



April 16, 2021

2021-SMT-0047  
10 CFR 50.30

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

- References:
- (1) SHINE Medical Technologies, LLC letter to the NRC, "SHINE Medical Technologies, LLC Application for an Operating License," dated July 17, 2019 (ML19211C143)
  - (2) NRC letter to SHINE Medical Technologies, LLC, "Issuance of Request for Additional Information Related to the SHINE Medical Technologies, LLC Operating License Application (EPID No. L-2019-NEW-0004)," dated October 16, 2020
  - (3) SHINE Medical Technologies, LLC letter to the NRC, "SHINE Medical Technologies, LLC Operating License Application Supplement No. 6 and Response to Request for Additional Information," dated December 15, 2020

SHINE Medical Technologies, LLC Application for an Operating License  
Revision 1 of SHINE Response to Request for Additional Information 3.4-6

Pursuant to 10 CFR Part 50.30, SHINE Medical Technologies, LLC (SHINE) submitted an application for an operating license for a medical isotope production facility to be located in Janesville, WI (Reference 1). The NRC staff determined that additional information was required to enable the staff's continued review the SHINE operating license application (Reference 2). SHINE provided the response to the NRC staff's request for additional information (RAI) via Reference (3).

SHINE has determined that the SHINE Response to RAI 3.4-6, provided via Reference (3), required revision to address the NRC staff's request in full.

Enclosure 1 provides Revision 1 of the SHINE Response to RAI 3.4-6. Revision 1 supersedes the previously provided SHINE Response to RAI 3.4-6, provided via Reference (3), in its entirety.

If you have any questions, please contact Mr. Jeff Bartelme, Director of Licensing, at 608/210-1735.

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I declare under the penalty of perjury that the foregoing is true and correct.  
Executed on April 16, 2021.

Very truly yours,

DocuSigned by:  
  
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James Costedio  
Vice President of Regulatory Affairs and Quality  
SHINE Medical Technologies, LLC  
Docket No. 50-608

Enclosure

cc: Project Manager, USNRC  
SHINE General Counsel  
Supervisor, Radioactive Materials Program, Wisconsin Division of Public Health

## ENCLOSURE 1

### SHINE MEDICAL TECHNOLOGIES, LLC

#### SHINE MEDICAL TECHNOLOGIES, LLC APPLICATION FOR AN OPERATING LICENSE REVISION 1 OF SHINE RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION 3.4-6

The NRC staff determined that additional information was required to enable the staff's continued review of the SHINE Medical Technologies, LLC (SHINE) operating license application (Reference 1). SHINE provided the response to the NRC staff's request for additional information (RAI) via Reference (2). SHINE has determined that the SHINE Response to RAI 3.4-6, provided via Reference (2), required revision to address the NRC staff's request in full. Revision 1 of the SHINE Response to RAI 3.4-6 is provided below.

#### **Chapter 3 – Design of Structures, Systems, and Components**

##### **RAI 3.4-6**

Section 3.4.2.6.3.1, "Soil Parameters," of the SHINE operating license application does not include all necessary parameters and does not provide sufficient information regarding the stability of the foundations and subsurface materials for the SHINE facility for NRC staff to confirm the acceptability of the site. The section provided some soil parameters that were used in a soil-structure interaction (SSI) analysis, such as the minimum average shear wave velocity, minimum unit weight, and Poisson's ratio. It also provided other parameters, such as net allowable static bearing pressure at 3 feet below grade and net allowable static bearing pressure at 17 feet below grade. However, the soil parameters necessary for the use of an SSI analysis and foundation stability assessment do not include information on how these net allowable static bearing pressures were determined. In addition, there are no details on the safety-related foundation settlements (total and differential settlements) evaluation.

In order for the NRC staff to determine whether SHINE has adequately evaluated the stability of the foundations and subsurface materials for SHINE facility, update the application to provide information on allowable soil bearing capacities at designated elevations and allowable settlements (i.e., total and differential settlements) for the specific designed structures, and a comparison of maximum structural foundation responses with soil/foundation capacities (e.g. maximum foundation pressure vs. allowable soil bearing capacity, maximum foundation settlements vs allowable settlements).

##### **SHINE Response**

The evaluation of the main production facility structure (FSTR) foundation and subgrade materials beneath the foundation utilizes a single allowable soil bearing pressure based on the average depth of foundation for the FSTR considering two cases - shallow foundations at 3 ft. below grade and deep foundations at 17 ft. below grade. The allowable soil bearing pressure for the building foundation is at least 6000 pounds per square foot (psf) with a factor of safety of 3. The method used to determine the allowable soil bearing capacity is consistent with Chapter 5 of Federal Highway Administration Report No. FHWA-SA-02-054, "Geotechnical Engineering Circular No. 6 - Shallow Foundations" (Reference 3). This allowable soil bearing pressure is

higher than the maximum foundation bearing pressures. The maximum foundation bearing pressure beneath the main mat at 3 ft. below grade is 2460 psf. The maximum foundation bearing pressure beneath the mats at 15 ft. and 19 ft. below grade (i.e., the mats supporting the irradiation unit [IU] cell, radioisotope production facility [RPF] pipe trench, RPF valve pit, and RPF tank areas) is 5970 psf. The maximum foundation bearing pressure beneath the mat at 25.5 ft. below grade (i.e., the mat supporting the carbon delay bed vault) is 5130 psf. Subsection 3.4.2.6.3.1 of the FSAR has been revised to include the maximum foundation bearing pressures and the allowable soil bearing pressure. A mark-up of the FSAR incorporating these changes is provided as Attachment 1.

Differential settlement of the FSTR is implicitly evaluated within the structural finite analysis model. The structural model is developed with soil springs supporting the foundation. The stiffness of the soil springs, which represents the stiffness of the soil, is developed based on soil subgrade moduli of the soil beneath the two foundation types (i.e., 3 ft. below grade and 17 ft. below grade). Deflections of the FSTR foundation (settlements), which are determined in the structural analysis model, produce moments and shears in the foundation based on and accounting for the soil stiffness. As such, design of the FSTR based on the structural analysis confirms acceptability of the settlements (differential and total). The maximum settlements for normal loading determined by the structural analysis (approximately 0.9 in. and 0.65 in. at 3 ft. below grade and 17 ft. below grade, respectively) are similar to those estimated to determine the subgrade modulus (approximately 0.9 in. and 0.35 in. at 3 ft. below grade and 17 ft. below grade, respectively) and therefore confirm the subgrade moduli that were used in the FSTR analysis are acceptable. There are no established allowable limits for differential and total settlements for the FSTR, but the predicted settlements based on the geotechnical and structural evaluations are reasonable and accounted for in the design of the FSTR.

## References

- (1) NRC letter to SHINE Medical Technologies, LLC, "Issuance of Request for Additional Information Related to the SHINE Medical Technologies, LLC Operating License Application (EPID No. L-2019-NEW-0004)," dated October 16, 2020
- (2) SHINE Medical Technologies, LLC letter to the NRC, "SHINE Medical Technologies, LLC Operating License Application Supplement No. 6 and Response to Request for Additional Information," dated December 15, 2020
- (3) Federal Highway Administration, "Geotechnical Engineering Circular No. 6 - Shallow Foundations", Report No. FHWA-SA-02-054, September 2002

**ENCLOSURE 1  
ATTACHMENT 1**

**SHINE MEDICAL TECHNOLOGIES, LLC**

**SHINE MEDICAL TECHNOLOGIES, LLC APPLICATION FOR AN OPERATING LICENSE  
REVISION 1 OF SHINE RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION 3.4-6**

**FINAL SAFETY ANALYSIS REPORT CHANGES  
(MARK-UP)**

- ANSI/AISC N690-12, Specification for Safety-Related Steel Structures for Nuclear Facilities (ANSI/AISC, 2012)

#### 3.4.2.6.3 Site Design Parameters

The following subsections provide the site-specific parameters for the design of the facility.

##### 3.4.2.6.3.1 Soil Parameters

The soil parameters for the facility are provided below.

- ~~Net allowable static~~ Maximum bearing pressure beneath major foundation elevations:
  - Main mat at 3 ft. below grade: ~~238460~~ 460 pounds per square foot (psf) (1148 kilopascal [kPa]).
  - ~~Net allowable static bearing pressure~~ Mats supporting RPF pipe trench, adjacent valve pits, and tank areas at ~~175~~ 17.5 ft. and 19 ft. below grade: ~~4235970~~ 5970 psf (528-96 kPa).
  - Mats beneath carbon delay bed vault at 25.5 ft. below grade: 5130 psf (246 kPa).
- Allowable soil bearing pressure: 6000 psf (287 kPa).
- Minimum average shear wave velocity: 459 ft./sec (140 m/s).
- Minimum unit weight: 117 pounds per cubic foot (lb/ft<sup>3</sup>) (1874 kilograms per cubic meters [kg/m<sup>3</sup>]).

The allowable soil bearing pressure is greater than the maximum soil bearing pressures at the supporting mats at the major foundation elevations.

##### 3.4.2.6.3.2 Maximum Ground Water Level

- 50 ft. (15.2 m) below grade level.

##### 3.4.2.6.3.3 Maximum Flood Level

- **Section 2.4** describes the design basis rainfall event.
- **Section 2.4** describes the probable maximum flood (PMF).

##### 3.4.2.6.3.4 Snow Load

- Snow load: 30 psf (1.44 kPa) (50-year recurrence interval).
- A factor of 1.22 is used to account for the 100-year recurrence interval required.

##### 3.4.2.6.3.5 Design Temperatures

- The winter dry-bulb temperature (-7°F [-22°C]).
- The summer dry bulb temperature (88°F [31°C]).

##### 3.4.2.6.3.6 Seismology

- SSE peak ground acceleration (PGA): 0.20 g (for both horizontal and vertical directions).
- SSE response spectra: per Regulatory Guide 1.60 (USNRC, 2014a).
- SSE time history: envelope SSE response spectra in accordance with SRP Section 3.7.1 (USNRC, 2014b).