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14.0 TECHNICAL SPECIFICATIONS

The principal purpose of the Technical Specifications (TS) is to maintain system performance and safe operation. This is accomplished by addressing limiting or enveloping conditions of design and operation ensuring that emphasis is placed on the safety of the public, the facility staff, and the environment. The TS are typically derived from the facility descriptions and safety considerations contained in the safety analysis report (SAR).

This chapter evaluates the probable subjects of TS (PSTS) for the SHINE irradiation facility (IF) and radioisotope production facility (RPF) as presented in Chapter 14, "Technical Specifications," of the PSAR, as supplemented by the applicant's responses to requests for additional information (RAIs).

14.1 Areas of Review

SHINE PSAR Chapter 14, "Technical Specifications," provides an evaluation of the PSTS identified in the preliminary design of the SHINE facility. SHINE PSAR Section 14a2 covers the PSTS for the IF and Section 14b covers PSTS for process outside the RPF.

The staff reviewed SHINE PSAR Chapter 14 against applicable regulatory requirements using regulatory guidance and standards to assess the sufficiency of the preliminary design for the SHINE facility. The staff reviewed SHINE's identification and justification for the selection of those variables, conditions, or other items which are determined to be probable subjects of technical specifications for the facility, with special attention given to those items which may significantly influence the final design.

Specific areas of review for this chapter included those PSTS identified in the SHINE IF and RPF. Within these review areas, the staff assessed whether the applicant identified PSTS, including relevant safety limits, limiting control settings, limiting conditions for operation, surveillance requirements, design features that affect function, availability, or reliability of structures, systems, or components (SSCs) identified as PSTS, as well as management or administrative measures would ensure the availability of SSCs identified as PSTS.

14.2 Summary of Application

As stated above and described in SHINE PSAR Section 14, the purpose of the TS is to maintain system performance and safe operation emphasizing the safety of the public, the facility staff, and the environment. The summary provided below applies to both the IF and RPF (together, the SHINE facility).

PSAR Sections 14a2 and 14b identify the variables and conditions that are PSTS for the SHINE facility. These may change with the operating license application. These variables and conditions are based on the preliminary design of the SHINE facility. SHINE will submit formal TS with the operating license application as required by 10 CFR 50.36.

These proposed variables have been identified on the premise that this material presents a sound framework upon which a final, complete set of TS can be provided with the operating license application. As stated in SHINE PSAR Section 14a2.1, "Introduction," the format and content of the TS will be written with the guidance provided in ANSI/ANS 15.1, "The

Development of Technical Specifications for Research Reactors” (ANSI/ANS 2007) (Reference 55). The TS will comply with the regulations in 10 CFR 50.36, “Technical Specifications.” Technical Specifications for SSCs located outside of the SHINE irradiation facility will follow the relevant portions of 10 CFR 50.36 pertaining to fuel reprocessing facilities, as described in the ISG Augmenting NUREG-1537, Part 1, Section 14b, “Radioisotope Production Facility Technical Specifications” (Reference 4).

14.3 Regulatory Basis and Acceptance Criteria

As previously stated, the TS provide an envelope to maintain system performance and safe operation, and are typically derived from the facility descriptions and safety considerations contained in the SAR. Therefore, the regulatory basis and acceptance criteria provided below apply to both the SHINE IF and radioisotope production facility (RPF).

The staff reviewed Chapter 14 of SHINE’s PSAR against applicable regulatory requirements, using regulatory guidance and standards, to assess the sufficiency of the preliminary design and performance of SHINE’s irradiation unit (IU) cooling systems in support of the issuance of a construction permit. In accordance with paragraph (a) of 10 CFR 50.35, “Issuance of Construction Permits,” a construction permit authorizing SHINE to proceed with construction may be issued once the following findings have been made:

- (1) SHINE has described the proposed design of the facility, including, but not limited to, the principal architectural and engineering criteria for the design, and has identified the major features or components incorporated therein for the protection of the health and safety of the public;
- (2) Such further technical or design information as may be required to complete the safety analysis, and which can reasonably be left for later consideration, will be supplied in the final safety analysis report;
- (3) Safety features or components, if any, which require research and development have been described by SHINE and SHINE has identified, and there will be conducted, a research and development program reasonably designed to resolve any safety questions associated with such features or components; and that
- (4) On the basis of the foregoing, there is reasonable assurance that, (i) such safety questions will be satisfactorily resolved at or before the latest date stated in the application for completion of construction of the proposed facility, and (ii) taking into consideration the site criteria contained in part 100, the proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public.

The staff’s evaluation of the preliminary design criteria for the SHINE facility’s PSTS does not constitute approval of the safety of any design feature or specification. Such approval will be made following the evaluation of the final design of the SHINE facility TS, as described in the FSAR as part of SHINE’s operating license application.

14.3.1 Applicable Regulatory Requirements

The applicable regulatory requirements for the evaluation of SHINE’s PSTS are as follows:

- 10 CFR 50.34, “Contents of applications; technical information,” paragraph (a), “Preliminary safety analysis report.”

14.3.2 Regulatory Guidance and Acceptance Criteria

The NRC staff evaluated SHINE’s PSTS against the applicable regulatory requirements listed above, primarily using the guidance and acceptance criteria contained in Chapter 14, “Technical Specifications,” of NUREG-1537, Part 1, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Format and Content,” issued February 1996 (Reference 4), and NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Standard Review Plan and Acceptance Criteria,” issued February 1996 (Reference 5), as well as the “Final Interim Staff Guidance [ISG] Augmenting NUREG-1537, Part 1, ‘Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content,’ for Licensing Radioisotope Production Facilities and Aqueous Homogeneous Reactors,” dated October 17, 2012 (Reference 6), and “Final Interim Staff Guidance Augmenting NUREG-1537, Part 2, ‘Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Standard Review Plan and Acceptance Criteria,’ for Licensing Radioisotope Production Facilities and Aqueous Homogeneous Reactors,” dated October 17, 2012 (Reference 7).

As appropriate, additional guidance (e.g., NRC regulatory guides, Institute of Electrical and Electronics Engineers [IEEE] standards, American National Standards Institute/American Nuclear Society [ANSI/ANS] standards) has been utilized in the review of SHINE’s SSC design criteria. The use of additional guidance is based on the technical judgement of the reviewer, as well as references in NUREG-1537, Parts 1 and 2; the ISG Augmenting NUREG-1537, Parts 1 and 2; and the SHINE PSAR.

Specific acceptance criteria are provided in the section-by-section technical evaluation in Section 14.4, “Review Procedures, Technical Evaluation, and Evaluation Findings,” of this SER. Additional guidance documents used to evaluate SHINE’s PSTS are provided as references in Appendix B.

14.4 Review Procedures, Technical Evaluation, and Evaluation Findings

As described in SHINE PSAR Section 14, this section evaluates the SHINE PSTS based on the preliminary design of the SHINE facility. The TS will be submitted with the operating license application as required by 10 CFR 50.36. These PSTS have been formulated on the premise that this material presents a sound framework upon which a final, complete set of specifications can be developed with the operating license application. The technical evaluation applies to both the SHINE IF and RPF.

The staff performed an evaluation of the PSTS presented in SHINE PSAR Section 14, as supplemented by the applicant’s responses to RAIs, to assess the sufficiency of the preliminary design and performance of the SHINE facility in support of the issuance of a construction permit, in accordance with 10 CFR 50.35(a). The sufficiency of the SHINE facility’s PSTS is demonstrated by compliance with applicable regulatory requirements, guidance, and acceptance criteria, as discussed in Section 14.3, “Regulatory Basis and Acceptance Criteria,” of this SER. The results of this technical evaluation are described in SER Section 14.5, “Summary and Conclusions.”

For the purposes of issuing a CP, the identification of the SHINE facility PSTS may be adequately described at a functional or conceptual level. The staff evaluated the sufficiency of the preliminary design of the SHINE facility based on the applicant's design methodology and ability to provide reasonable assurance that the final design will conform to the design bases with adequate margin for safety. As such, the staff's evaluation of the preliminary design of the SHINE facility does not constitute approval of the safety of any design feature or specification. Such approval will be made following the evaluation of the final design of the SHINE facility, as described in the FSAR, as part of SHINE's operating license application.

In accordance with 10 CFR 50.34(a)(5), the staff evaluated the sufficiency of the applicant's identification and justification for the selection of those variables, conditions, or other items which are determined to be probable subjects of technical specifications for the SHINE cooling systems, with special attention given to those items which may significantly influence the final design.

Consistent with the review procedures of NUREG 1537, Part 2, Chapter 14, "Technical Specifications," and the ISG Augmenting NUREG-1537, Part 2, Section 14b, the staff confirmed that the PSTS and basis were determined from the analysis in the PSAR and confirmed that each PSPS is supported by appropriate references to PSAR analysis and statements.

SHINE PSAR Table 4a2-1, "SHINE Facility Proposed Parameters for Technical Specifications," groups anticipated safety limits and limiting safety system settings by chapter, including the bases for the identification and selection of each parameter. Further explanation and analysis of selected parameters is provided in relevant chapters of the SHINE PSAR. The staff's evaluations of SHINE's PSTS are provided in the corresponding chapters of this SER.

The SHINE facility has been designed such that normal operation within the limits of technical specifications will not result in off-site radiation exposure in excess of the limits provided in 10 CFR Part 20.

In the IF, safety limits (SLs) will be placed on important process variables, as necessary to reasonably preserve the integrity of the primary system boundary (PSB) and prevent the uncontrolled release of radioactivity. SLs may also be established for the character and quality of the target solution. For irradiated and unirradiated special nuclear material outside of the TSV, SLs are derived for criticality accident prevention. Limits are specified, using the double-contingency principle, to avoid a criticality accident with conservative margins of subcriticality. Safety limits will also be developed for radiochemical and chemical processing, according to the regulations in 10 CFR 50.36.

Limiting conditions for operation (LCOs) in both the IF and RPF are derived from the safety analyses and are implemented through administrative or engineered controls to ensure safe operation of the facility.

Surveillance requirements for both the IF and RPF will be provided in TS submitted in support of the SHINE operating license application.

While, administrative controls will be provided in the SHINE operating license application, Section 14a2.6, "Administrative Controls," of SHINE's PSAR identifies proposed subjects of administrative controls, including criticality safety, as low as reasonably achievable

considerations, waste container procurement and transport, fire protection, solvent control, tritium control, light water coolant activity monitoring, and chemical control.

Based on the information provided in SHINE PSAR Chapter 14, as well as other chapters of the SHINE PSAR, the staff finds that identification and justification of the proposed technical specifications is sufficient and meets the applicable regulatory requirements to support the issuance of a construction permit in accordance with 10 CFR 50.35. A complete evaluation of technical specifications, including SLs, LSSS's, LCOs, surveillance requirements, and administrative controls will be performed during the review of SHINE's operating license application.

14.5 Summary and Conclusions

As described in SHINE PSAR Section 14, this section identifies the SHINE PSTS based on the preliminary design of the SHINE facility. These PSTS have been formulated on the premise that this material presents a sound framework upon which a final, complete set of specifications can be developed with the operating license application. The summary and conclusions provided below apply to both the SHINE IF and RPF.

The staff evaluated the descriptions and discussions of the SHINE facility's PSTS, as described in Chapter 14 and other relevant chapters of the SHINE PSAR, and finds that the PSTS of the SHINE's SSCs meet all applicable regulatory requirements and acceptance criteria in NUREG-1537 and the ISG augmenting NUREG-1537. Based on these findings, the staff has made the following conclusions to support the issuance of a construction permit in accordance with 10 CFR 50.35:

- (1) Further technical or design information required to complete the safety analysis of the SHINE TS may reasonably be left for later consideration the FSAR.
- (2) On the basis of the foregoing, taking into consideration the site criteria contained in part 100, there is reasonable assurance that the proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public.