

**Response regarding the Westinghouse eVinci Micro Reactor to NRC
Regulatory Issue Summary (RIS) 2017-08, “Process for Scheduling and
Allocating Resources for Fiscal Years 2020 Through 2022 for the Review of
New Licensing Applications for Light-Water Reactors and Non-Light-Water
Reactors”**

(Non-Proprietary)

June 2019

Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, PA 16066

© 2019 Westinghouse Electric Company LLC
All Rights Reserved

¹ eVinci is a trademark or registered trademark of Westinghouse Electric Company LLC, its affiliates and/or its subsidiaries in the United States of America and may be registered in other countries throughout the world. All rights reserved. Unauthorized use is strictly prohibited. Other names may be trademarks of their respective owners.

**Response regarding the Westinghouse eVinci Micro Reactor to
RIS 2017-08, “Process for Scheduling and Allocating Resources for Fiscal Years 2020
Through 2022 for the Review of New Licensing Applications for Light-Water Reactors and
Non-Light-Water Reactors”**

Licensing process questions:

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

Response:

[

]°

Westinghouse will issue a regulatory engagement plan for the **eVinci** Micro Reactor design to provide additional details to the information provided below on the current licensing strategy.

[

]°

[

]°

The demonstration reactor is currently planned to be submitted []°

Commercial Operation

Westinghouse plans to submit a []° and will request that the NRC review said application before finally ruling on and issuing the Westinghouse eVinci Micro Reactor []° This application will build upon the information provided by the testing of the demonstration reactor.

Topical Reports

Westinghouse plans to submit various technical reports to support specific portions of the design prior to and at the time of submittal of the applications. Additional details on the current plans for these submittals will be described in the regulatory engagement plan and discussed during regulatory drop-in meetings.

(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:

[

]°

2. *In which month and year do you expect to submit your applications or other documents?*

Response:

Westinghouse currently intends to submit the demonstration reactor []°

3. (a) *If applicable at this time, is there a designated reference COL applicant?*
(b) *In what order would you like the NRC to review the subsequent applications?*

Response:

[]^e

4. (a) *Where will the facility be located?*
(b) *How many units or modules will the design contain, or a specific facility contain, if known?*

Response:

Westinghouse anticipates that the demonstration reactor is to be built upon a []^e

[

]a,c,e

5. (a) *Will you be part of an organized DCWG or TWG?*
(b) *Who are the other members of the DCWG or TWG?*
(c) *Who will be the primary point of contact for each DCWG or TWG?*

Response:

Westinghouse fully supports a design-centered working group (DCWG) approach described in RIS 2006-06, *New Reactor Standardization Needed to Support the Design-Centered Licensing Review Approach*.

Applicants, who desire to license the Westinghouse eVinci Micro Reactor at their locations, will be added to the DCWG as they are identified.

Westinghouse would be the primary DCWG point of contact.

Technical questions:

1. (a) *What type of reactor design will be used?*
(b) *What type of coolant and fuel will be used?*

Response:

The **eVinci** Micro Reactor is an advanced non-light water reactor (non-LWR) design.

The **eVinci** Micro Reactor design is based on proven heat pipe reactor technology with an experience base from decades of space nuclear reactor technology. Los Alamos National Laboratory (LANL) redesigned its space reactor Kilopower, into a terrestrial application called Megapower. Westinghouse has advanced the Megapower design and [

] ^{a,c}

The current reference design **eVinci** Micro Reactor utilizes uranium-based fuel.

2. (a) *What is the current status of the development of the facility design (i.e., conceptual, preliminary, or final)?*
(b) *Have you established a schedule for completing the design?*

Response:

The basic technological components of the **eVinci** Micro Reactor have been previously demonstrated and have been integrated in representative designs: SAFE-100A, KiloPower and MegaPower. Tests performed complete and partial loss of cooling (secondary heat removal, i.e. Stirling engines were tripped). [^{a,c}

The Westinghouse **eVinci** Micro Reactor design development is currently in the later stages of the [^{a,c} design. Based on the high technology readiness level of the components and the compact, simple design of few moving parts, it is expected that the **eVinci** Micro Reactor design will support construction on the demonstration reactor beginning in [] ^e

Westinghouse currently has a schedule to get the design through the [

] ^{a,c}

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

Response:

Yes, Westinghouse does intend to submit technical and topical reports for the eVinci Micro Reactor in addition to the industry white papers for some policy and technical issues. [

] ^e

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

Response:

Yes, the current plan for the prototype licensing of the demonstration reactor is discussed in the licensing process question #1.

5. (a) *Are vendors or consultants assisting you in preparing the application?*
(b) *If so, please describe their roles and responsibilities for the design and licensing activities.*

Response:

Yes, Westinghouse is leveraging key partners in the execution of this project scope. In addition to the national laboratory support described in response to technical question #6 the following are supporting the development of the eVinci Micro Reactor.

[

] ^{a,c}

6. (a) *Are the U.S. Department of Energy, national laboratories, universities, or other institutions assisting you in developing the design or preparing the application?*
(b) *If so, please describe their roles and responsibilities for the design and licensing activities.*

Response:

Yes. Westinghouse expects to have assistance from multiple laboratories, universities in developing the design which will lead to the preparation of the applications.

Westinghouse will be the vendor and lead design authority of the **eVinci** Micro Reactor.

As stated in Technical Question #1, the **eVinci** Micro Reactor is an advancement of the LANL Megapower design. LANL is the leading expert in heat pipe reactor technology. LANL also has extensive capability in space nuclear system development and tests. LANL will support Westinghouse in several ways including:

[

] ^{a,c}

To assist with siting evaluations and fuel performance tests, Westinghouse has partnered with Idaho National Laboratory (INL) and will build upon the relationship and experience INL has with Westinghouse in advanced reactor design.

University of Pittsburgh is developing and demonstrating high temperature, radiation hardened fiber optic sensors for use in measuring reactor temperature.

The **eVinci** Micro Reactor project has been selected under the DOE FOAK Nuclear Demonstration Readiness Project pathway. Westinghouse is currently in the process of negotiating an agreement.

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

Response:

Westinghouse has developed a preliminary schedule for the **eVinci** Micro Reactor project. The high level project schedule is provided as Figure 1. A significant portion of the qualification of the major systems and components and fuel has been planned in the following demonstrations:

Electrical Demonstration Unit (EDU): The primary purpose of the EDU is to demonstrate the integrated operation of a heat pipe reactor using electrically heated rods to simulate the nuclear fuel. In addition, the EDU also provides the following benefits: [

] ^{a,c}

Demonstration Reactor:

The demonstration reactor is a nuclear experiment of the **eVinci** Micro Reactor, which is a first-of-a-kind, full-scale demonstration.

Figure 1: High Level Project Schedule

] ^{a,c,e}

8. (a) *Have you developed computer codes and models to perform design and licensing analyses?*
(b) *Have you established a schedule for completing the design and licensing analyses?*

Response:

A DOE ARPA-E Modeling-Enhanced Innovations Trailblazing Nuclear Energy Reinvigoration (MEITNER) award (DE-AR0000979) will be utilized to support establishment of the computer codes

and analyses by employing end-to-end modeling and simulation tools developed in the National laboratories and industry to collectively simulate the characteristics of the **eVinci** Micro Reactor Solid Core Block (SCB) to show evidence of inherent self-regulating behavior that can become the foundation to provide evidence for licensing basis.

[
]°

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

Response:

The high level project schedule is provided as Figure 1 as part of the response to Technical Question #7.

10. (a) *Have you developed procedures for the use of thermal fluidic testing facilities and for use of the results of their tests to validate computer models?*
(b) *Have you established a schedule for completing the thermal fluidic testing?*
(c) *Have you established a schedule for the construction of testing facilities?*

Response:

Response to Technical Question #7 provides the planned testing for the **eVinci** Micro Reactor.

11. (a) *Have you identified system and component suppliers (including fuel suppliers), manufacturing processes, and other major factors that could influence design decisions?*
(b) *Have you established a schedule for identifying suppliers and key contractors?*

Response:

[
]°

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

Response:

To comply with regulatory, industry, statutory, and customer quality requirements imposed by customers or regulatory agencies, Westinghouse produces items and services under the Westinghouse

Quality Management System (QMS). The QMS describes Westinghouse commitments to the quality assurance (QA) requirements of:

- ISO 9001
- ISO 90003
- 10CFR50, Appendix B
- ASME NQA-1-1994 Edition
- Other national/international regulatory requirements

The U.S. NRC reviewed and approved the Westinghouse QMS.

13. (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)?*
- (b) *Do you plan to use the PRA for any risk-informed applications (e.g., risk-informed technical specifications, risk-informed inservice inspection, risk-informed categorization and treatment, risk-informed inservice testing)?*
- (c) *Do you plan to use the PRA models in the development 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:

[

] ^{a,c}

Westinghouse plans to document the PRA when [

] ^c

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

Response:

[

] ^{a,c}

15. (a) *Do you have a staffing plan?*
(b) *What is your current staffing level for the execution and testing of the reactor design?*
(c) *Do you plan to increase staffing?*

Response:

The Westinghouse eVinci Micro Reactor development program is staffed to [

]°

16. (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?*
(b) *What is intended to be assembled and constructed on site versus at a remote facility?*
(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:

[

]°c