

## SAFETY EVALUATION REPORT

DOCKET NO: 70-398  
LICENSE NO: SNM-362  
LICENSEE: U.S. DEPARTMENT OF COMMERCE  
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY  
SUBJECT: LICENSE AMENDMENT REQUEST FOR APPOINTMENT OF  
RADIATION SAFETY OFFICER (COST ACTIVITY CODE 000222)

### BACKGROUND

National Institute of Standards and Technology (NIST) is a Federal agency within the Department of Commerce and uses licensed materials for research, development, calibration, and testing activities. Under special nuclear material (SNM) license SNM-362, NIST develops, maintains, and disseminates national standards for ionizing radiation and radioactivity to support industry, health care, and homeland security at its Gaithersburg, Maryland, site. The SNM-362 license was first issued in 1960 by the Atomic Energy Commission to the National Bureau of Standards (renamed as the U.S. Department of Commerce National Institute of Standards and Technology in 1988).

The SNM-362 license was last renewed in September 2013 (Agencywide Documents Access and Management System [ADAMS] Accession Number ML13207A206). The last amendment to the license was requested on November 14, 2016, requesting to revise the training and experience requirements for the Radiation Safety Officer position. This amendment was approved February 23, 2017 (ADAMS ML17033A307).

### REGULATORY REQUIREMENTS

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 36.15 states that commencement of construction of a new irradiator may not occur prior to submission to the U.S. Nuclear Regulatory Commission (NRC) of both an application for a license for the irradiator and the fee required by 10 CFR Section 170.31 of this chapter.

Section 36.2 of 10 CFR defines construction as the installation of foundations, or in place assembly, erection, fabrication, or testing for any structure, system, or component of a facility or activity subject to the regulations in this part that are related to radiological safety or security.

### PROPOSED CHANGES

The purpose of this amendment request for the SNM-362 license is to seek authorization for commencement of construction of a new Part 36 irradiator facility in the expansion of building 245 at the NIST Gaithersburg facility.

### DISCUSSION

Buildings 235 and 245 are the primary buildings on the NIST campus where radioactive materials are used, possessed, stored, and/or consolidated for radioactive waste shipments. Building 245 houses the majority of the radiation facilities at NIST, and include an in-pool irradiator, panoramic beam and self-contained irradiators, facilities containing primary

beta/gamma standard sources for instrument and secondary source cross calibrations, californium and other neutron source and instrument calibration facilities, radiochemistry laboratories for standard source production, charged particle accelerators, and x-ray device facilities. Building 245 also houses two 10 CFR Part 36 vertical beam irradiators. The current Part 36 irradiator facilities were installed in the early 1960's and irradiations began in 1965. The irradiators are used as a vertical beam irradiation facility, utilizing teletherapy sources. The sources are used for research and development projects, calibration of instruments, and irradiations of dosimeters and other materials. Customers include medical, commercial, federal and state government, and international facilities. NIST has an extensive record of experience with the safe use of Part 36 irradiators.

Building 245 is preparing to undergo a planned expansion to provide additional working space to carry out the NIST mission. The 5-level building addition will provide approximately 75,000 square feet of research and facility space. The addition will be connected to the B and C wings of the existing building. A Part 36 irradiator facility is proposed to be included in the addition. NIST submitted a license amendment request (LAR) (ADAMS ML17290A363), requesting authorization to commence construction for the building which will include the irradiator. Section 36.15 of 10 CFR "Commencement of Construction" requires that an application for license amendment be submitted prior to commencement of construction as defined in 10 CFR 36.2. This proposed irradiator facility will house a teletherapy-type vertical beam unit for irradiation of materials or objects similar to another Part 36 facilities already in operation under the SNM-362 license. Irradiator installation is tentatively planned for late fiscal year 2019 and is not requested at this time. Construction planning is currently at the 65 percent architectural design stage. The LAR was found to be acceptable for further review (ADAMS ML17293A071).

## FINDINGS

NUREG-1556 Volume 6 "Program-Specific Guidance About 10 CFR Part 36 Irradiator Licenses," provides detailed information required for installation of an irradiator. The general description of requirements for irradiator installation are that facilities and equipment must be adequate to protect public health and safety and to minimize danger to life or property. A diagram of the facility must be submitted for review with enough detail designating the location of required interlocks, radiation monitors, alarms and other required systems to be used at the facility. The diagram should include a general layout of the entire facility, identifying areas surrounding the irradiator room.

The LAR provided a detailed facility diagram for the Building 245 expansion. A narrative description is provided which addresses details for each level. The NIST LAR contained details on construction planning for the expansion, including pertinent building codes and floor plans. Natural phenomena considerations for wind, snow load, and seismic capacity are addressed in the LAR. The design loads for these phenomena are specified in the LAR. Applicable Codes cited in the LAR include:

- Montgomery County Building code, referencing International Building Code (IBC, 2015), referencing American society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE 7-2010);
- Building codes for Structural Concrete, American Concrete Institute (ACI 318-2014); and
- Specification for Structural Steel Buildings, March 2011, 14<sup>th</sup> Edition, American Institute of Steel Construction (AISC-LRFD).

NUREG-1556, Vol. 6, "Program-Specific Guidance About 10 CFR Part 36 Irradiator Licenses," calls for the provision of a diagram of the facility, designating the location of required interlocks,

radiation monitors, alarms, and other required systems to be used at the facility. This should include a diagram of the entire facility, including areas surrounding the irradiation facility. A vertical elevation of the entire addition was provided that gives perspective on spaces above and below the irradiation facility.

Floor plans of the building expansion, submitted with the LAR, indicate the irradiation facility will be located in the basement level of the building (labeled Room C077A), which is below ground level. The orientation for irradiator use is downward, with no occupancy below. The facility is located in the southwest corner of the building, with no occupancy exterior to the south or west. All walls and the ceiling of the irradiation facility have been evaluated for required shielding, described below. The north and east sides of the irradiation facility possess buffers to the interior of the general Building 245 addition where general building occupants may reside. The irradiation facility is labeled C077A on the diagram provided. On the north wall of the irradiation facility is the control room for operating the irradiator, with limited occupancy, labeled C077 on the diagram. On the east wall of the irradiation facility is the maze passageway from the control room, with limited occupancy, also labeled C077. The irradiation facility, control room, and maze comprise the irradiation facility proper. Access to the irradiation facility is via the control room and maze. Outside the north wall of the control room is corridor C001C3 and east of the maze passageway is the industrial radiology vault, labeled C075A. On the first level, above the irradiation facility are three limited occupancy spaces; Source Receiving (C175), Temporary Holding Vault (C175C), and Recycling (C179). Shielding considerations for all spaces are addressed below.

Detailed plans on the radiation monitors, alarms, and other systems were not a part of the drawings provided in the LAR. These are not required to begin construction. NIST has extensive, qualified experience with the use of Part 36 irradiators and possesses two facilities in other parts of Building 245. A separate amendment will need to be submitted to acquire and install an irradiator. At that time, specifications for interlocks, alarms, and monitors will be required. A shielding evaluation for the specific irradiator to be installed will need to be submitted for review and approval at that time. Hensel-Phelps Construction is the prime contractor for planning and construction of the Building 245 addition. Advanced Technologies and Laboratories, Inc. was hired as a subcontractor to provide an analysis of shielding requirements. This analysis was provided with the LAR and addresses shielding requirements with the following assumptions:

- 15,000 Curie (Ci) Cobalt-60 ( $^{60}\text{Co}$ ) teletherapy-type irradiator. This approximates the maximum radioactivity of irradiators already in use at NIST. No credit is taken for radioactive decay. A dose rate of 198 Gray per hour at 1 cm from the side of the irradiator is assumed. This dose rate estimate was evaluated by staff and considered appropriate for an irradiator with this radioactivity.
- 15 hours usage per week.
- All adjacent areas, except for the Control Room and the maze passageway are treated as public areas (uncontrolled), and all walls and ceiling evaluated. The Control Room and maze are treated as controlled areas.
- The radiation dose rate goal for uncontrolled areas is 0.05 millirem per hour (mRem/hr) and 2 mRem per week. Controlled areas dose rate goal is 1 mRem/hr and 40 mRem per week.
- The use of a 3 foot by 3 foot water tank in the beam of the irradiator. This device is used by NIST for some dosimetry work and provides the maximum amount of radiation scatter to be encountered using the irradiator.

- Reference Source: National Council on Radiation Protection, Report Number 49, “Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma Rays of Energies up to 10 MeV,” NCRP, 1976.

Concrete shielding for walls and lead shielding for the maze door were recommended. Thicknesses of concrete for walls and ceiling ranged from 11 inches for the south wall to 3 feet for the north wall. The ceiling thickness required to achieve the uncontrolled area radiation levels 2 feet, 7 inches. The thickness of lead required for the maze door was 84 millimeters of lead. The maze door is on the south end of the irradiation facility proper. Lead shielding makes opening and closing the door a more manageable and practical recommendation. The shielding analysis has been reviewed by NIST staff and has been approved for incorporation into the floor plans. Shielding recommendations have been incorporated into the floor diagram submitted as a part of the LAR. The shielding analysis was reviewed by technical staff and found to be acceptable. Any request for future irradiator installation will require additional evaluation to ensure consideration of adjacent room usage and occupancy, as well as irradiator specifications.

An applicant should provide a schedule for construction activities associated with the irradiator. This will allow the NRC to inspect and ensure construction activities meet design requirements described in NRC Manual Chapter 2815, entitled “Construction and Preoperational Inspection of Panoramic, Wet-Source-Storage Gamma Irradiators” and Appendix P to this Volume, “Interim Staff Guidance on Construction.” Construction design and acceptance is a multi-stage process, allowing NIST management to review, comment, and approve on design plans prior to finalization. A proposed schedule of design and construction activity was enclosed as part of the LAR. The schedule allows for NIST review, incorporation of change, and approval of design prior to execution. The concept design stage, or 35 percent plan was received by NIST in April 2017 and approved in July 2017. The design development stage, or 65 percent plan was submitted to NIST in October 2017 and was submitted with this LAR. The final corrected and approved final design for the entire construction of the Building 245 expansion is due March 2018. This does not preclude proceeding with approved plans for construction. There are some construction activities that have begun that are unrelated to the irradiation facility. These include clearing land for construction laydown areas and heavy equipment and materials delivery. Foundations had been scheduled to begin in November 2017. These are delayed until December 2017 pending planning delays and the approval of this amendment.

## ENVIRONMENTAL REVIEW

NIST uses its license for research and development purposes. Pursuant to 10 CFR Paragraph 51.22(c)(14)(v), renewal of materials licenses issued under 10 CFR Parts 30 or 70 (among others) for research and development and for educational purposes is a category of actions which the NRC has determined does not individually or cumulatively have a significant effect on the human environment and thus, no environmental assessment or environmental impact is required, provided that:

- (i) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.
- (ii) There is no significant increase in individual or cumulative occupational radiation exposure.
- (iii) There is no significant construction impact.
- (iv) There is no significant increase in the potential for or consequences from radiological accidents.

This request does not involve any nuclear materials, so there are no significant hazards considerations. This amendment has limited construction impact, being an addition to an existing building. Because NIST requests an authorization to commence construction, there are no effluents or offsite releases or significant increase in radiation exposure to workers or members of the public associated with this request. Therefore, pursuant to 10 CFR 51.22(c)(14)(v), no environmental impact statement or environmental assessment need be prepared in connection with the approval of this LAR. For the reasons described above, NIST's request meets the criteria for a 10 CFR 51.22(c)(14)(v) categorical exclusion.

#### CONCLUSION

The NRC staff reviewed the licensee's amendment request as submitted on October 7, 2017. The NRC staff concludes that the information and regulatory commitments provided by NIST in their license application provide reasonable assurance of adequate safety for the proposed expansion and that this construction will not have an adverse impact on the public health and safety, the common defense and security, or the environment; and meet the applicable requirements in 10 CFR Parts 19, 20, 36, 51, 70, 73, and 74.

#### RECOMMENDATION

The NRC staff recommends that the amendment request for construction be approved. This license amendment does not authorize the installation of an irradiator without subsequent LAR.

#### PRINCIPAL CONTRIBUTOR

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