

Attachment 1

Oregon State University Application for Special Nuclear Material License Request for Additional Information Reply

Organization

ORG-1: Revise the safety program description to clarify that the individual delegated overall responsibility for the health, safety and environmental protection functions will have the authority to shut down operations if they appear to be unsafe and, in that case, must approve restart of shutdown operations. This delegation of authority is necessary to demonstrate compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) 70.22(a)(6).

A sentence will be added to the third paragraph under section 5.II.A of the application which states:

The RSO shall be the individual delegated overall responsibility for the health, safety and environmental protection functions and will have the authority to shut down operations if they appear to be unsafe and, in that case, must approve restart of shutdown operations.

Radiation Protection

RP-1: Section 7 of the application states that test loop water will be periodically sampled. Revise to clarify the purpose of the sampling, what action limits will be applied, and what actions taken if the action limit is exceeded. This is needed to assure compliance with 10 CFR 20, Subpart K and/or 10 CFR 20.1501.

A sentence will be added to the third paragraph under section 7 of the application which states:

The water the elements will be used in will be sampled before release to the sanitary sewer to ensure there is no radioactivity present above 10 CFR20 Appendix B limits. If results are not below the limits found in 10 CFR 20, Appendix B, the water will be pumped to a storage tank for further evaluation and disposal.

RP-2: Section 7, subsection 1, bullet D, states fuel assemblies will be leak tested on a 6 month cycle. Revise to state the guidance that will be followed for performing leak tests, action levels, and actions taken if the action levels are exceeded. This is necessary to assure compliance with 10 CFR 20.1501.

A sentence will be added to the third paragraph under section 7.I.D of the application which states:

The wipe sample will be taken of the entire assembly. The wipe sample will be analyzed for radioactive contamination with the appropriate instrument capable of detecting the presence of 0.005 μ Ci of radioactive material. If the test reveals the presence of 0.005 μ Ci or more of removable radioactive material, the assembly will be removed from testing for further evaluation.

RP-3: Section 7, subsection 3, does not discuss internal exposure monitoring. Please revise to state the criteria for internal exposure monitoring (assumed to be in response to unanticipated release of encapsulated material) and what guidance or methods will be followed for assessing internal exposures. This is needed to assure compliance with 10 CFR 20.1204.

A sentence will be added to the first paragraph under section 7 of the application which states:

The SNM will be a metallic U-Mo alloy between layers of aluminum cladding. The SNM will not be in a soluble or readily dispersible form. As such, personnel are not expected to receive 10% of the applicable limit and therefore will not be routinely monitored for internal exposure. However, if there is evidence of dispersible material and suspect that an uptake has occurred, appropriate bioassay would be performed to determine the uptake and dose.

RP-4: Section 7, subsection 1 and Section 6, subsection 3 do not require any personnel contamination monitoring. Because direct handling of fuel elements is allowed and there is no other mention of contamination control or monitoring other than periodic leak tests, a contamination monitor should be available to personnel when handling fuel elements. This could alert personnel to loss of encapsulation so that corrective measures could be more timely acted upon and have a better impact on reducing exposures. Please revise the appropriate section to state that a personnel contamination monitor will be available when handling fuel elements. This is needed to assure compliance with 10 CFR 20.1501.

Section 7.II.B states that a portable radiation monitor will be available at all times in the facility. This implies portable radiation instrumentation will be available for contamination monitoring.

A sentence will be added to section 7.II.B of the application which states:

Personnel will be required to perform a contamination survey after handling the material.

RP-5: Section 6, subsection 3, has no detail regarding calibration of radiation protection monitoring instruments. Please revise this section to state that calibration will be performed in accordance with applicable guidance (e.g., ANSI N323A or similar) and using standards that are traceable to the National Institute of Standards and Technology. Frequency of calibration will be consistent with the history of use of the instrument and the stability of its settings. Source checks should also be utilized to verify correct instrument operation prior to use at the beginning of the day. This is needed to assure compliance with 10 CFR 20.1501.

A sentence will be added to the second paragraph under section 6.III of the application which states:

Radiation monitors will be calibrated annually in accordance with ANSI N323A using NIST traceable standards. Procedures will require that check sources will be utilized to verify correct instrument operation prior to use at the beginning of the day.

RP-6: Section 6, subsection 4, does not discuss disposal of water from the test loop. Revise this section, or other applicable section, to discuss potentially contaminated water from the test loop. This is needed to assure compliance with 10 CFR 20, Subpart K.

Please see response to RP-1.

RP-7: Revise Section 6, subsection 3, or other applicable section of the application to state that reports of individual monitoring results, incidents, and exposures exceeding the dose limits in 10 CFR 20 will be submitted consistent with 10 CFR 20, Subpart M. This is needed to assure compliance with the reporting requirements in this Subpart.

A sentence will be added to the first paragraph under section 6.III of the application which states:

All individual monitoring results, incidents, and exposures exceeding the dose limits in 10 CFR 20 will be submitted consistent with the applicable criteria of 10 CFR 20, Subpart M.

RP-8: Revise the application to include recordkeeping commitments consistent with 10 CFR 20 Subpart L.

A sentence will be added to the last paragraph under section 10 of the application which states:

Recordkeeping commitments are and will be consistent with the requirements of 10 CFR 20, Subpart L.

RP-9: Revise Section 6, subsection 3, to state that dosimetry will be processed by National Voluntary Laboratory Accreditation Program accredited vendors. This is necessary to assure compliance with 10 CFR 20.1501(c).

A sentence will be added to the second paragraph under section 6.III of the application which states:

Dosimetry will be processed by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited vendor.

Nuclear Criticality Safety

NCS-1: Revise the license application to include a statement that should the criticality accident alarm system (CAAS) be out of service for any amount of time, all

movement of special nuclear material (SNM) must cease until the alarm service has been restored. However, routine testing, calibration, and/or maintenance of the system is permitted without suspension of fissile material movement. In the event suspending fissile material movement, even to make this operation safe, carries a larger risk than being without a CAAS for a short time period, and thus compensatory measures (e.g., limiting access, providing continuously attended portable monitoring), approved by the nuclear criticality safety function, are needed until the CAAS becomes functional, commit to implement these compensatory measures for the time needed to either restore CAAS or safely shut fissile material movement. Define the criteria that will be used to determine when it is not safe to shut down fissile material movement such that compensatory measures will be used. In addition, justify the time period required to safely shut down fissile material movement on a risk basis.

The licensee did not provide any compensatory measures while the CAAS is out of service, and did not define criteria for when it is not safe to shut down fissile material movement. Since the CAAS is the primary means to identify a criticality accident and mitigate its effects, the licensee needs to provide further justification for allowing fissile material movement to continue if the CAAS is out for an extended time.

10 CFR 70.24 states that a CAAS is required for operations containing greater than 700 g of contained U-235. In addition, NUREG-1520, Section 5.4.3.4.3(7) states that "the applicant commits to rendering operations safe, by shutdown and quarantine if necessary, in any area where CAAS coverage has been lost and not restored within a specified number of hours. The number of hours should be determined on a process-by-process basis, because shutting down certain processes, even to make them safe, may carry a larger risk than being without a CAAS for a short time. The applicant should commit to compensatory measures (e.g., limit access, halt SNM movement) when the CAAS system is not functional."

We are making a request for an exemption under 10 CFR 70.17 to remove the requirement for a CAAS. Please see Attachment 2 of this submission. As such, the third paragraph of section 6.III will be removed from the application.

Fire Safety

FIRE-1: Describe the facility's building construction, fire area determination, electrical installation, emergency lighting, life safety/egress, ventilation, and lightning protection.

From section 7.III.B, precautions for material storage are used to minimize the potential for airborne radioactivity from exposure to fire hazards. Storage of the fuel assemblies when not in use and during testing will be away from flammable materials. All materials licensed under this application will be stored within the confines of room D104 which is locked and alarmed when the facility is not occupied. The room D104 superstructure consists of 6-inch precast, prestressed concrete exterior wall panels and poured-in-place concrete pilasters, a structural steel roof frame with metal deck and insulating concrete fill, and a structural steel interior floor frame with metal formed

concrete slabs. Structural floors are designed for superimposed loads of 100 pounds per square foot and roofs for 25 pounds per square foot. The ventilation system provides fresh air to the reactor bay (D104) area at the rate of $4.4E6 \text{ cm}^3 \text{ s}^{-1}$ and is independent of the attached buildings and laboratories. The conditioned air then discharges into the reactor bay through four outlet ducts near the ceiling. The exhaust air exits the reactor bay through four outlet ducts; three near the ceiling and one near the floor. The floor duct exhausts half of the total volume of effluent to help facilitate mixing within the bay. The stack extends approximately 7.2 meters above the roof of the building, which places the exhaust approximately 20 meters above the ground. The air is discharged at approximately $1.97E3 \text{ cm}^3 \text{ s}^{-1}$, which ensures that the exhaust air carries to higher elevations and mixes rapidly with the surrounding air. The room is maintained at a negative pressure in relationship to outside static air pressure by controlling the amount of air pumped into the bay.

Emergency lighting is checked annually and covers the room and all stairwells and corridors.

The use room, room F106, building superstructure consists of steel reinforced 8-inch concrete masonry walls with a membrane-lined steel deck roof. Because of the high-bay orientation, there will be no ventilation system for the use area. Emergency lighting will be provided in the new building and implemented in a similar methodology as the present system.

Two sentences will be added to section 7.III.B of the application which states:

In this case, the fire areas are defined as the inside areas (rooms) of the buildings because they are each physically separated from other areas by space, barriers, walls, or other means in order to contain fire within that area. All electrical systems are installed in accordance with NFPA 70, National Electrical Code. Lightning protection is not required; however, the building is grounded in accordance with the National Electrical Code.

FIRE-2: Describe the facility's fire protection features (suppression, alarm, detection, fire rated walls/opening protection).

From section 7.III B, room D104 has four rate-of-rise/fixed temperature detectors located on the ceiling along with a smoke detector located in the exhaust ducting. All detectors are connected to the Radiation Center building fire alarm distribution panel. Room F106 will have four rate-of-rise/fixed temperature detectors. All detectors will be connected to the Radiation Center building fire alarm distribution panel.

The following three sentences will be added to section 7.III.B of the application which state:

The walls for room D104 have a minimum fire rating of 3 hours (International Building Code, 2003, Section 721.2.1.1). The walls of F106 have a fire rating of 4 hours (International Building Code, 2003 Section 720, Table 720.1 or Northwest Concrete and Masonry Association, "Concrete Masonry Fire Resistance" February 2005.). There is no sprinkler or automated fire suppression system in either room.

FIRE-3: Describe any inspection, testing, and maintenance of fire protection systems.

From section 7.III.B, the building, including rooms D104 and F106, is inspected annually by the City of Corvallis Fire Department for compliance with applicable building fire codes. Each of the detectors is fully tested annually. The fire extinguishers are inspected annually.

FIRE-4: Describe, by fire area, any potential combustible loading, possible fire scenarios, the potential consequences, and any mitigative controls.

From section 7.III.B, in room D104, there is no appreciable combustible loading within the storage room. Movement of combustible materials into the storage room is strictly controlled/inventoried but generally prohibited. There is currently nothing on the inventory of combustible materials in the storage room.

In room F106, there is no appreciable combustible loading, hazardous chemicals or processes anticipated to be in the room.

FIRE-5: Describe the physical barriers separating the radioactive material from a single fire incident. Do these barriers have a fire rating?

The following sentence will be added to section 7.III.B of the application which states:

The physical barrier for the storage rack is stainless steel with a minimum thickness of 0.125 inches. The barrier does not have a fire rating.

FIRE-6: Are there any hazardous chemicals or processes which may contribute to the fire hazards in radiological areas?

From section 7.III.B, in room D104, There are no hazardous chemicals or processes which may contribute to a fire hazard in this room. In room F106, there are no hazardous chemicals or processes anticipated that may contribute to a fire hazard.

FIRE-7: Is the facility compliant with NFPA 45, Standard for Fire Protection in Laboratory Facilities, and/or NFPA 801, Standard for Fire Protection for Facilities Handling Radioactive Materials?

The following sentences will be added to section 7.III.B of the application which state:

NFPA 45 does not apply since neither room will contain flammable or combustible liquids equal or greater than 4 L nor contain greater than 2.2 standard m³ of flammable gas. Each room complies with most, but not all, of that described in NFPA 801.

FIRE-8: Describe the frequency and scope of any training for facility workers in response to a fire (fire extinguisher, safe shutdown, evacuation, etc.)?

From section 7.III.A, as required by the Emergency Response Plan, the Radiation Center has an annual training program for staff and building residents. Annually, we perform building evacuation tests/exercises, refresher training, and emergency drills.

Biennially, as part of the Emergency Response Plan refresher training, the Radiation Center staff undergoes on-site fire extinguisher training provided by the Corvallis Fire Department. The Emergency Response Plan requires annual building evacuation tests and exercise, refresher training and emergency drills. These activities apply to the Radiation Center as a whole, including room F106.

FIRE-9: Is the responding fire department located on-site? Describe the responding fire department's qualifications and training. Describe any pre-fire plan coordination with the responding fire department(s) (fire drills, preparation for hazardous materials response, etc).

From section 7.III.A, the Plan requires that the emergency drills occur with an outside first responder agency at least biennially. Both the Corvallis Fire Department and Samaritan Regional Medical Center receive annual training on the use and unique nature of the Radiation Center. This training usually consists of an hour lecture on the Emergency Response Plan and their procedures on handling radiological incidents, followed by a "nuts-and-bolts" tour of the entire facility. Additionally, both have current copies of the Emergency Response Plan for the Radiation Center.

The fire department is not on-site; however, the closest station is located less than 1 mile from the facility.

Emergency Planning

Comment: These RAIs are based on a comparison of the application for license of SNM, dated October 2009 and the OSU Radiation Center Emergency Plan, Revision 4, dated November 2009, with the regulations in 10 CFR 70.22 and 70.24, and with the guidance provided in ANSI/ANS-15.16-2008.

We respectfully submit that changes to the OSU Radiation Center Emergency Response Plan (ERP) are not necessary because the form of the SNM and the uses of it. Specifically, an evaluation of use and potential accidents related to the fuel could not produce a dose to a member of the public offsite due to a release of radioactive materials that would exceed 1 rem effective dose equivalent or an intake of 2 mg of soluble uranium.

The fuel will be an aluminum clad U-Mo alloy that will not be in a soluble or readily dispersible form. The material in each fuel element will be physically separate from material in the other elements. There is no possibility of "mixing" the material between elements because the fuel elements will not be purposefully altered, disassembled, or otherwise processed. We believe this meets the intent of 10 CFR 70.22(i)(2)(i).

The material in each fuel element will not be subject to release during an accident or to criticality because of the way it is stored or packaged. The criticality analysis in the application demonstrated that any credible combination/configuration of these fuel elements will remain subcritical for all requested uses. It also showed that if the room is completely flooded to the ceiling with water, both a normally full storage rack and completely melted fuel that has pooled at the bottom of the storage rack have a $k_{\text{eff}} < 0.9$. Because alteration of the fuel elements themselves will not occur, they will be stored in one location, and removal from the storage rack will be limited to one of the five different elements at any given time, a criticality accident is not a

credible scenario. Furthermore, the material is a hard metal alloy that is unlikely to volatilize or otherwise readily disperse as a result of a fire. The worst accident would involve a mechanical destruction of the storage cabinet or the hydro-mechanical test loop during a time when the loop contained an element. This type of situation would unlikely result in release of material because the material form does not lend itself to aerosol dispersion or even contamination. It would likely bend or deform but it should not be released in a respirable or soluble form. We believe this meets the intent of 10 CFR 70.22(i)(2)(ii).

The material in each fuel element will be highly insoluble. The fuel form is a metal alloy whose entire purpose is to remain insoluble while in the primary water of a reactor. We believe this meets the intent of 10 CFR 70.22(i)(2)(iv).

Given the material form and the proposed use of the material, we find it difficult to create a circumstance where the general public could potentially receive any dose even under credible accident scenarios (i.e., a fire). Given this, we believe that 10 CFR 70.22(i)(1)(i) provides that changes to the ERP are not necessary.

EP-1: The application references the Emergency Plan under license R-106, but that Emergency Plan does not address the SNM for which the license has been submitted. The Emergency Plan only addresses the existing OSTR. The regulations in 10 CFR 70.22(i)(3)(i), state the Emergency Plan must include a description of the facility (in this case, reference should be made to the facility where the SNM is to be used). Revise the Emergency Plan to describe the facility where the SNM will be used, or provide justification why this is deemed not required.

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-2: The regulations in 10 CFR 70.22(i)(3)(ii) state that the Emergency Plan must include an identification of each type of radioactive materials accident for which protective actions may be needed. Revise the Emergency Plan to include identification of accidents related to the SNM and the new process, or provide justification why this is deemed not required?

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-3: The regulations in 10 CFR 70.22(i)(3)(iii) state that the Emergency Plan must include a classification scheme for classifying accidents as an Alert or a Site Area Emergency. Revise the Emergency Plan to include the adoption of a Site Area Emergency classification in accordance with the requirements of 10 CFR 70.22(i)(3)(iii), or provide justification why this is deemed not required.

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-4: The regulations in 10 CFR 70.22(i)(3)(iv) state that the Emergency Plan must include identification of the means of detecting each type of accident (associated with the SNM, per RAI #4 above) in a timely manner. Are there any means, other than the criticality monitoring systems described in the Application, Section 6.III, by which SNM

accidents may be detected in a timely manner? How will the described criticality monitoring systems be used to detect accidents and how will it be incorporated into the emergency action levels for each emergency classification? Revise the Emergency Plan to address, or provide justification why this is deemed not required.

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-5: The regulations in 10 CFR 70.22(i)(3)(vi) state that the Emergency Plan must include a brief description of the methods and equipment to assess releases of radioactive materials from the SNM. What are the methods and equipment that will be used to assess releases from either the storage or use of the SNM? Revise the Emergency Plan to address, or provide justification why this is deemed not required.

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-6: The regulations in 10 CFR 70.22(i)(3)(viii) state that the Emergency Plan must include:

- provisions to ensure notification and coordination should a lack of personnel, lack of facility access, or lack of equipment occur, and
- a commitment "to notify the U.S. Nuclear Regulatory Commission operations center immediately after notification of the appropriate offsite response organizations and not later than one hour after the licensee declares an emergency."

Revise the Emergency Plan to address these requirements with respect to the SNM, or provide justification why this is deemed not required.

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-7: The regulations in 10 CFR 70.22(i)(3)(ix) state that information to be communicated to NRC and offsite response organizations during notifications must include recommended protective actions, if necessary. Recommended protective actions are not listed as part of the information to be communicated. Revise the Emergency Plan to include Staff Requirements Memorandum, or provide justification why this is deemed not required.

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-8: The regulations in 10 CFR 70.22(i)(3)(x) state that the Emergency Plan must include a description of the plan to provide training, including frequency, performance objectives, and tours, to both on and off-site personnel. The training should familiarize personnel with site-specific emergency procedures and should thoroughly prepare site personnel for their responsibilities. Revise the Emergency Plan to reflect the training program necessary to support the addition of SNM, its storage and monitoring, the hydro-mechanical test facility and room F106, or provide justification why this is deemed not required.

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-9: The regulations in 10 CFR 70.22(i)(3)(xii) state that the Emergency Plan must include provisions for quarterly communications checks with offsite response organizations, including checks and updates of all necessary telephone numbers. Revise the Emergency Plan to include these communication requirements in support of the SNM, or provide justification why this is deemed not required.

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-10: The regulations in 10 CFR 70.22(i)(3)(xii) state that the Emergency Plan must have provisions for preventing knowledge of the exercise scenarios to most participants and for ensuring that individuals critiquing the exercise do not have direct implementation responsibility for the plan. Revise the Emergency Plan to include these exercise characteristics for the SNM, or provide justification why this is deemed not required.

For the reasons given in response to the comment above, modifications to the ERP are not required.

EP-11: The regulations in 10 CFR 70.22(i)(3)(xiii) state that the Emergency Plan must have a certification that the applicant has met its responsibilities under the Emergency Planning and Community Right-to-Know Act of 1986, Title III, Rub. L. 99-499, if applicable. Revise the Emergency Plan to include this certification, or provide justification why this is deemed not required.

The Emergency Planning and Community Right-to-Know Act of 1986, Title III, Rub. L. 99-499, is not applicable. The materials used related to this application do not appear in the list of extremely hazardous substances so the emergency planning requirements of sections 301-303 of the Act do not apply. Additionally, the amount of uranium present related to this application will be below the reportable quantity reporting requirements of sections 304 of the Act.