UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

July 11, 2022

MEMORANDUM TO: Ronald G. Ballinger, Lead
SHINE License Application Review Subcommittee
Advisory Committee on Reactor Safeguards

FROM: Matthew W. Sunseri, Member
Advisory Committee on Reactor Safeguards

Matthew W. Sunseri Digitally signed by Matthew W. Sunseri Date: 2022.07.11 07:43:01 -04'00'

SUBJECT: INPUT FOR ACRS REVIEW OF SHINE OPERATING LICENSE – SAFETY EVALUATION FOR CHAPTER 9, "AUXILIARY SYSTEMS"

In response to the Subcommittee's request, I have reviewed the Nuclear Regulatory Commission (NRC) staff's safety evaluation report (SER) with no open items, and the associated section of the applicant's final safety analysis report, for Chapter 9, "Auxiliary Systems." In addition, representatives from SHINE Medical Technologies, LLC (SHINE) met with the SHINE subcommittee on May 6, 2022, to discuss these auxiliary systems. The following is my recommended course of action concerning further review of this chapter and the staff's associated safety evaluation.

Background

Chapter 9 of the SER documents the staff's review of the final design of the SHINE auxiliary systems as presented in Chapter 9, Safety Analysis Report and supplemented by the applicant's responses to staff requests for additional information. The auxiliary systems are designed for the operation of the SHINE irradiation facility and radioisotope production facility. The auxiliary systems of interest include heating, ventilation and air conditioning; handling and storage of target solution; fire protection; communication; cover gas control in the closed primary system; tritium purification; neutron driver assembly system service cell; vacuum transfer; radioactive liquid waste storage and immobilization; solid waste packing and shipment; and nitrogen purge.

SER Summary

The SER documents the staff's evaluation of the applicant's design for compliance with applicable regulations and standards. The NRC staff evaluated the descriptions and discussions of SHINE's auxiliary systems. Based on the above determinations, the NRC staff found that the descriptions and discussions of the auxiliary systems are sufficient and meet the applicable regulatory requirements and guidance, and acceptance criteria, for the issuance of an operating license.

Concerns

I did not identify any specific deficiencies in my review. I observed that over all the application was well documented, and the staff's evaluation was thorough. One enhancement for SHINE to consider involves the technical specification associated with the nitrogen purge system.

Nitrogen purge provides a backup supply of sweep gas to each irradiation unit and to all tanks normally ventilated by the process vessel vent system during a loss of normal power or loss of normal sweep gas flow. The off gas resulting from the nitrogen purge is treated by passive process vessel vent system filtration equipment prior to being discharged to the stack. The nitrogen supply pressure is regulated to overcome the pressure drop through pipe fittings, process vessel vent system filtration components, and the facility stack. Nitrogen purge is safety-related and Seismic Category I. Proposed technical specification 3.8.1 requires that 11 of 12 nitrogen storage tubes filled with nitrogen at a minimum pressure of 2,100 psig per tube and that the system is capable of 16 scfm of sweep gas flow both be available when the facility is not secured. If this condition is not met, then place all irradiation units undergoing irradiation in Mode 3 within 12 hours and restore the nitrogen purge system to operable within 72 hours. Considering the relatively large number of components involved to maintain operability, there may be a reliability challenge to maintain this level of availability for a backup safety system with the risk being a shutdown of the entire facility if the technical specification limiting condition for operation is not met. While shutting down is a conservative measure, should reliability of the system not meet expectations, repetitive shutdowns could lead to the introduction of a human performance issue affecting safety. I recommend that SHINE consider gaining more margin in this technical specification to avoid unnecessary facility shutdowns.

There are no areas of performance with the auxiliary systems that are worthy of further review. Should a related cross-cut focus area review identify any involvement with an auxiliary system we will address that interface in the cross-cut area review.

Recommendation

As lead reviewer for SHINE Chapter 9, I recommend that no further review of auxiliary systems is necessary.

References

1. U. S. Nuclear Regulatory Commission, "Auxiliary Systems," Chapter 9, Staff Safety Evaluation Report, April 28, 2022 (ML22118A764).

2. SHINE Technologies, LLC, Application for Operating License Supplement 14m Revision to Final Safety Analysis Report, Chapter 9, Auxiliary Systems, June 26, 2022 (ML22034A623).

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Package No: ML22164A908
Memo Accession No: ML22164A915 **Publicly Available Y** **Sensitive N**
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