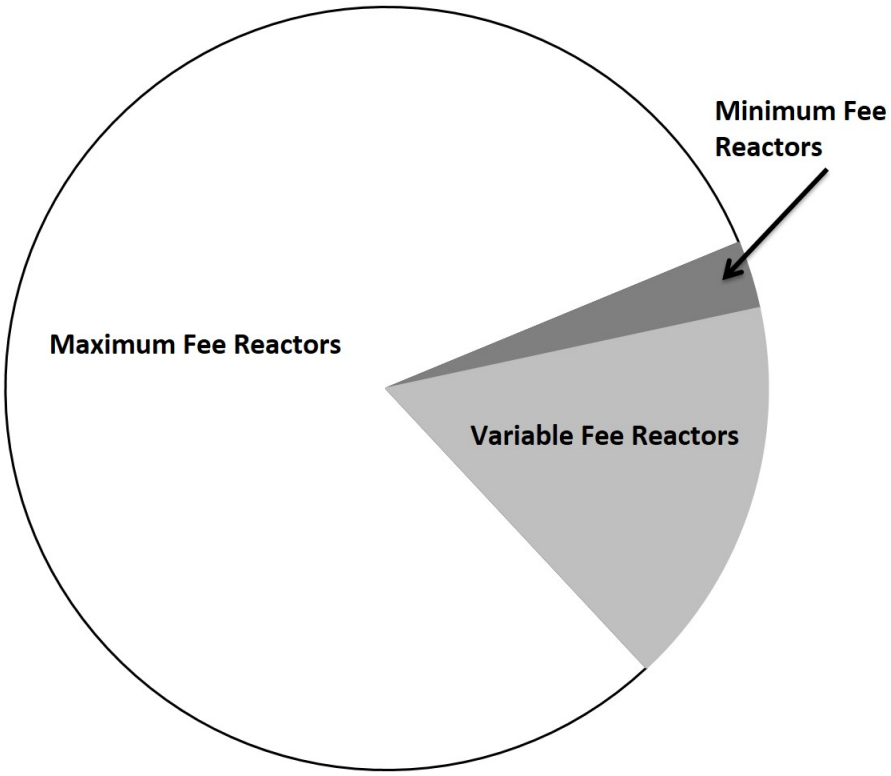

Figure 3 A conceptual representation of the part 171 annual fee composition

Consider a situation with the existing fleet of operating reactors and several SMR sites with operating SMRs. A number of bundled units will be on SMR sites that have 250 MWt or less and would pay only the Minimum Fee (dark gray). On other SMR sites, there will be bundled units that have a cumulative MWt rating that is greater than 250 MWt but less than or equal to 2,000 MWt. For these bundled units, they would pay the Minimum Fee for the first 250 MWt and the Variable Fee for the remainder of their thermal rating (light gray). The combined contribution of SMR sites paying Minimum Fees or Minimum plus Variable Fees reduces the total part 171 fee that must be paid by all the bundled units rated above 2,000 MWt and the existing fleet of large operating reactors (white). Figure 3 illustrates the basic distribution of the part 171 SMR annual fee structure in that very small (in thermal rating terms) SMR sites pay a small part of the total fee, and as the SMR site grows in thermal capacity, so does its contribution, to the point that when the bundled unit grows past 2,000 MWt, it becomes a Maximum Fee payer equal with existing fleet reactors.

Within the SMR class, Alternative 4 addresses the limitations of small SMR projects and maintains an equitable process for assigning fees to larger SMR projects while providing a measure of balance between the annual fee for small and large reactors. The Minimum Fee addresses the needs of very small projects by assessing a single fee that corresponds to the NRC's generic cost efforts for small-scale issues. The Variable Fee addresses the increasing ability of larger SMR projects greater than 250 MWt and less than or equal to 2,000 MWt to pay their fair share of the NRC's recoverable costs. The Maximum Fee for reactors greater than 2,000 MWt and less than or equal to 4,500 MWt (at the same level as all operating power reactors in the current fleet) does not penalize licensees for incremental additions of new SMRs (up to the 4,500-MWt threshold), and offers consistency to licensees for planning purposes.

By establishing a 4,500 MWt threshold as the maximum for a group of SMRs to be considered equivalent to a large power reactor, the fee structure resets the 4,500 MWt threshold for the site. This does not require the licensee to again pay a Minimum Fee as the Minimum Fee is established on a site basis, not on a bundled unit basis. Once the threshold has been crossed and the SMR site begins another bundled unit, the licensee would begin paying a Variable Fee per MWt toward an additional Maximum Fee at 6,500 MWt (2,000 MWt for the second bundled unit), which holds relatively constant at twice the single reactor fee until a cumulative 9,000-MWt rating (4,500 MWt for the second bundled unit) resets the process with a third bundled unit. Figure 4 displays the change in the SMR Fee and that paid by the current fleet for a range of NuScale SMRs at a single site. For multiple SMR sites, the cost savings to the current fleet increases.

Figure 4 Fee sizes for different SMR site sizes

As noted previously, Alternative 4 is a dynamic fee structure because, with the addition of each new bundled unit to the fleet (not just the site), the total annual fee assessed to each operating reactor in the fee class is periodically recalculated. Because the total annual fees are divided equally among all operating reactor licensees, the addition of new bundled units—either all at one site or at multiple sites—spreads the cost over a larger base. Along with the Minimum Fee, each SMR site must pay a Variable Fee for a licensed thermal power rating greater than 250 MWt and less than or equal to 2,000 MWt. Beyond 2,000 MWt, the only change to the SMR fee that takes place until the 4,500-MWt threshold has been reached is that the Maximum Fee—which is constant at the rate paid by the current fleet—is spread across an increasing thermal power capacity. This is consistent with the current fee structure and maintains fairness between SMRs and current operating reactors. Consequently, the 2,500 MWt range of the Maximum Fee allows SMR licensees to spread fee costs across a larger capacity without an increase in fees. This is also consistent with the treatment of power uprates for operating reactors, in which the increase in rated licensed thermal power rating does not result in a fee increase.

Figure 4 displays how the annual fee for SMRs applies to a hypothetical situation with the current fleet of 99 large operating power reactors and 1 SMR site incrementally adding NuScale SMRs. As indicated by the graph, once the bundled unit surpasses 2,000 MWt (with the 13th NuScale reactor), the licensee pays the same fee as the current large operating power reactors.

At or below 2,000 MWt, the bundled unit pays a smaller fee than that paid by current operating reactors, commensurate with the economic benefit derived from its license. The difference is between the bundled unit's fee and the full fee paid by current operating reactors. The fee benefit to all operating reactors from the addition of a new reactor to the fee base is offset slightly by the smaller SMR fee. This offset varies with bundled unit's size.

For example, with only the current operating fleet, the part 171 annual fee is $5,030,000 ($497,970,000 divided by 99 reactors). The addition of a single SMR reactor to the fleet increases the number of reactors to 100, with the total part 171 fee spread across 100 reactors, each of which would pay $4,979,700 if all were charged equal annual fees. But a single reactor rated less than 251 MWt (here, a single 160-MWt NuScale reactor) pays only the Minimum Fee under the fee schedule, requiring the current operating fleet to absorb the "unpaid" $4,823,908—about $48,742 per operating reactor—that the SMR licensee would have paid if it had instead been assessed the same fee as a large light-water reactor licensee.

Even with the additional cost of the SMR subsidy, the new fee to the current operating fleet is still less than the fee they would have paid without the bundled unit added to the fleet (about $1,559 per reactor), and, once the SMR site passes the 250-MWt threshold, each additional new 160-MWt SMR reduces the part 171 annual fee to the existing operating fleet by $4,597. (The bend in the line between reactors 1 and 2 is because the second reactor has only 70 MWt of its total 160 MWt subject to the Variable Fee.) Because of the scale of Figure 4, it is difficult to see the change in fee to the current operating fleet. Figure 5 displays this decline in current operating fleet fees between zero bundled units and the point where a bundled unit attains the Maximum Fee rate (the flat portion of Figure 4).

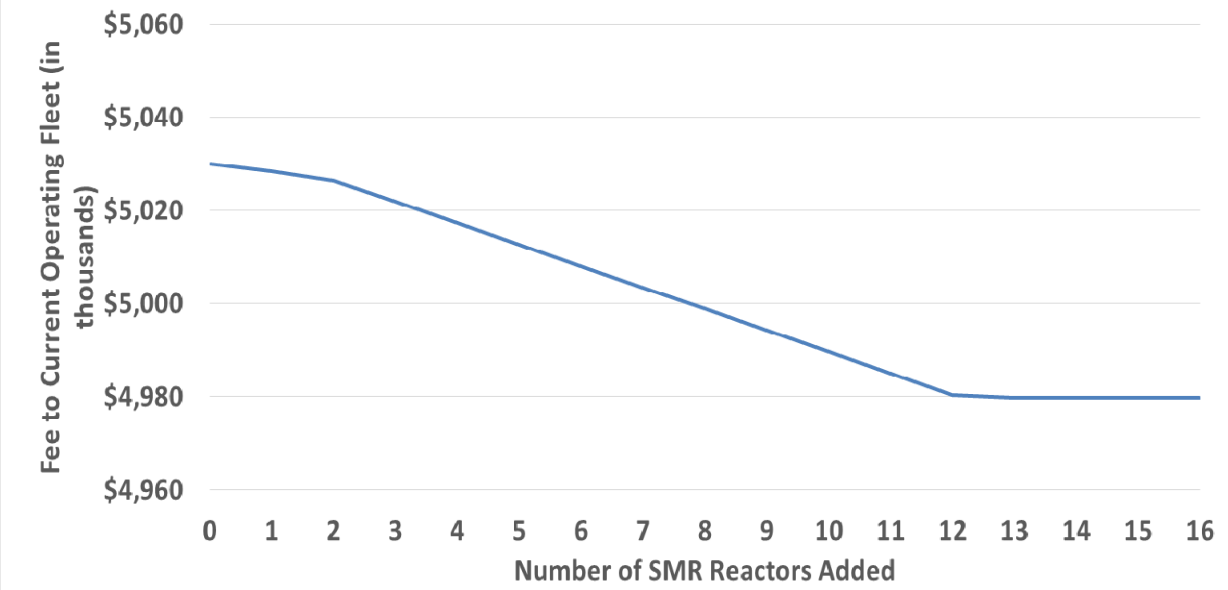

Figure 5 The change in fees to the current operating fleet as SMR reactors are added to the SMR site

When a second NuScale reactor joins the SMR site, the total number of reactors over which the total part 171 fee is divided does not change, because that second reactor is part of the first bundled unit. Only the bundled unit's fee changes, surpassing the 250 MWt threshold for the minimum fee and beginning the 1,750 MWt "climb" from that minimum fee to the maximum fee. Again, the "unpaid" $4,649,672 has to be absorbed by the current operating fleet—about $46,742 per reactor. This process continues with the bundled unit fee increasing and the "unpaid" portion diminishing until the bundled unit passes the 2,000 MWt threshold and begins paying the same fee as the current operating fleet of $4,979,700.

Figure 6 demonstrates the general fairness of the preferred Alternative 4 in terms of each reactor's cost per unit of thermal load. Figure 6 displays the change in fee per MWt for the hypothetical SMR site example. The figure includes four lines: an upper bound cost per MWt (currently paid by Fort Calhoun, the smallest reactor in the fleet) and a lower bound cost paid by the largest reactor in the operating fleet—Grand Gulf, Unit 1. The central almost horizontal line represents the average cost per MWt for the current operating fleet (using a cumulative fleet thermal power value of 306,274 MWt).The final line represents the hypothetical SMR fleet.

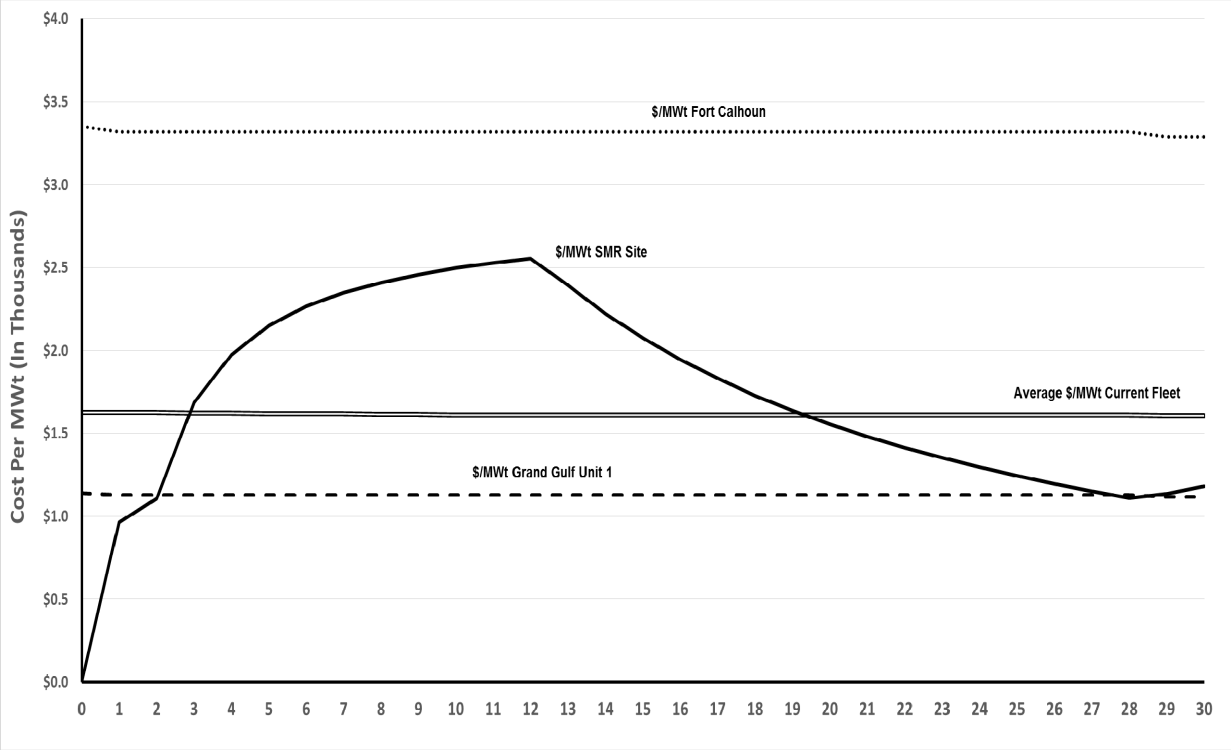

Figure 6 The change in cost per MWt for the hypothetical SMR site scenario

Once the second (and additional) NuScale units are added to the site, the annual fees paid by the licensee all fall within the maximum and minimum bounds of the per-MWt costs paid by the current operating fleet. Since the first NuScale unit on the site does not pass the 250-MWt threshold, the licensee pays $964 per MWt ($153,250 divided by 160 MWt), slightly less per MWt than the Grand Gulf, Unit 1, lower bound of the fleet's range. As the number of NuScale units increases, so does the cost per MWt, but not linearly as one would expect from a per-unit fee. The reason for this is that the Minimum Fee payment becomes distributed over a larger thermal capacity as new units are added, causing the concave shape of the curve. The Variable Fee peaks at the 12th NuScale reactor installed when the total licensed MWt for the

site is less than one reactor away from surpassing the 2,000 MWt threshold. From this point on, the NuScale site has reached the same annual fee rate as the current fleet. As more units are added to the fleet, the MWt increases, but the cost remains the same. The result is a steadily declining cost per MWt for the SMR site until the 29th unit goes on line and the fleet surpasses the 4,500-MWt threshold.

For an SMR site with 19 reactors, the licensee pays almost the same per MWt as the operating fleet average; from that point on, adding more reactors to the site brings the SMR site cost per MWt below the operating fleet average. For an SMR site with 28 reactors (4,480 MWt), the SMR site has a slight per MWt advantage over Grand Gulf, the largest power reactor in operation, as indicated by the SMR line dipping slightly below the Grand Gulf line. However, the advantage is short-lived because the 30th reactor added to the NuScale site again triggers the Variable Fee on a per-MWt basis and the SMR fleet's fee begins to increase again. (Note the slight dip in the average, Fort Calhoun, and Grand Gulf Unit cost lines as the addition of a second bundled unit reduces the fee to all reactors.)

4. CONSIDERATION OF UNCERTAINTY

The NRC staff guidance indicates a regulatory analysis should include "expressions of uncertainty that can be presented in terms of upper- and lower-bounds, and studies, data, and methodologies that support or fail to support the value and impact estimates must, to the extent practical, be reported in the regulatory analysis" (NRC, 2004, p. 23). The regulatory history reflects that the NRC staff has provided an examination of the underlying assumptions by analyzing benefits and costs, the characterization of any bias those assumptions may impose, and the sensitivity of the conclusions when simplifying assumptions vary.

An exhaustive assessment of the consequences of uncertainty is not appropriate for this regulatory analysis because of the nature of the input involved. The annual fee structure under 10 CFR parts 170 and 171 provides little room for error. In the case of the part 171 annual fee for operating power reactors, the calculation is little more than dividing the total fee by the number of reactors in the fleet. That total fee and the per-reactor fee that derives from it form the basis for this regulatory analysis. The only source of uncertainty that can arise comes from the simplifying assumptions used. The following discussion explains the potential impacts of each of those assumptions.

(1) The Minimum Fee per SMR reactor under Alternative 4 is $153,250 (Wylie, 2015)(80 FR 37432)**.**

"Minimum fee is defined as the low threshold on the variable scale for an SMR or multi-module nuclear plant with a total licensed thermal power rating for all modules less than or equal to 250 MWt. The minimum fee is the average of the individual fees for the research and test reactor fee class and the spent fuel storage/reactor decommissioning fee class" (Wylie, 2015 pp. 6–7). This assumption has two places where uncertainty could enter the analysis:

- The Minimum Fee applies to the first 250 MWt at the site. 250 MWt was chosen as a representative thermal power rating for very small reactors, based upon recommendations from NEI (NEI, 2010, p. 7). The NRC staff finds the NEI analysis to be analytically sound and reliable and therefore accepts their recommendation. Changing the thermal threshold for the Minimum Fee would only change the slope of the Variable Fee line and therefore would have negligible impact on the decision.

- The Minimum Fee is $153,250. Similarly, NEI recommended the amount of the Minimum Fee in its 2010 *NRC Annual Fee Assessment for Small Reactors*. The rate was based on calculating the average of the fees for research and test reactor fee class and the fee for the spent fuel storage/ reactors-in-decommissioning fee class. The fee is a proxy amount, given the NRC staff's limited experience in SMR oversight. Consequently, the NRC staff finds the NEI recommended Minimum Fee to be reasonable.

(2) Under Alternative 4, the fee per SMR reactor is $2,786 for each MWt greater than 250 MWt but less than or equal to 2,000 MWt.

The NRC staff determined this value by dividing the remaining annual fee (after the Minimum Fee) by the remaining thermal power in the fee structure—1,750 MWt. That

value would change if the Minimum Fee, the total MWt to reach the Maximum Fee were to change, but as with the above assessment, such changes would only change the slope of the Variable Fee because the Maximum Fee is set by the current annual fee process—equal distribution of the total part 171 annual fee across all operating reactors. Consequently, the end result of any such change would not affect the final outcome of the fee process or provide meaningful information to the decision.

(3) When an SMR joins the licensed fleet, the total part 171 fee remains the same for that year.

The fee is set each year and applies equally to all reactors in the operating fleet. That aspect of the part 171 fee structure is not being revised. Consequently, there is no room for uncertainty within each year's fee.

5. CONCLUSION

The NRC staff finds the Alternative 4 fee structure to be the most fair and equitable allocation of part 171 fees for operating power reactors and for SMRs, as SMRs are anticipated to be simpler in operation and more flexible in application because of their unique designs and small size. This alternative accommodates the broadest possible range of potential SMR designs, provides regulatory certainty to future SMR applicants, and enhances regulatory efficiency. In working to develop a fee structure that would appropriately account for SMRs and satisfy the requirements of OBRA-90, the NRC staff invited public comments and also received position papers from the NEI and the ANS (NEI, 2010, ANS, 2010). Based on that input and the efforts of the SMR Fee Working Group, the NRC staff developed the fee structure for SMRs, which is site-based rather than reactor-based, and which the NRC staff considers to be fair and equitable for both SMRs and the operating power reactor class. The part 171 SMR fee has three parts for each bundled unit (4,500 MWt increment) at a specific SMR site:

(1) A Minimum Fee paid by an SMR site (applies until the licensed thermal power capacity of the site exceeds 2,000 MWt),

(2) A per-MWt Variable Fee for all cumulative MWt at an SMR site greater than 250 MWt and less than or equal to 2,000 MWt,[14] and

(3) A flat Maximum Fee equal to the part 171 annual fee paid by the current operating fleet for all cumulative MWt at an SMR site greater than 2,000 MWt and less than or equal to 4,500 MWt. For the first bundled unit on a site, the Maximum Fee includes equals the Minimum Fee plus the maximum Variable Fee. For additional bundled units, the maximum Variable Fee equals the Maximum Fee.

[14] After the first 4,500 MWt has been met, subsequent bundled units do not pay an additional Minimum Fee. Instead the licensee pays a Variable Fee for the full 2,000 MWt range.

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ATTACHMENT A

Calculating Part 171 SMR Variable Annual Fees

The Dynamic Nature of the SMR Part 171 Fee

This refers to the fee that small modular reactors (SMRs) would pay under Title 10 of the *Code of Federal Regulations* (10 CFR) part 171, "Annual Fees for Reactor Licenses and Fuel Cycle Licenses and Materials Licenses, Including Holders of Certificates of Compliance, Registrations, and Quality Assurance Program Approvals and Government Agencies Licensed by the NRC." The part 171 fee paid by all operating power reactors is established by Section 6101, "NRC User Fees and Annual Charges," of the Omnibus Budget Reconciliation Act of 1990 (OBRA-90), as amended, which states:

> (3) AMOUNT PER LICENSEE—The Commission shall establish, by rule, a schedule of charges fairly and equitably allocating the aggregate amount of charges described in paragraph (2) among licensees. To the maximum extent practicable, the charges shall have a reasonable relationship to the cost of providing regulatory services and may be based on the allocation of the Commission's resources among licensees or classes of licensees.

(OBRA-90, 42 U.S.C. 2214, as amended)

In 1995, the NRC established that the part 171 annual fee structure for multi-module nuclear plants would be allocated 10 CFR part 171 annual fees on a per-licensed-module basis. In other words, Grand Gulf Nuclear Station, with only one licensed reactor, pays a single fee, but Vogtle Electric Generating Plant, with two licensed reactors, pays two fees, and, once Vogtle, Units 3 and 4, are completed and operational, Southern Nuclear Operating Co, Inc., the licensee for Vogtle, would pay *four* fees. The 2015 total part 171 annual fee is $497,970,000, which is divided equally among all existing operating reactors (99 licenses), and each license pays $5,030,000. For the proposed SMR part 171 rate structure, SMR licensees would pay fees on a per-site and per-"bundled unit" basis.

Each site would pay a Minimum Fee that would cover the NRC's costs for very small sites—250 MWt or less—at a rate calculated as the average fee for the research and test reactors class and the spent fuel storage/reactor in decommissioning class.

Once the total MWt at a site surpasses 250 MWt, the licensee begins paying a Variable Fee in addition to the Minimum Fee. The Variable Fee is on a per-MWt basis until the site surpasses 2,000 MWt, when the licensee pays a single Maximum Fee that is equal to the fee paid by the existing operating fleet. The Maximum Fee replaces the Minimum and Variable Fees and remains in place until the total licensed thermal power rating of the site surpasses 4,500 MWt, the maximum licensed thermal power rating for a bundled unit. When the site surpasses the 4,500-MWt bundled unit threshold (and all further multiples of 4,500 MWt), subsequent additions to the site's capacity become a new bundled unit, with no Minimum Fee and a Variable Fee that covers the first 2,000 MWt of that bundled unit, and a new Maximum Fee for capacities beyond 2,000 MWt and up to 4,500 MWt.

While simple in design, the SMR part 171 fee structure contains a subtle complexity that results in a potential change to the fees paid by all operating reactors (including bundled units) with the addition of each new SMR site or SMR reactor. To calculate the part 171 annual fee to all reactors in the fleet involves the following steps.

Note: This iterative fee calculation process is used to establish the Part 171 annual fees to be assessed to the large light-water reactor operating fleet and to sites with SMR bundled units. If there are no SMRs licensed to operate in a given fee year, the step-by-step fee calculation process shown below is not required. In that case, the annual fee per reactor for operating reactors is taken directly from the text accompanying Table XIII, "Annual Fee Summary Calculations for Operating Power Reactors" of the proposed or final annual fee rule.

The Step-by-Step Part 171 (Annual Fee) Process

(1) Determine the Part 171 total required annual fee recovery (Part 171 Total Fee) found on Table XIII, "Annual Fee Summary Calculations for Operating Power Reactors" of the proposed or final annual fee rule.

(2) Determine the Minimum Fee value by calculating the average of the individual fees for the research and test reactor fee class and the spent fuel storage/reactor decommissioning fee class. These individual fees are found on Table XIV, "Annual Fee Summary Calculations for the Spent Fuel Storage/Reactor in Decommissioning Fee Class" and Table XV, "Annual Fee Summary Calculations for Research and Test Reactors" of the proposed or final annual fee rule.

(3) Assign the Minimum Fee from Step 2 to all SMR sites that have less than or equal to 2,000 MWt. Subtract the sum of all assigned minimum fees from the Part 171 Total Fee to obtain the Intermediate Part 171 Total Fee.

(4) Determine the number of reactors and bundled units that should pay variable or maximum annual fees by summing all large light water reactors in the existing fleet plus all bundled units on SMR sites with more than 250 MWt.

(5) Divide the Intermediate Part 171 Total Fee by the number of all reactors and bundled units in Step 4 to get the Intermediate Maximum Fee per reactor or bundled unit.

(6) For all SMR sites with a single bundled unit having a capacity greater than 250 MWt but less than or equal to 2,000 MWt, establish Variable Rate 1 by the following equation:

$$Variable\ Rate\ 1 = Intermediate\ Maximum\ Fee \div 1{,}750\ MWt$$

(7) For each bundled unit subject to the Variable Rate 1, determine Variable Fee 1 by the following equation:

$$Variable\ Fee\ 1 = (Capacity\ of\ bundled\ unit\ minus\ 250\ MWt) \times Variable\ Rate\ 1$$

For all SMR sites with a single bundled unit having a capacity greater than 250 MWt but less than or equal to 2,000 MWt, go to Step 10.

(8) For all SMR sites with more than one bundled unit and where their last bundled unit is less than or equal to 2,000 MWt, establish Variable Rate 2 by the following equation:

$$Variable\ Rate\ 2 = Intermediate\ Maximum\ Fee \div 2{,}000\ MWt$$

(9) For each bundled unit subject to the Variable Rate 2, determine Variable Fee 2 by the following equation:

$$Variable\ Fee\ 2 = Capacity\ of\ bundled\ unit \times Variable\ Rate\ 2$$

(10) Determine the Final Part 171 Total Fee by the following equation:

$$Final\ Part\ 171\ Total\ Fee = Intermediate\ Part\ 171\ Total\ fee - (SUM\ of\ all\ Variable\ Fee\ 1s\ \&\ Variable\ Fee\ 2s)$$

(11) Determine the total number of Maximum Fee reactors and Maximum Fee bundled units by subtracting the number of bundled units that pay a Minimum Fee and/or a Variable Fee from the sum of all large light water reactors in the current fleet and all bundled units (regardless of MWt).

(12) Determine the Final Maximum Fee per reactor or bundled unit by the following equation:

$$Final\ Maximum\ Fee = Final\ Part\ 171\ Total\ Fee \div Total\ No.\ of\ Maximum\ Fee\ Reactors\ and\ Maximum\ Fee\ Bundled\ Units$$

This is the flat-rate annual fee that will apply to all large operating fleet reactors and to all SMR bundled units subject to the maximum fee.

(13) As a final check, add all minimum fees assigned, all variable fees (1 & 2) assigned, and all final maximum fees per reactor and bundled unit from the calculation above. The total should equal the Part 171 total required annual fee recovery found on Table XIII, "Annual Fee Summary Calculations for Operating Power Reactors" of the proposed or final annual fee rule.

See the following page for an example calculation of fees for four hypothetical SMR sites.

Part 171 Annual Fee Model for SMRs - Step-By-Step Process for Hypothetical SMR with 200 MWt per Module

Input Data from Typical Annual Fee Rule (not actual data)						
A	Part 171 total required annual fee recovery	$ 500,000,000				
B	Number of Operating Reactors	100				
C	Annual Fee per Reactor (no SMRs) (A÷B)	$ 5,000,000				
D	Annual individual fee - research and test reactors	$ 85,000				
E	Annual individual fee - spent fuel storage and reactor decommissioning	$ 225,000				
	SMR Site Information	**Module Power in MWt**	**No. of Modules**	**Total Capacity MWt**	**Number of Bundled Units ≤ 4,500 MWt**	**Annual Fee Type**
	Site 1	200	1	200	1	Minimum
	Site 2	200	8	1600	1	Minimum + Variable
	Site 3	200	15	3000	1	Maximum
	Site 4	200	25	5000	2	Maximum + Variable
Step-By-Step Calculation			**Notes**			
1	Part 171 Total Fee [A]	$ 500,000,000				
2	Minimum Fee Value [(D+E)÷2]	$ 155,000				
3a	Minimum Fee - all sites ≤ 2,000 MWt (Sites 1 & 2)	$ 310,000				
3b	Intermediate Part 171 Total Fee (A - Step 3a)	$ 499,690,000				
4	No. of reactors and bundled units paying variable or maximum fees (B + Sites 2, 3, 4)	103				
5	Intermediate Maximum Fee per reactor or bundled unit (Step 3b ÷ Step 4)	$ 4,851,359				
6	Variable Rate 1 in $/MWt (Step 5 ÷ 1,750)	$ 2,772				
7	Variable Fee 1 (Site 2) [(Capacity of Site 2 - 250 MWt) × Step 6]	$ 3,742,477	For first bundled unit with total capacity >250 MWt ≤ 2,000 MWt			
8	Variable Rate 2 in $/MWt (Step 5 ÷ 2,000)	$ 2,426				
9	Variable Fee 2 (Site 4, 2nd bundled unit) [(5,000 MWt - 4,500 MWt) × Step 8]	$ 1,212,840	For additional bundled units with total capacity ≤ 2,000 MWt			
10	Final Part 171 Total Fee [Step 3b - (sum of all Variable Fees 1&2)]	$ 494,734,683				
11	Total no. of max. fee reactors and max. fee bundled units [B + all bundled units - (no. of min./var. fee bundled units)	102	All reactors less the bundled units paying a minimum fee or a minimum and variable fee only			
12	Final maximum fee per reactor [Step 10 ÷ Step 11]	$ 4,850,340	For reactors and bundled units subject to maximum fee - Operating Reactors, Site 3, Site 4			
13	Check Sum - All Fees [Step 3a + Step 7 + Step 9 + (Step 11 × Step 12]	$ 500,000,000				