TerraPower

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington DC 20555-0001

Ref: NRC Regulatory Issue Summary (RIS) 2016-08, "Process for Scheduling and Allocating Resources in FY 2019 for the Review of New Licensing Applications for Light-Water Reactors and Non-Light-Water Reactors," dated June 7, 2016

Subject: TerraPower Response to NRC Regulatory Issue Summary 2016-08

The purpose of this letter is to provide TerraPower's voluntary response to NRC Regulatory Issue Summary (RIS) 2016-08, "*Process for Scheduling and Allocating Resources in FY 2019 for the Review of New Licensing Applications for Light-Water Reactors and Non-Light-Water Reactors*". RIS 2016-08 states in part that the NRC is seeking information to assist the NRC in determining fiscal year (FY) 2019 resource and budget needs. TerraPower recognizes the value in assisting the NRC in determining fiscal year FY2019 resource and budget to ensure the effective implementation of the NRC's regulatory processes. This letter makes no regulatory commitments and no revisions to any existing regulatory commitments.

Enclosure 1 to this letter provides the "TerraPower Response to NRC Regulatory Issue Summary 2016-08."

If you have any questions concerning TerraPower's comments, please contact me at 425-324-2732 or at pgaillard@terrapower.com.

Sincerely,

Peter C Gaillard

Peter C. Gaillard
Manager, Licensing

Enclosure 1: TerraPower Voluntary Response to NRC Regulatory Issue Summary (RIS) 2016-08

Distribution: Mr. Michael Franovich, NRC/DSRA, NRC

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NRR

330 120th Avenue NE, Suite 100, Bellevue, WA 98005 www.TerraPower.com P. +1 (425) 324-2888 F. +1 (425) 324-2889

Mr. Michael Mayfield, NRO, NRC
Mr. John Monninger, NRO/DSRA, NRC
Ms. Vonna Ordaz, NRO, NRC
Mr. Joseph Williams, NRO/DSRA/ARPB, NRC
NRC Document Control Desk

ENCLOSURE 1

TerraPower Voluntary Response to NRC Regulatory Issue Summary (RIS) 2016-08

In support of the development of the Molten Chloride Fast Reactor (MCFR), TerraPower anticipates the need for an operational Test Reactor. The Test Reactor will provide licensing information and empirical test data in support of a prototype reactor which will be used to support the licensing of a commercial MCFR.

TerraPower's initial license application submittal will be for a Test Reactor developed using NUREG-1537, *Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors*, modified as appropriate for a molten salt reactor. This reactor will serve to demonstrate the key features of the technology in a nuclear environment.

The following information is provided by TerraPower in response to RIS 2016-08.

Licensing process questions for all potential/future applicants:

1. a) *What type(s) of NRC interaction(s) do you plan to seek (e.g., pre-application, focused review, permit, license, design approval, amendment, renewal, or certification)? This may be in the form of a topical report, CP, DC, ESP, LWA, COL, SDA, ML, LA request, or purchasing approval request.*

   TerraPower intends to seek pre-application interactions with the NRC within the time frame specified for this RIS submittal on a limited number of Topical Reports and interactions. The purpose of these pre-application interactions is to familiarize the staff with MCFR design concepts. An early submittal to the NRC is expected to be the Quality Assurance Topical Report. Other early pre-applications will be identified and coordinated with the NRC.

   b) *If you plan to request an ESP, will you seek approval of either proposed major features of the emergency plans in accordance with 10 CFR 52.17(b)(2)(i) or with 10 CFR 52.17(b)(2)(ii)?*

   Not applicable.

2. *In which month and year do you expect to submit your application or other document(s)?*

   TerraPower currently anticipates an early submittal of a Quality Assurance Topical Report. Delivery of this Topical Report has not been finalized at this time and schedules for other submittals is under development. The plans and schedules will be provided when they become available.

3. *a) If applicable at this time, is there a designated reference COL applicant?*

   Not applicable.

   b) In what order would you like the NRC to review the subsequent applications?

   The order of the review of subsequently issued reports will be discussed later.

4. a) *Where will the plant be located?*

   To be determined. The NRC will be notified upon selection of a site.

   b) *How many units or modules will the design contain, or a specific plant contain, if known?*

   Not applicable.

5. a) *Will you be part of an organized DCWG?*

   Not applicable for the initial licensing efforts for the TerraPower MCFR Test Reactor.

   b) *Who are the other members of the DCWG?*

   Not applicable for the initial licensing efforts for the TerraPower MCFR Test Reactor.

   c) *Who will be the primary point of contact for each DCWG?*

   Not applicable for the initial licensing efforts for the TerraPower MCFR Test Reactor.

Technical questions for all potential/future applicants, answered to the extent practical and possible:

1. a) *What type of reactor design will be used?*

   TerraPower is developing an MCFR, a pool-type reactor based on molten salt reactor (MSR) technology. The TerraPower MCFR Test Reactor will have a similar configuration.

   b) *What type of coolant and fuel will be used?*

   The MCFR fuel design is being designed to use a high-actinide content chloride salt. The primary coolant is a molten salt that carries heat from the fuel salt to the main and reheat steam generators.

2. a) *What is the current status of the development of the plant design (i.e., conceptual, preliminary, or final)?*

   The Test Reactor design is currently pre-conceptual.

   b) *Have you established a schedule for completing the design?*

   A detailed schedule is being developed for completing the design work needed to support regulatory activities.

3. a) *Do you plan to submit white papers or technical and topical reports related to the features of your design, or for the resolution of policy or technical issues?*

   TerraPower plans to submit white papers and technical and topical reports for support of resolution of policy and technical issues. The MCFR Quality Assurance Topical Report is

expected to be submitted early in the licensing process in support of the testing performed as part of the basis for the licensing application. Other early discussions with the NRC are expected to include the licensing strategy for the MCFR concept and a pre-conceptual design overview.

b) Do you have a schedule for submitting such papers or reports?

These are currently in the process of being identified and validated.

4. *a) Are you interested in licensing and testing a first-of-a-kind plant under the prototype provisions of 10 CFR 50.43(e)?*

Yes. TerraPower's initial focus will be on development of a Test Reactor application utilizing NUREG-1537 guidance for PSAR and FSAR application development. The Test Reactor would support the prototype plant application as described in 10 CFR 50.43(e).

b) If so, to the extent practical, describe milestones, plans, and intended tests.

The schedules, including milestones, plans, and intended tests, for licensing and testing a first-of-a-kind plant under the prototype provisions of 10 CFR 50.43(e) are under development.

5. *a) Are vendors or consultants assisting you in preparing the application(s)?*

Preparation of licensing applications may involve vendors or consultants who will perform work in support of our licensing effort.

b) If so, please describe their roles and responsibilities for the design and licensing activities.

Vendor roles and responsibilities for the design and licensing activities have not yet been determined.

6. *Have you established a schedule for qualifying fuel and other major systems and components?*

The schedule, technical and regulatory approaches to fuel salt synthesis will be developed prior to licensing of the Test Reactor. An Integrated Effects Test (IET) is being developed to support the licensing, detail design, and operation of the Test Reactor including qualifying other major systems and components. Separate effects tests will also be employed for fuel salt studies.

The schedule for the development of the IET and Test Reactor is under development.

7. *a) Have you developed computer codes and models to perform design and licensing analyses?*

Yes. Computer codes and models to perform design and licensing analyses have been and are being developed.

b) Have you established a schedule for completing the design and licensing analyses?

The plans and schedules for completing the design and licensing analyses is being developed.

8. *Describe, to the extent practical, your schedule for defining principal design criteria, licensing-basis events, and other fundamental design and licensing relationships.*

Determining the principal design criteria, licensing-basis events, and other fundamental design and licensing relationships is currently underway. Principal design criteria for the prototype reactor will be developed reflecting ANS 20.2 for MSR specific design criteria. The principal design criteria are based on the general design criteria of 10 CFR 50 Appendix A.

The SAR for the test reactor will be developed using NUREG-1537 and its associated documents. NUREG-1537 provides the high-level requirements for the MCFR Test Reactor including the development of principal design criteria.

9. a) *Have you developed procedures regarding the use of thermal fluidic testing facilities and regarding the use of the results of their tests to validate computer models?*

To support the licensing, detail design, and operation of the Test Reactor, an Integrated Effects Test (IET) and key programmatic technologies in support of deployment are being developed. The IET does not require a license from the NRC. It will be operated prior to operation of the testing facility. Development of procedures regarding the use of results have not yet been developed.

b) Have you established a schedule for completing the thermal fluidic testing?

A schedule and the requirements that need to be determined from the IET and separate effects tests are being developed.

c) Have you established a schedule for the construction of testing facilities?

A schedule for the construction is being developed.

10. *a) Have you identified system and component suppliers (including fuel suppliers), manufacturing processes, and other major factors that could influence design decisions?*

TerraPower is in the process of identifying, evaluating, and selecting system and component suppliers.

b) Have you established a schedule for identifying suppliers and key contractors?

The plans and schedules for identifying suppliers and key contractors is being developed.

11. *Do you have a quality assurance program or a schedule to develop one?*

TerraPower has established a Quality Assurance Program that complies with 10 CFR 50 Appendix B, ASME NQA-1, 2008 Edition, with 2009 Addenda, and Regulatory Guide 1.28 Revision 4 for all nuclear safety related work.

12. a) *Have you developed probabilistic risk assessment (PRA) models needed to support your applications, including the information needed to support risk-informed licensing approaches (for Chapter 19)?*

TerraPower is developing PHA and Fault Tree Analysis, which will lead to initiating event selection. Further analysis and details will allow Event Trees and an initial PRA to be developed.

In order to develop and assess the transient and safety behavior of the MCFR design using processes that will streamline communications with the NRC, the team will utilize guidance from Regulatory Guide 1.203 "Transient and Accident Analysis Methods". ASME/ANS RA-S-1.4-2013: *Probabilistic Risk Assessment Standard for Advanced Non-LWR Nuclear Power Plants* will be followed in doing PRA work.

b) *Do you plan to use the PRA for any risk-informed applications (e.g., risk-informed technical specifications, risk-informed in-service inspection, risk-informed categorization and treatment, or risk-informed in-service testing)?*

TerraPower intends to use the PRA for future risk-informed applications. Many of these applications are designed for use on as-built, as-operated reactors and due to lack of data may not be included in the initial license application.

c) *Do you plan to use the PRA models in the development of the design?*

Yes. The PRA will help inform design basis event selection and severe accident mitigation. Top cut sets and vulnerabilities are expected to be identified and improved through the course of the design.

d) *At what level will the PRA be prepared, and at what point during the application process will it be submitted?*

The plans and schedules for PRA development and application will be provided when they become available. The PRA is to have a progressively higher level of detail as the design evolves.

13. *Have you developed the plans for the construction and use of a control-room simulator?*

No. A conventional control room simulator is not required for the Test Reactor.

14. a) *Do you have a staffing plan?*

A preliminary staffing plan is under development.

b) *What is your current staffing level for the execution and testing of the reactor design?*

Current staffing levels are commensurate with the staffing needs as the design of the MCFR progresses. TerraPower's current staff capabilities address needs in integrated modeling and design as well as licensing, project management, procurement, quality assurance irradiation studies, large scale computing, etc.

c) *Do you plan to increase staffing?*

Yes, our staff size will grow in accordance with the staffing plan.

15. a) *Which systems, structures, and components, including fuel, do you foresee will be fabricated off-site and delivered for the manufacturing, fabrication, and site construction of a completed operational nuclear power plant?*

TerraPower's initial license application submittal will be for a Test Reactor. The design approach will consider final cost for manufacturing, fabrication, and site construction but may not consider the same factors as considered for small modular reactors.

b) What is intended to be assembled and constructed on-site versus at a remote facility?

TerraPower's initial license application submittal will for a Test Reactor. On-site assembly and construction may be considered for impacts to final cost and schedule.

c) In addition, and as applicable, provide the construction plans and schedules for the fabrication of large components and modules of the applicable SMR or non-LWR designs when these are available.

These plans and schedules are under development.