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SAFETY EVALUATION RELATED TO TERRAPOWER, LLC QUALITY ASSURANCE TOPICAL REPORT TP-QA-PD-0001, "TERRAPOWER QA PROGRAM DESCRIPTION," REVISION 12 (EPID NO. L-2020-TOP-0043/CAC NO. 000431)

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APPLICATION INFORMATION

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Brief Description of the Topical Report: The TerraPower Quality Assurance Program Description (QAPD) topical report addresses the activities associated with the design and construction of TerraPower's advanced nuclear power reactor. The QAPD is based on the applicable portions of both Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and the American Society of Mechanical Engineers (ASME) NQA-1-2015, "Quality Assurance Program Requirements for Nuclear Facilities," as endorsed by the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.28, "Quality Assurance Program Criteria (Design and Construction)," Revision 5, dated October 2017 (Reference 6).

For additional details on the submittal, please refer to the documents located at the ADAMS Accession No(s). identified above.

REGULATORY EVALUATION

NRC regulatory requirements related to quality assurance (QA) programs for construction permit applications are set forth in 10 CFR 50.34(a)(7) and Appendix B to 10 CFR Part 50.

Regulations in 10 CFR 50.34(a)(7) require that a description of the QA program to be applied to the design, fabrication, construction, and testing of the structures, systems, and components (SSCs) of the facility be included as part of the minimum information in the preliminary safety analysis report. Regulations in 10 CFR 50.34(a)(7) further require that the description of the QA program for a nuclear power plant include a discussion of how the applicable requirements of Appendix B to 10 CFR Part 50 will be satisfied.

Appendix B to 10 CFR Part 50 establishes QA requirements for the design, fabrication, construction, and testing of SSCs for the facility. The pertinent requirements of Appendix B to 10 CFR Part 50 apply to all activities affecting the safety-related functions of those SSCs and include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, operating, maintaining, repairing, refueling, and modifying SSCs.

TECHNICAL EVALUATION

In evaluating the adequacy of the TerraPower QAPD, the NRC staff utilized the guidance contained in Section 17.5 of the standard review plan (SRP), NUREG-0800 which provides guidance to the staff for the review of a QAPD for design certification, early site permit, combined license, construction permit, and operating license applicants. Section 17.5 of the SRP is based on Appendix B to 10 CFR Part 50 and describes regulatory and industry guidance determined to be acceptable methods for meeting the requirements of Appendix B to 10 CFR Part 50. The ASME standard NQA-1-2015 Edition, upon which the TerraPower QAPD is based, is endorsed by the NRC, with certain exceptions and clarifications, in RG 1.28, Revision 5. The regulatory conclusions made below pertain to the QA requirements for a construction permit application and not an operating license application.

1.0 Quality Assurance Program Overview

Topical report TP-QA-PD-0001, Revision 12, provides for the control of TerraPower's activities affecting the quality and performance of SSCs related to the design activities in support of a construction permit for TerraPower's advanced nuclear power reactor.

1.1 Organization

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.A for providing an organizational description that includes an organizational structure, functional responsibilities, levels of authority, and interfaces for establishing, executing, and verifying the implementation of TerraPower's QA program. The TerraPower QAPD establishes that those responsible for the execution of the QAPD may delegate to others any or all of the work but shall retain responsibility thereof. In addition, the responsibility and authority for planning, establishing, and implementing an effective overall QA program are clearly described and defined, including identifying the person responsible for directing and managing the onsite QA program.

The TerraPower QAPD identifies the QA Manager as being responsible for the implementation of the QAPD and free from cost and schedule considerations associated with fulfilling its assigned responsibilities. In addition, TerraPower's QAPD provides the authority and responsibility to stop unsafe or non-compliant work or work that cannot be performed correctly due to inadequate procedures. Furthermore, TerraPower's QAPD provides measures for the resolution of disputes involving quality, arising from a difference of opinion between QA personnel and personnel from another department (engineering, procurement, manufacturing, etc.).

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 1, “Organization,” without further clarifications or exceptions. The NRC staff determined that TerraPower’s organization controls as described above comply with the requirements of Criterion I, “Organization,” of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.2 Quality Assurance Program

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.B for establishing the necessary measures and governing procedures to implement a QA program to ensure that the design of TerraPower’s advanced nuclear power reactor is in accordance with governing regulations and license requirements. TerraPower’s QAPD uses a Quality Level (QL) system to establish the compliance basis and associated work controls used to complete work. The Quality Levels consider the regulatory and customer requirements. Level QL-1 applies for work performed that impacts a nuclear SSC. The QL-1 also applies to work (e.g., material testing) if the results are to be used as a safety-related design input to support licensing activities. Examples of safety-related activities include, but are not limited to, design, testing, procurement, etc. A list or system used to identify which SSCs and activities the QA program applies to is maintained at TerraPower.

The TerraPower QAPD provides measures to assess the adequacy and effective implementation of the QA program at least once each year. In addition, TerraPower’s QA program applies a grace period of 90 days to annual supplier evaluations and triennial supplier audits. The grace period does not allow the “clock” for a particular activity to be reset forward. However, the “clock” for an activity is reset backward by performing the activity early.

The TerraPower QAPD provides measures to establish and maintain formal indoctrination and training programs for: (1) inspection and test personnel; (2) nondestructive examination personnel; (3) audit personnel; (4) and personnel performing, verifying, or maintaining activities within the scope of the QA program to assure that suitable proficiency is achieved and maintained. Inspection and test personnel are required to be trained and qualified in accordance with Section 302, “Inspection and Test,” of Requirement 2, “Quality Assurance Program,” of NQA-1-2015. Nondestructive examination personnel are required to be trained and qualified in accordance with Section 301, “Nondestructive Examination,” of Requirement 2 of NQA-1-2015. Audit personnel are required to be trained and qualified in accordance with Sections 303, “Lead Auditors,” of Requirement 2 of NQA-1-2015, as modified by the regulatory positions in Revision 5 of RG 1.28. The TerraPower QAPD provides the minimum training requirements for all personnel responsible for implementation of TerraPower’s QA program.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 2, “Quality Assurance Program,” as modified by the regulatory positions described in Revision 5 of RG 1.28 without further clarifications or exceptions. The NRC staff determined that TerraPower’s QA program controls as described above comply with the requirements of Criterion II, “Quality Assurance Program,” of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.3 Design Control

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.C, for establishing the necessary measures and governing procedures to control the design input, design changes,

design analyses, design verification, interfaces, software, and design documentation that are subject to the provisions of TerraPower's QA program. The TerraPower design process includes provisions to control design inputs, outputs, changes, interfaces, records, and organizational interfaces. These provisions assure that design inputs (e.g., performance, regulatory, quality, codes, and standards) are identified and documented, and their selection reviewed and approved by the design organization.

The TerraPower QAPD provides for design verification activities. TerraPower's organization responsible for the design shall identify and document the design verification methods used. Design verifications are performed by competent individuals or groups other than those who performed the original design but who may be from the same organization. The extent of the design verification required is a function of the importance to safety, the complexity of the design, the degree of standardization, the state of the art, and the similarity with previously proven designs. Verification methods may include, but are not limited to, any one or a combination of design reviews, alternative calculations, and qualification testing.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 3, "Design Control," Subpart 2.7, "Quality Assurance Requirements for Computer Software for Nuclear Facility Applications," and Subpart 2.14, "Quality Assurance Requirements for Commercial-Grade Items and Services," without further clarifications or exceptions. The NRC staff determined that TerraPower's design controls as described above comply with the requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.4 Procurement Document Control

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.D, for establishing the necessary measures and governing procedures to ensure that applicable regulatory, technical, and QA program requirements are included or referenced in procurement documents. The applicable technical, regulatory, administrative, quality, and reporting requirements (e.g., specifications, codes, standards, tests, inspections, special processes) are invoked for the procurement of items and services. In addition, TerraPower's QAPD states that procurement documents for safety-related items or services for nuclear reactor project work require suppliers to have a documented QA program that meets the applicable requirements.

The TerraPower QAPD requires the review of procurement documents, including the technical and QA Program requirements, prior to award of a contract and for procurement document changes. These reviews are done by personnel with access to pertinent information and who have an adequate understanding of the requirements and intent of the procurement documents.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 4, "Procurement Document Control," without further clarifications or exceptions. The NRC staff determined that TerraPower's procurement document controls as described above comply with the requirements of Criterion IV, "Procurement Document Control," of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.5 Instructions, Procedures, and Drawings

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.E, for establishing the necessary measures and governing procedures to ensure that activities affecting quality are prescribed by and performed in accordance with documented procedures or instructions that

include or reference appropriate acceptance criteria for ensuring prescribed results have been satisfactorily achieved. The level of detail in written procedures or instructions is determined based upon complexity of the task, significance of the item or activity, work environment, and worker proficiency and capability. QA personnel review and approve procedures and instructions for performance of safety-related work to ensure that quality requirements for the work are appropriately described.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 5, “Instructions, Procedures, and Drawings,” without further clarifications or exceptions. The NRC staff determined that TerraPower’s controls for instructions, procedures, and drawings as described above comply with the requirements of Criterion V, “Instructions, Procedures, and Drawings,” of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.6 Document Control

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.F, for establishing the necessary measures and governing procedures to control the preparation, issuance, and revision of documents that specify quality requirements or prescribe how activities affecting quality, such as procedures, instructions, specifications, and drawings shall be controlled to ensure that correct documents are being employed. TerraPower’s QAPD provides measures to assure that such documents and their revisions are reviewed for adequacy and approved for release by authorized personnel. Revisions or changes (other than those defined in implementing procedures as minor changes), are reviewed and approved by the same organization that performed the original review and approval unless another responsible organization is designated in writing. TerraPower manages an Electronic Document Management System (EDMS) for all controlled documents to maintain current revisions where only authorized personnel have access to the documents.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 6, “Document Control,” without further clarifications or exceptions. The NRC staff determined that TerraPower’s document controls as described above comply with the requirements of Criterion VI, “Document Control,” of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.7 Control of Purchased Material, Equipment, and Services

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.G, for establishing the necessary measures and governing procedures to control the procurement of items and services to ensure conformance with specified requirements. These measures provide for supplier evaluation and selection, evaluation of objective evidence of quality furnished by the supplier, audit (minimum triennial) and annual evaluation of suppliers, source surveillance or inspection, examination of items or services upon delivery, specific measures to be taken to ensure no suspect / counterfeit items or documents are included in the items or services being purchased, and product certifications.

The TerraPower QAPD establishes and implements measures for evaluating a potential supplier's capability to provide items or services in accordance with the quality requirements of the procurement documents. In addition, the TerraPower QAPD establishes measures to interface with the supplier and to verify the supplier's performance. Furthermore, TerraPower’s QAPD provides for using source verification, receipt inspection, post-installation testing,

certificates of conformance, and review of objective evidence for conformance to the procurement document requirements.

The TerraPower QAPD commits to implement the quality standards described in NQA-1-2015, Requirement 7, "Control of Purchased Items and Services," Subpart 2.14, "Quality Assurance Requirements for Commercial Grade Items and Services," and the regulatory positions described in RG 1.28, Revision 5, with the following clarifications and exceptions:

- TerraPower considers that audits are not required for U.S. government agencies such as the National Institute of Standards and Technology (NIST).

The NRC staff acknowledges that NIST, or other U.S. government agencies work under their own quality programs, and no additional audit or evaluation is required by TerraPower. The NRC staff determined that this approach is acceptable as these are organizations known to the NRC to have QA programs that meet the requirements of Appendix B to 10 CFR Part 50 or are organizations with proven abilities and disciplines. However, TerraPower is still responsible for ensuring that the items and services procured from these suppliers conform to the applicable criteria in Appendix B to 10 CFR Part 50, as well as other technical and regulatory requirements and commitments. TerraPower is also responsible for ensuring that procured items or services are suitable for the intended application, as well as for documenting the associated evaluation.

The NRC staff evaluated this proposed alternative and determined that it provides an appropriate level of quality and safety. Therefore, the NRC staff concluded that this alternative is acceptable.

TerraPower may apply a 25 percent extension to triennial audits and commercial-grade surveys when performance of an audit or a commercial-grade survey is not feasible due to exigent conditions at the location of TerraPower's domestic and/or international suppliers. In a safety evaluation dated August 6, 2020 (Reference 9), the NRC staff concluded that the conditions stated in the safety evaluation for implementing a 25 percent extension on the frequency of triennial audits or commercial-grade surveys ensure that the quality of items and services will continue during this extension period.

The NRC staff evaluated this proposed alternative and determined that it is consistent with the NRC's current staff position regarding a 25 percent extension on the frequency of triennial audits and commercial-grade surveys due to exigent conditions. Therefore, the NRC staff concluded that this alternative is acceptable.

TerraPower will implement the guidance from Nuclear Energy Institute (NEI) 14-05, "Guidelines for the Use of Accreditation in Lieu of Commercial Grade Surveys for Procurement of Laboratory Calibration and Test Services," Revision 1 (Reference 10), for using the International Laboratory Accreditation (ILAC) accreditation process in lieu of performing commercial-grade surveys as part of the commercial-grade dedication process. In a safety evaluation report dated November 23, 2020 (Reference 11), the NRC staff concluded that NEI 14-05, Revision 1, provides an acceptable approach for licensees and suppliers of basic components for using the ILAC accreditation process in lieu of performing commercial-grade surveys as part of the commercial-grade dedication process.

The NRC staff evaluated this proposed alternative and determined that it is consistent with the NRC's current regulatory position regarding the acceptability of procuring commercial-grade

calibration and testing services from laboratories accredited by ILAC. Therefore, the NRC staff concluded that this alternative is acceptable.

The NRC staff determined that TerraPower's controls for purchased material, equipment, and services as described above comply with the requirements of Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.8 Identification and Control of Materials, Parts, and Components

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.H, for establishing the necessary measures and governing procedures to ensure that only the correct and accepted items are used or installed. TerraPower's QAPD ensures that identification of items is maintained on the items or in documents traceable to the items in a manner which ensures that identification is established and maintained. Identification of items is maintained from the initial receipt and fabrication up to and including installation or use. Identification markings shall be applied which provide a clear and legible identification and do not degrade the function or service life of the item. Markings shall be transferred to each part of an identified item when subdivided and shall not be obliterated by surface treatment or coating unless other means of identification are substituted. The TerraPower QAPD provides measures for identifying items having a limited calendar or operating life, or cycles, to preclude use of items whose shelf or operating life has expired.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 8, "Identification and Control of Items," without further clarifications or exceptions. The NRC staff determined that TerraPower's identification and controls for materials, parts, and components as described above comply with the requirements of Criterion VIII, "Identification and Control of Materials, Parts, and Components," of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.9 Control of Special Processes

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.I, for establishing the necessary measures and governing procedures to assure that special processes that control or verify quality, such as welding, heat treating, and non-destructive examination, are adequately controlled. These special processes are accomplished by qualified personnel using qualified procedures and equipment, and in accordance with specified requirements. In addition, these special processes are controlled by instructions, procedures, drawings, checklists, travelers, or other process control documentation. This documentation ensures that process parameters are controlled and that specified environmental conditions are maintained. Records documenting the currently qualified personnel, methods, and equipment for each special process are controlled and maintained.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 9, "Control of Special Processes," without further clarifications or exceptions. The NRC staff determined that TerraPower's controls of special processes as described above comply with the requirements of Criterion IX, "Control of Special Processes," of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.10 Inspection

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.J, for establishing the necessary measures and governing procedures to implement inspections that verify conformance of an item or activity to specified requirements. Types of inspections may include source, in-process, final, and in-service inspection and these are controlled by instructions, procedures, drawings, checklists, and/or travelers. These types of inspections are performed by properly qualified personnel independent of those who performed or directly supervised the work being inspected, as well as including the documentation of inspection results.

The TerraPower QAPD requirements for inspection planning include identifying the characteristics to be inspected, the methods of inspection, and the acceptance criteria. Inspection documentation includes: (1) item inspected; (2) inspection date; (3) inspector's name; (4) measuring and test equipment used; (5) type of inspection; (6) inspection results; and (7) any nonconformances identified.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 10, "Inspection," without further clarifications or exceptions. The NRC staff determined that TerraPower's inspection controls as described above comply with the requirements of Criterion X, "Inspection," of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.11 Test Control

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.K, for establishing the necessary measures and governing procedures to collect data such as design input, to verify conformance of an item or computer program to specified requirements, or to demonstrate that items subject to the QAPD will perform satisfactorily in service.

TerraPower's QAPD establishes a test program with tests procedures that include: (1) test configuration and objectives; (2) provisions for assuring that prerequisites and suitable environmental conditions are met; (3) provisions for assuring that adequate instrumentation is available and used; (4) provisions for assuring that appropriate tests and equipment are used; and (5) provisions for assuring that necessary monitoring is performed. In addition, test requirements and acceptance criteria shall be provided or approved by the responsible design organization. Test results are documented and evaluated by the organization performing the test and reviewed by the responsible authority to ensure that test requirements have been satisfied.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 11, "Test Control," and Subpart 2.7, without further clarifications or exceptions. The NRC staff determined that TerraPower's testing controls as described above comply with the requirements of Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.12 Control of Measuring and Test Equipment

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.L, for establishing the necessary measures and governing procedures to control the calibration, maintenance, and use of measuring and test equipment (M&TE) that is used for activities affecting quality and/or for acceptance of safety-related SSCs or processes. The M&TE is labeled, tagged, or otherwise

controlled to indicate its calibration status and to ensure its traceability to calibration test data. The types of equipment covered by the program (e.g., tools, gages, instruments) are controlled, calibrated at specified intervals, adjusted, and maintained to required accuracy limits.

The M&TE are calibrated at prescribed times or intervals or prior to use, and whenever the accuracy of the equipment is suspect. Calibration shall be against, and traceable to, certified equipment or reference standards having known valid relationships to nationally recognized standards. If no nationally recognized standards exist, the basis for calibration shall be documented. M&TE that is overdue for calibration, or found to be out-of-calibration, shall be tagged and/or segregated or removed from service and not used until it has been recalibrated. M&TE consistently found to be out of calibration shall be repaired or replaced.

When M&TE is lost, damaged, or found to be out of calibration, an evaluation is performed and documented to determine the validity of previous inspection or test results and of the acceptability of items previously inspected or tested with that equipment. Records are established and maintained to indicate calibration status and the capability of the M&TE to satisfactorily perform their intended functions. Calibration reports and certificates reporting the results of calibration shall include the information and data necessary for interpretation of the calibration results and verification of conformance to applicable requirements.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 12, “Control of Measuring and Test Equipment,” without further clarifications or exceptions. The NRC staff determined that TerraPower’s controls for M&TE as described above comply with the requirements of Criterion XII, “Control of Measuring and Test Equipment,” of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.13 Handling, Storage, and Shipping

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.M, for establishing the necessary measures and governing procedures to control the handling, storage, cleaning, packaging, shipping, and preservation items to prevent damage or loss and to minimize deterioration. These activities are performed in accordance with established work procedures, process control documentation, specifications, shipment instructions, manufacturer's recommendations, or other pertinent documentation.

The TerraPower QAPD establishes instructions for marking and labeling for packaging, shipment, and storage of items necessary to adequately identify, maintain, and preserve the item. Any special controls (e.g., preservation requirements, special equipment, special protective environments, etc.) are provided and specified when required. In addition, special handling tools and equipment are controlled to ensure safe and adequate handling. These special tools and handling equipment are inspected and tested periodically or prior to use to verify that they are adequately maintained.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 13, “Handling, Storage, and Shipping,” without further clarifications or exceptions. The NRC staff determined that TerraPower’s controls for handling, storage, and shipping as described above comply with the requirements of Criterion XIII, “Handling, Storage, and Shipping” of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.14 Inspection, Test, and Operating Status

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.N, for establishing the necessary measures and governing procedures to identify the inspection, test, and operating status of items and components subject to the provisions of the QAPD. TerraPower's QAPD provides measures to ensure that required inspections and tests have been performed and to ensure that items which have not passed required inspections and tests are not inadvertently used, installed, or operated. The status of SSCs is maintained through indicators such as physical location, tags, markings, process control documents, stamps, or other suitable means. The authority for application and removal of tags, markings, labels, and stamps is documented in implementing procedures.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 14, "Inspection, Test, and Operating Status," without further clarifications or exceptions. The NRC staff determined that TerraPower's inspection, test, and operating status controls as described above comply with the requirements of Criterion XIV, "Inspection, Test, and Operating Status," of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.15 Nonconforming Materials, Parts, or Components

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.O, for establishing the necessary measures and governing procedures to control items that do not conform to specified requirements to prevent inadvertent installation or use. Controls are provided for the identification, documentation, evaluation, segregation (when practical), disposition of nonconforming items, and notification to affected organizations. In addition, controls are provided to ensure that identified nonconformance's are screened to determine if the condition needs to be evaluated for potential reportability pursuant to 10 CFR Part 21, "Reporting of Defects and Noncompliance."

Non-conforming items are identified by legible marking, tagging, or other methods not detrimental to the item, on either the item, the container, or the package containing the item. When practical, nonconforming items will be placed in a clearly identified hold area until they are properly dispositioned. When segregation is impractical or impossible due to size, weight or access limitations, other precautions will be employed to preclude inadvertent use of the non-conforming item. Non-conformances are documented on a nonconformance report in accordance with applicable procedures.

Non-conforming items which are dispositioned "repair" or "use-as-is" are subject to design control measures commensurate with those applied to the original design, and the technical justification for the acceptability of these nonconforming items is documented. The disposition, such as use as-is, reject, repair, or rework, of nonconforming items is identified and documented. Reworked and repaired items are reexamined and tested in accordance with applicable procedures and the original acceptance criteria. Personnel performing evaluations to determine a disposition shall demonstrate competence in the specific area they are evaluating, have an adequate understanding of the requirements, and have access to pertinent background information.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 15, "Control of Nonconforming Items," without further clarifications or exceptions. The NRC staff determined that TerraPower's controls for nonconforming materials, parts, or

components as described above comply with the requirements of Criterion XV, “Nonconforming Materials, Parts, or Components,” of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.16 Corrective Action

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.P, for establishing the necessary measures and governing procedures to promptly identify and correct conditions adverse to quality. In the case of a significant condition adverse to quality, the cause of the condition shall be determined and both corrective action and action to preclude recurrence shall be identified and completed. The identification, cause, and corrective action for significant conditions adverse to quality shall be documented and reported to appropriate levels of management. TerraPower’s QAPD provides measures for screening conditions adverse to quality to determine if the condition needs to be evaluated for potential reportability in accordance with 10 CFR Part 21. Adverse conditions are trended to determine whether additional analysis, management action, and/or corrective action is needed.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 16, “Corrective Action,” without further clarifications or exceptions. The NRC staff determined that TerraPower’s corrective action controls as described above comply with the requirements of Criterion XVI, “Corrective Action,” of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.17 Quality Assurance Records

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.Q, for establishing the necessary measures and governing procedures to ensure that records for safety-related work are identified, generated, authenticated, maintained, and controlled, and that their final disposition is specified in implementing procedures. These records provide documentary evidence that safety-related items or activities meet specified quality requirements.

TerraPower’s procedures provide measures for the generation of, authentication of, classification of, receipt of, preservation of, retention of, storage of, safekeeping of, retrieval of, access controls for, user privileges for, and final disposition of records.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 17, “Quality Assurance Records,” and the regulatory positions described in RG 1.28, Revision 5, without further clarifications or exceptions. The NRC staff determined that TerraPower’s controls for QA records as described above comply with the requirements of Criterion XVII, “Quality Assurance Records,” of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

1.18 Audits

The TerraPower QAPD conforms to SRP Section 17.5, Subsection II.R, for establishing the necessary measures and governing procedures to implement audits to verify compliance with the QAPD and associated implementing procedures. Audits also evaluate the effectiveness of the implementation of TerraPower’s QAPD.

The TerraPower QAPD provides for conducting periodic internal and external audits. Internal audits are conducted in accordance with a schedule prepared by the QA department with input

from other TerraPower organizations. The internal audit schedule ensures that all elements of the QA program are audited annually, or at least once during the lifetime of the activity, whichever is shorter. External audits are performed on a triennial basis and supplemented by annual evaluations of the suppliers' performance. External or supplier audits may be tracked on the audit schedule and/or the Evaluated Supplier List. A grace period of 90 days may be applied to extend the schedule of an audit, but this does not allow the "clock" for the original audit schedule to be reset forward.

A written plan is prepared for each audit. The plan identifies the audit scope, requirements, audit personnel, activities to be audited, organizations to be notified, applicable documents, and schedule. These audits are conducted by trained personnel who do not have direct responsibilities in the area being audited and have sufficient authority and organizational freedom to make the audit process meaningful and effective. Auditors shall have experience or training commensurate with the scope, complexity, or special nature of the activities to be audited.

The TerraPower QAPD provides for all audit results to be documented and reviewed by responsible management. Management of the audited organization or activity shall investigate adverse audit findings, identify and schedule corrective actions, and notify the audit team leader in writing of action taken or planned. In addition, where corrective actions are indicated, a follow-up action shall be taken to verify that the corrective action was completed satisfactorily as scheduled. This shall be done prior to completing the closeout section of the Corrective Action Report.

The TerraPower QAPD commits to the quality standards described in NQA-1-2015, Requirement 18, "Audits," and the regulatory positions described in RG 1.28, Revision 5, without further clarifications or exceptions. The NRC staff determined that TerraPower's QA controls for audits as described above comply with the requirements of Criterion XVIII, "Audits," of Appendix B to 10 CFR Part 50, and therefore, are acceptable.

2.0 Quality Requirements for Non-Safety-Related Work for Reactor Projects and for Non-Reactor Projects

The TerraPower QAPD conforms to SRP Section 17.5, Paragraph II.U.1, "Non-safety Related SSCs that are Significant Contributors to Plant Safety," for establishing specific program controls applied to nonsafety-related SSCs that are significant contributors to plant safety, for which the requirements of Appendix B to 10 CFR Part 50 are not applicable. The TerraPower QAPD applies specific controls to those items in a selective manner and targeted at those characteristics or critical attributes that render the SSC a significant contributor to plant safety.

3.0 Non-Safety-Related Structures, Systems, and Components Credited for Regulatory Events

In establishing the quality requirements for nonsafety-related SSCs credited for regulatory events, TerraPower's QAPD conforms to SRP Section 17.5, Paragraph II.U.2, "Nonsafety-Related SSCs Credited for Regulated Events," with the following exceptions.

Specifically, TerraPower did not include a commitment to conform with the following quality guidance for the specified equipment:

- NRC's Generic Letter (GL) 85-06, "Quality Assurance Guidance for ATWS Equipment That Is Not Safety-Related," dated January 16, 1985, for anticipated transient without scram (ATWS) equipment

- Regulatory Position 3.5, "Quality Assurance and Specific Guidance for SBO Equipment That Is Not Safety-Related," and Appendix A, "Quality Assurance Guidance for Non-Safety Systems and Equipment," in RG 1.155, "Station Blackout," dated August 1988, for Station blackout (SBO) equipment

The NRC staff acknowledges that because of the substantial differences between TerraPower's plant design and a light water reactor design, a direct commitment to these quality guidance positions may not be practical. However, TerraPower would have to justify in its application why these quality guidance positions are not applicable to its advanced reactor design. Therefore, the NRC staff identified that the review of TerraPower's commitments and exceptions to these quality guidance positions will be addressed as part of a future application review. This is identified as Limitation No. 1.

4.0 Regulatory Commitments

The TerraPower QAPD conforms to SRP Section 17.5, paragraph II.V, for establishing QA program commitments. TerraPower commits to conform with the following NRC RGs and other QA standards to supplement and support the QA program, as applicable:

- GL 89-02, "Actions to Improve the Detection of Counterfeit and Fraudulently Marked Products."

- GL 91-05, "Licensee Commercial-Grade Dedication Programs."

- RG 1.234, "Evaluating Deviations and Reporting Defects and Noncompliance Under 10 CFR Part 21," Revision 0, dated April 2018. RG 1.234 describes methods acceptable to the NRC staff for complying with the provisions of 10 CFR Part 21.

- RG 1.28, "Quality Assurance Program Criteria (Design and Construction)," Revision 5, dated October 2017. RG 1.28 describes a method acceptable to the NRC staff for complying with the provisions of Appendix B to 10 CFR Part 50 with regards to establishing and implementing the requisite QA program for the design of nuclear power plants.

For the RGs listed below, TerraPower stated that conformance and exceptions for the applicable regulatory position guidance provided in the RGs would be identified in the subsequent application documents, i.e., the PSAR. The NRC staff acknowledges that because of the substantial differences between TerraPower's plant design and a light water reactor design, direct commitment to these RGs may not be appropriate. Therefore, the NRC staff

identified that the review of TerraPower's commitments and exceptions to the RGs listed below were not assessed as part of this review and will be addressed as part of the subsequent PSAR. This is identified as Limitation No. 2.

- RG 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," Revision 5, dated February 2017. RG 1.26 defines classification of systems and components.

- RG 1.29, "Seismic Design Classification for Nuclear Power Plants," Revision 5, dated July 2016. RG 1.29 defines the systems required to withstand a safe shutdown earthquake.

- RG 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants," Revision 3, April 2017. RG 1.54 provides guidance for the application of protective coatings within nuclear power plants to protect surfaces from corrosion, contamination from radionuclides, and for wear protection.

- RG 1.164, "Dedication of Commercial-Grade Items for Use in Nuclear Power Plants," Revision 0 dated June 2017. RG 1.164 describes methods acceptable to the NRC staff for complying with the regulatory requirements for dedication of commercial-grade items and services used in nuclear power plants.

- RG 1.189, "Fire Protection for Operating Nuclear Power Plants," Revision 3, dated February 2018.

- RG 1.231, "Acceptance of Commercial-Grade Design and Analysis Computer Programs Used in Safety-Related Applications for Nuclear Power Plants," Revision 0, dated January 2017. RG 1.231 describes methods acceptable to the NRC staff for complying with the regulatory requirements for acceptance and dedication of commercial-grade design and analysis computer programs used in safety-related applications for nuclear power plants.

LIMITATIONS AND CONDITIONS

The NRC has identified the following two limitations associated with TerraPower's QAPD:

Limitation No. 1

TerraPower did not include a commitment to conform with NRC's GL 85-06 and Regulatory Position 3.5 in RG 1.155 in the QAPD. The NRC staff acknowledges that with the substantial differences between TerraPower's plant design and a light water reactor design, a direct commitment to these quality guidance positions may not be practical. However, TerraPower will have to justify in its application why these two quality guidance positions are not applicable to its advanced reactor design.

Limitation No. 2

TerraPower stated it did not include a commitment to conform with the applicable regulatory guidance in the following RGs: 1.26, 1.29, 1.54, 1.164, 1.189, and 1.231. The NRC staff acknowledges that with the substantial differences between TerraPower's plant design and a

light water reactor design, a direct commitment to these RGs may not be appropriate at this time. However, TerraPower will have to address in its application its conformance and/or exceptions to the applicable regulatory position guidance provided in the RGs.

CONCLUSION

The TerraPower QAPD delineates the policies, processes, and controls established by TerraPower and associated implementing documents relative to U.S. domestic licensing requirements for a construction permit for nuclear power plants. Together, the QA program documents defined in the QAPD provide for control of TerraPower's activities that affect the quality of safety-related nuclear plant SSCs and include all planned and systematic activities necessary to provide adequate confidence that such SSCs will perform satisfactorily in service, with the exception of the limitations discussed above.

The TerraPower QAPD may also be applied to certain equipment and activities that are not safety-related, but support safe plant operations, or where other NRC guidance establishes program requirements.

The TerraPower QAPD conforms to the format of SRP Section 17.5. The NRC staff used the acceptance criteria of SRP Section 17.5 as the basis for evaluating the compliance of TerraPower's QAPD with Appendix B to 10 CFR Part 50. On the basis of its review of the TerraPower QAPD, the NRC staff concludes, subject to the limitations discussed above, that:

- The TerraPower QAPD adequately describes the authority and responsibility of management and supervisory personnel, performance and verification personnel, and self-assessment personnel, in relation to activities to which the TerraPower QA program is applicable.

- The TerraPower QAPD adequately provides for organizations and personnel to perform verification and self-assessment functions related to TerraPower's activities that affect the quality of safety-related nuclear plant SSCs, as well as select nonsafety-related SSCs, with these organizations and personnel having the authority and independence to conduct activities without undue influence from those directly responsible for costs and schedules.

- The TerraPower QAPD adequately applies to activities and items that are important to safety.

- The TerraPower QAPD adequately establishes controls that, when properly implemented, comply with the applicable requirements of Appendix B to 10 CFR 50, and 10 CFR Part 21, consistent with the criteria contained in SRP Section 17.5, as well as the relevant regulatory guidance.

On the basis of its review, as documented above, the NRC staff determined that TerraPower's QAPD adequately describes TerraPower's QA program for a construction permit application, with the exception of the limitations discussed above. Accordingly, subject to these limitations, the NRC staff concludes that TerraPower's QA program complies with the applicable NRC regulations and can be used by TerraPower for its design, fabrication, construction, and testing activities associated with a nuclear power reactor.

REFERENCES

1. Letter from Peter C. Gaillard, Director, Regulatory Affairs, TerraPower, LLC, to the NRC's Document Control Desk, "TerraPower, LLC Quality Assurance Topical Report," dated August 5, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20218A590)

2. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 17.5, "Quality Assurance Program Description - Design Certification, Early Site Permit and New License Applicants," Revision 1, dated August 2015 (ADAMS Accession No. ML15037A441)
3. Letter from Peter C. Gaillard, Director, Regulatory Affairs, TerraPower, LLC, to the NRC's Document Control Desk, "Revision to TerraPower, LLC - Quality Assurance Topical Report," dated December 23, 2020 (ADAMS Accession No. ML21005A015)

4. Letter from Peter C. Gaillard, Director, Regulatory Affairs, TerraPower, LLC, to the NRC Document Control Desk, "TerraPower, LLC Quality Assurance Topical Report," dated February 26, 2021 (ADAMS Accession No. ML21057A084)

5. Letter from Peter C. Gaillard, Director, Regulatory Affairs, TerraPower, LLC, to the NRC Document Control Desk, "Response to Request for Additional Information on NRC's Assessment of the Quality Assurance Program Description for TerraPower, LLC's Quality Assurance Topical Report," dated May 28, 2021 (ADAMS Accession No. ML21148A236)

6. Letter from Peter C. Gaillard, Director, Regulatory Affairs, TerraPower, LLC, to the NRC Document Control Desk, "Revised Response to Request for Additional Information on NRC's Assessment of the Quality Assurance Program Description for TerraPower, LLC's Quality Assurance Topical Report," dated July 2, 2021 (ADAMS Accession No. ML21183A200)

7. American Society of Mechanical Engineers NQA-1-2015, "Quality Assurance Program Requirements for Nuclear Facilities," New York, NY, dated February 20, 2015

8. Regulatory Guide (RG) 1.28, "Quality Assurance Program Criteria (Design and Construction)," Revision 5, dated October 2017 (ADAMS Accession No. ML17207A293)

9. Safety Evaluation Report by the Office of Nuclear Reactor Regulation, "Callaway Plant, Unit No. 1 - Operating Quality Assurance Manual Change, Revision 34b," dated August 6, 2020 ADAMS Accession No. ML20216A681)

10. Revision 1 of NEI 14-05A, "Guidelines for the Use of Accreditation in Lieu of Commercial-Grade Surveys for Procurement of Laboratory Calibration and Test Services," dated September 2020 (ADAMS Accession No. ML20259B731).

11. Final Safety Evaluation for Technical Report NEI 14-05, "Guidelines for the Use of Accreditation in Lieu of Commercial Grade Surveys for Procurement of Laboratory 16 Calibration and Test Services," Revision 1, dated November 23, 2020 (ADAMS Accession No. ML20322A019)

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