SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REGARDING TOPICAL REPORT BE-BOPTR-02, REVISION 1,

"RESEQUENCING BALANCE-OF-PLANT AND NUCLEAR ISLAND CONSTRUCTION FOR

BLUE ENERGY DEPLOYMENTS"

1.0 INTRODUCTION

1.1 Summary

By letter dated September 11, 2025 (Reference 1), Blue Energy Global, Inc., (Blue Energy) submitted Revision 1 of Topical Report (TR) BE-BOPTR-02, "Resequencing Balance-of-Plant [BOP] and Nuclear Island [NI] Construction for Blue Energy Deployments," (BOP-NI) (Reference 2) for the U.S. Nuclear Regulatory Commission (NRC) staff (the staff) review and approval. The staff conducted a regulatory audit from August 19 to August 29, 2025 (Reference 3) on BE-BOPTR-02, Revision 0 (Reference 4).

Blue Energy's BOP-NI TR describes a methodology to determine if fabrication and installation of the BOP structures, systems, and components (SSCs) are activities not constituting construction per the definition in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," §50.10(a)(1) "License required; limited work authorization." The application of this methodology will provide the basis for building the BOP prior to the issuance of a construction permit (CP).

Blue Energy aims to disconnect the start of building the BOP from the NI construction, ensuring BOP activities do not meet the criteria of "construction" per NRC regulations. The TR presents a high-level overview of the logic supporting the proposed sequencing approach, including dependency mapping and preliminary safety justifications.

However, the TR identifies several key elements that will be addressed in future submittals. The staff notes that the acceptability of the proposed methodology is contingent upon the adequacy of the future submittals. Thus, the TR may form a partial basis for planning purposes, but no regulatory conclusions regarding the acceptability of the approach on specific nuclear designs can be drawn until all outstanding issues are addressed and formally submitted for NRC review.

1.2 Scope of NRC Staff review and Approval

The scope of the staff's review of TR BE-BOPTR-02 was limited to the evaluation of the methodology proposed by Blue Energy, for determining whether specific BOP building activities may be performed prior to the issuance of a CP, in accordance with the requirement of 10 CFR 50.10(b) and 10 CFR 50.10(c) and the definition of "construction" in 10 CFR 50.10(a)(1). The review assessed whether the proposed approach adequately distinguishes BOP building activities from those constituting "construction" as defined in 10 CFR 50.10(a), and whether it provides sufficient criteria to prevent unintended impacts on safety-related SSCs. The NRC's approval of this topical report will be limited to the acceptability of the methodology described as a general framework. It does not constitute approval of any specific plant design, site-specific implementation, or exemption requests. Approval of future licensing actions, building plans, or operational activities based on this methodology will be contingent upon the review of additional

information submitted in accordance with the conditions and limitations identified in this safety evaluation (SE).

2.0 REGULATORY BASIS

This SE considers applicable NRC regulations that govern construction activities, exemptions, maintenance, and record-keeping to ensure compliance with regulatory requirements and protection of public health and safety. Key regulations evaluated in the TR and assessed by the NRC include:

10 CFR 50.10 – Construction Permit and Limited Work Authorization Requirements

This regulation defines the scope of activities considered as "construction" and mandates that such activities cannot proceed without an appropriate CP or limited work authorization (LWA). The evaluation verifies that the process for resequencing of BOP and NI building proposed in BE-BOPTR-02 aligns with these requirements and that any building activities conducted prior to issuance of a full CP do not conflict with the requirements in 10 CFR 50.10.

10 CFR 50.2 – Definitions, including Safety-Related

The regulation's definitions, particularly for "safety-related" SSCs, guide the evaluation of which portions of a facility are subject to heightened regulatory control. The SE confirms that safety-related SSCs are managed in accordance with regulatory expectations.

10 CFR 50.12 – Exemptions

This section provides the regulatory framework for granting specific exemptions from requirements of 10 CFR Part 50. The NRC would evaluate whether a proposed exemption to accommodate construction sequencing is acceptable after receiving an exemption request for specific activities.

10 CFR Part 51 "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions"

10 CFR Part 51 outlines the NRC's procedures for complying with the National Environmental Policy Act (NEPA) in support of licensing actions such as CPs and LWAs.

Pursuant to 10 CFR 50.10(e), an LWA may only be granted after completion of the appropriate environmental review required by Part 51. This review must address potential environmental impacts from activities defined as "construction" under 10 CFR 50.10(a)(1). Consequently, determining whether specific BOP activities constitute "construction" directly affects the treatment of these activities in the NEPA-related environmental reviews.

10 CFR Part 73, "Physical Protection of Plants and Materials"

This regulation defines the physical protection requirements for nuclear facilities, including provisions for access control, intrusion detection, and emergency response. Pursuant to 10 CFR 50.10(a)(1)(v), any installation of SSCs necessary to meet the requirements of 10 CFR Part 73 is considered "construction" and therefore may not proceed without a CP or LWA.

In reviewing TR BE-BOPTR-02, the staff evaluated whether the proposed resequencing could involve or affect SSCs associated with physical security functions. If such SSCs are included in early BOP construction activities, the applicant must demonstrate that the methodology conforms to 10 CFR Part 73 requirements. In such cases, NRC approval may be required to ensure that the facility's physical protection systems remain fully effective and compliant throughout construction.

3.0 TECHNICAL EVALUATION

This section presents the staff's technical review of Blue Energy's NI and BOP resequencing activities as described in BE-BOPTR-02. The evaluation focuses on the methodology outlined in the Topical Report (TR) for determining modifications to the building sequence of safety-related and non-safety-related SSCs within the NI and BOP.

BE-BOPTR-02 proposes a construction resequencing methodology intended to allow early initiation of BOP building activities prior to NI construction. The methodology seeks to demonstrate the acceptability of the described process for determining which activities fall within the scope of construction under §50.10(a).

The staff's review of BE-BOPTR-02 evaluates whether the methodology:

- Clearly defines the boundaries between safety-related and non-safety-related activities.
- Provides sufficient criteria to prevent unlicensed construction.
- Identifies any dependencies or interface risks between BOP and NI that could compromise safety.
- Ensures that early BOP work does not indirectly affect safety-related SSCs.

This technical evaluation addresses whether the proposed activities fall outside the scope of construction work defined under applicable NRC regulations, including 10 CFR 50.10, and assesses any implications for the licensing basis, safety, and regulatory compliance. Particular emphasis is placed on the impact of resequencing on safety-related SSCs, required inspections, and the necessity for exemptions or NRC approvals under 10 CFR 50.12.

3.1 Description of proposed activities

BE-BOPTR-02 proposes modifications to the construction sequencing of selected NI and BOP SSCs. The proposed resequencing described in the TR can be used to support a strategy that separates the building and installation of those BOP systems that do not constitute "construction" as defined under 10 CFR 50.10(a)(1) from the construction of the NI.

Pursuant to 10 CFR 50.10(c), "no person may begin the construction of a production or utilization facility on a site on which the facility is to be operated until that person has been issued either a CP… or a limited work authorization [LWA] …." The 10 CFR 50.10(a) definition of "construction" is divided in two parts: 10 CFR 50.10(a)(1) specifies activities deemed to constitute "construction," and 10 CFR 50.10(a)(2) specifies certain specific activities which are excluded from the definition.

3.2 Evaluation Against 10 CFR 50.10

10 CFR 50.10(a)(1)(i) - Assessment of Whether BOP Activities include Safety-related structures, systems, or components (SSCs) of a facility, as defined in 10 CFR 50.2

Section 50.10(a)(1)(i) defines construction activities to include those involving safety-related SSCs as outlined in 10 CFR 50.2.

Upon review of the TR, the staff found that the methodology described in the TR for determining which activities constitute construction under §50.10(a)(1)(i) does not conflict with the definition of construction and remains within the scope of activities for which a license is required pursuant to §50.10(c) activities. The TR states that the intention is to resequence only those BOP activities that are not safety-related. The BOP portions identified for early building are those which are not intended to perform safety-related functions, and no safety-related SSCs are expected to be included.

Section 4.1 of the TR specifies that there are no safety-related SSCs in the BOP that would be built prior to the issuance of a CP. Therefore, the staff considers that even if safety-related SSCs were later included in the BOP, the topical report methodology properly identifies the requirement for NRC approval prior to construction of those SSCs.

10 CFR 50.10(a)(1)(ii) - Assessment of Whether BOP Activities Involve SSCs Relied Upon to Mitigate Accidents or Transients or Used in Emergency Operating Procedures

In 10 CFR 50.10(a)(1)(ii) defines "construction" to include activities related to the installation of *non-safety-related* structures, systems, or components (SSCs) that are “relied on to mitigate accidents or transients or used in plant emergency operating procedures.”

The staff reviewed BE-BOPTR-02, Revision 1, submitted by Blue Energy, which proposes a methodology to permit the resequencing of the construction schedule such that BOP structures and systems that meet the specified criteria are built in advance of the NI, without requiring a license under 10 CFR 50.10(c).

Section 4.2 of the TR specifies that there are no SSCs in the BOP that would be built prior to the issuance of a CP and that are relied upon to mitigate anticipated operational occurrences (AOOs) or postulated accidents, including emergency operations of the reactor. Section 4.2 correctly identifies the wording of the criteria in 10 CFR 50.10(a)(1)(ii) to include both SSCs relied upon to mitigate AOOs or postulated accidents and SSCs that are used in plant emergency operating procedures. The staff notes that whether or not a particular SSC falls within these criteria is known once a design is selected. Therefore, the staff cannot independently verify that none of the BOP SSCs fall within this criterion. However, the staff considers that even if SSCs meeting the criteria in 10 CFR 50.10(a)(1)(ii) were later included in the BOP, the topical report methodology properly identifies the requirement for NRC approval prior to construction of those SSCs.

Therefore, the staff finds the methodology proposed in the TR acceptable and notes that they are not making a finding with regard to whether or not any SSCs in the BOP design would meet the criteria in 10 CFR 50.10(a)(1)(ii).

10 CFR 50.10(a)(1)(iii) - Assessment of Whether BOP Activities Involve SSCs Whose Failure Could Prevent Safety-Related SSCs from Fulfilling Their Safety Function

BE-BOPTR-02 outlines a proposed strategy allowing the early installation of BOP SSCs prior to the issuance of a CP. The TR consistently states that these BOP activities are intended to exclude safety-related SSCs and avoid physical or functional dependencies with the NI, where most safety-related systems are located.

The TR indicates that the BOP systems chosen for early construction are not intended to support or provide critical functions to safety-related SSCs. It also makes clear that none of the components installed under the resequencing plan are anticipated to influence or compromise the performance of safety-related systems, either during installation or afterward.

While the TR asserts functional independence between early BOP installations and safety-related systems, the staff notes that the TR acknowledges that specific SSC classification and interface documentation will be provided in future submittals, including identification of components subject to review under 10 CFR 50.10(a)(1)(iii).

Based on the information provided in the TR—particularly the applicant's statement in Section 2.3 that the BOP systems selected for early building do not support or affect safety-related SSCs—the staff finds that the conceptual approach appears consistent with the definition of construction in 10 CFR 50.10(a)(1). The TR does not propose activities that clearly meet the definition of "construction" under the regulation at this stage.

Section 4.3 of the TR specifies that "actuation or failure of a BOP SSC will not impair the NI's response to safely shutdown the reactor and maintain it in a safe shutdown condition," and that "there are no SSCs in the BOP to be built prior to issuance of a CP or relevant exemption that meet criterion (iii)." Therefore, the staff considers that even if in the final design stages an SSC in the BOP met criterion (iii), the methodology specified in the topical report properly identifies the requirement for NRC approval prior to construction of those SSCs.

10 CFR 50.10(a)(1)(iv) Assessment of Whether BOP Activities Involve SSCs Whose Failure Could Cause a Reactor Scram or Actuation of a Safety-Related System

BE-BOPTR-02 proposes to resequence construction by initiating fabrication and installation of BOP SSCs prior to the issuance of a CP.

The TR asserts that the BOP SSCs planned for early construction do not interface functionally with systems that could initiate a scram or the actuation of safety-related systems. The sequencing excludes equipment or control pathways that could result in unintended signal propagation, failure dependencies, or transient system responses.

The staff find this general statement aligns with the intent of §50.10(a)(1)(iv). However, the TR does not include a detailed identification or analysis of:

- BOP systems or components that may interface electrically, mechanically, or through control logic with NI systems.

- Potential failure modes of BOP SSCs that could inadvertently cause a reactor trip or actuate safety systems.

TR methodology

Section 4.4 of the TR notes that the criteria in Section 2.4 ensure that the failure of SSCs in the BOP built prior to issuance of a CP or relevant exemption would not result in a reactor scram or actuation of a safety-related system. Further, the criteria in Section 2.4 includes, in part, a statement that "failure or errant/intentional actuation of a BOP SSC built prior to issuance of a CP shall not…result in a reactor trip or actuation of a safety-related SSC."

Detailed design information will be needed for the NRC to independently verify that no failure of BOP SSCs could result in a scram or safety system actuation, particularly if future BOP components involve power distribution, or control interfaces that cross-connect with the NI. Further, the specific NI design selected may impact which, if any, BOP components could meet criterion (iv). However, the staff considers that even once an NI design is selected, and once the SSCs are designed, if an SSC in the BOP met criterion (iv), the methodology specified in the topical report properly identifies the requirement for NRC approval prior to construction of those SSCs.

10 CFR 50.10(a)(1)(v and vi) SSCs necessary to comply with 10 CFR Part 73 and 10 CFR 50.48 Criterion 3 of 10 CFR Part 50, Appendix D

BE-BOPTR-02 is a topical report intended for construction sequencing purposes and does not involve security or physical protection systems. Security requirements under Part 73 are not relevant to the methodology being proposed, so they were not included in the TR. However, future submittals should explicitly state how Part 73 requirements are considered in relation to construction sequencing.

BE-BOPTR-02 does not include any fire protection-related SSCs within the scope of the proposed resequenced activities. As a result, the requirements of this provision are not currently applicable. However, future submittals should clearly indicate whether any fire protection SSCs are involved and ensure that such systems are either explicitly excluded or addressed in a manner consistent with regulatory expectations.

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

At the point of this review, 50.10(a)(1)(vii) is not applicable to the TR because BE-BOPTR-02 does not propose or authorize construction of SSCs important to safety, it only provides a sequencing framework that could later be applied in a licensed project. Actual construction activities involving SSCs would be reviewed under a separate license application or LWA request**,** where 50.10(a)(1)(vii) compliance would be required.

Additional screening criteria

In Section 4.8 of the TR, Blue Energy provided information on how it intends to further demonstrate the lack of safety-based reliance on BOP SSCs through imposing additional screening criteria "for what can be installed in the BOP or otherwise, outside of the 10 CFR 50.10(a)(1) framework." The staff considers the inclusion of additional criteria to be a

conservative aspect of the methodology. The staff notes that the criteria in 10 CFR 50.10(a)(1) are the requirements that must be met, or an exemption must be sought, prior to issuance of a CP.

Discussion on 10 CFR 50.10(a)(1)

SECY-25-0074 (Reference 5) seeks to clarify construction and nexus to radiological safety for non-safety-related SSCs. The SECY states:

> In regard to the provisions of 10 CFR 50.10(a)(1)(ii)-(vii), which pertain to non-safety-related SSCs, the NRC staff will ensure that the application of the definition of construction for a facility focuses on only those SSCs that have a reasonable nexus to radiological safety and common defense and security based on a review of the design of that facility. The non-safety-related SSCs that are not within the scope of the definition of construction would include those SSCs that do not directly affect the radiological health and safety of the public or the common defense and security, and their indirect effect on such health and safety or common defense and security is so low as to be considered negligible. They could include non-safety-related SSCs that are not directly relied upon to mitigate an accident or transient or used in plant emergency operating procedures (10 CFR 50.1 0(a)(1)(ii)), whose failure would not directly prevent safety-related SSCs from performing their safety-related function (10 CFR 50.10(a)(1)(iii)), whose failure would not directly cause a scram or actuation of a safety-related system (10 CFR 50.10(a)(1)(iv)), which are not used directly to comply with security and emergency preparedness requirements (10 CFR 50.10(a)(1)(v), (vi), and (vii)) and whose indirect effect is so low as to be considered negligible.

The SECY also states:

> If an applicant determines that a non-safety-related SSC has a direct effect on one of the criteria in 10 CFR 50.1 0(a)(1), or if an indirect effect had a more than negligible effect on health and safety and common defense and security, that applicant could submit an exemption request to the NRC to allow for this construction activity to occur before issuance of a license, and the exemption will be granted if the underlying requirements of 10 CFR 50.12 are met.

The SECY also includes illustrative examples to highlight the difference between direct and indirect effects. The staff review of the TR discussion on 10 CFR 50.10(a)(1) sections notes that Blue Energy states they will implement this methodology and implement the results in future regulatory submittals. The above SECY could be used in evaluation of necessary regulatory actions depending on the future reactor technology used and the specific designs of the BOP SSCs. This would allow Blue Energy or future applicants using the TR methodology to take advantage of optimized time frames and reduce costs.

TR Section 5.6

The staff reviewed the discussion of interfaces between the NI and the BOP components as presented in Section 5.6 “NI/BOP Interfaces”. The evaluation looked to see that the proposed resequencing of construction activities does not introduce potential risk to safety-related functions. The methodology appropriately identifies the physical and functional separation

required by the regulations and that NI/BOP interface considerations are adequately addressed to prevent inadvertent impacts on safety during resequencing of BOP building activities.

TR Section 5.7

In TR Section 5.7, “Transient Demonstration,” the staff reviewed the strategy regarding AOOs and Transients and agrees that this methodology should be acceptable. The staff notes that since the design of the Nuclear Island is not yet known, the staff did not review the list in Table 1 under Section 5.7 for completeness since it may change based on the selected design. The Blue Energy strategy of evaluation laid out in Section 2 of the TR as well as Section 5.7 should allow future applicants to evaluate the impacts of the resequencing on AOOs and postulated accidents and support future licensing submittals.

TR Section 5.8

The staff reviewed TR Section 5.8 “BOP SSCs,” which describes the scope and classification of BOP SSCs. The information was included to demonstrate that when the BOP resequencing methodology is implemented, BOP SSCs will meet 10 CFR 50.10(a)(1)(iv) or form the basis for an exemption request. Section 5.8 of the TR states that the list of BOP SSCs to be built prior to issuance of a CP will be evaluated to determine whether the SSCs meet the definition of construction per 10 CFR 50.10(a)(1) consistent with the BOP SSC scoping process described in Section 5.8. Based on its review of the information in TR Section 5.8, the staff finds that classification and treatment of BOP SSCs in the TR provide an acceptable framework to support compliance with the regulation. The staff notes (as does Blue Energy) that the bulleted list of components and systems in Section 5.8 may not be all-inclusive depending on future design updates. Therefore, the staff are not making a finding of the adequacy of the list. The staff does find that the methods described in the TR Section 5.8 to evaluate the BOP resequencing acceptable.

4.0 CONCLUSION

Based on the current contents of TR BE-BOPTR-02, the staff finds that the proposed methodology is conceptually consistent with 10 CFR 50.10(a)(1) regarding resequencing of construction activities and the definition of construction specified in 10 CFR 50.10. However, this conclusion is subject to the limitations and conditions listed in the following section of the SE.

Section 5.2 of the TR proposes an order of licensing actions to support the resequencing effort. The staff has reviewed the order of the actions and agrees that they should be satisfactory to support the resequencing and eventual CP submittal(s).

The staff notes that the TR does not specify a reactor design when it comes to the NI. While the current design is unspecified, future applicants using this TR may achieve different levels of efficiency in achieving resequencing of many of the BOP SSCs, since different reactor designs are expected to impact whether or not some of the criteria in 10 CFR 50.10(a)(1) are met. As part of the methodology, as described in Section 5.2 of the TR, the applicant will submit exemption request(s) and/or an LWA application if BOP SSCs are to be built prior to staff issuance of a CP meet any of the criteria in 10 CFR 50.10(a)(1).

The adequacy of record-keeping and data management programs related to BOP construction activities could assist future licensing submittals, inspections, and safety reviews in demonstrating compliance with applicable regulatory requirements.

The NRC's approval of TR BE-BOPTR-02 is limited to the acceptability of the methodology described as a general framework. It does not constitute approval of any specific plant design, site-specific implementation, or exemption requests.

5.0 LIMITATIONS AND CONDITIONS

TR BE-BOPTR-02, Revision 1, evaluated in this SE, describes a methodology to determine if fabrication and installation of the Balance of Plant (BOP) structures, systems, and components (SSCs) are activities not constituting construction per the definition in 10 CFR 50.10(a)(1).

Blue Energy proposed four limitations and conditions (L&Cs) in Section 7.0 of its TR. Based on the staff's review of the TR including the four L&Cs identified by Blue Energy in Section 7.0 of the TR, the staff has determined that the four L&Cs are applicable to an applicant or licensee that uses the methodology of the TR.

The staff notes that TR BE-BOPTR-02, Revision 1, applies to the building of non-safety-related structures, systems, and components (SSCs) within the BOP prior to issuance of a construction permit (CP). An applicant referencing the TR must confirm that all BOP SSCs built prior to the issuance of a CP are non-safety-related. If an applicant proposes to include safety-related SSCs in pre-CP building activities, the applicant must submit supplemental licensing information to the NRC demonstrating compliance with all applicable regulatory requirements (e.g., 10 CFR Part 50, Appendix B) and must obtain NRC approval prior to initiating construction of those SSCs.

6.0 REFERENCES

1. Letter from CJ Fong, Submission of Topical Report BE-BOPTR-02 "Resequencing Balance-of-Plant and Nuclear Island Construction for Blue Energy Deployments" ("Blue Energy"), September 11, 2025 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML25254A215).

2. Blue Energy Global, Inc., Topical Report BE-BOPTR-02, "Resequencing Balance-of-Plant and Nuclear Island Construction for Blue Energy Deployments," Revision 1, September 11, 2025 (ML25254A218 [proprietary]; ML25254A217 [non-proprietary]).

3. Plan for the Regulatory Audit of Blue Energy Global, Inc. Topical Report BE-BOPTR-02, "Resequencing Balance-of-Plant and Nuclear Island Construction for Blue Energy Deployments" (ML25216A095).

4. Blue Energy Topical Report BE-BOPTR-02-NP, "Resequencing Balance-of-Plant and Nuclear Island Construction for Blue Energy Deployments" Revision 0, May 28, 2025 (ML25148A421 [Proprietary]; ML25148A420 [non-proprietary]).

5. SECY-25-0074 "Expedited Construction of Certain Structures, Systems, and Components," August 28, 2025 (ML25157A119).