

**From:** [Wardrobe, Leonardo](#)  
**To:** [Naquin, Tyrone](#)  
**Cc:** [Ulrich, Elizabeth](#); [Gordon, Craig](#)  
**Subject:** RE: For Comment  
**Date:** Wednesday, November 01, 2017 11:09:50 AM

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Ty,

I have reviewed the SE for NIST's amendment request for construction only of a new irradiator facility. I concur with the evaluation and have no comments at this time.

I do have some comments of things that we may need to review later prior to issuing an amendment to install the irradiator:

1. Do the shielding calculations include dose buildup factors in the calculations?
2. The amendment request for construction has shielding calculations for 1 irradiator. The construction drawings indicate space for 2 irradiators. If NIST is planning for future use of a second installation of an irradiator in that space, is the shielding calculations adequate for running 2 self-shielded irradiators in that room?
3. What is the reasoning for performing the shielding calculations for the ceiling and south wall from the location of irradiator #1 on the drawing and shielding calculations for the other walls from irradiator #2? If the licensee is only going to install 1 irradiator, shouldn't all the calculations be from the same positions?

Thanks and call me if you have any questions.

*Leo Wardrobe  
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**From:** Naquin, Tyrone  
**Sent:** Wednesday, October 25, 2017 10:26 AM  
**To:** Wardrobe, Leonardo <Leonardo.Wardrobe@nrc.gov>  
**Subject:** FW: For Comment

Leo,

The pertinent ML's are embedded in the write-up. This is an amendment for construction only. By the time NIST alerted us to the fact they were going to add an irradiator facility, the laydown area was already established and other issues were ensuing. So, my intention

was to get an amendment out for construction such that Region I can inspect and review as construction progresses.

They don't intend to install an irradiator until late FY19 at best, so this is for construction only. Should be straightforward. Let me know if you need anything else.

Ty

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**From:** Ullrich, Elizabeth

**Sent:** Wednesday, October 25, 2017 10:12 AM

**To:** Naquin, Tyrone <[Tyrone.Naquin@nrc.gov](mailto:Tyrone.Naquin@nrc.gov)>

**Cc:** Wardrobe, Leonardo <[Leonardo.Wardrobe@nrc.gov](mailto:Leonardo.Wardrobe@nrc.gov)>; Gordon, Craig <[Craig.Gordon@nrc.gov](mailto:Craig.Gordon@nrc.gov)>

**Subject:** RE: For Comment

Ty,

Leo Wardrobe from our branch will review the SE, but thinks that November 1 is a more reasonable date given the current workload. Can you please send him that accession number for the incoming information as well? Leo will be a continuing contact for this action, and will coordinate any inspection etc that we may need to do there during construction.

Thanks,  
Betsy

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**From:** Naquin, Tyrone

**Sent:** Wednesday, October 25, 2017 9:47 AM

**To:** Ullrich, Elizabeth <[Elizabeth.Ullrich@nrc.gov](mailto:Elizabeth.Ullrich@nrc.gov)>

**Subject:** For Comment

I am processing an amendment request from NIST to begin construction for the B245 addition, in prep for a Part 36 irradiator. This is the SE I've written up and I am sending this for your comment or input. This is for construction only to give you leverage in your inspection processes. Please give me your feedback on this by COB Friday. If Friday is too soon, please let me know when you can do this. I'd like to get this off to them as soon as possible.

#### REGULATORY REQUIREMENTS

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 36.15 states that commencement of construction of a new irradiator may not occur prior to submission to the NRC of both an application

for a license for the irradiator and the fee required by § 170.31 of this chapter.

10 CFR 36.2 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 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 a long 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 LAR (ADAMS ML17290A363), requesting authorization to commence construction for the building which will include the irradiator. 10 CFR 36.15 "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 FY19 and is not requested at this time. Construction planning is currently at the 35% 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 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. They are not essential at this time to the request to begin construction on the building. 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. Hensel-Phelps Construction is the prime contractor for planning and construction of the building 245 addition. Advanced Technologies and Laboratories, Inc. (ATL) 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.

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% plan was received by NIST in April 2017 and approved in July 2017. The design development stage, or 65% 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 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 amendment does not alter NIST commitments states that gaseous and liquid effluents, if any, will be within 10 CFR Part 20 limits and will be subject to appropriate effluent monitoring and controls. For example, any laboratory operations determined to have significant potential for exceeding 10% of the 10 CFR 20, Appendix B, Table 2, release limitations shall be monitored on an as needed basis, and liquid effluents collected in holding tanks will be sampled to assure compliance with 10 CFR Part 20, Appendix B, limits prior to any release to the sanitary sewer. Accordingly, the NIST license renewal falls within a category of actions that does not require the preparation of an EA.

### 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 of the proposed operations and 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

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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 license amendment request.

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