UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 7, 2023

APPLICANT: SHINE Technologies, LLC

SUBJECT: SUMMARY OF PUBLIC MEETING ON MAY 11, 2023, WITH SHINE TECHNOLOGIES, LLC

On May 11, 2023, the U.S. Nuclear Regulatory Commission (NRC) staff conducted a hybrid (in person and virtual) observation meeting with representatives of SHINE Technologies, LLC (SHINE). The meeting was conducted in accordance with NRC Management Directive 3.5, "Attendance at NRC Staff-Sponsored Meetings" (Agencywide Documents Access and Management System Accession No. ML21180A271). SHINE requested this meeting with the NRC staff to present its plans for revising the seismic design basis for installing components and process equipment in SHINE's Medical Isotope Production Facility (the facility). SHINE plans to implement a risk-informed performance based seismic approach to the installation of components and process equipment. The meeting notice and agenda, dated April 19, 2023, are available at (ML23117A199). The list of meeting attendees and the presentation used in the meeting are provided as enclosures to this summary.

SHINE began the presentation with a discussion of SHINE's current seismic design basis as described in SHINE's final safety analysis report. SHINE then described the challenges for installing structure, systems, and components (SSCs) using the current seismic design approach. These challenges included spatial conflicts with oversized structural supports, depth and spacing with anchor interference, rigorous seismic analysis, and significant impacting cost and schedule. SHINE explained the benefits of using a risk-informed, performance based, seismic design methodology. These benefits include seismic design requirements informed by level of risk, use of SSC limit states not restricted to elastic behavior, use of more standard support designs and spacing, and space constraints to better facilitate SSC installation. For the revised seismic design methodology, SHINE plans to use guidance in the American National Standards Institute/American Nuclear Society (ANSI/ANS)-2.26-2004, "Categorization of Nuclear Facility Structures, Systems, and Components for Seismic Design," reaffirmed on May 27, 2010. SHINE plans to use the categorization methodologies in ANSI/ANS-2.26-2004 to select seismic design categories and limits states for Quality Level 1 and Quality Level 2 SSCs. SHINE also plans to generate site-specific uniform hazard response spectra using the data from the United States Geological Survey National Seismic Hazard Model and use deterministic methods to determine site amplification with existing soil profiles. ANSI/ANS-2.26-2004 references the use of American Society of Civil Engineers (ASCE) standard ANSI/ASCE/SEI 43-19, "Seismic Design Criteria for Structures, Systems and Components in Nuclear Facilities," for the seismic design approach of SSCs. The NRC staff asked SHINE whether ANSI/ASCE/SEI 41-17, "Seismic Evaluation and Retrofit of Existing Buildings," applies in SHINE's situation since the facility building is currently constructed. SHINE stated it would check on the applicability of ANSI/ASCE/SEI 41-17. The NRC staff and SHINE also discussed factoring uncertainty into the seismic analysis.

SHINE anticipates supplementing its final safety analysis report to describe the revised seismic approach in approximately 6 to 8 months. The NRC staff expressed interest in performing a

regulatory audit in accordance with LIC-111, “Regulatory Audits” (ML19226A274), once SHINE starts implementing the revised seismic approach.

There were no comments from members of the public at this meeting.

Please direct any inquiries to Michael Balazik at 301-415-2856 or Michael.Balazik@nrc.gov.

Sincerely,

Signed by Balazik, Michael
on 06/07/23

Michael F. Balazik, Project Manager
Non-Power Production and Utilization Facility
Licensing Branch
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Docket No. 05000608

Enclosures:
1. List of Attendees
2. SHINE’s Presentation

SUBJECT: SUMMARY OF PUBLIC MEETING ON MAY 11, 2023, WITH SHINE TECHNOLOGIES, LLC DATED: JUNE 7, 2023

DISTRIBUTION:
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RidsNrrDanu Resource
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ADAMS Accession Number: ML23156A612 **NRC-001**

OFFICE	NRR/DANU/PM	NRR/DANU/LA	NRR/DANU/BC	NRR/DANU/PM
NAME	MBalazik	NParker	JBorromeo	MBalazik
DATE	6/5/2023	6/6/2023	6/6/2023	6/7/2023

OFFICIAL RECORD COPY

LIST OF ATTENDEES

MAY 11, 2023, MEETING WITH SHINE TECHNOLOGIES, LLC

Name	Organization
Eric Schutt	SHINE Technologies, LLC
Tracy Radel	SHINE Technologies, LLC
Jeff Bartelme	SHINE Technologies, LLC
Kevin O'Connor	SHINE Technologies, LLC
Aric Cowne	SHINE Technologies, LLC
Christopher Hewitt	Simpson Gumpertz & Heger (supporting SHINE)
Benjamin Kosbab	Simpson Gumpertz & Heger (supporting SHINE)
Marc Anderson	Sargent & Lundy (supporting SHINE)
Joshua Borromeo	U.S. Nuclear Regulatory Commission
Holly Cruz	U.S. Nuclear Regulatory Commission
Michael Balazik	U.S. Nuclear Regulatory Commission
Linh Tran	U.S. Nuclear Regulatory Commission
Clifford Munson	U.S. Nuclear Regulatory Commission
Jeremy Wachutka	U.S. Nuclear Regulatory Commission
Scott Stovall	U.S. Nuclear Regulatory Commission
Andrew Prinaris	U.S. Nuclear Regulatory Commission
Sunwoo Park	U.S. Nuclear Regulatory Commission
Ben Chen	Argonne National Laboratory
Mory Diané	Oklo Inc.

Seismic Design Basis of the SHINE Facility

TRACY RADEL, VICE PRESIDENT OF ENGINEERING

Enclosure 2

Agenda

- Current Seismic Design Basis
- Motivation for Change
- Revised Seismic Design Basis Methodology
  - Radiological Hazard
  - Seismic Hazard
  - Design of Structures, Systems, and Components
- Summary

Current Seismic Design Basis

- Uses Sections 3.7.1 and 3.7.2 of NUREG-0800, as described in the FSAR
- Response spectra generated in accordance with Regulatory Guide 1.60, Revision 2, “Design Response Spectra for Seismic Design of Nuclear Power Plants”
- Uses deterministic soil structure interaction to generate in-structure seismic demand
- Results in seismic requirements similar to a commercial power reactor or Seismic Design Category (SDC) 5 facility
- QL-1 and QL-2 structures, systems, and components (SSCs) are designed to this design basis earthquake (DBE)
- QL-1 SSCs are required to maintain elastic behavior
- Does not account for lower risk at SHINE facility

Motivation for Change

- Currently faced with significant challenges in installation of SSCs
  - Spatial conflicts with oversized structural supports
  - Depth, spacing, and tolerance for anchors
  - QL-1 and QL-2 SSCs require rigorous seismic analysis with significant impact on cost and schedule
- What will be gained in the new approach:
  - Seismic design requirements informed by level of risk
  - SSC Limit States not restricted to elastic behavior (i.e., Limit State D)
  - Use of more standard support designs and spacing
  - Manage space constraints to better facilitate SSC installation

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Revised Seismic Design Basis Methodology

OVERVIEW

- Objective:
  - Recharacterize seismic hazards commensurate with level of radiological risk associated with the SHINE facility
- Approach:
  - Use categorization methodology in American National Standards Institute/American Nuclear Society (ANSI/ANS)-2.26-2004, "Categorization of Nuclear Facility Structures, Systems, and Components for Seismic Design," to select SDC and Limit States for QL-1 and QL-2 SSCs
  - Generate site-specific seismic spectra for SDC-3
  - Assign SSC design requirements in a graded fashion based on SDC

Revised Seismic Design Basis Methodology

CATEGORIZATION METHODOLOGY

- Unmitigated dose analysis performed in accordance with Section 6.2 of ANSI/ANS-2.26-2004
  - SSCs and all other relevant engineered mitigating features are assumed not to function unless the robustness of each mitigating feature can be demonstrated to survive the postulated event
  - Uses mean values for the parameters related to material releases, dispersal in the environment, and health consequences
  - The computed dose consequences are the total effective dose equivalent (TEDE), and the dose to the public is based on the maximally exposed off-site individual, located at the exclusion area boundary
- Robustness is assessed in accordance with Sections 6.2.9 and 6.3.2.5 of ANSI/ANS-2.26-2004
- SDCs are assigned in accordance with Table 1 and with guidance from Table A.3 of ANSI/ANS-2.26-2004
- Limit States are assigned in accordance with Section 5 and with guidance from Appendix B of ANSI/ANS-2.26-2004

Revised Seismic Design Basis Methodology

PRELIMINARY CATEGORIZATION RESULTS

	Public Dose (rem)	Worker Dose (rem)
Unmitigated release of 8 batches of target solution (nominal source term as defined in Table 11.1-1 of the FSAR)	1.1E+01	4.9E+01
with facility structure assumed intact	1.3E-01	4.9E+01
with irradiation unit confinements assumed intact	1.7E-02	2.3E-01
Unmitigated release of full facility tritium inventory	1.4E-01	7.9E+00

- Based on preliminary dose results and guidance in Table A.3 of ANSI/ANS-2.26-2004, the facility structure and concrete confinements are categorized as SDC-3
- Tritium and supercell confinements are categorized as SDC-2
- Facility structure and concrete confinements have been designed and constructed to SDC-5 comparable seismic requirements, meeting robustness criteria

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Revised Seismic Design Basis Methodology

AT-BEDROCK SPECTRA

- Use at-bedrock uniform hazard response spectra (UHRS) data from United States Geological Survey (USGS) National Seismic Hazard Model (NSHM)
  - The SHINE facility is located in one of the lowest-seismic hazard regions in the country
  - Based on the low seismic hazards present and the limited radiological consequences of failure, the SHINE facility presents a very low level of risk
  - USGS data is appropriate to use for generating design response spectra (DRS) for design of SDC-3 and lower SSCs
- Benchmark UHRS against other compatible seismic hazard studies in the area to confirm that the USGS UHRS are reasonable

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Revised Seismic Design Basis Methodology

SITE RESPONSE AND NEAR-SURFACE SPECTRA

- Use a deterministic site response analysis methodology and existing soil profile for the SHINE facility to generate near-surface UHRS from at-bedrock UHRS
  - Use existing site-specific geotechnical information to generate site amplification from bedrock to near- surface spectra
  - Subsurface profiles, properties, and variability are anticipated to be consistent with those used for the existing soil-structure interaction (SSI) analysis of the facility
- Use near-surface UHRS to define SDC-3 DRS in accordance with Section 2 of American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) 43-05, “Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities”

Revised Seismic Design Basis Methodology

DESIGN OF STRUCTURES, SYSTEMS, AND COMPONENTS

- Design each SSC based on its SDC and Limit State, determined using categorization methodology in ANSI/ANS-2.26-2004
- Select the appropriate seismic design requirements
  - SDC-3
    - Design to current licensing basis seismic acceptance criteria with SDC-3 seismic demand, or
    - Design to applicable section of ASCE/SEI 43-05 with SDC-3 seismic demand
  - SDC-2
    - Potential interaction with SDC-3 SSCs
      - Design to International Building Code (IBC) acceptance criteria with SDC-3 seismic demand
    - No potential interaction with SDC-3 SSCs
      - Design to IBC acceptance criteria with ASCE 7 seismic demand

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Summary

- SHINE faces challenges related to installation of SSCs due to current seismic design basis
- SHINE is revising the seismic design basis to align with the level of risk for the facility
  - Using categorization methodologies in ANSI/ANS-2.26-2004 to select SDC and Limit States for QL-1 and QL-2 SSCs
  - Generating site-specific UHRS from USGS NSHM
  - Using deterministic methods to determine site amplification with existing soil profiles
  - Designing SSCs in accordance with updated seismic design requirements

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