

DRAFT REQUEST FOR ADDITIONAL INFORMATION
SHINE MEDICAL TECHNOLOGIES, INC.
REGARDING THE PRELIMINARY SAFETY ANALYSIS REPORT SUPPORTING A
CONSTRUCTION PERMIT APPLICATION
DOCKET NO. 50-608
TAC NOS. MF2305 AND MF2307

CHAPTER 6 – ENGINEERED SAFETY FEATURES

The following request for information is based on a review of Chapter 6 of the SHINE PSAR (ADAMS Accession No. ML15175A213) using NUREG-1537, Parts 1 and 2 in conjunction with the Final ISG Augmenting NUREG-1537, Parts 1 and 2, as supplemented by SHINE's responses to requests for additional information (RAIs).

Section 6b.3 – Nuclear Criticality Control

RAI 6b.3-34 As required by 10 CFR 50.34(a), "Contents of applications; technical information," a preliminary safety analysis report should include "[a] preliminary analysis and evaluation of the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility..., and the adequacy of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents." Additionally, the preliminary design of the facility should provide reasonable assurance to the NRC staff that the final design will conform to its design bases with adequate margin for safety.

With respect to nuclear criticality control, the Interim Staff Guidance (ISG) Augmenting NUREG-1537, Part 2, Section 6b.3, "Nuclear Criticality Safety for the Processing Facility," states, in part that "[c]riticality process safety controls should be provided for criticality safety, and a description of their safety function should be described. The applicant should use enough safety controls to demonstrate that, under normal and abnormal credible conditions, all nuclear processes remain subcritical" and that "NCS [nuclear criticality safety] limits on controlled parameters will be established to ensure that all nuclear processes are subcritical, including an adequate margin of subcriticality for safety."

The ISG Augmenting NUREG-1537, Part 2, Section 6b.3, states, in part, that the reviewer should determine "whether the margin of subcriticality for safety is sufficient to provide reasonable assurance of subcriticality."

In response to RAI 6b.3-4, SHINE states it intends to utilize a subcritical margin of 0.05 with additional considerations for uncertainty in the validation and modeling. In addition, SHINE states in multiple places in the PSAR that processes will be maintained to a $k_{eff} \leq 0.95$ (assuming a subcritical margin of 0.05).

The NRC staff's review of SHINE's responses to RAIs 6b.3-1 and 6b.3-26 found that there was insufficient benchmarking of the code against experiments utilizing the materials and enrichments expected in SHINE's processes. For this reason,

the proposed subcritical margin of 0.05 is not sufficient to adequately address the uncertainty associated with the neutron interactions of these process materials. The subcritical margin of 0.05, which SHINE quoted from NUREG-1520, was intended for facilities with enrichment less than five percent utilizing well established processes and for which there is significant experience and data. In contrast, the SHINE facility will be a first-of-a-kind facility using materials not normally utilized and of an enrichment up to 20 percent.

Provide additional information describing how SHINE has or will sufficiently benchmark against experiments utilizing the materials and enrichments expected to be used in SHINE facility processes for its proposed margin of subcriticality, or propose a new margin of subcriticality that appropriately takes into account materials and enrichment.