

# TERRESTRIAL ENERGY USA

November 18<sup>th</sup>, 2016

U.S. Nuclear Regulatory Commission  
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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 Large Light-Water Reactors and Small Modular Reactors," dated June 7, 2016

Subj: Terrestrial Energy USA Ltd Response to NRC Regulatory Issue Summary 2016-08

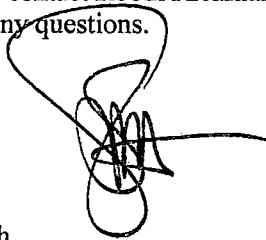
On June 7, 2016, the NRC published NRC Regulatory Issue Summary (RIS) 2016-08, "Process for Scheduling and Allocating Resources in FY 2019 for the Review of New Licensing Applications for Large Light-Water Reactors and Small Modular Reactors." In part, the subject RIS states that the NRC is seeking information which includes pre-application activities, new license applications, early site permits (ESP) and limited work authorization (LWA) applications, license amendment (LA) requests, topical report submissions, revisions to applications, reactivation of suspended applications, applications for renewal of ESPs and design certifications (DC), construction activities, and license transfer requests to assist the NRC in determining fiscal year (FY) 2019 resource and budget needs with respect to future construction-related activities, and other anticipated 10 CFR Part 50 and Part 52 licensing and design certification rulemaking actions for large light-water reactors (LWRs), non-LWRs, small modular reactors (SMRs), and other reactor technologies.

The purpose of this letter is to provide the response of Terrestrial Energy USA Ltd (TEUSA) to RIS 2016-08. TEUSA recognizes the value in assisting the NRC in determining fiscal year FY2019 resource and budget needs with respect to future construction-related activities, and other anticipated 10 CFR Part 50 and Part 52 licensing and design certification rulemaking actions for large light-water reactors (LWRs), non-LWRs, small modular reactors (SMRs), and other reactor technologies in ensuring the effective implementation of the NRC's regulatory processes. This response includes the current status of the design, analyses, testing, licensing, and project planning for the TEUSA Integral Molten Salt Reactor (IMSR), a liquid fueled molten salt, 400 MWth advanced reactor design.

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

This letter makes no regulatory commitments and no revisions to any existing regulatory commitments. Please feel free to contact Robin Rickman, TEUSA, at (646) 687-8212 ext. 331 or at rrickman@terrestrialusa.com if you have any questions.

Sincerely,



Simon Irish  
CEO, Terrestrial Energy USA Ltd.

Enclosure 1: "TEUSA Response to NRC Regulatory Issue Summary 2016-08"

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Terrestrial Energy USA Ltd

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# TERRESTRIAL ENERGY USA

## Terrestrial Energy USA Ltd Response to NRC Regulatory Issue Summary 2016-08

On June 7, 2016, the NRC published NRC Regulatory Issue Summary (RIS) 2016-08, "Process for Scheduling and Allocating Resources in FY 2019 for the Review of New Licensing Applications for Large Light-Water Reactors and Small Modular Reactors." In part, the subject RIS states that the NRC is seeking information which includes pre-application activities, new license applications, early site permits (ESP) and limited work authorization (LWA) applications, license amendment (LA) requests, topical report submissions, revisions to applications, reactivation of suspended applications, applications for renewal of ESPs and design certifications (DC), construction activities, and license transfer requests to assist the NRC in determining fiscal year (FY) 2019 resource and budget needs with respect to future construction-related activities, and other anticipated 10 CFR Part 50 and Part 52 licensing and design certification rulemaking actions for large light-water reactors (LWRs), non-LWRs, small modular reactors (SMRs), and other reactor technologies.

The following information is provided by Terrestrial Energy USA Ltd (TEUSA) in response to RIS 2016-08.

This response includes the current status of the design, analyses, testing, licensing, and project planning for the TEUSA Integral Molten Salt Reactor (IMSR) a liquid fueled molten salt, 400 MWth advanced reactor design.

### Question for COL license holders:

How many licensing actions (e.g., license amendment requests, exemption requests, and relief requests) would you expect to submit to the NRC during FY 2019 through FY 2021-time frame?

**Response:** TEUSA does not expect to submit any licensing actions such as license amendment requests, exemption requests or relief requests during the timeframe identified.

### 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.

**Response:** TEUSA intends to seek pre-application interaction with the NRC prior to the 2019 timeframe. TEUSA intends to submit to the NRC either a Design Certification Application (DCA) for the TEUSA IMSR-400 seeking NRC approval and Design Certification (DC) of the design in accordance with 10 CFR Part 52 or a Construction Permit (CP) in accordance with 10 CFR Part 50. TEUSA will inform the NRC as soon as the licensing pathway (Part 50 or 52) decision has been made. Additionally, TEUSA anticipates submitting a limited number of topical reports associated with the IMSR-400 (e.g. quality assurance plan) prior to 2019.

- 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)?

**Response:** TEUSA does not expect to request an ESP at this time.

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

**Response:** TEUSA expects to submit either a DCA or CP application no later than October 2019 as described in question 1 above.

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

**Response:** Not applicable at this time.

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

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**Response:** Not applicable at this time.

4. a) Where will the plant be located?

**Response:** TEUSA is examining four sites: these four sites include the Idaho National Laboratory (INL), near Idaho Falls; and three additional sites east of the Mississippi River. In all four cases, TEUSA has begun to investigate the commercial prospects for an IMSR power plant, particularly in regards to potential electric-power off-takers. Final site selection is projected for the end of 2017.

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

**Response:** The IMSR-400 contains a single 400 MWth operating reactor Core-unit (module). The selected site may contain as many as four modules.

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

**Response:** Currently, TEUSA does not plan to be part of an organized Design Centered Working Group as the focus of initial licensing efforts. Unlike the review situation described in RIS 2006-06 where the NRC anticipated applicants may be submitting at least 12 COLs for NRC review in late FY 2007 and FY2008, which challenged the NRC with an unprecedented review effort, the TEUSA focus will be on licensing the first commercial IMSR-400. When a larger group of potential subsequent COL (S-COL) applicants form, those S-COL applicants, the R-COL applicant and TEUSA would form a DCWG to assure that the COL reviews can be completed on the desired schedule and that the quality of review will ensure that a license will not be granted for a new nuclear power plant unless it is operated so as to provide adequate protection of the public health and safety. TEUSA recognizes this approach would allow the staff, to the maximum extent practical, to use a "one issue, one review, one position" strategy to optimize the staff's review effort, the resources needed to perform reviews, and the review schedules.

#### Design-Centered Working Group (DCWG)

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

**Response:** Members of a DCWG will be identified at the time a DCWG is formed.

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

**Response:** The primary point of contact for each member of the DCWG will be identified at the time a DCWG is formed.

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

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

**Response:** The IMSR-400 is a 400 MWth, small modular, high temperature, self-contained, pool-type, liquid fueled, thermal spectrum, graphite moderated, molten salt advanced reactor operating with a once-through fuel cycle.

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

**Response:** The IMSR-400 utilizes molten fluoride salts for both fueling (with low-enriched uranium) and for cooling. Fuel feedstock is a low enriched uranium fluoride, UF<sub>4</sub>.

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

**Response:** The IMSR-400 conceptual design is complete and basic engineering effort is underway to advance the design to a preliminary and then final design.

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

**Response:** Yes, a detailed schedule has been established for completing the design work needed to support regulatory activities. The schedule is resource loaded by a work breakdown structure using Primavera P6 software. Rolling wave planning is being employed in which detailed activities are planned for the near-term period, and major activities are planned for following years. This approach is being used to efficiently plan and address necessary details at the appropriate time.

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?

**Response:** Yes, TEUSA plans to submit white papers and technical and topical reports related to features of the IMSR-400 plant design and for support of resolution of policy and technical issues. These are currently in the process of being identified and validated. We will share with the NRC our proposed plan and timing for these white papers later in 2017.

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

**Response:** No. A specific schedule for submitting such papers and/or reports has not been completed (see question 3 above)

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)?

**Response:** No. TEUSA intends to license and construct a first commercial IMSR-400 and is not interested in licensing and testing a first-of-a-kind plant under the prototype provisions of 10 CFR 50.43(e).

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

**Response:** Not applicable.

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

**Response:** Preparation of licensing applications may involve vendors, consultants and law firms who will perform work in support of our licensing effort. The vendors and consultants will work under an approved Appendix B quality program as qualified suppliers and will not have a direct interface with the NRC staff.

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

**Response:** TEUSA accepts the complete responsibility for the plant design aspects of the license activities, a responsibility that will not be delegated to vendors or consultants.

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

**Response:** Yes. TEUSA expects to share more details about our schedule with the NRC staff in 2017.

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

**Response:** Yes. TEUSA expects to share more details about our design and licensing activities with the NRC staff in 2017.

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

**Response:** Yes. A detailed and comprehensive schedule has been established for completing the design and licensing analysis needed. The design and licensing analysis schedule is included in the overall project schedule as described in response to question 2b above.

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

**Response:** Determining the principal design criteria, licensing-basis events, and other fundamental design and licensing relationships is currently underway and these activities are included in the overall project schedule as described in response to question 2b above. We expect to provide additional details regarding this schedule with the NRC staff in 2017.

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?

**Response:** No. The design state of testing facilities is at such a point as the development of procedures regarding the use of results is still premature.

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

**Response:** Yes. Schedules include the necessary design, construction, and operation of thermal fluidic testing facilities for the validation of system and computational fluid dynamics software used for IMSR safety analysis and design.

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

**Response:** Yes. Please see the response to item 9.b above.

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

**Response:** Yes. TEUSA is in the process of identifying, evaluating, and selecting through a best-value-selection process, significant component suppliers. These selections include fuel suppliers, Engineering, Procurement, and Construction (EPC) contractors, and critical system and component suppliers; all of which could influence design decisions.

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

**Response:** Yes. A schedule has been established for identifying critical suppliers and key contractors. We expect to share more details about this schedule with the NRC staff in 2017.

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

**Response:** No. However, TEUSA anticipates developing a Quality Assurance Program Description (QAPD) for design certification of the IMSR-400 and that a final safety evaluation (SE) approving the IMSR-400 QAPD will be issued by the NRC on a schedule that supports all regulatory activities associated with TEUSA applications to the agency.

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)?

**Response:** Modifications to conventional probabilistic risk assessment (PRA) models are needed to reflect the passive and inherent safety characteristics of IMSR-400. Models are currently being developed by an independent expert group utilizing methodologies consistent with US and international standards such as IAEA. TEUSA intends to periodically update the PRA throughout the design process to help identify and reduce the impact of dominant risk factors.

- 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)?

**Response:** Yes. TEUSA plans to use the PRA for risk-informed applications such as, risk-informed technical specifications, risk-informed in-service inspection, risk-informed categorization and treatment, or risk-informed in-service testing.

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

**Response:** Yes. While its main purpose will be to confirm numerical safety goals are met, the PRA will also be used to validate various system and subsystem elements of the design.

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

**Response:** TEUSA expects to prepare a Level 1 preliminary PRA, and also plans to prepare a Level 2 PRA at a later date. TEUSA, as appropriate will provide the NRC with periodic reports on the progress and impact of the PRA activities on the IMSR design process.

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

**Response:** No. Plans for the construction and use of a control-room simulator are yet to be developed. We expect this decision will be made by 2019 and intend to update the NRC accordingly.

14. a) Do you have a staffing plan?

**Response:** Yes

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

**Response:** Current staffing of the engineering and technical team has been aggregated from industry and draws from the pool of experienced design and engineering resources that have participated in multiple new reactor design, engineering, and licensing efforts. The staffing level has been consistent with the resource needs as the design progressed from pre-conceptual to the conceptual design, and into the basic engineering of the plant design.

c) Do you plan to increase staffing?

**Response:** The level of staffing has increased as design and engineering needs have increased from the pre-conceptual design level and will continue to increase in order to meet future needs.

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?

**Response:** Currently, the IMSR-400 Core-unit which includes the reactor vessel containing the graphite moderator, primary salt pumps, primary heat exchangers, instrumentation, shutdown devices, and other components will be fabricated off-site and shipped for final inspection, assembly, and installation into the nuclear power plant. Other plant component modules are being considered for complete off-site manufacturing and fabrication. Components and systems being evaluated include items such as the in-containment storage vault, and the secondary salt pumps and heat exchanger module. The IMSR design anticipates utilizing modular construction to the greatest extent practicable considering the final cost and schedule impacts. Various aspects of the plant are being considered for modularization including plant support system modules and plant process system modules.

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

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**Response:** TEUSA, considering the final cost and schedule impacts of such an approach, intends to maximize the use of factory modularization of other systems and structures that can be rail or truck shipped to the plant site. This approach includes leveraging the modularization lessons learned from current industrial construction projects.

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.

**Response:** These plans and schedules will be provided when they become available.