

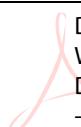
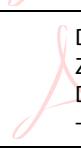
**Enclosure 1 – Non-Proprietary version of Blue Energy Topical Report BE-BOPTR-02-NP,
“Resequencing Balance-of-Plant and Nuclear Island Construction for Blue Energy
Deployments,” Revision 1**

RESEQUENCING BALANCE-OF-PLANT AND NUCLEAR ISLAND CONSTRUCTION FOR BLUE ENERGY DEPLOYMENTS BLUE ENERGY GLOBAL, INC.

REVISION 1



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Information Notice

This is a non-proprietary version of the Blue Energy (BE) document BE-BOPTR-02-P Revision 1. Portions of this document in the non-proprietary version will indicate the removed information by an open and closed double bracket as shown here [[]].

The design, engineering, and other information contained in this document is furnished for the purpose of obtaining Nuclear Regulatory Commission (NRC) review and determination of acceptability for the Blue Energy Small Modular Reactor design and licensing basis information contained herein. The use of this information by anyone for any purpose other than that for which it is intended is not authorized; and with respect to any unauthorized use, Blue Energy makes no representation or warranty, and assumes no liability as to the completeness, accuracy, or usefulness of the information contained in this document.

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1.0 Introduction

1.1. Purpose

The purpose of this licensing topical report is to request Nuclear Regulatory Commission (NRC) approval of a methodology to allow for fabrication and installation of 1) non-safety related balance-of-plant (BOP) structures, systems, and components (SSCs) and other onsite facilities limited to those outside of the 10 CFR 50.10(a)(1) "License required; limited work authorization," framework that constitutes construction (Reference 1), and 2) limited non-safety related balance-of-plant (BOP) structures, systems, and components (SSCs) that may meet criteria in 10 CFR 50.10(a)(1). This methodology does not extend into the nuclear island, regardless of SSC classification. This report provides the basis for [REDACTED]

[REDACTED]^{abcde} prior to seeking NRC approval for, or installation of, any safety-related (SR) SSCs that would be required to support an NRC-approved nuclear island (NI)¹ by adhering to the definition of construction in 10 CFR 50.2 and detailed criteria of 10 CFR 50.10(a)(1).

Blue Energy is requesting NRC review and approval of the methodology and determinations provided in Section 4.0, and certain portions of Section 5.0. If approved, subject to any NRC limitations and conditions, this methodology will be referenced in future licensing submittals and regulatory engagements.

This topical report outlines a method for determining which SSCs do not meet the definition of "construction" under 10 CFR 50.10(a)(1) and can be fabricated, installed, and built on site. Additionally, [REDACTED]

[REDACTED]^{abcde} it is anticipated that some SSCs, while not safety-related, will meet one or more criteria in 10 CFR 50.10(a)(1).

If BOP SSCs are determined to meet the definition of "construction" under 10 CFR 50.10(a)(1), Blue Energy would seek NRC approval through additional mechanisms, such as requesting an exemption from the applicable provisions of 10 CFR 50.10(a)(1) or after obtaining prior NRC approval through a construction permit application or other regulatory actions. The methodology described in Section 5 of this topical report will serve as the technical basis for such exemption requests. Accordingly, this topical report serves as a means to proactively engage with the NRC regarding site activities that do not require NRC oversight and to outline the approach that Blue Energy intends to take to expedite certain non-safety-related construction.

¹ The NI is the portion of the plant that will contain all safety-related SSCs [REDACTED]
[REDACTED]^{abcde}, including the reactor and reactor coolant system, as well as certain non-safety-related SSCs. The BOP constitutes the remainder of the plant (e.g. power conversion system) and does not include any safety-related SSCs.

1.2. Blue Energy Deployment Approach

A key feature of the Blue Energy deployment strategy is to resequence general construction and intentionally disconnect the [REDACTED] from NRC defined construction activities per 10 CFR 50.10(a)(1). The proposed approach is to demonstrate where the criteria of 10 CFR 50.10(a)(1) do and do not apply to the overall design. Blue Energy would then provide NRC with detailed site activities and SSCs to be installed outside of 10 CFR 50.10(a)(1) while continuing NRC engagement for those activities that fall under construction. If the BOP must contain safety-related SSCs to support a nuclear island, such SR SSCs would require additional NRC exemptions or approvals, such as a limited work authorization or construction permit. Blue Energy's proposed deployment strategy includes:

- Implementing internal design requirements for the NI to ensure that design choices are made such that the criteria of 10 CFR 50.10(a)(1) are not satisfied by the majority of BOP SSCs and therefore the BOP SSCs built prior to issuance of a Construction Permit (CP) is largely not considered construction per 10 CFR 50.10(a)(1).
- If fabrication and installation of the BOP is not considered construction per 10 CFR 50.10(a)(1), it is not considered construction as per 10 CFR 51.4.
- Where SSCs do meet the definition of construction per 10 CFR 50.10(a)(1), Blue Energy will apply for an exemption or seek other NRC approval. This is not anticipated to include safety-related SSCs.
- Fabricating and installing BOP SSCs to be built prior to issuance of a CP in accordance with local, state, and federal agencies other than NRC (e.g., state air permit requirements, local construction ordinances, etc.)
- Submitting an application to the NRC that would allow construction of an NI and installation of any additional SSCs, including those that are safety-related, in the BOP that satisfies applicable regulations to ensure the health and safety of the public and protection of the environment.
- Controlling NI construction in accordance with the regulations of 10 CFR 50.10(a).

To allow for this strategy, the portions of the BOP to be built prior to issuance of a CP:

- Will not include any SSCs or facilities that meet the criteria of 10 CFR 50.10(a)(1) or will be granted any necessary exemptions prior to fabricating and installing the BOP.
- Will be clearly and functionally separate from the NI to ensure distinction between the NI and BOP.
- Will be comprised of components that may eventually support a NI and will accordingly be rigorously assessed for safety significance and 50.10(a)(1) criteria applicability, with a burden being on Blue Energy to ensure that no safety-related SSCs are installed prior to a construction permit or other NRC approvals.

- Will be [[REDACTED]]
[[REDACTED]]]].
- [[REDACTED]]
[[REDACTED]]]].

2.0 Key Design Requirements

The following design requirements for a Blue Energy plant provide the underlying basis to determine that the definition of construction per 10 CFR 50.10(a)(1) is not applicable to the majority of BOP SSCs of a Blue Energy site, as discussed in Section 4.0. Each key design requirement shall be verified or demonstrated via a subsequent regulatory submittal to satisfy the methodology in Section 4.0. Blue Energy acknowledges that if a key design requirement cannot be demonstrated for a specific SSC, then an exemption from select regulations may be required.

The following sections provide each of the key design requirements, including a brief discussion and explanation of its importance and how it will be addressed in a future regulatory submittal. This is necessary because the NI and BOP design has not yet advanced to a stage where there is sufficient detail to demonstrate that each criterion is met. Blue Energy is seeking NRC approval of the methodology to allow for effective inclusion of these requirements in the facility design.

2.1. Reliance on NI SSCs for Design Basis Accidents

NI SSCs or SSCs installed with prior NRC approval shall be exclusively relied upon to mitigate anticipated operational occurrences (AOOs) and postulated accidents².

² 10 CFR 50.2 defines safety-related SSCs as those needed "...to remain functional during and following design basis events...." Section 15.0, "Introduction – Transient and Accident Analyses," Revision 4, of NUREG-0800, "Standard Review Plan," directs the NRC staff to review AOOs and postulated accidents to evaluate the safety of a nuclear power plant. Appendix A to 10 CFR 50 contains several General Design Criteria (GDC) which are specifically meant to ensure AOOs are mitigated. For the methodology presented in this topical report, Blue Energy will demonstrate that 10 CFR 50(a)(1)(i) and (ii) are not met for BOP SSCs. These criteria state that SR SSCs and those SSCs needed to mitigate accidents or transients (i.e. AOOs) are considered "construction." Blue Energy uses the phrase "AOOs and postulated accidents," in this topical report to encompass design basis events (as used in 10 CFR 50.2), as well as to be consistent with SRP Section 15.0 and the GDC. Therefore, in the context of this topical report, AOOs and postulated accidents encompass the events that could cause an SSC to meet either 10 CFR 50(a)(1)(i) or (ii). Additionally, SSC classification is preliminary given the stage of plant design. Because the methodology in this topical report only provides a way to demonstrate whether an activity is

Protection of the health and safety of the public and protection of the environment for AOOs and postulated accidents will be provided using exclusively the SSCs located within the NI or installed in the BOP post issuance of a construction permit. This is consistent with the definition of safety-related SSCs in 10 CFR 50.2 (Reference 1). AOOs and postulated accidents are mitigated by ensuring that the general reactor safety functions are maintained with safety-related SSCs only. These general reactor safety functions are to provide 1) reactivity control, 2) core cooling, 3) reactor coolant system pressure boundary integrity, 4) containment integrity, and 5) heat removal.

Verification of this requirement requires demonstration that NI SSCs or SSCs installed with prior NRC approval are sufficient SSCs to mitigate AOOs or postulated accidents within the licensing basis of the facility (e.g., demonstrate that the dose limits specified in 10 CFR 50.34(a)(1) and 10 CFR 100 (Reference 2) are met), including emergency operations of the reactor.

2.2. Clear Functional Separation

NI and BOP SSCs shall be clearly and programmatically separate.

The line of demarcation between the NI and BOP must be easily identified throughout all parts of the facility. From an SSC classification perspective, all SSCs classified as safety related (per 10 CFR 50.2) will be included in the scope of the construction permit application. Only SSCs classified as non-safety-related (NSR) will be included in the SSCs to be built prior to issuance of a CP.

Verification of this requirement requires demonstration that the NI and safety-related BOP SSCs are separated in terms of the design, procurement, layout, construction, and programmatic processes. For example, the NI and BOP facilities may be physically separated by some distance, with select interfaces where SSCs are physically connected between the facilities that are clearly defined.

2.3. No Reliance on BOP SSCs to be Built Prior to Issuance of a CP for Design Basis Accidents

BOP SSCs built prior to issuance of a CP shall not be credited for any safety-related functions to prevent or mitigate AOOs and postulated accidents, but may be considered for beyond design basis events and in probabilistic risk assessments. Also, the initial BOP SSCs shall not be necessary for meeting security regulations, fire protection regulations, nor emergency planning/preparedness requirements.

“construction” pursuant to 10 CFR 50(a)(1), it does not require all SSCs needed to mitigate an AOO to be SR. SSC classification is outside the scope of this topical report and will be addressed in a future submittal.

This requirement addresses the contrapositive of Requirement 2.1. Specifically, that the capabilities of BOP SSCs built prior to issuance of a CP will not be credited for mitigating AOOs or postulated accidents nor be credited for meeting the regulations of similar programmatic requirements (e.g., security, emergency planning, etc.). The requirement for defense in depth identified in regulations will also be met by only considering SSCs posed in a construction permit.

Note that, consistent with Limitation/Clarification 7 in Reference 3, some SSCs necessary to comply with the security requirements in Part 73 may be implemented at the BOP facility after its construction. These SSCs (if needed) will not be installed or operated without prior NRC approval. This approach will also apply to SSCs required for compliance with fire protection and emergency preparedness requirements.

2.4. *BOP SSCs to be Built Prior to Issuance of a CP Outside of the Definition for Construction Under 10 CFR 50.10(a)(1) Have no Adverse Impacts on the NI*

Failure or errant/intentional actuation of a BOP SSC built prior to issuance of a CP shall not impair safety functions of SR SSCs within the NI, nor result in a reactor trip or actuation of a safety-related SSC.

In large LWRs, there are interactions between NSR and SR SSCs that need to be considered when evaluating certain events (e.g., NSR SSCs impact the capability of SR functions). The Blue Energy design will only have select interfaces between the NI and BOP that will need to be assessed in order to ensure BOP SSCs do not adversely impact the ability of the NI to perform its functions. The purpose of this requirement is to simplify interactions between the NI and BOP and therefore require the design to demonstrate that actuation of BOP SSCs built prior to issuance of a CP will not impair the ability of NI, or post construction permit BOP SR SSC, to maintain reactor safety. The NI does not have to be so completely isolated that the BOP cannot cause changes in NI system conditions. However, the NI will be separated from the BOP such that the magnitude of any feedback from the BOP to the NI is bound by other transients, and that safety-related SSCs are not functionally degraded.

Requirements 2.1 and 2.3 impose limitations on the SSCs that can be credited in the deterministic safety analysis of AOOs and postulated accidents. Requirement 2.4 focuses on justifying that operation or failure of non-construction BOP SSCs will not hinder reactor safety.

Note that select regulations (e.g., 10 CFR 50.62, risk reduction for anticipated transients without scram for LWRs) may refer to SSCs that are contained within the BOP (e.g., the main turbine). These select regulations do not rely on nor impact the definition of “activities constituting construction” as described in 10 CFR 50.10(a)(1). Therefore, because the methodology described in Section 4.0 is limited to evaluating the applicability of 10 CFR 50.10(a)(1), these regulations are beyond the scope of the methodology described below. Blue Energy acknowledges that applicable regulations must be met in order to obtain an operating license. However, these regulations do not

need to be met in order to construct the BOP because these regulations are not related to the definition of activities constituting construction.

Verification of this requirement requires demonstration that errant or intentional actuation of a non-construction BOP SSC does not impact the NI's ability to perform required safety functions. This verification will be provided via the NI safety analysis, as part of a future regulatory submission.

3.0 Regulatory Definition of Construction

3.1. Purpose

Based upon a review of the regulatory history of 10 CFR 50.2, 50.10, and of similar changes in Part 73 (Reference 4), it is Blue Energy's perspective that the purpose of the current regulations defining "construction" is to:

- Avoid a situation where construction begins but the NRC subsequently concludes either the site or design does not satisfy regulatory requirements.
- Protection of the environment by assessing the potential environmental effects of building and subsequently operating and decommissioning a nuclear reactor facility.
- Allow the NRC to monitor early activities that are significant to reactor safety, such as adequacy of NI foundations and installation of safety-related SSCs.

3.2. Regulations Pertaining to Construction

The scope of construction is identified in multiple regulations (e.g., 10 CFR 51.4 for all licensees plus 10 CFR 30.4 for byproduct licensees; 10 CFR 50.2 and 10 CFR 50.10 for reactor licensees; 10 CFR 70.4 for special nuclear material licensees). In relation to 10 CFR 50.10, the definition of construction has evolved over time.

The initial issue of 10 CFR 50.10 in 1956 did not contain a restriction on initiating construction (21 FR 355 Jan. 19, 1956, Reference 5). In 25 FR 8712 Sep. 9, 1960 (Reference 6), the Atomic Energy Commission implemented a clarification of work permitted or prohibited with respect to any production or utilization facility prior to the issuance of a construction permit [emphasis added]:

"(b) No person shall begin the construction of a production or utilization facility on a site on which the facility is to be operated until a construction permit has been issued. As used in this paragraph, the term 'construction' shall be deemed to include pouring the foundation for, or the installation of, any portion of the permanent facility on the site; but does not include: (1) Site exploration, site excavation, preparation of the site for construction of the facility and construction of roadways, railroad spurs and transmission lines; (2) Procurement or manufacture of components of the facility; (3) Construction of non-nuclear facilities (such as turbo-generators and turbine buildings) and temporary buildings (such as construction equipment storage sheds) for use in connection

with the construction of the facility; and (4) With respect to production or utilization facilities, other than testing facilities, required to be licensed pursuant to section 104 a. or section 104 c. of the Act, the construction of buildings which will be used for activities other than operation of a facility and which may also be used to house a facility. (For example, the construction of a college laboratory building with space for installation of a training reactor is not affected by this paragraph.)"

Therefore, the initial inclusion of limitations on construction activities explicitly excluded non-nuclear facilities and specifically excluded turbine buildings. These exclusions constitute a major portion of the BOP.

Subsequently, 37 FR 5748 March 21, 1972 (Reference 7), stated that construction activities included those actions "determined by the Commission to have a significant impact on the environment" and reversed the position on turbine buildings, saying [emphasis added]

"Commencement of construction' is defined to include any clearing of land, excavation or other substantial action that would adversely affect the natural environment of a site and construction of nonnuclear facilities (such as turbogenerators and turbine buildings),..."

This reversal is associated with the National Environmental Policy Act (NEPA), which was signed into law in 1970. As a result, not only are non-nuclear buildings deemed construction but so are many site preparation activities. As the regulator for nuclear facility safety, the AEC (now NRC) was assigned responsibility for evaluating issuing a federal Environmental Impact Statement (EIS), as codified in 10 CFR 51 (Reference 8).

By the early 1980s, new plant construction had mostly ceased, and the definition of construction was not of much significance. In anticipation of new nuclear plant projects in the mid-2000s, the NRC pursued a number of initiatives, one of which was responding to industry requests to allow construction to begin earlier to shorten the time from site preparation to commercial operation.

The LWA rulemaking in 2007 evaluated the NRC's role under NEPA, and led to a revision of the definition of construction in 10 CFR 50.10 to expressly exclude certain activities and to define what activities required an early site permit (ESP), limited work authorization (LWA), CP, or combined operating license (COL). The NRC determined that its NEPA obligations and responsibilities arise only when the Commission undertakes a Federal action within the agency's statutory responsibility (72 Fed. Reg. 57416 and 57427 Oct. 9, 2007, Reference 9). Specifically, the NRC noted that NEPA, essentially a procedural statute, does not expand the NRC's jurisdiction beyond the scope of the Atomic Energy Act (AEA). The NRC further determined that,

"[W]hile NEPA may require the NRC to consider the environmental effects caused by the exercise of its permitting/licensing authority, the statute cannot be the source of the expansion of the NRC's authority to require . . . other forms of

permission for activities that are not reasonably related to radiological health and safety or protection of the common defense and security. Since NEPA cannot expand the Commission's . . . authority under the AEA, the elimination of the blanket inclusion of site preparation activities in the [then existing] definition of construction does not violate NEPA."

In 2010, the NRC staff issued SECY-10-0018 (Reference 100) with the aim to provide consistency across different parts of the regulations. It was intended to enable applicants for materials licenses to perform non-safety or non-security related site preparation activities not related to radiological health and safety or common defense and security considerations. The SECY provided the following examples: clearing land, site grading and erosion control, and construction of main access roadways, non-security related guardhouses, utilities, parking lots, or administrative buildings not used to process, handle or store classified information.

The line dividing construction from non-construction is generally defined in 10 CFR 50.2:

"Construction or constructing means, for the purposes of § 50.55(e), the analysis, design, manufacture, fabrication, quality assurance, placement, erection, installation, modification, inspection, or testing of a facility or activity which is subject to the regulations in this part and consulting services related to the facility or activity that are safety related."

However, 10 CFR 50.10(a) provides more specific definition of "activities constituting construction":

"Activities constituting construction are the driving of piles, subsurface preparation, placement of backfill, concrete, or permanent retaining walls within an excavation, installation of foundations, or in-place assembly, erection, fabrication, or testing, which are for:

- (i) Safety-related structures, systems, or components (SSCs) of a facility, as defined in 10 CFR 50.2;*
- (ii) SSCs relied upon to mitigate accidents or transients or used in plant emergency operating procedures;*
- (iii) SSCs whose failure could prevent safety-related SSCs from fulfilling their safety-related function;*
- (iv) SSCs whose failure could cause a reactor scram or actuation of a safety-related system;*
- (v) SSCs necessary to comply with 10 CFR part 73;*

(vi) *SSCs necessary to comply with 10 CFR 50.48 and criterion 3 of 10 CFR part 50, appendix A; and*

(vii) *Onsite emergency facilities necessary to comply with either § 50.160 or § 50.47 and appendix E to this part, as applicable.”*

These seven criteria ensure that appropriate NRC review and approval occurs prior to beginning construction of key SSCs with a reasonable nexus to reactor safety, security, or emergency preparedness.

As discussed in COL/ESP-ISG-4, “Interim Staff Guidance on the Definition of Construction and on Limited Work Authorizations” [ML082970729], (Reference 11) the scope of SSCs falling within the definition of construction in the LWA rule was derived from the scope of SSCs that are included in the program for monitoring the effectiveness of maintenance at nuclear power plants, as defined in 10 CFR 50.65(b), and supplemented with additional criteria (10 CFR 50.10(a)(1)(v-vii)). However, determining which SSCs fall within these additional criteria (10 CFR 50.10(a)(1)(v-vii)) should not be based on the maintenance rule guidance. Instead, SSCs are considered within the definition of “construction” if they are designed to comply with 10 CFR Part 73, “Physical Protection of Plants and Materials”; 10 CFR 50.48, “Fire Protection”; Criterion 3, “Fire Protection,” of Appendix A, “General Design Criteria for Nuclear Power Plants,” to 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities”; 10 CFR 50.47, “Emergency Plans”; or Appendix E, “Emergency Planning and Preparedness of Production and Utilization Facilities,” to 10 CFR Part 50

COL/ESP-ISG-4 includes examples of SSCs in and out of scope of construction. For example, the category Turbine Building Structure or Foundation is described as [emphasis added]:

“The turbine/generator system is within the scope of construction because failure of the turbine/generator could cause a reactor scram. However, depending on the plant design, it is possible for an applicant to demonstrate that a plausible failure of the turbine building structure or foundation (settling) would not result in a reactor scram or safety system actuation. Depending on the facility design, the turbine building structure or foundation may not fall within the scope of construction, if the reactor scram or safety system actuation criterion is the only reason to consider it.”

For large LWRs such as the PWRs currently operating in the U.S., the turbine building is a large structure adjacent to the reactor building. Because of the potential interactions between structures, specific structural considerations such as Seismic Category 2 over 1 apply to portions of the turbine building. This differs substantially from planned plant designs (such as Blue Energy’s) in which the BOP, which includes the building housing the turbine(s) and other non-radiological systems, will be remote and effectively isolated from directly affecting the NI.

As discussed above, the definition of “construction” in NRC regulations is intended to ensure that activities with a reasonable nexus to reactor safety, security, or emergency preparedness are performed with appropriate review and oversight. Therefore, within the purview of 10 CFR 50.10(a)(1), activities that fall outside the scope of “construction”, are not subject to the NRC’s review and oversight. Thus, these non-nuclear construction activities would be permitted to proceed without NRC approval.

3.3. Exemptions from Regulations

This section identifies NRC requirements for requesting and granting regulatory exemptions.

Subpart A of 10 CFR 51 implements section 102(2) of NEPA, 10 CFR 51.4 includes a definition of construction, and 10 CFR 51.6 allows the Commission to grant exemptions to regulations in Part 51.

Similarly, 10 CFR 50.12 allows granting specific exemptions to Part 50:

“(b) Any person may request an exemption permitting the conduct of activities prior to the issuance of a construction permit prohibited by § 50.10. The Commission may grant such an exemption upon considering and balancing the following factors:

“(1) Whether conduct of the proposed activities will give rise to a significant adverse impact on the environment and the nature and extent of such impact, if any;

“(2) Whether redress of any adverse environment impact from conduct of the proposed activities can reasonably be effected should such redress be necessary;

“(3) Whether conduct of the proposed activities would foreclose subsequent adoption of alternatives; and

“(4) The effect of delay in conducting such activities on the public interest, including the power needs to be used by the proposed facility, the availability of alternative sources, if any, to meet those needs on a timely basis and delay costs to the applicant and to consumers.

“Issuance of such an exemption shall not be deemed to constitute a commitment to issue a construction permit. During the period of any exemption granted pursuant to this paragraph (b), any activities conducted shall be carried out in such a manner as will minimize or reduce their environmental impact.”

Part 52, as identified in § 52.7, describes exemptions as:

“The Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of the regulations of this

part. The Commission's consideration will be governed by § 50.12 of this chapter, unless other criteria are provided for in this part, in which case the Commission's consideration will be governed by the criteria in this part. Only if those criteria are not met will the Commission's consideration be governed by § 50.12 of this chapter. The Commission's consideration of requests for exemptions from requirements of the regulations of other parts in this chapter, which are applicable by virtue of this part, shall be governed by the exemption requirements of those parts."

Exemptions are required for deviations from regulations. In the process proposed by this topical report, the NRC would not necessarily be the government agency initially responsible for reviewing compliance with NEPA for the BOP construction. As the BOP construction is disconnected from that of the NI, the activities requiring NRC as the lead federal agency may occur after the BOP construction is authorized by other government entities. Blue Energy believes that this is acceptable, as the BOP (even if completed at the time of NRC's determination under 10 CFR 51) may be remediated, repurposed, or relocated, if the NI is not approved.

4.0 Methodology for Evaluating the Applicability of Construction Definition

This section describes a methodology by which the regulations in 10 CFR 50.10(a)(1) can be evaluated in a manner that determines where additional NRC approval should be sought for installation of BOP SSCs. This methodology is founded on two principles:

- The site on which the NI will be built will have an environmental review performed by the NRC (e.g. via the construction permit process). This satisfies the NEPA provisions for which the NRC is responsible. A redress plan will be provided prior to beginning site work.
- The facility design will meet the requirements defined in Section 2.0. Demonstration of a specific nuclear facility design that meets these requirements will be provided in subsequent licensing submittals such as a topical report, a limited work authorization application, a construction permit application, or a combined license application.

Blue Energy acknowledges that the term "construction" is defined elsewhere in regulations (such as 10 CFR Part 51 and other non-NRC regulations). Blue Energy considers that the methodology outlined in this topical report will satisfy NRC regulatory requirements for both safety and environmental considerations. Construction activities that are subject to non-NRC regulations will comply with the applicable regulations (e.g., state and local). Items that are construction and/or require an exemption under 50.12 would also require an exemption under 51.6 for environmental considerations.

4.1. 10 CFR 50.10(a)(1)(i)

This criterion applies exclusively to safety-related SSCs as defined by 10 CFR 50.2. Per Requirement 2.2, no safety-related SSCs will be included within the boundary of the BOP, prior to seeking and receiving NRC approval.

Therefore, pending demonstration of Requirement 2.2 in a subsequent licensing submittal, there are no SSCs in the BOP to be built prior to issuance of a CP that meet criterion (i).

4.2. 10 CFR 50.10(a)(1)(ii)

This criterion applies exclusively to the SSCs relied upon to mitigate AOOs or postulated accidents or that are used in plant emergency operating procedures. Per Requirement 2.1, the SSCs that are relied upon to mitigate AOOs or postulated accidents (e.g., required to ensure that the dose limits specified in 10 CFR 50.34(a)(1) and 10 CFR 100 are met), including emergency operations of the reactor, will not be included in the BOP to be built prior to issuance of a CP. As per Requirement 2.3, the capabilities of the BOP SSCs will not be credited for mitigating accidents or transients.

Therefore, pending demonstration of Requirements 2.1 and 2.3 in a subsequent licensing submittal, there are no SSCs in the BOP to be built prior to issuance of a CP that meet criterion (ii).

4.3. 10 CFR 50.10(a)(1)(iii)

This criterion applies to any SSCs that could have an interaction with SR SSCs that would prevent the SR SSC from performing its safety function. Per Requirement 2.4, an actuation or failure of a BOP SSC will not impair the NI's response to safely shutdown the reactor and maintain it is a safe shutdown condition.

Therefore, pending demonstration of Requirement 2.4 in a subsequent licensing submittal, there are no SSCs in the BOP to be built prior to issuance of a CP or relevant exemption that meet criterion (iii).

4.4. 10 CFR 50.10(a)(1)(iv)

This criterion addresses SSCs that have a nexus to radiological safety but not explicitly perform a safety function. In traditional LWRs, there is an interface between SSCs that provide safety-related functions and/or asset-protection functions (e.g., NSR SSCs impact the capability of SR functions). For many new SMR technologies, this overlap is much more separated, as the nuclear reactor is designed to be inherently and passively safe, not requiring active functions to safely shutdown. Per Requirement 2.4, failure of a BOP SSC built prior to issuance of a CP will not result in a reactor scram or actuation of a safety-related system.

Therefore, pending demonstration of Requirement 2.4 in a subsequent licensing submittal, there are no SSCs in the BOP built prior to issuance of a CP or relevant exemption that meet criterion (iv).

4.5. 10 CFR 50.10(a)(1)(v)

This criterion applies to SSCs necessary to comply with 10 CFR 73, which delineates the NRC's physical protection requirements. Construction related to these SSCs can be integral to the NI (e.g., reactor housing) or separate (e.g., dedicated physical barriers). Per Requirement 2.3, there will not be any security-related SSCs implemented in the BOP prior to receiving appropriate NRC authority via a permit or license approval.

Therefore, pending demonstration of Requirement 2.3 in a subsequent licensing submittal, there are no SSCs in the BOP built prior to issuance of a CP that meet criterion (v).

4.6. 10 CFR 50.10(a)(1)(vi)

This criterion applies to SSCs necessary to comply with the fire protection requirements defined in 10 CFR 50.48 and General Design Criteria 3 in 10 CFR 50, Appendix A. Per Requirements 2.1 and 2.3, only NI SSCs will be required to ensure safe operation of the nuclear facility, and per Requirement 2.4, inadvertent actuation of BOP SSCs will not adversely impact the ability of NI SSCs to perform their required functions. Note that per Requirement 2.3, there will not be any SSCs required for NI fire protection implemented in the BOP prior to receiving appropriate NRC authority via a permit or license approval. Therefore, impacts from potential fires on the NI will be sufficiently mitigated using exclusively NI SSCs and SSCs implemented in BOP after NRC approval of a permit or license (if any). Similarly, potential fires on the BOP will not prevent or adversely impact the operation of any NI SSCs.

Thus, pending demonstration of Requirements 2.1, 2.3 and 2.4 in a subsequent licensing submittal, there are no SSCs in the BOP built prior to issuance of a CP that meet criterion (vi).

4.7. 10 CFR 50.10(a)(1)(vii)

This criterion applies to onsite emergency facilities necessary to comply with the emergency preparedness requirements defined in 10 CFR 50.160 or 10 CFR 50.47 and 10 CFR 50, Appendix E. Per Requirement 2.3, BOP SSCs will not contribute to meeting emergency preparedness requirements. Also, as noted in Requirement 2.3, there will not be any SSCs required for NI emergency preparedness installed or operated in the BOP without prior NRC approval.

Therefore, pending demonstration of Requirement 2.3 in a subsequent licensing submittal, there are no SSCs in the BOP built prior to issuance of a CP that meet criterion (vii).

4.8. Additional Criterion

Additionally, Blue Energy is choosing to further demonstrate the lack of safety-based reliance on BOP SSCs to be built prior to issuance of a CP in a manner familiar to NRC.

11

the first time in the history of the world, the people of the United States have been called upon to determine whether they will submit to the law of force, or the law of the Constitution. We shall not shrink from that great responsibility. We shall meet the emergency in the spirit of the Constitution, and in accordance with the principles of justice and freedom.

| Number of nodes | Error |
|-----------------|-------|
| 1 | ~95 |
| 2 | ~15 |
| 3 | ~10 |
| 4 | ~8 |
| 5 | ~7 |
| 6 | ~6 |
| 7 | ~5 |
| 8 | ~4 |
| 9 | ~3 |
| 10 | ~2 |

There are no SSCs that will be installed in the BOP to be built prior to issuance of a CP that meet these criteria without prior NRC approval, such as an exemption request, limited work authorization, or construction permit.

5.0 Blue Energy Plant Design Features

5.1. *Introduction*

The purpose of this section is to describe preliminary aspects of the Blue Energy plant design that will facilitate the implementation of this topical report. It may also be used to

[C]

$$J^{ab} = \frac{1}{2} \epsilon^{abc} \epsilon^{def} J_{cd} J_{ef}$$

5.2. Regulatory Request

When the methodology described in this topical report is implemented, the BOP SSCs described in Section 5.8 can be []^{abcde} with no additional NRC approval pursuant to 10 CFR 50.10(a)(1). If implementation of this methodology shows that certain BOP SSCs meet 10 CFR 50.10(a)(1)(iv), then Blue Energy will submit an exemption request, or Limited Work Authorization request to allow for fabrication and installation of those SSC(s). Blue Energy requests the NRC review and approve the scope of analysis in Sections 5.6, 5.7, and 5.8 that will support a future submittal that implements the methodology in this topical report. Below is a summary of the proposed order of licensing actions to implement this topical report:

[]



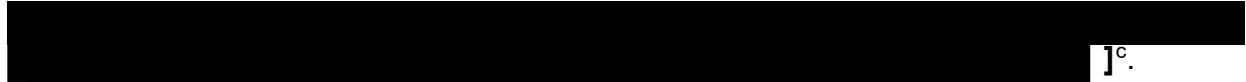
]]^{ab}

Accordingly, Blue Energy will not fully implement the methodology described in this topical report as part of this submittal. As noted in several parts of Section 5, Blue Energy will implement this methodology and detail the results of the implementation in a future regulatory submittal.

5.3. Blue Energy Plant Description

The Blue Energy plant will be []

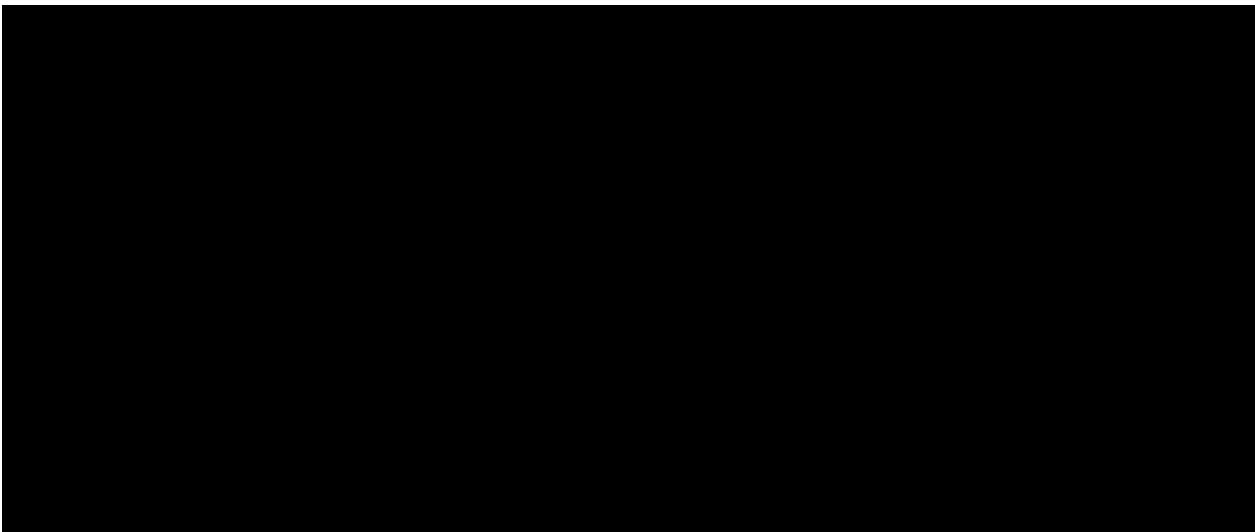




]^c.

Figure 1 shows the relative relationship between the NI and BOP. NI SSCs are highlighted in blue, and BOP SSCs are highlighted in orange. Figure 1 is conceptual and is not meant to reflect the exact layout of the plant.

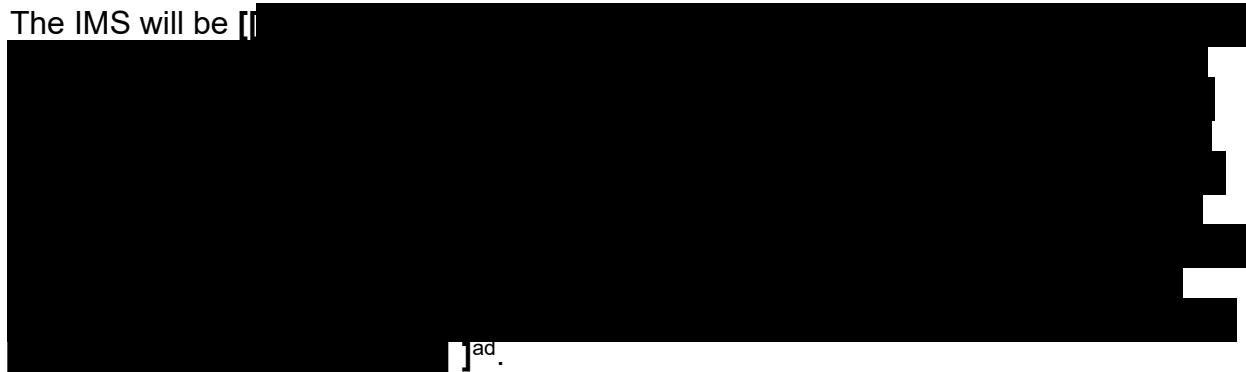
[[



]]^{de}

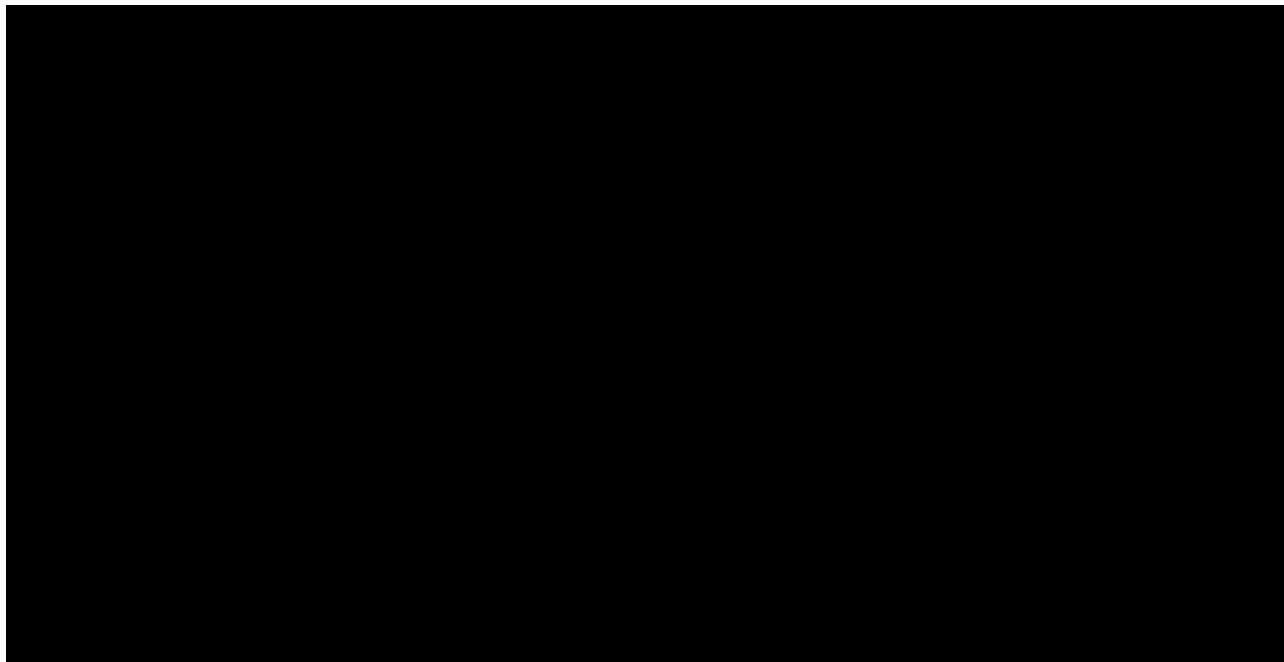
Figure 1 - Top View of NI and BOP SSCs

The IMS will be [[



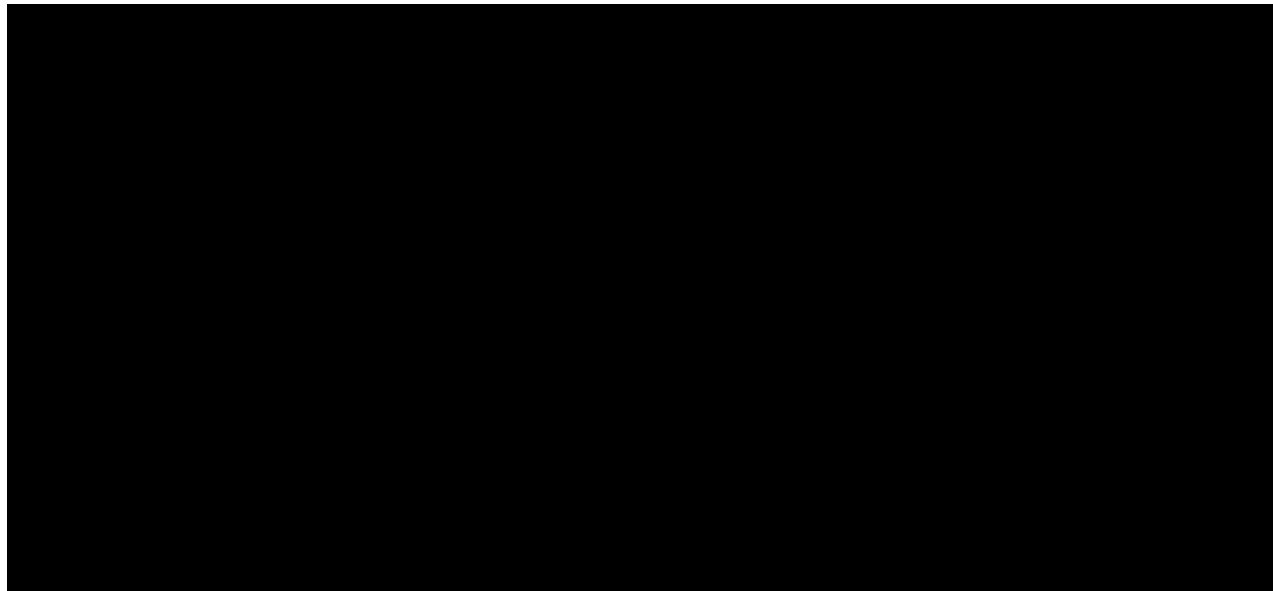
]]^{ad}.

[[



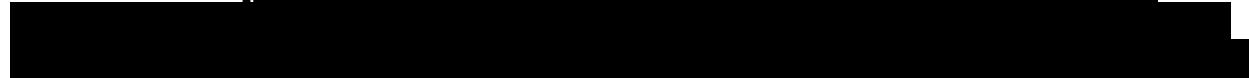
]]^d Figure 2 - Top View of NI, BOP, and Shared SSCs

[[



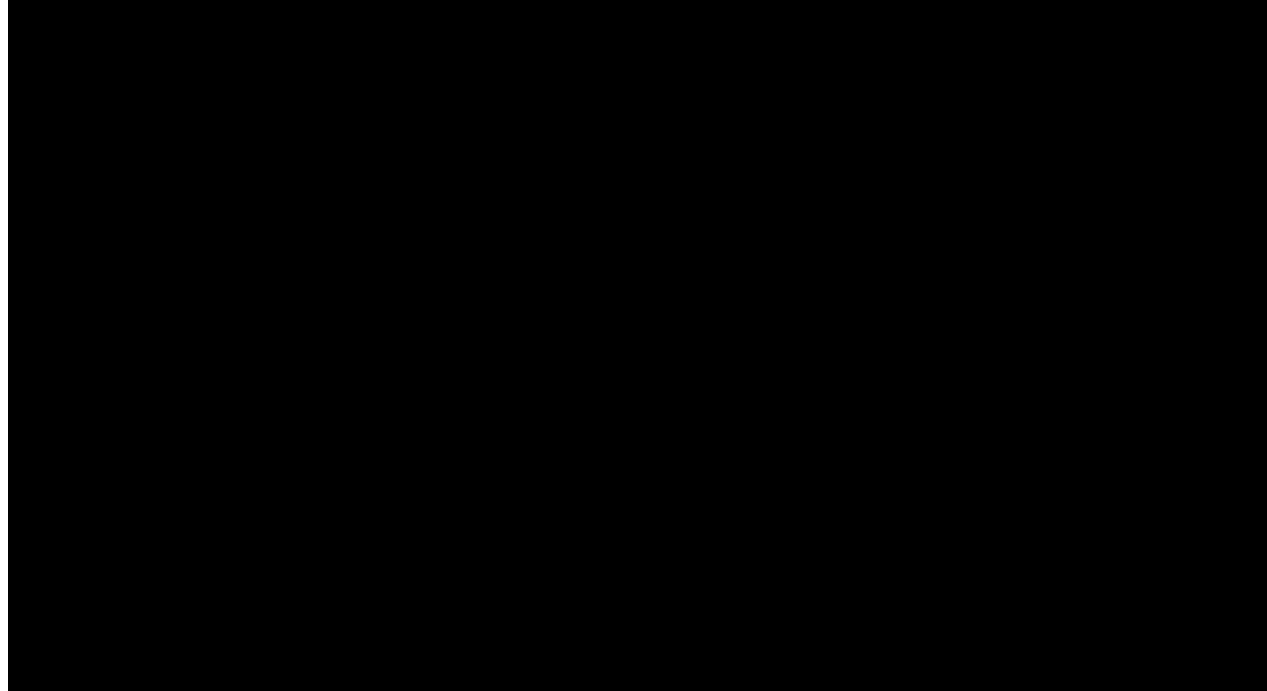
]]^d Figure 3 – Top View of Plant Layout

The IMS will be [[



[REDACTED] ^{jj^{de}}. The control room is outside the scope of this topical report and will not be constructed as part of the BOP.

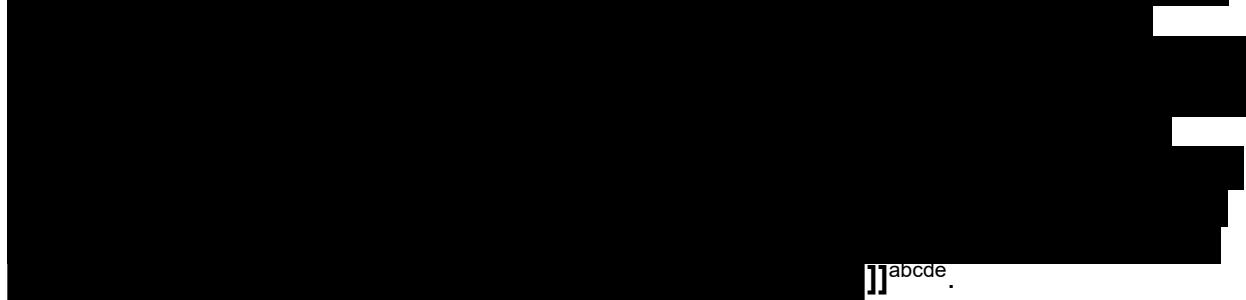
[[
[REDACTED]



^{jj^{de}} Figure 4 - Preliminary IMS Typical Section ([REDACTED])

])

Blue Energy intends to re-sequence the commissioning of the NI and BOP SSCs for several reasons. The primary reason is this will allow Blue Energy to [REDACTED]



^{jj^{abcde}}.

5.4. NI Design Features

The NI design features described below are used to implement the resequencing methodology to demonstrate that BOP SSCs to be built prior to issuance of a CP do not meet 10 CFR 50.10(a)(1)(i), (ii), (iii). The NI portion of the plant will be [REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]]]^d

These characteristics allow for complete functional and physical separation of the NI from the BOP.

5.5. *IMS and Physical Separation*

This section describes how the Blue Energy plant achieves physical separation of the NI and the BOP. The physical separation between the IMS and the BOP SSCs is used to demonstrate that BOP SSCs do not meet 10 CFR 50.10(1)(a)(iii). As shown in Figures 1 and 2, [REDACTED]

]]^d.

The IMS is a [REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]

³ [REDACTED]

]]

[REDACTED]
]]^{de}.

Blue Energy is also considering a version of the IMS that is a [REDACTED]
]]^{de}.

As part of the methodology in this topical report, Blue Energy will use [REDACTED]
]]^{ade}

Future licensing submittals will demonstrate that there is no SR equipment outside of the proposed separation demarcation, no class 1E power will be needed, and that no critical digital equipment will be installed in the BOP without prior NRC approval. Additionally, a future submittal will demonstrate how separation of these systems ensures no adverse interaction between the non-SR and SR portions of the systems.

5.6. NI/BOP Interfaces

NI SSCs, and the BOP, will interface at the separation point shown on Figure 2. The information in this section will be used to demonstrate that 10 CFR 50.10(a)(1)(ii) and (iii) are not met for BOP SSCs. There will also be a portion of the BOP that will [REDACTED]
]]^a, as shown on Figure 5.

Although the NI and BOP are physically separated, they interface at several points. As shown in Figure 1, these interfaces include the following:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]]]^e

The separation boundary and resulting interfaces were chosen to [REDACTED]
[REDACTED]]]^a.

The interfaces between the NI and BOP will be reviewed, and Blue Energy will demonstrate in a future licensing submittal that the BOP, and its interfaces with the NI, are compatible with the SR aspects of the plant design. Blue Energy will demonstrate this compatibility consistent with the methodology described below.

For each of the SSC interfaces described in Section 5.4, Blue Energy will [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]]]^{ae}.

After the [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]]]^{ae}.

Once all required scenarios have been analyzed, results will be [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]]]^{ae}.

All analyses and results of interfacing SSC interactions will be [REDACTED]
[REDACTED]
[REDACTED]]]^{ae}.

Blue Energy will ensure that [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

⁴ Because Blue Energy might not yet be a licensee at the time the methodology in this topical report is implemented, [REDACTED]
[REDACTED].

[REDACTED]

]]^{ae}.

Certain interfaces between the NI and BOP [[REDACTED]

[REDACTED]

]]^{abde}.

[[

[REDACTED]

]]^{abd}

5.7. *Transient Demonstration*

Table 1 lists [[REDACTED]

[REDACTED]

]]^{ae}. This section provides information that will be used

to demonstrate 10 CFR 50.10(a)(1)(i), (ii), and (iii) are not met for BOP SSCs built prior to issuance of a CP.

As part of a future licensing submittal, Blue Energy will

tae.

Table 1, "AOOs and Postulated Accidents for Potential Evaluation"

| | |
|------------|------------|
| [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] |

]]^{ae}.

The BOP portion of the plant will be designed to include [[REDACTED]]



[[REDACTED]]

[[REDACTED]]

]]^{de}.

Final design details that demonstrate the Key Design Requirements in Section 2 of this topical report will be provided as part of a future licensing submittal. The analyses and evaluations described above will be documented as part of this methodology, and programs, or procedures, will be implemented to ensure changes BOP SSCs are evaluated to determine if they impact the analyses in Table 1, or associated acceptance criteria.

5.8. BOP SSCs

As part of the Blue Energy deployment approach, Blue Energy will [[REDACTED]]

[[REDACTED]]. The information in this section demonstrates that when the BOP resequencing methodology is implemented, BOP SSCs will not meet 10 CFR 50.10(a)(1)(iv) or form the basis for an exemption request. The methodology in this section will be used to ensure [[REDACTED]]

]].

BOP SSCs to be built prior to issuance of a CP [REDACTED]
[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

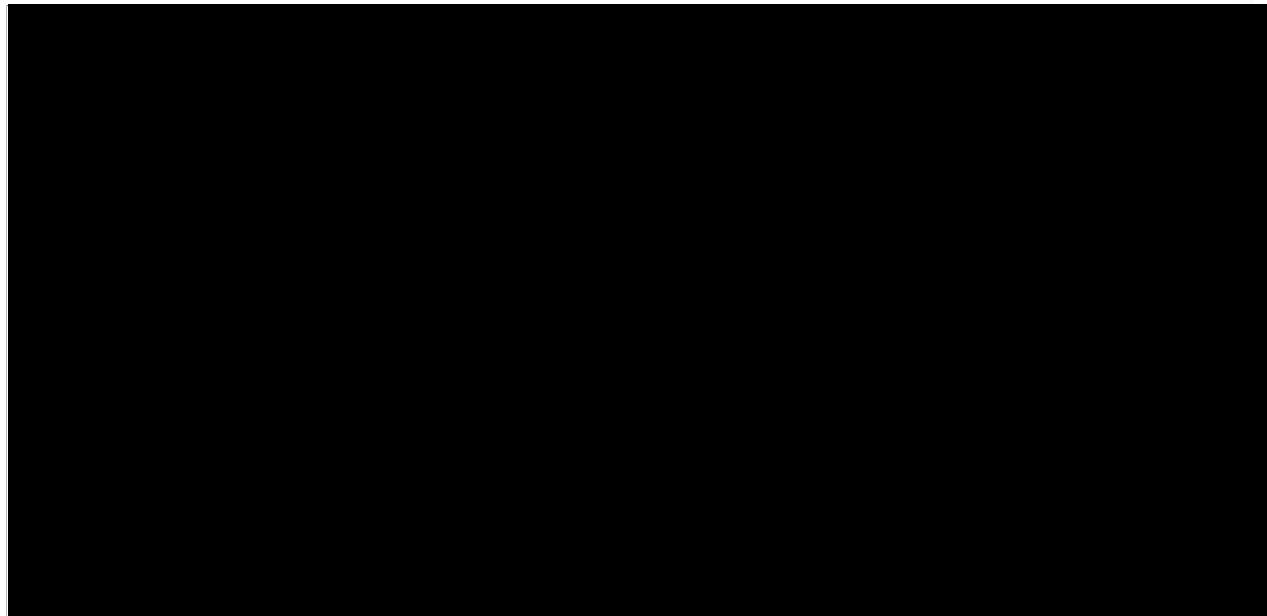
]]^{ae}.

These SSCs do not include [REDACTED]
[REDACTED]

]]^{acde}.

Figure 6 below shows a process flow diagram with the SSCs needed to [REDACTED]
[REDACTED]]^{acde}.

[[



[[]]^{]]acde}

To account for [[

[[
[[
[[^{]]acde.}

- [[
[[
[[
[[^{]]acde}

[[
[[

⁶ At the time the methodology in this topical report is implemented, Blue Energy might not yet be a licensee. Therefore, Blue Energy [[
[[^{]]}].

⁷ Blue Energy will apply Revision 2, 3, or 4. The applicable Revision will be stated in a future licensing submittal.

11 acde

Blue Energy will implement

Blue Energy will []

The []

Blue Energy will []

⁸ If a BOP SSC to be built prior to issuance of a CP meets the definition of construction in 10 CFR 50.10(a)(1), Blue Energy may opt to remove the SSC from the scope of resequencing instead of pursuing an exemption request. The SSC will then be described in a future CPA and constructed with prior NRC approval.

[REDACTED]

]]^{ad}

Blue Energy will evaluate BOP SSCs against the [REDACTED]

[REDACTED]

[REDACTED]

]]^{ae}

Table 2, "Regulatory Analysis of BOP SSCs"

[[

| | | | |
|------------|------------|------------|------------|
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |

| | | | |
|------------|------------|------------|------------|
| [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] |

The figure displays a 2x4 grid of binary images, each consisting of a white background with black, irregular shapes. The shapes in the top row are smaller and more compact than those in the bottom row. The shapes in the bottom row are larger and more complex, featuring multiple lobes and irregular edges, suggesting a growth or transformation process. The grid is defined by a light gray border and internal vertical and horizontal lines.

]]^{ae}

llae.

]^{ae} .

Maes

II
[REDACTED]

]]^{ae}.

6.0 Conclusion

This topical report describes a methodology to determine whether the BOP SSCs of a planned nuclear facility are activities constituting construction per the definition in 10 CFR 50.10(a)(1) and where NRC approval may be sought for those SSCs that do meet 10 CFR 50.10(a)(1) prior to a construction permit application. Application of this methodology, in conjunction with verifying the Key Design Requirements specified in Section 2.0, will provide the basis for building the BOP prior to issuance of a CP.

Blue Energy is requesting NRC review and approval of the methodology and determinations provided in Section 4.0. As described in section 5.0, Blue Energy also requests review and approval of]]

]]^{acde}. Once approved, this methodology will be implemented in subsequent licensing submittals to demonstrate the design Requirements listed in Section 2.0 for the NI design.

This approach supports an efficient and effective deployment strategy that aligns with the ADVANCE Act. Additionally, Blue Energy's]]

]]^{acde}.

7.0 Limitations and Conditions

Blue Energy proposes the following limitations and conditions applicable to referencing this TR:

1. As plant design and transient response that play a significant role in the independence of the NI and BOP, as discussed in this topical report. Future applications referencing this TR must demonstrate a design in detail sufficient to assess 10 CFR 50.10(a)(1) criteria and maintain the conclusions in the topical report.
2. Prior to the use of this topical report as a basis for non-applicability of 10 CFR 50.10(a)(1)(v) to the BOP, an applicant referencing this topical report must provide detailed information demonstrating that the physical and cyber security programs would be implemented in such a way that the initial building operations would not include any SSCs that meet the 10 CFR 50.10(a)(1)(v) criterion (i.e., not include any "SSCs necessary to comply with 10 CFR part 73," or otherwise not construct the BOP SSCs necessary to comply with 10 CFR Part 73 until a CP has been issued).
3. Prior to the use of this topical report as a basis for non-applicability of 10 CFR 50.10(a)(1)(vi) to the BOP, an applicant referencing this topical report must provide detailed information demonstrating that any SSCs needed to comply with

fire protection requirements defined in 10 CFR 50.48 and General Design Criteria 3 in 10 CFR 50, Appendix A, are not located in the BOP.

4. Prior to the use of this topical report as a basis for non-applicability of 10 CFR 50.10(a)(1)(vii) to the BOP, an applicant referencing this topical report must provide detailed information demonstrating that any SSCs needed to comply with the emergency preparedness requirements defined in 10 CFR 50.160 or 10 CFR 50.47 and 10 CFR 50, Appendix E, are not located in the BOP.

8.0 References

1. "Domestic Licensing of Production and Utilization Facilities", *Code of Federal Regulations*, 10 CFR 50.
2. "Reactor Site Criteria", *Code of Federal Regulations*, 10 CFR 100.
3. *TerraPower, LLC – Final Safety Evaluation for Topical Report NATD-LIC_RPRT-0001, "Regulatory Management of Natrium Nuclear Island and Energy Island Design Interfaces," Revision 0*, September 28, 2023 (ML23257A259).
4. "Physical Protection of Plants and Materials", *Code of Federal Regulations*, 10 CFR 73.
5. Federal Register, Volume 21, pg. 355, January 19, 1956.
6. Federal Register, Volume 25, pg. 8712 September 9, 1960.
7. Federal Register, Volume 37, pg. 5748 March 21, 1972.
8. "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions", *Code of Federal Regulations*, 10 CFR 51.
9. Federal Register, Volume 72 pgs. 57416 and 57427, October 9, 2007.
10. *Proposed Rulemaking to Revise the Definition of Construction in 10 CFR Parts 30, 36, 40, 51, 70, and 150 (M081211 – Staff Requirements)*, NRC Commission Paper SECY-10-0018, February 5, 2010.
11. *Interim Staff Guidance on the Definition of Construction and on Limited Work Authorizations*, NRC Interim Staff Guidance COL/ESP-ISG-4, February 9, 2009. [ML082970729]
12. "Licenses, Certifications, and Approvals for Nuclear Power Plants", *Code of Federal Regulations*, 10 CFR 52.
13. United States Nuclear Regulatory Commission, Regulatory Guide RG 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," Revision 3 (ML011340072).
14. Federal Register, Volume 72, pg. 57416 November 08, 2007
15. United States Nuclear Regulatory Commission, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," various sections.

^aWithheld pursuant to 10 CFR 2.390(a)(4) as information which discloses process, method, or apparatus, including supporting data and analyses, where prevention of its use by Blue Energy competitors without license or contract from Blue Energy constitutes a competitive economic advantage over other companies in the industry.

^b Withheld pursuant to 10 CFR 2.390(a)(4) as information, which if used by a competitor, would reduce his or her expenditure of resources or improve his or her competitive position in design, manufacture, shipment, installation, assurance of quality.

^c Withheld pursuant to 10 CFR 2.390(a)(4) as information which reveals aspects of past, present, or future Blue Energy or customer funded development plans or programs, of potential commercial value to Blue Energy.

^d Withheld pursuant to 10 CFR 2.390(a)(4) as information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

^e Withheld pursuant to 10 CFR 2.390(a)(4) as information obtained through Blue Energy actions which could reveal additional insights into reactor system development, testing, qualification processes, and/or regulatory proceedings, and which are not otherwise readily obtainable by a competitor.