ENCLOSURE 2

SHINE TECHNOLOGIES, LLC

**SHINE TECHNOLOGIES, LLC APPLICATION FOR AN OPERATING LICENSE
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
PUBLIC VERSION**

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The U.S. Nuclear Regulatory Commission (NRC) staff determined that additional information was required (Reference 1) to enable the continued review of the SHINE Technologies, LLC (SHINE) operating license application (Reference 2). The following information is provided by SHINE in response to the NRC staff's request.

Chapter 9 – Auxiliary Systems

RAI 9-6

Section 9.3 of NUREG-1537, Part 1, states that discussions of the fire protection systems and program should include descriptions of "any possible effects of a fire on the safe shutdown of the [facility]." As part of its review, as described in Section 9.3 of NUREG-1537, Part 2, the NRC staff is to evaluate the "designs of [facility] systems that can ensure safe [facility] shutdown in the event of fire."

While the SHINE FSAR Section 9a2.3.4, "Safe Shutdown Analysis," states that a safe shutdown analysis is to be performed as part of the SHINE fire protection program and included in implementing procedures and reports, insufficient detail is included for the NRC staff to ensure that the design of systems and implementation of such procedures is sufficient to provide for the safe shutdown of the SHINE facility in the event of fire. Therefore, additional information is needed for the NRC staff to confirm that SHINE has adequately performed a safe shutdown analysis, such that the design of its facility and implementing procedures can ensure safe facility shutdown in the event of fire. Provide descriptions of the following, as applicable, including key objectives and elements of design and implementation for the fire protection program related to the SHINE safe shutdown analysis:

a. Summarize the safe shutdown performance goals and the safe shutdown analysis methodology.

b. Identify the functions required for safe shutdown. Such functions may include inventory control, process monitoring, and reactivity control. Include any auxiliary equipment or cables required to support a safe shutdown function (e.g., room cooling).

c. Identify any required safe shutdown function that has only a single train and justify how such a configuration can ensure safe shutdown in the event of a fire.

d. Describe the separation criteria for redundant trains of a safe shutdown function located in the same fire area.

e. Describe and justify any deviations from the separation criteria described in item (d).

f. Identify the fire area(s) that contain equipment or cables from all trains of a required safe shutdown function. If such area(s) exist, describe how safe shutdown is ensured for a fire occurring in that fire area(s).

g. Identify any fire areas where fire damage could prevent safe shutdown. If such areas exist, justify how safe shutdown is ensured for a fire occurring in those fire areas.

h. Identify the entry conditions for the facility fire safe shutdown procedure.

i. Identify the guidance used to perform any safe shutdown-related circuit analysis.

This information is necessary for the NRC staff to ensure that SHINE is satisfying the elements of 10 CFR 50.48(a) to which it has committed and to make the necessary evaluation findings described in NUREG-1537, Part 2, Section 9.3. Specifically, the requested information will support the NRC staff in concluding the following:

- The plans for preventing fires ensure that the facility meets local and national fire and building codes;

- The systems designed to detect and combat fires at the facility can function as described and limit damage and consequences at any time;

- The potential for radiological consequences of a fire will not prevent safe shutdown, and any fire-related release of radioactive material from the facility to the unrestricted environment has been adequately addressed in the appropriate sections of the facility emergency plan; and

- Any release of radioactive material as a result of fire would not cause radiation exposures that exceeded the requirements of 10 CFR Part 20.

SHINE Response

a. The Safe Shutdown Analysis performance goals are as follows:

    - Reactivity of the target solution shall be maintained subcritical in the event of a fire.
    - Combustible gas control systems shall be capable of performing their necessary functions in the event of a fire.
    - Target solution cooling shall be capable of removing heat such that target solution boiling does not occur.
    - Uncontrolled release of radioactive material shall be prevented.

    The Safe Shutdown Analysis identifies how safe shutdown of the irradiation units (IUs) is accomplished and uncontrolled release of radioactive material is prevented for a fire in each fire area.

    After performance goals and criteria are established, systems credited for safe shutdown analysis are selected. The systems were selected based on their ability to accomplish the performance goals. The safe shutdown equipment list (SSEL) documents the credited safe shutdown systems, components, and functions which are required to achieve the safe shutdown conditions. The components were then located by fire area utilizing fire area

layout drawings, plant equipment layout drawings, and other technical reports and relevant system drawings that identify equipment location.

A deterministic evaluation is conducted on a fire area-by-fire area basis to ascertain potential damage and assess the effectiveness of the provided protection. Where safe shutdown components are redundant and fail-safe, or where a fire area contains safe shutdown equipment of only one train, a fire in this fire area will not jeopardize safe shutdown capability. Further evaluation is performed where multiple trains of non-fail-safe safe shutdown equipment are located in the same fire area. This evaluation relies on the establishment of separation criteria. If the components in the fire area meet this separation criteria, a fire in this fire area will not jeopardize safe shutdown capability

Component cable selection and circuit analysis was not performed, based on the SHINE redundant fail-safe design and the SHINE cable separation criteria.

b. The functions required for safe shutdown at the SHINE facility (i.e., to meet the performance goals) are as follows:

- Reactivity shall be maintained subcritical in the event of a fire:
    - IU Cell Safety Actuation initiated by the target solution vessel (TSV) reactivity protection system (TRPS). This entails the opening of the TSV dump valves and the closing of the TSV fill valves.
- Combustible gas control systems shall be capable of performing their necessary functions in the event of a fire:
    - Combustible gas control (within the primary system boundary), which includes the active function of the TSV off-gas system (TOGS) and subsequent nitrogen purge (via the nitrogen purge system [N2PS]), initiated by the TRPS and the engineered safety features actuation system (ESFAS).
        - To maintain hydrogen concentrations at acceptable levels in the primary system boundary, TOGS must be powered for 5 minutes after an IU Cell Safety Actuation. The uninterruptible power supply system (UPSS) is the safety-related source of this power.
- Decay heat removal shall be capable of removing heat such that target boiling does not occur:
    - Natural convection cooling of the TSV dump tank through the dump tank wall via the passive light water pool system (LWPS).
- Prevent uncontrolled release of radioactive material to the environment::
    - IU Cell Safety Actuation initiated by TRPS and Radiologically Controlled Area (RCA) Isolation initiated by ESFAS. These actuations require certain valves, ventilation dampers, and circuit breakers to move to, and remain in, their safe positions.
        - Components required to perform these functions are identified on the SSEL.

c. There are no required safe shutdown functions that rely on only a single train.

d. Where credited equipment or divisional raceway routes are located in the same fire area, the following shutdown separation criteria are considered in an assessment:

- Redundant, fail-safe components performing the safe shutdown function
- Spatial separation distance of at least 20 feet where automatic fire suppression is provided and at least 40 feet where automatic fire suppression is not provided

- Embedment of cable conduit in structural concrete
- Fixed fire suppression and/or detection in the fire area
- Areas which have restricted access and/or are sealed
- Areas which are continuously occupied
- Administrative controls on combustible loading

Where these separation criteria cannot be met as determined by analysis, fire modeling was performed to determine if both trains of components can be damaged by a single fire.

e. There are no fire areas where deviation from the separation criteria is required.

f. The following fire areas contain safe shutdown credited equipment and/or divisional raceway cable routes from all trains of a required safe shutdown function. A description of how safe shutdown is ensured for a fire occurring in that area is also provided.

Fire Area 1 – Radioisotope Production Facility (RPF) General Area

Based on the large spatial separation between Division A and Division B cables, embedment of most Division A cables in the area, limits on combustible loading, and hot gas layer (HGL) temperature calculations, a fire in Fire Area (FA)-1 is not expected to damage both divisions of the TOGS cables simultaneously.

Additionally, where other equipment from both trains needed for safe shutdown are located in FA-1, including N2PS equipment needed for combustible gas control and dampers actuated by an RCA Isolation Actuation, this equipment will go to their safe states upon loss of power. Each component needed for safe shutdown has a redundant component on a different train, so if one component spuriously powers, the redundant component will fulfill the safe shutdown function.

This justification provides reasonable assurance that the SHINE facility can be placed in a safe shutdown condition for a fire in FA-1.

Fire Area 2 – IU and TOGS Cells (8 cells each)

Based on the low combustible load, the sealed nature of the IU and TOGS cells resulting in quickly depleted oxygen levels in the event of a fire, and the early warning fire detection capabilities in the exhaust duct of each IU and TOGS cell, fire damage to redundant trains of TOGS components needed for combustible gas control will not simultaneously occur within the TOGS cells. The other equipment credited for safe shutdown functions in the IU and TOGS cells, including the TSV dump valves, TSV fill valves, and valves actuated by an IU Cell Safety Actuation, are redundant and fail-safe.

This justification provides reasonable assurance that the SHINE facility can be placed in a safe shutdown condition for a fire in FA-2 IU and TOGS cells.

Fire Area 2 – Irradiation Facility (IF) General Area Mezzanine

Based on the limited combustible load, very early smoke detection capabilities, manual fire suppression capabilities, and strict transient combustible controls, fire damage to redundant divisions of safe shutdown equipment will not occur within this fire area.

Additionally, where equipment from both trains needed for safe shutdown are located in the FA-2 mezzanine, including N2PS equipment needed for combustible gas control and dampers actuated by an RCA Isolation Actuation, this equipment will go to their safe states upon loss of power. Each component needed for safe shutdown has a redundant component on a different train, so if one component spuriously powers, the redundant component will fulfill the safe shutdown function.

This justification provides reasonable assurance that the SHINE facility can be placed in a safe shutdown condition for a fire in FA-2 mezzanine.

Fire Area 2 – Tritium Purification System (TPS) Room

Based on the limited combustible load, very early smoke detection capabilities, manual fire suppression capabilities, and strict transient combustible controls, fire damage to redundant divisions of valves will not occur within this fire area.

Additionally, where equipment from both trains needed for safe shutdown are located in TPS room, including valves actuated by an IU Cell Safety Actuation, this equipment will go to their safe states upon loss of power. Each component needed for safe shutdown has a redundant component on a different train, so if one component spuriously powers, the redundant component will fulfill the safe shutdown function.

This justification provides reasonable assurance that the SHINE facility can be placed in a safe shutdown condition for a fire in FA-2 TPS room.

Fire Area 2 – TOGS Motor Control Center (MCC) Hallway

Results from the Consolidated Model of Fire and Smoke Transport (CFAST) computational model show that no potential fires are capable of damaging both divisions of TOGS MCCs. The Division A cables powering these MCCs run entirely in embedded conduit in this fire area. Due to their embedment, they will not be damaged in a fire in this area.

This justification provides reasonable assurance that the SHINE facility can be placed in a safe shutdown condition for a fire in FA-2 TOGS MCC hallway.

Fire Area 15 – Facility Control Room

Based on the spatial separation of redundant trains of safe shutdown equipment (UPSS, ESFAS, and TRPS panels), prompt detection and suppression due to the Control Room being continuously occupied, and automatic clean agent fire suppression system, a fire in the facility control room will not be able to simultaneously damage redundant trains of safe shutdown equipment.

This justification provides reasonable assurance that the SHINE facility can be placed in a safe shutdown condition for a fire in FA-15.

Fire Area 19 – Ship/Receive Alcove

FA-19 has strict controls on transient and in-situ combustible materials (i.e., procedural controls) and is equipped with a smoke detection system in accordance with NFPA 72, "National Fire Alarm and Signaling Code" (Reference 3).

Additionally, where equipment from both trains needed for safe shutdown are located in FA-19, dampers actuated by an RCA Isolation Actuation, this equipment will go to their safe states upon loss of power. Each component needed for safe shutdown has a redundant component on a different train, so if one component spuriously powers, the redundant component will fulfill the safe shutdown function.

This justification provides reasonable assurance that the SHINE facility can be placed in a safe shutdown condition for a fire in FA-19.

g. The Safe Shutdown Analysis has not identified any fire areas where a fire could prevent safe shutdown.

h. Operators will be directed by procedure(s) and training to manually actuate TRPS and ESFAS from the facility control room (assuming TRPS or ESFAS had not already actuated automatically) under any one or more of the following conditions:

- The fire is unable to be controlled or requires off-site assistance;
- Facility control room habitability is degrading; or
- At the discretion of the Operator for:
    - Loss of control of facility equipment;
    - Loss of power to facility equipment;
    - Erratic indication, alarm, annunciation of facility equipment; or
    - Spurious operation of facility equipment.

i. Circuit analysis has not been explicitly performed in support of the Safe Shutdown Analysis. There is no regulatory requirement for non-power production and utilization facilities to consider fire-induced circuit failures in demonstrating that the performance goals of the Safe Shutdown Analysis can be achieved.

RAI 9-9

NUREG-1537, Part 1, Section 9.3, states, in part, that "[t]he applicant should discuss passive design features required by the [facility] design characteristics." In addition, the objectives of the fire protection program should limit fire consequences and provide that the facility is designed, and protective systems exist to prevent the uncontrolled release of radioactive material should a fire occur. Additionally, NUREG-1537, Part 2, Section 9.3, states, in part, that "[t]he fire protection plan should discuss the prevention of fires, including limiting the types and quantities of combustible materials."

SHINE FSAR Section 9a2.3.7, "Facility Fire Protection System Description," does not provide sufficient detail of the use of SHINE's fire hazards analysis and the results. Therefore, additional information is needed to ensure that the passive design features, including fire barriers and facility fire areas and zones, are adequate to limit fire consequences to prevent the uncontrolled release of radioactive material should a fire occur.

a. Discuss means of egress for fire areas and zones and means of egress protection.

b. Describe the types of combustibles found in each fire area.

c. Describe combustible loading in fire areas and zones.

d. Discuss fire hazards and ignition sources that were considered for facility fire areas.

e. Describe the types of fire-resistant coatings and electric raceway fire barriers systems used for the protection of electrical cables and structural steel.

f. Identify the fire modeling tools or methods used in the development of the fire hazard analysis including how these tools or methods were applied. Describe the process to validate and verify the fire models, including any calculational and numerical methods used, used in support of fire hazard analysis. Discuss how the fire modeling uncertainties were accounted in the fire modeling calculations.

g. Describe how the installed cabling in the fire areas was characterized. Specifically, describe the critical damage threshold temperatures and heat fluxes for thermoset and thermoplastic cables consistent with the use of these cables in the facility. Include an explanation of how exposed temperature-sensitive equipment was treated in the fire modeling and justify the damage criteria that was used for such equipment. Alternatively, justify why this information is not necessary.

This information is necessary for the NRC staff to ensure that SHINE is satisfying the elements of 10 CFR 50.48(a) to which it has committed and to make the necessary evaluation findings described in NUREG-1537, Part 2, Section 9.3. Specifically, the requested information will support the NRC staff in concluding the following:

- The plans for preventing fires ensure that the facility meets local and national fire and building codes;

- The systems designed to detect and combat fires at the facility can function as described and limit damage and consequences at any time;

- The potential for radiological consequences of a fire will not prevent safe shutdown, and any fire-related release of radioactive material from the facility to the unrestricted environment has been adequately addressed in the appropriate sections of the facility emergency plan; and

- Any release of radioactive material as a result of fire would not cause radiation exposures that exceeded the requirements of 10 CFR Part 20.

This information is also requested to ensure that SHINE is satisfying its Design Criterion 3, which provides that “noncombustible and heat resistant materials are used whenever practicable….”

SHINE Response

a. Emergency exits are available from all areas of the SHINE facility within a travel distance of 200 feet. Common paths of travel do not exceed 100 feet, and dead-end corridors do not exceed 50 feet. Exit access corridors are constructed to have a fire resistance rating of not less than 1 hour, in accordance with Section 1020 of the International Building Code (IBC) (Reference 4). Stairways used as a means of egress from the mezzanine are constructed to have a fire resistance rating of 2 hours.

b. The following table provides the types of combustibles (fixed and stored) found in each fire area of the SHINE facility. Transient combustibles can be present in any fire area in the SHINE facility. The types and quantities of transient combustibles allowed in each fire area of the facility are governed by a combustible loading procedure.

Fire Area	Combustible Types
FA-1	Batteries, cellulosics, charcoal, clothing, electrical equipment, cable insulation, hydrocarbon fluids, synthetic polymers
FA-2	Cable insulation, cellulosics, charcoal, clothing, electrical equipment, flammable gases, synthetic polymers, rubber, hydrocarbon fluids,
FA-3	Cellulosics, clothing, flammable and combustible liquids, synthetic polymers
FA-4	Hydrocarbon fluids
FA-5	Cellulosics, [ ]SRI
FA-6	Cable insulation, cellulosics, electrical equipment, synthetic polymers
FA-7	Flammable and combustible liquids, chemicals, electrical equipment, insulation
FA-8	Cable insulation, electrical equipment
FA-9	Cable insulation, hydrocarbon fluids
FA-10	Cable insulation, electrical equipment, resin
FA-11	Flammable gases, cable insulation, cellulosics, electrical equipment, rubber, synthetic polymers
FA-12	Cable insulation, electrical equipment, hydrocarbon fluids
FA-13	Cable insulation, batteries, electrical equipment
FA-14	Cable insulation, batteries, electrical equipment
FA-15	Cable insulation, electrical equipment, cellulosics, synthetic polymers
FA-16	Clothing, synthetic polymers
FA-17	Cellulosics, charcoal, cable insulation, rubber, hydrocarbon fluids
FA-18	Cable insulation, electrical equipment
FA-19	Cellulosics, synthetic polymers
FA-20	None
FA-21	Cable insulation, electrical equipment
FA-22	None
FA-23	None
FA-24	None
FA-25	Cable insulation, electrical equipment

c. Fire areas in the RCA have their combustible loading (i.e., heat load density, measured in BTU/ft^2) calculated, and are categorized based on the fire loading categorization scheme described in the SHINE Fire Protection Program. The combustible loading of fire areas outside the RCA is determined qualitatively. The following table provides the fire loading categorization of each fire area.

Fire Area	SHINE Fire Loading Category
FA-1	Moderate
FA-2	Moderate
FA-3	Low
FA-4	Extremely Low
FA-5	Moderate
FA-6	Outside the RCA. See Note 1 below.
FA-7	Outside the RCA. See Note 2 below.
FA-8	Outside the RCA. See Note 1 below.
FA-9	Outside the RCA. See Note 1 below.
FA-10	Outside the RCA. See Note 1 below.
FA-11	Moderate
FA-12	Outside the RCA. See Note 1 below.
FA-13	Outside the RCA. See Note 3 below.
FA-14	Outside the RCA. See Note 3 below.
FA-15	Outside the RCA. See Note 1 below.
FA-16	Very Low
FA-17	Outside the RCA. See Note 1 below.
FA-18	Outside the RCA. See Note 1 below.
FA-19	Extremely Low
FA-20	Outside the RCA. See Note 1 below.
FA-21	Outside the RCA. See Note 1 below.
FA-22	Outside the RCA. See Note 4 below.
FA-23	Very Low
FA-24	Very Low
FA-25	Outside the RCA. See Note 1 below.

Notes:

1) For FA-6, FA-8, FA-9, FA-10, FA-12, FA-15, FA-17, FA-18, FA-20, FA-21, and FA-25, the combustibility of the materials is low and the associated quantity of combustibles is low.
2) For FA-7, the combustibility of materials is moderate and the associated quantity of combustibles is moderate.
3) For FA-13 and FA-14, the combustibility of the materials is moderate and the associated quantity of combustibles is low.
4) For FA-22, the FA does not have fixed or stored combustibles. Only transient combustibles may be present.

d. The following fire hazards and ignition sources were considered for facility fire areas:

- Leaks of insulating oil from the high voltage power supplies;
- Maintenance or hot work involving transient combustibles or equipment;
- Hydrogen deflagration in process vessels due to loss of sweep gas;
- Ignition of carbon delay beds due to high moisture or high temperature;
- Electrical short-circuits in equipment (e.g., switchgear, electrical cabinets);

- Internal over-pressurization of high voltage power supplies;
- Human error during laboratory work; and
- Battery ignition.

e. Where cables or circuits of different divisions are required to be installed in a single conduit or enclosure, high temperature glass sleeving is used. The wires/circuit of one division is enclosed in a high temperature sleeve to provide protection of hot-shorts or heat from the opposite division. The sleeves are typically made of braided glass or fiberglass.

   Electric raceway fire barriers systems are not used in the SHINE facility.

   Structural steel in the SHINE facility does not have any fire-resistant coatings. The SHINE facility is IBC Type II-B construction. Table 601 of the IBC (Reference 4) specifies a 0-hour fire resistance rating for buildings with Type II-B construction.

f. SHINE used the National Institute of Standards and Technology (NIST) Consolidated Model of Fire and Smoke Transport (CFAST) (Versions 7.5.2 and 7.7.2) in the development of the fire hazards analysis. The following two fire modeling analyses are performed using CFAST:

   - Determination of whether the hot gas layer (HGL) temperature for a fire within the RCA could reach temperatures high enough to impact the structural integrity of the roof or the cranes within the RCA. (CFAST Version 7.5.2)
   - Determination of the zone of influence (ZOI) of a fire in a TOGS MCC and a transient fire within FA-2 to evaluate whether both trains of TOGS can be damaged from a single fire. (CFAST Version 7.7.2)

   CFAST Version 7.0.0 was verified and validated, as documented in NUREG-1824, Supplement 1, “Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications” (Reference 5). NIST Technical Note 1889v3 (References 6 and 7) detail the verification and validation actions performed for CFAST Versions 7.5.2 and 7.7.2.

   The CFAST analyses were performed within the limits of applicability and within validated ranges of NUREG-1824, Supplement 1. The normalized parameters, where applicable, are within the validated ranges for the use of CFAST.

   Regarding model uncertainty, NUREG-1824, Supplement 1 analyzed validation tests for HGL temperature, HGL depth, and target temperature. The uncertainty of the validation results was numerically characterized using a bias factor and standard deviation to indicate the propensity of the model to either over-predict or under-predict the calculated quantity. A bias factor of 1 indicates the model predictions are the same as the measured values, so the model is accurate compared to the measured values the model was validated against. These bias factors and standard deviations were originally published in Table 6-1 of NUREG-1824, Supplement 1 for CFAST Version 7.0.0.

   NUREG-1824, Supplement 1 recommends that when using a newer version of CFAST, the user needs to confirm that the model developers have published updates to the accuracy metrics that are listed in Table 6-1. Updated uncertainty metrics for HGL temperature and depth and target temperature using CFAST Version 7.5.2 and 7.7.2 were published in NIST Technical Note 1889v3 (References 6 and 7). Based on the validation tests, both versions of CFAST used show a propensity to overpredict target temperature and HGL temperature,

which is conservative when considering target failures. CFAST may slightly under-predict the HGL depth based on the validation experiments; however, the bias factor for this parameter is very close to 1, and for the purposes of the SHINE fire modeling analysis, is not expected to have a significant impact on the results since the HGL depth isn't a key parameter used to determine target failures in the analysis.

g. Cable materials are typically classified as either thermoset or thermoplastic when determining which damage criteria to use. Appendix A to NUREG-1805, "Fire Dynamics Tools (FDTs), Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program" (Reference 8), provides damage criteria for thermoset and thermoplastic cables typically found in nuclear power plants. When there is a mixture of cable materials within a raceway, the lower failure damage criteria are typically utilized.

   There is a mixture of thermoset and thermoplastic materials being used at SHINE. For cables with a mixture of thermoplastic and thermoset cables, or when the cable types within each raceway are not known, the cable failure criteria for thermoplastic was conservatively applied for fire modeling. Consistent with Appendix A of NUREG-1805, the following generic screening thermal damage criteria has been used for cable targets:

   - Critical Temperature: 205°C (400°F)
   - Critical Heat Flux: 6 kW/m^2 (0.5 BTU/ft^2s)

   For cables known to contain only thermoset material, and without thermoplastic or unknown jacketing or insulation, the following thermoset damage criteria are used:

   - Critical Temperature: 330ºC (625ºF)
   - Critical Heat Flux: 11 kW/m^2 (1.0 BTU/ft^2s)

   Ignition of bulk cables and cable trays utilizes the guidance in Fire Probabilistic Risk Assessment (PRA) Frequently Asked Question (FAQ) 16-0011 (Reference 9). The ignition of both thermoplastic and thermoset bulk cables and cable trays applies the following ignition criteria:

   - Critical Temperature: 500°C (932°F)
   - Critical Heat Flux: 25 kW/m^2 (2.2 BTU/ft^2s)

   Equipment needed for safe shutdown are on redundant trains. With the exception of the TOGS MCCs, separation of redundant equipment has been analyzed and shown to be adequate without the use of calculations or modeling. Therefore, it is not necessary for SHINE to establish quantitative damage criteria for temperature-sensitive equipment.

References

1. NRC letter to SHINE Medical Technologies, LLC, “SHINE Medical Technologies, LLC – Request for Additional Information Related to Fire Protection (EPID No. L-2019-NEW-0004),” dated June 23, 2021 (ML21162A318)

2. SHINE Medical Technologies, LLC letter to the NRC, “SHINE Medical Technologies, LLC Application for an Operating License,” dated July 17, 2019 (ML19211C143)

3. National Fire Protection Association, “National Fire Alarm and Signaling Code,” NFPA 72-2013, Quincy, MA

4. International Code Council, Inc., “International Building Code,” IBC-2015, Country Club Hills, IL

5. U.S Nuclear Regulatory Commission, “Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications,” NUREG-1824, Supplement 1, November 2016 (ML16309A011)

6. National Institute of Standards and Technology, “CFAST – Consolidated Fire And Smoke Transport (Version 7), Volume 3: Verification and Validation Guide,” NIST Technical Note 1889v3, CFAST Version 7.5.0, April 2020

7. National Institute of Standards and Technology, “CFAST – Consolidated Fire And Smoke Transport (Version 7), Volume 3: Verification and Validation Guide,” NIST Technical Note 1889v3, CFAST Version 7.7.0, August 2021

8. U.S. Nuclear Regulatory Commission, “Fire Dynamics Tools (FDTs), Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program,” NUREG-1805, December 2004 (ML043290075)

9. U.S. Nuclear Regulatory Commission Memorandum, “Close-Out of Fire Probabilistic Risk Assessment Frequently Asked Question 16-0011 on Alternative Methodology to NUREG/CR-6850 for Bulk Cable Tray Ignition Criteria,” dated March 20, 2018 (ML18074A020)