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Safety Evaluation Report for the  
Special Nuclear Material License Application  
Johns Hopkins University Applied Physics Laboratory  
Laurel, Maryland

Docket Number 70-7028

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Division of Fuel Cycle Safety, Safeguards, and Environmental Review  
Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001



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## **I. INTRODUCTION**

On December 23, 2016, the Johns Hopkins University Applied Physics Laboratory (JHU/APL or applicant) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) requesting a Special Nuclear Material (SNM) License (Agencywide Documents Access and Management System [ADAMS] Accession Number ML17013A241). The applicant's request was made pursuant to the requirements in Title 10 of the Code of Federal Regulations (10 CFR), Part 70, "Domestic Licensing of Special Nuclear Material." The applicant requests an NRC license for possession and use of SNM in quantities greater than critical mass as defined in 10 CFR 70.4, for analytical or scientific research and development as described in the license application (LA). The applicant also requested an exemption from criticality monitoring as required by 10 CFR 70.24. The NRC accepted JHU/APL's application on March 2, 2017 (ADAMS Accession Number ML17058A414). The applicant responded to NRC's Request for Additional Information (RAI) in a letter dated October 31, 2017 (ADAMS Accession Number ML17328A509). In accordance with 10 CFR Part 70, the term of JHU/APL's license, if granted, would be 10 years.

## **II. SCOPE OF REVIEW**

The NRC staff conducted its safety and safeguards review in accordance with 10 CFR as follows:

- Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations;"
- Part 20, "Standards for Protection Against Radiation;"
- Part 21, "Reporting of Defects and Noncompliance;"
- Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions;"
- Part 70, "Domestic Licensing of Special Nuclear Material;"
- Part 73, "Physical Protection of Plants and Materials;" and
- Part 74, "Material Control and Accounting of Special Nuclear Material."

The NRC staff used the guidance documents listed in Section V, References, herein to conduct its safety review.

The NRC staff participated in three site visits and focused discussions on material control and accounting (MC&A) on April 4, 2017, physical security on May 16, 2017, and radiation protection (RP) and criticality safety on June 27, 2017. The NRC staff participated in a teleconference with JHU/APL on February 9, 2018, following submittal of a response to a RAI.

The applicant has a Maryland Radioactive Materials License Number MD 27-014-02 for source and byproduct materials. Activities associated with the Agreement State License are independent of the SNM license requested by JHU/APL and are not discussed in this Safety Evaluation Report (SER). The JHU/APL's Maryland license was reviewed by NRC staff to determine if it included quantities of SNM that would impact the review of this application. The materials regulated by the Agreement State License may be used at approved remote locations in accordance with reciprocity agreements. All of the materials regulated by the SNM license will be limited to the JHU/APL site only.

A Notice of Opportunity to Request a Hearing on the LA was published in the *Federal Register* on December 15, 2017 (82 FR 59660). No requests for a hearing were received.

This SER documents NRC's review and findings with regard to JHU/APL's 10 CFR Part 70 LA.

## **1.0 GENERAL INFORMATION**

The applicant is a University Affiliated Research Center with a number of U.S. Government sponsors and conducts a research program for the development of prototypes that may be transitioned to industry. The material requested by the LA will be used to support testing of nuclear detection technologies.

The applicant is requesting approval to use the SNM listed in the table below for its research and development programs. The quantity of SNM is greater than a critical mass as defined in 10 CFR 70.4, and the quantity of SNM is within the limits of SNM of low-strategic significance as defined in 10 CFR 73.2.

MATERIAL	FORM	MAXIMUM QUANTITY	AUTHORIZED USE(S)
Uranium enriched up to 93 percent U-235	solid or metal oxide in sealed sources	[REDACTED]	Research and development programs at JHU/APL
Plutonium	solid or metal oxide sealed sources	[REDACTED]	Research and development programs at JHU/APL
Uranium-238	solid metal in sealed sources	[REDACTED]	Research and development programs at JHU/APL

The applicant will handle and store these materials at JHU/APL's facility located in Laurel, Maryland.

The cumulative materials authorized by both licenses may be co-located at JHU/APL's facility in Laurel, Maryland. All material described in the LA will be handled, transported, used, and stored in accordance with the testing program described in the SNM license under consideration.

The LA described the characteristics and composition of the SNM to be used in the testing program. It also included drawings illustrating containers, the facility location and floor plan where the proposed activities would take place, and where the material would be stored.

The information that must be included in a 10 CFR Part 70 LA is set forth in 10 CFR 70.22.

After review, the NRC staff determined that JHU/APL's LA contained the information required by 10 CFR 70.22. Using the information provided in the LA, NRC staff conducted a detailed technical evaluation and documented its findings in this SER.

## **2.0 STAFF QUALIFICATIONS**

### **2.1 Regulatory Requirements**

The regulatory basis for the review of JHU/APL's staff qualifications is contained in 10 CFR Paragraph 70.23(a)(2), which requires the applicant to be qualified by reason of training and experience to use the SNM.

## **2.2 Staff Review and Analysis**

The Radiation Safety Officer (RSO) manages the Radiation Protection (RP) Program at JHU/APL and is also part of the Ionizing Radiation Safety Subcommittee (IRSS). The LA describes the responsibilities and qualifications of the individuals in these positions, including their educational background and professional experience. In addition to the RSO, activities involving the material under this license will be performed by Authorized Users (AUs).

The RSO is responsible for the oversight of radioactive materials, package receipt surveys and delivery, shipping activities, personnel dosimetry and training, maintenance of radiation monitoring and survey equipment, closeout surveys, and records management. The RSO has expertise in the principles and practices of the control of hazards from the use of radioisotopes and radiation detection equipment. The RSO will administer the SNM license and is responsible for licensing and regulatory compliance, including compliance with State and NRC licenses.

The applicant provided a description of the RP program used at the facility, including personnel monitoring and training practices, procedures for leak-testing sources, procedures for maintaining doses as low as is reasonably achievable (ALARA), and waste disposal. The LA also discussed the roles and responsibilities of the different individuals implementing the RP program.

## **2.3 Evaluation Findings**

After reviewing the LA, the NRC staff concluded that those individuals with access to the SNM at JHU/APL are trained and experienced in using the SNM. This conclusion is based on the description of the RSO's qualifications, roles and responsibilities, and the description of JHU/APL's RP program and procedures. In accordance with 10 CFR 70.23(a)(2), the NRC staff concludes that the information provided by JHU/APL adequately demonstrates that JHU/APL is qualified to use the material for the purpose requested and is therefore acceptable.

## **3.0 INTEGRATED SAFETY ANALYSIS**

The NRC staff reviewed the LA to determine whether JHU/APL was required to provide Integrated Safety Analysis (ISA) Summary information, pursuant to the provisions in 10 CFR Part 70, Subpart H, "Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass of Special Nuclear Material." The proposed activities for which the SNM would be used do not meet the criteria in 10 CFR 70.60. The applicant will be authorized to possess SNM in an amount greater than critical mass but an ISA Summary is not necessary under 10 CFR 70.60 because JHU/APL will not be engaged in enriched uranium processing, fabrication of uranium fuel or fuel assemblies, uranium enrichment, enriched uranium hexafluoride conversion, plutonium processing, fabrication of mixed-oxide fuel or fuel assemblies, scrap recovery of SNM or any other activity that the Commission determines could significantly affect public health and safety. The NRC staff determined that JHU/APL's proposed activity is not one of the listed activities requiring an ISA summary. Therefore, 10 CFR Part 70, Subpart H, is not applicable to the LA. As a result, the NRC staff concludes that JHU/APL is not required to submit an ISA Summary in support of its LA.

## **4.0 RADIATION PROTECTION**

### **4.1 Purpose of Review**

The NRC staff conducted this review to determine whether the RP Program described in the JHU/APL LA is adequate to protect the health and safety of staff and protect public health and safety and the environment, and to comply with the associated regulatory requirements in 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations;" 10 CFR Part 20, "Standards for Protection Against Radiation;" and 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material." Specifically, 10 CFR 70.23(a)(3) and (4), require, prior to the approval of an application, a determination that the proposed equipment and facilities are adequate to protect health and minimize danger to life or property; and that the applicant's proposed procedures to protect health and to minimize danger to life or property are adequate.

### **4.2 Staff Review and Analysis**

The NRC staff used the acceptance criteria in Chapter 4 of NUREG-1520 "Standard Review Plan for Fuel Cycle Facilities and License Applications,"(NRC, 2015) for this review, as well as NUREG-1556 "Program Specific Guidance About Special Nuclear Material of Less Than Critical Mass," Vol. 17 (NRC, 2018). NUREG-1556, Volume 17 states on page 1-1, "Purpose of Report" that it is not applicable for applications for a license to possess greater than a critical mass. It is, however, appropriate for most sealed source licenses. Because the quantity of SNM requested, when considered cumulatively with the SNM authorized under Maryland license MD-27-014-02, is greater than a critical mass as defined in 10 CFR 70.4, NUREG-1520 was used as the primary guidance document for this review. The information to support this review was obtained from the LA submitted on December 23, 2016 and additional information submitted on October 31, 2017.

#### **4.2.1 Commitment to Radiation Protection Program Implementation**

In accordance with 10 CFR 20.1101(a), each licensee must develop, implement, and document a RP Program commensurate with the scope and extent of licensed activities. An applicant demonstrates compliance with this by ensuring that the requirements of 10 CFR Part 20 are addressed in regards to the applicant's requested materials or procedures. An application should sufficiently describe an adequately staffed and trained organization, appropriate procedures and approval authority, and necessary equipment and documentation to ensure protection of health and the environment relative to the material or process requested. The discussion below identifies each acceptance criterion from NUREG-1520, Section 4.4.1.3 and summarizes the staff's evaluation as to whether the information provided by the applicant meets the criterion.

- (1) A documented management commitment to keep exposures As Low As Reasonably Achievable (ALARA);

Senior management has established the RP Program for JHU/APL via the Assistant Director of Operations (ADO), who also chairs the facility Safety Committee. The applicant has established a subcommittee, the IRSS, for providing oversight to activities involving radioactive materials and radiation exposure. Senior management grants authority to the RSO to implement the RP Program. Additionally, as discussed in more detail below, JHU/APL commits to conduct radiological surveys and assessments to maintain all doses from potential exposure to licensed material ALARA.

Additionally, as discussed in more detail in Section 4.2.2 below, JHU/APL commits to conduct radiological surveys and assessments to maintain all doses from potential exposure to licensed material ALARA.

- (2) A trained and qualified radiation protection organization with independence from the facility's operations, well-defined responsibilities, and sufficient authority to carry out those responsibilities;

Section 7.1 of the application identifies the lines of responsibility and authority for the RSO. An organizational diagram is provided that shows the RSO works for the ADO, who is the Safety Committee Chair. The IRSS is a multidisciplinary team providing oversight involving radioactive materials and annually reviews the RP Program to evaluate adequacy and effectiveness. The RSO is a member of the IRSS. Through a delegation of authority memorandum from the Safety Committee Chairman, the RSO has been granted stop work authority whenever health and safety may be compromised, or where an action may result in a regulatory non-compliance.

Additionally, as discussed in more detail in Section 4.2.5 below, Section 7.2 of the application describes the qualifications and training of the RSO and authorized users of the material possessed under this license.

- (3) Adequate facilities, equipment, and procedures to effectively implement the program;

The application adequately describes the facility, materials requested, equipment, and procedures pertinent to the RP Program in support of the material requested. Section 5.2 of the application states the material requested is being used in conjunction with a State of Maryland Agreement State License (MD-27-014-02). A copy of that license was provided with the application and provides additional assurance of adequate procedures and controls for use of the material requested.

- (4) The review, at least annually, of the RP Program's content and implementation, as required by 10 CFR 20.1101(c). The review should consider facility changes, new technologies, and other process enhancements that could improve the effectiveness of the overall program.

Section 10.1 of the application states the IRSS provides oversight and support to the RP Program. In that capacity the committee annually reviews various ionizing radiation programs, including the State of Maryland Broad Scope License, a State of Maryland Irradiator License, and a review of radiation producing machines. The application commits to including the SNM license as a part of the annual review. Section 7.1 of the application states a report of the annual audit is provided to the ADO, who is a member of senior management, and the Safety Committee Chair.

As indicated above, 10 CFR 20.1101(a) requires an applicant to have a program commensurate with the scope of activities requested. Based on the staff's evaluation of the application commitments pertaining to the acceptance criteria in NUREG-1520, Section 4.4.1.3, the staff finds that the RP Program provides assurance that the JHU/APL will satisfy the requirements in 10 CFR 20.1101(a). The application describes a RP Program appropriate for possession, handling, and procedures for use of materials described. The application describes an adequate organizational structure, providing appropriate management oversight of materials, ensuring the radiation safety organization is adequately trained and staffed, with sufficient

independence to safely carry out work, and is annually reviewed by key management personnel as required by 10 CFR 20.1101(c). Therefore, the NRC staff finds that the RP Program is acceptable.

#### 4.2.2 Commitment to As Low As Reasonably Achievable Program

In accordance with 10 CFR 20.1101(b), a licensee must use, to the extent practical, procedures and engineering controls to achieve occupational doses and doses to the members of the public that are ALARA. The staff reviewed the applicant's ALARA program commitments against the acceptance criteria in NUREG-1520, Section 4.4.2.3. The following discussion identifies each acceptance criterion from NUREG-1520 and provides the staff's evaluation as to whether the information provided by the applicant meets the criterion:

- (1) Establish a written, comprehensive, and effective ALARA program;

Section 7.1 of the application identifies the management commitment established by senior management, as well as the responsibilities of the IRSS, the RSO, project supervisors, and individuals. Training, dose limits, the authorization process, documentation, and programmatic review are specified. The senior management official with responsibility for the RP Program, the ADO and the Safety Committee Chair, has signed the delegation of authority memorandum granting authority to the RSO to stop work whenever health and safety may be compromised, or where an action may result in regulatory non-compliance.

- (2) Prepare policies and procedures to ensure occupational exposures are maintained ALARA, and that such exposures are consistent with the requirements of 10 CFR 20.1101;

Section 10.4 of the application states the JHU/APL policy to monitor all individuals working with radiation sources who are likely to exceed 10 percent of the allowable annual limit described in 10 CFR 20.1201. Additionally, public dose is monitored and documented to ensure that all doses are ALARA. Monitoring of other individuals for particular environments is at the discretion of the RSO, who oversees the dosimetry program. The applicant commits to conducting radiation surveys to verify radiation levels in Section 10.8 of the application. The radiation surveys and radiological assessments that will be conducted as needed are described in Section 10.2 of the application. All organizational components shall keep radiation exposures to employees and to the general public ALARA.

- (3) Outline specific ALARA program goals, establish an ALARA program organization and structure, and have written procedures for its implementation in the facility design and operations;

Section 7.1 of the application addresses the ALARA program in general and the management position on limiting exposure of staff and public through a strong RP Program. The applicant requires personnel monitoring devices for all individuals working with radiation sources if the individual is likely to exceed 10 percent of the occupational exposure limits of 10 CFR Part 20. However, personnel monitoring is at the discretion of the RSO and staff may be monitored for documentation to rule out exposure. Written procedures and instructions are in place to foster ALARA within the research facility. Section 7.1 of the application states that the IRSS meets quarterly and the program is audited annually.

- (4) Establish an ALARA Committee, or equivalent organization, with sufficient staff, resources, and clear responsibilities to ensure that the occupational radiation exposure dose limits specified in 10 CFR Part 20 are not exceeded under normal operations;

The IRSS is a group appointed by the Safety Committee and includes a multi-disciplinary group of staff involved in research activities of JHU/APL. The IRSS is responsible for oversight of the uses of radioactive materials and the implementation of the RP Program. The IRSS meets on a quarterly basis. The IRSS is responsible for conducting the annual review of the RP Program. The results of this audit are reviewed by the committee, formalized, and forwarded to the Safety Committee for review by senior management. The applicant's senior management has granted the RSO the authority to implement JHU/APL's RP Program. A delegation of authority memorandum, executed on January 27, 2010 by the Safety Committee Chairman, grants the RSO stop work authority over any operation where health and safety may be compromised or may result in regulatory non-compliance. Overhead funding and administrative support is provided to ensure the organizational elements of this structure maintain freedom from the cost and the schedule burden of directly funded programs.

- (5) Use the ALARA program as a mechanism to facilitate interaction between RP and operations personnel;

Section 7.2 of the application describes the role of AUs, their access to radioactive material at JHU/APL, and oversight of the AU list. Authorized Users have primary responsibility to ensure that licensed materials are used safely and according to regulatory requirements. Training of AUs is consistent with the guidance of NUREG-1556, Vol. 17, Section 8.72. All AUs have at least one year of experience working with radioactive materials under the Agreement State License and the additional security requirements associated with working with SNM. The approved list of AUs was provided in Appendix B of the application.

- (6) Regularly review and revise, when appropriate, the ALARA program goals and objectives and to incorporate, when appropriate, new approaches, technologies, operating procedures or changes that could reduce potential radiation exposures at a reasonable cost.

Section 7.1 of the application states the IRSS will meet on a quarterly basis. The response to RAI 16 provides additional detail on the review of new processes. The Program Manager that proposes new work or technology must develop a comprehensive risk management strategy that documents the methodology for mitigating the risks. The risk management strategy is then independently reviewed by the APL Environment Health and Safety Group which requires review and approval by both the JHU/APL RSO and the IRSS chair. In addition, Section 7.1 of the application identifies a JHU/APL policy commitment that all organizational components shall keep radiation exposures to employees and to the general public ALARA. Based on the staff's evaluation of the application commitments pertaining to the acceptance criteria in NUREG-1520, Section 4.4.2.3, the staff finds that the RP Program provides assurance that the JHU/APL will satisfy the requirements in 10 CFR 20.1101(b). Use of specifically licensed radioactive material at JHU/APL is regulated by the IRSS using radiation protection procedures under the license. The JHU/APL commits to ensuring that the release of radioactive material and the exposure of people to ionizing radiation be kept ALARA.

Based on the staff's evaluation of the application commitments pertaining to the acceptance criteria in NUREG-1520, Section 4.4.2.3, the staff finds the RP Program provides reasonable assurance that the JHU/APL will satisfy the requirements of 10 CFR 20.1101(b).

Use of specifically licensed radioactive material at JHU/APL is regulated by the IRSS using radiation protection procedures under the license. The JHU/APL commits to ensuring that the release of radioactive material and the exposure of people to ionizing radiation be kept ALARA. The staff finds that the commitment to an effective ALARA program is acceptable because the procedures are based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA, as required by 10 CFR 20.1101(b).

#### 4.2.3 Organization and Personnel Qualifications

In accordance with 10 CFR 70.22(a)(6), each application for a license must contain the technical qualification, including training and experience of the applicant and members of his staff to engage in the proposed activities in accordance with the regulations of 10 CFR Part 70.

The staff reviewed the applicant's organization and personnel qualifications against the acceptance criteria in NUREG-1520, Section 4.4.3.3. The following discussion identifies each acceptance criterion from NUREG-1520 and summarizes the staff's evaluation as to whether the information provided by the applicant meets the criterion:

- (1) Appoint radiation protection personnel and identify their authority and responsibilities for implementing the radiation protection program functions;

Section 7.1 of the application identifies the duties of the RSO for this and the Agreement State License, in the response to the RAI, identifies two RP staff who support the program. The RSO is identified by name and a synopsis of his qualifications and experience are provided. This individual has been the RSO for APL since 2006 and is also named as the RSO on the Agreement State Licenses. A brief summary of his primary responsibilities pertinent to radioactive material is provided. The RSO is a member of the IRSS and is also a designated AU. In consideration of the limited staff, the description of the RSO's duties and qualifications, along with the description of the duties of the Program Manager is acceptable.

- (2) Establish clear organizational relationships among the individual positions responsible for the RP Program and other line managers;

Section 7.1 of the application outlines organizational relationships and authority for the RP Program. This section also identifies where the RSO is aligned in the organizational structure and for whom he works. An organizational chart was provided to illustrate the lines of accountability and responsibility. The primary responsibility for safety rests with the AU, who is also responsible to ensure that procedures and engineering controls are used to keep occupational doses and doses to members of the public ALARA.

- (3) Appoint a suitably educated, experienced, and trained RP Program director (typically referred to as the radiation safety officer) who (1) has direct access to the plant manager, (2) is skilled in the interpretation of data and regulations pertinent to RP, (3) is familiar with the operation of the facility and RP concerns of the site, (4) participates as a resource in radiation safety management decisions, and (5) will be responsible for establishing and implementing the RP Program;

As noted above, Section 7.1 of the application identifies the RSO by name and gives a synopsis of his qualifications and experience. This individual has been the RSO for APL since 2006 and is named as the RSO on the Agreement State License. Section 7.1 of the application provides a brief summary of his primary responsibilities pertinent to radioactive material which include

implementation of the RP. The RSO is a member of the IRSS and is also a designated AU. The RSO is also a board-certified health physicist since 2004. Certification by the American Board of Health Physics in the comprehensive practice of health physics is recognized as fulfillment of these qualifications.

- (4) Describe the minimum training requirements and qualifications for the RP staff. Section 7.2 of the application describes the education, experience, certifications, and training of the RP staff. All have at least 1 year experience working with radioactive materials under the existing broad scope license, although most have 5 to 10 years of relevant experience. All have advanced degrees and extensive training.

Based on the staff's evaluation of the application commitments pertaining to the acceptance criteria in Section 4.4.3.3 of NUREG-1520, the staff finds the commitments provide reasonable assurance that during the license term the radiation safety organization will adequately protect health and minimize danger to life and property in accordance with 10 CFR 70.23(a)(4), and that RP staff will be qualified by reason of training and experience to use the licensed material for the purpose requested in accordance with 10 CFR 70.23(a)(2). Therefore, the NRC staff finds that the organization and personnel qualifications are acceptable.

#### 4.2.4 Commitment to Written Procedures

In accordance with 10 CFR 70.22(a)(8), each application for a license must contain proposed procedures to protect health and minimize danger to life or property (such as procedures to avoid accidental criticality, procedures for personnel monitoring and waste disposal, post-criticality accident emergency procedures). The staff reviewed the applicant's written procedure commitments against the acceptance criteria in NUREG-1520, Section 4.4.4.3. The following discussion identifies each acceptance criterion from NUREG-1520 and summarizes the staff's evaluation as to whether the information provided by the applicant meets the criterion:

- (1) Prepare written, approved procedures to carry out activities related to the RP Program. Procedures should address applicable RP requirements found in 10 CFR Parts 19, 20, 70, and 71 and any other applicable regulations;

The applicant currently holds a licensee with the State of Maryland, an Agreement State, with its last license renewal being completed in April 2011. The radiation safety organization has committed to the use of procedures for the conduct of RP in accordance with NUREG-1556, Volume 17. That guidance is cited throughout the application and has been in place for use of SNM authorized under JHU/APL's current license with the State of Maryland. More specifically, Section 7.1 of the application, including the addendum provided by the response to the RAI 17, states that the use or storage of materials under the SNM license shall be accomplished by written procedures under JHU/APL's risk management process. These written procedures are required for the use of materials and procedures may only be revised if approved by the RSO, and the IRSS. There is no source material requested under this application. Therefore, compliance with 10 CFR Part 40 is not applicable.

- (2) Establish a process for procedure generation or modification, authorization, distribution, and training, such that changes in technology or practices are communicated effectively and in a timely manner. Review and revise procedures, as necessary, to incorporate any facility or operational changes, including changes in the ISA. The RSO, or an individual who has the qualifications of the RSO, should approve all procedures related to RP;

Processes and procedures used at JHU/APL are of a limited nature and developed as needed as contractual opportunity arises. As JHU/APL considers potential research, an AU is assigned to develop a protocol for review by the IRSS. Authorized Users are generally research staff, assigned to JHU/APL, authorized by the IRSS, and trained in accordance with NUREG-1556, Volume 17. These AUs are also authorized under the State of Maryland to act in this capacity. Authorized Users have advanced scientific degrees and extensive knowledge and training, and will develop procedures, which are reviewed and approved by the IRSS Chairman and the RSO in writing prior to implementation.

- (3) Specify written, approved radiation work permits (RWPs) for activities involving licensed material that are not covered by written radiation protection procedures. Radiation work permits should define the authorized activities, the level of approval required (a radiation specialist, as a minimum), information requirements, period of validity, expiration and termination times, and recordkeeping requirement.

The applicant develops procedures, which are reviewed and approved by the IRSS prior to implementation. The response to RAI 16 provides additional detail regarding the development, review, approval, and implementation of work instructions. The content of procedures used by JHU/APL are reviewed by the appropriate radiation safety authority, as well as supervision and management via the IRSS. Changes to operating and quality procedures are incorporated into the written procedures. Therefore, the staff finds that the written procedures are acceptable.

#### 4.2.5 Radiation Safety Training

In accordance with 10 CFR 70.22(a)(6), each application for a license must contain the technical qualifications, including training and experience of the applicant and members of his staff to engage in the proposed activities in accordance with the regulations in 10 CFR Part 70. More specifically, 10 CFR 19.12(a) specifies training requirements for all individuals who in the course of employment are likely to receive in a year an occupational dose in excess of 100 millirem (1 mSv). The staff reviewed the applicant's training commitments against the acceptance criteria in NUREG-1520, Section 4.4.5.3. The following discussion identifies each acceptance criterion from NUREG-1520 and provides the staff's evaluation as to whether the information provided by the applicant meets the criterion:

- (1) Design and implement an employee RP training program that complies with the requirements of 10 CFR Parts 19 and 20;

In Section 7.2 of the application, JHU/APL describes the generic training requirements for those individuals who are assigned duties that involve exposure to radiation and/or radioactive materials, and who may, in the course of a year receive an occupational dose of radiation greater than 100 millirem (1 mSv). General employee training conforms to 10 CFR 19.12.

- (2) Provide training to all personnel and visitors entering restricted areas that is commensurate with the health risk to which they may be exposed, or provide trained escorts;

In the response to RAI 18, regarding the training and escort requirements for visitors or administrative staff, JHU/APL stated that only Controlled Access Area (CAA) trained staff are allowed access to the licensed material. If an untrained individual (visitor or an APL staff member that is not CAA trained) requires access to the CAA or material storage area, two CAA trained staff members are required to keep a line-of-sight escort on the untrained individual(s).

- (3) Provide a level of training based on the potential radiological health risks associated with that employee's work responsibilities;

Section 7.2 of the application states that AUs will be permitted to work with all materials requested to be possessed under the LA and will be approved by the IRSS. A review of AU training is conducted as a part of the annual audit to ensure staff are current on relevant training. An initial list of approved and qualified AUs is furnished on page 27 of the application. The applicant commits to submitting license amendments to add AUs to the list of approved users. Special training is required for staff whose responsibilities involve the shipping and receiving of radioactive material. Controlled Access Area training is also provided for staff involved with the security and handling responsibilities of SNM.

- (4) Conduct refresher training, at least every 3 years that will accurately address changes in policies, procedures, requirements, and the facility ISA;

Employee training is described in Section 7.2 of the application. Annual refresher training is offered on general employee radiation training; job-specific training related to shipping and receiving packages containing radioactive material and quality assurance; and CAA training.

- (5) Incorporate into the RP training program, the provisions of 10 CFR 19.12 and additional relevant topics such as: correct handling of radioactive materials; the storage, transfer, or use of radioactive material as relevant to the individual's activities; minimization of exposures to radiation and/or radioactive materials; access and egress controls and escort procedures; radiation safety principles, policies, and procedures; monitoring for internal and external exposures; radiation exposure reports available to workers; monitoring instruments; contamination control procedures, including protective clothing and equipment; ALARA and exposure limits; radiation hazards and health risks; emergency response; and responsibility to report promptly any condition that may lead to, or cause, a violation of regulations and licenses or create unnecessary exposure;

General employee training is described in Section 7.2 of the application and includes:

- Radiation protection principles;
- Characteristics of ionizing radiation;
- Units of radiation dose and quantities;
- Radiation detection and instrumentation;
- Biological hazards of exposure to ionizing radiation; and
- Radiation control principles related to minimizing potential dose.

- (6) Review and evaluate the accuracy, effectiveness, and adequacy of the RP training program curriculum and instructors, as applicable, at least every 3 years.

The response to RAI 13 provides an addendum to Section 10.1 of the application that confirms all aspects of the RP Program are audited annually including the accuracy, effectiveness, and adequacy of the RP training program curriculum and instructors. In addition, appropriate training is provided to individuals likely to receive more than 100 mRem (1 mSv) of occupational exposure in a year. All such individuals receive training in accordance with 10 CFR 19.12.

Based on the staff's evaluation of the application commitments pertaining to the acceptance criteria in Section 4.4.5.3 of NUREG-1520, the staff finds that there is reasonable assurance that the JHU/APL training program will ensure that personnel are qualified by reason of training and experience to safely use licensed material in accordance with 10 CFR 70.23(a)(2). Therefore, the NRC staff finds that this program is acceptable.

#### 4.2.6 Ventilation and Respiratory Protection Programs

In accordance with 10 CFR 70.22(a)(7), each application for a license must contain a description of equipment and facilities which will be used by the applicant to protect health and minimize danger to life or property. The requirements in Subpart H of 10 CFR Part 20 state that the licensee shall use, to the extent practical, process or other engineering controls to control the concentration of radioactive material in air.

Section 5.1 of the application states that the license is only for sealed sources. As a result, these sources do not present an internal hazard requiring an evaluation of ventilation capability or a respiratory protection program and thus the regulatory requirement is met.

#### 4.2.7 Radiation Surveys and Monitoring Programs

In accordance with 10 CFR 70.22(a)(8), each application for a license must contain proposed procedures to protect health and minimize danger to life or property (such as procedures to avoid accidental criticality, procedures for personnel monitoring and waste disposal, post-criticality accident emergency procedures, etc.). The staff reviewed the applicant's radiation survey and monitoring program commitments against the acceptance criteria in NUREG-1520, Section 4.4.7.3. The following discussion identifies each acceptance criterion from NUREG-1520 and summarizes the staff's evaluation as to whether the information provided by the applicant meets the criterion:

- (1) Provide radiation survey and monitoring programs that are necessary to comply with the requirements of 10 CFR Part 20 and that are reasonable to evaluate the magnitude and extent of radiation levels, the concentrations or quantities of radioactive material, and the potential radiological hazards.

Table 4 of Section 10.2 of the application provides a list of instrumentation used by JHU/APL. The list of instruments possessed by JHU/APL are adequate to support the work described in the application.

- (2) Prepare written procedures for the radiation survey and monitoring programs that include an outline of the program objectives, sampling procedures, data-analysis methods, types of equipment and instrumentation to be used, frequency of measurements, recordkeeping and reporting requirements, and actions to be taken when measurements exceed regulatory limits in 10 CFR Part 20 or administrative levels established by the applicant.

The basis of the radiation survey and monitoring program is NUREG-1556, Volume 17. The applicant has generated procedures in accordance with the guidance in the NUREG. These are reviewed and approved by the IRSS and have been inspected under the Agreement State Program for the State of Maryland.

- (3) Design and implement a personnel monitoring program for external occupational radiation exposures that outlines methods or procedures to do the following:
  - a. Identify the criteria for worker participation in the program;
  - b. Identify the types of radiation to be monitored;
  - c. Specify how exposures will be measured, assessed and recorded;

- d. Identify the type and sensitivity of personal dosimeters to be used, when they will be used, and how the collected data will be processed and evaluated; and
- e. Identify the plant's administrative exposure levels or the levels at which actions are taken to investigate the cause of exposures exceeding these levels.

Monitoring of an individual's external radiation exposure is required if the external occupational dose is likely to exceed 10 percent of the annual dose limit appropriate for the individual. Evaluations of the individual's potential exposure levels are performed during the registration and training of radiation workers by the radiation protection office staff. Only a small fraction of individuals meet the monitoring requirements of 10 CFR 20.1502, "Conditions Requiring Individual Monitoring of External and Internal Occupational Dose." The basis of the external radiation exposure program is NUREG-1556, Volume 17.

Regular personnel are assigned an individual monitoring device for appropriate characterization of dose received from gamma, beta, and neutron radiation. A National Voluntary Laboratory Accreditation Program-certified vendor supplies and processes these monitors as required by 10 CFR 20.1501(c). Badges are processed on a quarterly basis and provide the dose of record. Extremity dosimeters are available if needed. Radiation monitoring is supplemented with pocket ionization chambers to allow the estimation of personnel dose between badge readouts. Pocket ionization chambers are calibrated periodically and the results recorded at pre-set levels.

(4) Design and implement a personnel monitoring program for internal occupational radiation exposures based on the requirements of 10 CFR 20.1201, 20.1204, and 20.1502(b), that outlines methods or procedures to do the following:

- a. Identify the criteria for worker participation in the program;
- b. Identify the type of sampling to be used, the frequency of collection and measurement, and the minimum detection levels;
- c. Specify how worker intakes will be measured, assessed, and recorded;
- d. Specify how the data will be processed, evaluated, and interpreted;
- e. Identify the plant's administrative exposure levels or the levels at which actions are taken to investigate the cause of exposures exceeding these levels.

A personnel monitoring program is in place to ensure that the regulatory requirements of 10 CFR 20.1201 are met. Because the LA is only for sealed sources that do not present an internal hazard, an evaluation of internal exposures or bioassay under 10 CFR 20.1502(b), and further explained in 10 CFR 20.1204, is not necessary. The LA request is only for sealed sources that do not present an internal hazard requiring an evaluation of internal exposure or bioassay.

(5) Design and implement an air-sampling program in areas of the plant identified as potential airborne-radioactivity areas to conduct airflow studies and to calibrate and maintain the airborne sampling equipment in accordance with the manufacturer's recommendations.

The LA request is only for sealed sources that do not present an internal hazard therefore an evaluation of ventilation capability or air sampling program is not required.

(6) Implement additional procedures, as may be required by 10 CFR Part 20 and the ISA Summary to control exposure to airborne radioactive material (e.g., control of access, limitation of exposure times to licensed materials, and use of respiratory protection equipment).

The applicant is not required to have an ISA. The LA request is only for sealed sources that do not present an internal hazard therefore an evaluation of ventilation capability or a respiratory protection program is not required.

- (7) Conduct a contamination survey program in areas of the facility most likely to be radiologically contaminated; the program must include the types and frequencies of surveys for various areas of the facility and the action levels and actions to be taken when contamination levels are exceeded.

The applicant employs methods to control surface contamination. Instrumentation used to survey for contamination are specified in Section 10.2 of the application. Material requested under this application are sealed materials which will not contribute to surface contamination. These sealed sources will be leak tested semi-annually and analyzed by an organization authorized by the NRC or an Agreement State to provide leak test services.

- (8) Implement the facility's corrective action program when the results of personnel contamination monitoring exceed the applicant's administrative personnel contamination levels.

The applicant is not required to have a formal corrective action program as a 10 CFR Part 70 licensee, due to the nature of the limited materials and uses. One of the RSO's responsibilities is to ensure radiation surveys are conducted where indicated and to keep records of such surveys, including summaries of corrective measures recommended and/or instituted.

- (9) Implement the facility's corrective action program when any incident results in either unplanned occupational exposures exceeding the facility's administrative limits or unplanned airborne contamination exceeding the applicable concentration in Appendix B of 10 CFR Part 20 for 1 week. Note that applicants utilizing soluble uranium may be more restricted by the soluble uranium intake limit in 10 CFR 20.1201(e) than the values in Appendix B of 10 CFR Part 20.

As discussed above, JHU/APL is not required to have a formal corrective action program due to the nature of the limited materials and uses. The application is for sealed sources with no potential for airborne contamination. There is no request to use materials that could cause airborne contamination or to use uranium in a soluble form.

- (10) Use equipment and instrumentation with sufficient sensitivity for the type or types of radiation being measured and calibrate and maintain equipment and instrumentation in accordance with manufacturers' recommendations or applicable American National Standards Institute standards.

Section 10.2 of the application identifies the instrumentation used for the survey program. The inventory consists of a variety of equipment that is adequate to evaluate all aspects of the survey program for JHU/APL. The inventory includes ion chambers, Geiger-Mueller detectors, Sodium Iodide Detectors, Alpha-Beta Scintillations, Proportional Counters, neutron detection, and Liquid Scintillation Counting. Radiation survey meters are calibrated on an annual frequency using National Institute of Standards and Technology traceable sources.

- (11) Establish policies to ensure that equipment and materials removed from restricted areas to unrestricted areas are not contaminated above the release levels presented in Appendix A, "Acceptable Surface Contamination Levels," to Regulatory Guide (RG) 8.24.

The application request is only for sealed sources that do not present an internal hazard requiring an evaluation of surface contamination. The applicant maintains appropriate and calibrated equipment, decontamination, and sampling supplies to protect health and minimize danger to property and the environment.

- (12) Leak-test all sealed sources consistent with direction provided in Appendix C, "Leak Test Requirements," to RG 8.24 or the applicable regulations for the materials involved (e.g., 10 CFR 31.5[c][2] has direction for leak testing of certain byproduct devices).

In Section 10.7 of the application, JHU/APL commits to leak testing sources identified in the application semi-annually. Leak tests will be performed consistent with the guidance in the Agency Branch Technical Position of 1993, Leak Testing of Sealed Sources (NRC, 1993). The basis of the radiation survey and monitoring program is NUREG-1556, Volume 17. The applicant has generated procedures in accordance with the guidance in the NUREG. These are reviewed and approved by the RSO and have been inspected under the Agreement State Program for the State of Maryland.

- (13) Establish and implement an access control program that ensures that (1) signs, labels, and other access controls are properly posted and operative; (2) restricted areas are established to prevent the spread of contamination and are identified with appropriate signs; and (3) step-off pads, change facilities, protective clothing facilities, and personnel-monitoring instruments are provided in sufficient quantities and locations.

Section 9.1 of the application describes physical access restrictions to the JHU/APL campus with further detail provided regarding access to the material storage area. Adequacy of physical security is addressed in Section 10.0 of this report. Material storage is identified as a Vault-Type Room (VTR) and treated as a CAA in accordance with RG 5.59 (NRC, 1983). During the site visit, the NRC staff confirmed that JHU/APL labs/areas where radioactive materials are used or stored are so designated and posted with appropriate caution signs.

The LA request is only for sealed sources that do not present a surface or spreadable contamination hazard requiring an evaluation. During a site visit, the NRC confirmed that protective clothing (laboratory coats, coveralls, booties, caps and/or gloves) are available, but not applicable to the needs of the application.

- (14) Establish a radiation reporting program consistent with the requirements of 10 CFR Parts 19 and 20.

The RP Program and the established procedures described in the LA have been developed based on NUREG-1556, Volume 17 recommendations. Section 10.4 of the LA states that JHU/APL requires personnel monitoring devices for all individuals working with radiation sources if the individual is likely to exceed 10 percent of their allowable annual dose limit to 10 CFR Part 20, in accordance with the criteria in the section entitled "Radiation Safety Program – Occupational Dose" in NUREG-1556, Volume 17.

Based on the staff's evaluation of the application commitments, the NRC staff concludes with reasonable assurance that the application adequately addresses the regulatory requirements for radiation surveys and monitoring.

#### 4.2.8 Control of Radiological Risk Resulting From Accidents

In accordance with 10 CFR 70.22(a)(8), each application for a license must contain proposed procedures to protect health and minimize danger to life or property (such as procedures to avoid accidental criticality, procedures for personnel monitoring and waste disposal, post-criticality accident emergency procedures). The staff reviewed the applicant's additional program commitments against the acceptance criteria in NUREG-1520, Section 4.4.8.3.

The applicant has developed and maintains operating and emergency procedures that meet the criteria in Section 8.10.6 of NUREG-1556, Volume 17. These procedures are properly posted and cover onsite use and storage of licensed material. They include actions to safeguard SNM objects while material is outside of secure storage. Procedures may be revised only if:

- The changes are reviewed and approved by the IRSS Chairman and the RSO in writing;
- The affected staff members are provided training in the revised procedures prior to implementation;
- The changes are in compliance with NRC regulations and the license conditions; and
- The changes do not degrade the effectiveness of the program.

The NRC staff concludes with reasonable assurance that the application adequately addresses the regulatory requirements for control of radiological risk from accidents.

#### 4.2.9 Additional Program Requirements

Each licensee must maintain records of the RP Program, including the provisions of the program, survey records, audits and other records identified in Subpart L of 10 CFR Part 20. Each licensee must make reports and notifications, including theft or loss, notification of incidents, and other reports as required by Subpart M of 10 CFR Part 20. The staff reviewed the applicant's additional program commitments against the acceptance criteria in NUREG-1520, Section 4.4.9.3. The following discussion identifies each acceptance criterion from NUREG-1520 and summarizes the staff's evaluation as to whether the information provided by the applicant meets the criterion.

- (1) Maintain records of the RP Program (including program provisions, audits, and reviews of the program content and implementation), radiation survey results (air sampling, bioassays, external-exposure data from monitoring of individuals, internal intakes of radioactive material), and results of its corrective action program referrals, RWPs, and planned special exposures.

Records associated with ALARA findings, employee training, and personnel radiation exposures will be generated and retained in such a manner as to comply with the relevant requirements of 10 CFR Part 20. The commitment to the audit program and the required records are contained in Sections 10.1, 10.2, 10.4, 10.8, and 10.10 of the application.

Establish a program to report to the NRC, within the time specified in regulations, incidents specified in 10 CFR 20.2202, "Notifications of Incidents," and safety significant events specified in 10 CFR 70.74. Refer reportable incidents or events to the facility's corrective action program and report to the NRC both the corrective action(s) taken (or planned) to protect against a recurrence and any proposed schedule to achieve compliance with applicable license conditions.

The applicant has established procedures based on NUREG-1556 Volume 17, Appendix L, NRC Incident Notifications, which are sufficient to assure compliance with the 10 CFR 20.2202 reporting requirements. The staff also confirmed that 10 CFR 70.74 is not applicable. Therefore, 10 CFR Part 70, Appendix A reporting requirements are not applicable.

- (2) Prepare and submit to the NRC an annual report of the results of individual monitoring required by 10 CFR 20.2206(b). Establish a program that will assure shipment and receipt of radioactive materials consistent with regulations in 10 CFR 20, 10 CFR 71, 49 CFR, and others, as applicable. This includes having (a) qualified personnel performing these operations, (b) procedures to implement the program and generate and maintain appropriate records, and (c) a supporting quality assurance function.

The application from JHU/APL is not for a reactor, nor is it for spent fuel or the materials listed in 10 CFR 20.2206(b). Therefore, this requirement is not applicable. However, the responses to the RAIs confirm JHU/APL commitments to generate and maintain the records required to meet the acceptance criteria in NUREG-1520, Section 4.4.9.3.

Based on the staff's evaluation of the application commitments pertaining to the acceptance criteria in Section 4.4.8.3 of NUREG-1520, the staff finds the commitments provide assurance that JHU/APL will comply with 10 CFR 20.2202. Therefore, the NRC staff finds that these program commitments are acceptable.

### **4.3 Evaluation Findings**

The applicant has committed to an acceptable RP Program that includes the following:

- an effective, documented program to ensure that occupational radiological exposures are ALARA;
- an organization with adequate qualification requirements for the RP personnel;
- approved, written radiation protection procedures; and
- radiation protection training for all personnel who have access to restricted areas.

The NRC staff concludes based on the review and analysis provided in the previous sections that there is reasonable assurance that during the license term the applicant's radiation protection program will meet the applicable requirements of 10 CFR Parts 19, 20, and 70 as discussed in Section 4.2 above.

## **5.0 NUCLEAR CRITICALITY SAFETY**

### **5.1 Regulatory Requirements**

The regulatory basis for the review of nuclear criticality safety (NCS) at JHU/APL is contained in 10 CFR 70.23(a)(3) and (4), which requires a determination that the applicant's proposed equipment, facilities, and procedures be adequate to protect public health and safety. This section of the SER also discusses the applicant's requested exemption from the criticality monitoring requirements of 10 CFR 70.24(a).

### **5.2 Staff Review and Analysis**

The JHU/APL application for a 10 CFR Part 70 license requested approval for possession of [REDACTED]. This is in addition to the quantities that are authorized under Maryland license MD-27-014-02, which are [REDACTED] or any combination of them provided the sum of the

fractions (quantities of  $^{235}\text{U}$ ,  $^{233}\text{U}$  and  $^{239}\text{Pu}$  divided by 350 g, 200 g, and 200 g of each respectively) is less than unity. With all material at the maximum enrichment permitted under both the 10 CFR Part 70 license and the Maryland license MD-27-014-02, JHU/APL's requested total onsite, co-located, possession limit would result in three possible possession scenarios of fissile material that have the maximum quantities as follows:

Possession Scenario 1 – [REDACTED]

Possession Scenario 2 – [REDACTED]

Possession Scenario 3 – [REDACTED]

The potential for co-located depleted uranium permitted by both licenses is not of concern for NCS.

Collectively, this represents a quantity of SNM in excess of the definition of a critical mass in 10 CFR 70.4, which is defined as 700 g uranium-235 ( $^{235}\text{U}$ ), 520 g uranium-233 ( $^{233}\text{U}$ ), 450 g plutonium (Pu), or 450 g of any combination thereof. (Such quantities are to be cut in half in the presence of special moderators consisting of beryllium, deuterium, or graphite; JHU/APL stated, however, that it does not have significant quantities of such moderators in close proximity with the SNM.) These values are recognized as representing minimum critical masses, which are very conservative and do not take into consideration the specific forms and compositions of the SNM.

[REDACTED]

While not part of the definition in 10 CFR 70.4, the sum of fractions rule is frequently used in the industry (e.g., in 10 CFR 150.11) to quantify the margin of safety. Applying the sum of fractions rule indicates a ratio only slightly in excess of 1, for all three possible co-located source possession scenarios as shown below:

Possession Scenario 1  
[REDACTED]

Possession Scenario 2  
[REDACTED]

Possession Scenario 3  
[REDACTED]

While less than a minimum critical mass of  $^{235}\text{U}$ ,  $^{233}\text{U}$ , and Pu individually, collectively this is slightly in excess of a critical mass. Attaining criticality with such small quantities, however, requires that geometry, moderation, and reflection conditions be nearly optimal. By contrast, the materials in JHU/APL's possession consist entirely of sealed sources in a very stable and fixed configuration and no identified credible means of achieving such nearly-optimal conditions. Therefore, the likelihood of accidental criticality is qualitatively judged to be extremely low.

The applicant performed five calculations to demonstrate that the most reactive configuration of SNM under the combined Maryland and 10 CFR Part 70 licenses would still be highly subcritical. For this purpose, it is the total quantity authorized in the requested possession limits, rather than the currently inventory or quantity represented by the description of sources,

that is of interest. The five configurations modeled by JHU/APL were as follows. The staff notes that while JHU/APL stated it will move material possessed under its State of Maryland and 10 CFR Part 70 licenses, it will remain below the Category III limits of 10 CFR Part 70. All the material may be co-located. Hence, it is the total quantity under the two licenses that must be bounded by the criticality analysis. The results are shown below:

[TABLE REDACTED]

The applicant modeled spheres of SNM for each of the five configurations [REDACTED]. The most reactive configurations, [REDACTED], were still deeply subcritical.

To confirm JHU/APL's results, and verify that the models represented the most conservative configuration under the requested possession limits, the NRC staff performed a series of its own independent calculations. The staff modeled the maximum quantity of [REDACTED] under the Maryland license plus [REDACTED] under the prospective 10 CFR Part 70 license, plus [REDACTED] under the Maryland license plus [REDACTED] under the prospective 10 CFR Part 70 license. The [REDACTED] was all assumed to be [REDACTED]. This represents the maximum quantity of SNM under both the Maryland and 10 CFR Part 70 licenses and resulted in a calculated  $k_{eff}$  of [REDACTED]. This initial model did not contain any [REDACTED], and did not account for the fact that the [REDACTED], but is still deemed conservative in that it models all the material consolidated into a single sphere that is then fully reflected by water. In actuality, the sources are discrete and would need to be melted down and forged into a sphere. Also, there are few sources of moderator present, so attainment of this configuration is considered extremely unlikely. Regardless of its likelihood, this worst-case and nearly incredible condition still has a substantial margin to criticality.

The staff also considered whether consolidating all the material in such a sphere was the most reactive condition, following observation that a metal sphere at full theoretical density would occupy a sphere on the order of [REDACTED], whereas the actual sources are much larger. The staff modeled several cases in which the diameter of the fissile region gradually increased [REDACTED]. For these models in which the source size was increased, a homogeneous mixture [REDACTED] was assumed. The staff also modeled several different configurations in which various arrangements of [REDACTED] were modeled in the [REDACTED]. These studies confirmed that the most reactive configuration occurs when the highest reactivity material is [REDACTED].

Lastly, the staff observed that, although the [REDACTED] sources currently present in inventory, [REDACTED]. To bound this, the staff modeled the [REDACTED] discussed above and gradually increased the interstitial [REDACTED]. Thus, for those sources that have the potential for water intrusion, the highest  $k_{eff}$  resulted from cases with the greatest water flooding. The worst case reactivity, however, still remained deeply subcritical [REDACTED]. This study was repeated with [REDACTED]. All such cases remained deeply subcritical, with the highest  $k_{eff}$  being that for [REDACTED].

The worst-case condition therefore represents a condition in which all the fissile material has been [REDACTED]. In all such cases, achieving such a configuration is probably not credible, requiring the melting and reforming of all the SNM present under both the Maryland and 10 CFR Part 70 licenses into a [REDACTED], plus the introduction of significant quantities of water moderation both within and around the [REDACTED] source. While the models in which realistic source dimensions were used instead of [REDACTED], the margin of subcriticality was so great that reasonable assurance remains that a more reactive [REDACTED] model as

discussed above would still be deeply subcritical. The most reactive such [REDACTED] model still had a substantial [REDACTED] margin to criticality, which was not significantly eroded by the [REDACTED] between the [REDACTED] and most reactive [REDACTED] model above [REDACTED].

Therefore, the staff determined that the worst possible configuration, consisting of all the fissile material under the Maryland and prospective 10 CFR Part 70 licenses, reconfigured into the worst-case geometry, intimately mixed with the greatest possible amount of water, and fully reflected by a tight-fitting water reflector, remains deeply subcritical with a substantial margin. The sources are very robust and there are few sources of significant quantities of moderator present in the storage vault of lab areas where the sources will be stored and used, and therefore attaining this configuration is at least extremely unlikely and probably incredible. Based on this analysis, the staff did not identify any credible means of achieving criticality.

The applicant requested an exemption from the criticality monitoring requirements of 10 CFR 70.24(a) for the handling, use, and storage of the test objects containing SNM. Under 10 CFR 70.17, the Commission may grant exemptions from the requirements of the regulations as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public's interest. The NRC staff determined that the installation of a criticality accident alarm system (CAAS) at the applicant's facilities would not significantly reduce the risk to the workers or the public because there is no credible criticality accident associated with the SNM test objects. Therefore, the lack of a criticality alarm system will not endanger life or property or the common defense and security. The NRC staff determined that the exemption will be in the public's interests because it will reduce unnecessary costs, including JHU/APL's expenses and NRC's regulatory costs for evaluating and inspecting the systems. Therefore, the staff recommends granting the requested exemption as provided in Appendix E of the application.

### **5.3 Evaluation Findings**

Based on the staff's evaluation of the application, the staff finds that the applicant's equipment, facilities, and procedures will be adequate to assure subcriticality of the SNM test objects consistent with 10 CFR 70.23(a)(3) and (4), thus adequately protecting health and minimizing danger to life or property.

In addition, in accordance with the criteria in 10 CFR 70.17, an exemption to the criticality monitoring requirements of 10 CFR 70.24 is warranted based on the extremely low risk of criticality and negligible benefit of an alarm system.

The following license condition will be imposed in the license to address the exemption from the criticality monitoring regulatory requirements:

The applicant is granted an exemption to the requirements of the Title 10 of the *Code of Federal Regulations* Section 70.24 to maintain a criticality accident alarm system.

## **6.0 FIRE SAFETY**

### **6.1 Regulatory Requirements**

The regulatory basis for the fire safety review can be found in 10 CFR 70.23(a)(3) and (4).

### **6.2 Staff Review and Analysis**

The applicant's facility complies with the applicable building code regulations (State of Maryland Building Code). The portion of the facility where the licensed material is used and stored is constructed of non-combustible materials. Material storage precautions will be used to minimize potential for airborne radioactivity from exposure to fire hazards. The applicant stated in the LA that the sealed sources described in this license will be stored in a 1-hour (minimum) fire rated safe inside a VTR free of any combustible materials. The VTR is located within a laboratory room equipped with fire suppression systems and alarms. The building is wired and grounded in accordance with the applicable edition(s) of the National Fire Protection Agency (NFPA) 70, "National Electrical Code."

The applicant also stated in the LA that the fire protection systems installed at JHU/APL's facility include a sprinkler system and an offsite monitored fire alarm system with manual pull stations available. Fire loading in JHU/APL's facility is minimal. The fire protection systems interface through a central monitoring station which notifies the JHU/APL fire department. Portable fire extinguishers are deployed within the building and fire hydrants are located throughout the area in accordance with industry standards.

The NRC staff reviewed the LA and finds that the fire prevention program is consistent with applicable NFPA codes and standards.

The NRC staff's review and site visits determined that the applicant's program is consistent with applicable guidance provided in NFPA 45, "Standard for Fire Protection in Laboratory Facilities", as well as NFPA 801, "Standard for Fire Protection for Facilities Handling Radioactive Material." The NRC staff notes that a complete release of the licensed material at JHU/APL would be highly unlikely since the material at risk is in the form of sealed sources that are unlikely to volatilize or otherwise readily disperse as a result of a fire. The NRC staff further determined that given the low risk to public health and safety of the materials covered by the proposed license, a formal fire hazards analysis is not necessary.

### **6.3 Evaluation Findings**

The NRC staff reviewed JHU/APL's fire protection program and determined that the facility maintains an adequate level of fire protection to protect public health and safety. The staff concludes that the applicant's equipment, facilities, and procedures provide a reasonable level of assurance that adequate fire protection will be provided consistent with the requirements of 10 CFR 70.23(a)(3) and (4).

## **7.0 EMERGENCY MANAGEMENT**

The regulatory basis for emergency management is found in 10 CFR 70.22(i)(1) which states that "Each application to possess enriched uranium or plutonium for which a CAAS is required, uranium hexafluoride in excess of 50 kilograms in a single container or 1000 kilograms total, or in excess of 2 curies of plutonium in unsealed form or on foils or plated sources, must contain

either (ii) An emergency plan for responding to the radiological hazards of an accidental release of special nuclear material and to any associated chemical hazards directly incident thereto.” The applicant does not possess uranium hexafluoride in any quantity, will be exempt from the requirement to possess a criticality alarm, and does not possess in excess of 2 curies of plutonium in unsealed form or on foils or plated sources. Therefore, JHU/APL is not required to have an Emergency Plan.

## **8.0 DECOMMISSIONING**

The regulatory basis for financial assurance and decommissioning funding requirements are found in 10 CFR 70.22(a)(9) and 70.25. The applicant is requesting authorization to possess and use SNM in the form of sealed sources, which pose less risk to the health and safety of the workers and the environment than unsealed SNM. Paragraph 70.22(a)(9) and 70.25(a) of 10 CFR require an applicant for a specific license for a uranium enrichment facility or authorizing possession and use of unsealed SNM in certain quantities to submit a decommissioning funding plan or certification of financial assurance for decommissioning. As previously indicated, JHU/APL will only possess and use sealed SNM. Thus, the NRC staff concludes that the requirements in 10 CFR 70.22(a)(9) and 70.25 do not apply to the proposed activities, and that JHU/APL is not required to provide decommissioning financial assurance in support of its LA.

## **9.0 ENVIRONMENTAL ASSESSMENT**

### **9.1 Categorical Exclusion for the Facility**

The applicant proposes to use sealed sources of SNM for research and development. The JHU/APL’s application states that it does not propose to release to the environment radioactive materials that originated onsite, and JHU/APL states that it will be conducting only non-destructive experiments while utilizing the SNM. Therefore, consistent with 10 CFR 51.22(c)(14)(v) and the criteria in NUREG-1748, “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs,” Section 2.2.7.5, pp. 2-9 and 2-10, this licensing action is categorically excluded from the need to prepare an EA or an Environmental Impact Statement (EIS).

### **9.2 Categorical Exclusion for Exemptions**

As noted above in Section 5.0, Nuclear Criticality Safety, the staff conducted an NCS review of the research activities to be performed on the SNM sources. As a result of that review, the staff found that there was no accident scenario, even a worse-case accident scenario, under which a criticality would occur. Because the proposed activities under this license cannot result in a criticality event or include gamma or neutron radiation associated with such an event, JHU/APL also requested an exemption from 10 CFR 70.24 criticality monitoring, surveillance, and associated recordkeeping and reporting requirements.

For an exemption to qualify for a categorical exclusion, the exempted regulatory activity must meet the criteria of 10 CFR 51.22(c)(25)(i)-(vi). Specifically, 10 CFR 51.22(c)(25) states that an exemption is categorically excluded provided that: “(i) There is no significant hazards

consideration; (ii) There is no significant change in the types or no significant increase in the amounts of any effluents that may be released offsite; (iii) There is no significant increase in individual or cumulative public or occupational radiation exposure; (iv) There is no significant construction impact; (v) There is no significant increase in the potential for or consequences from radiological accidents; and (vi) The requirements from which the exemption is sought involve: (A) recordkeeping requirements; (B) reporting requirements; (C) inspection or surveillance requirements....”

The exemption sought by the applicant from the requirement to have a CAAS satisfies each of these criteria. First, as discussed in Section 5.0, because there will be no criticality or criticality-related gamma or neutron radiation resulting from the research activities using SNM sources as described, an exemption from 10 CFR 70.24 under this proposed license will not introduce a significant hazards consideration. For the same reason, there will be not be any significant change or increase in: the types or amounts of effluents released offsite; the individual, cumulative public or occupational radiation exposure; or the potential for or consequences from radiological accidents. Additionally because there are no construction activities associated with this request, there is no significant construction impact. For these reasons, the requirements in 10 CFR 51.22(c)(25)(i)-(v) are met.

Second, the criteria of 10 CFR 51.22(c)(25)(vi) are met because the exemption sought from 10 CFR 70.24 is among the types of activities permitted for this categorical exclusion. Specifically, 10 CFR 70.24 requires installation of a CAAS which would provide continuous monitoring and surveillance for criticality events. The CAAS provides an alarm in case of a criticality event and also provides continuous recordkeeping as output from the CAAS. As a result, the exemption requested pertains to inspection or surveillance requirements as well as recordkeeping and reporting requirements, all of which are eligible requirements for the categorical exclusion provided in 10 CFR 51.22(c)(25).

Therefore, because the requirements under 10 CFR 51.22(c)(14)(v) have been met, the staff finds that JHU/APL's licensed activities are categorically excluded from the requirement to prepare an EA. In addition, because an exemption from the regulatory requirements of 10 CFR 70.24 meets the provisions identified in 10 CFR 50.22(c)(25), the staff also finds that the exemption from this regulatory requirement is categorically excluded from the requirement to prepare an EA.

## **10.0 PHYSICAL PROTECTION AND PHYSICAL SECURITY**

### **10.1 Regulatory Requirements**

The regulatory basis for the review of JHU/APL's site physical protection and security management is in 10 CFR 73.40 and 10 CFR 73.67(a)(1) and (2). In accordance with 10 CFR 73.40, a licensee must provide physical protection against radiological sabotage or against theft of SNM. In accordance with 10 CFR 73.67(a)(1), a licensee who possesses, uses, or transports SNM of moderate or low strategic significance must establish and maintain a physical protection system that minimizes the possibilities for unauthorized removal of SNM and facilitate the location and recovery of missing SNM. Additionally, 10 CFR 73.71, requires a licensee to report safeguards events. As provided above in Section 1.1, JHU/APL is seeking a license is for a quantity of SNM that is of low-strategic significance as defined in 10 CFR 73.2.

## **10.2 Staff Review and Analysis**

The NRC staff used RG 5.59, "Standard Format and Content for a Licensee Physical Security Plan for the Protection of Special Nuclear Material of Moderate or Low Strategic Significance" to evaluate JHU/APL's physical protection system. The RG serves as an aid to uniformity and completeness in the preparation and evaluation of physical security, including site use and storage, detection, access control, communication, response, and in-transit handling of radioactive materials evaluated below. The information to support this review was obtained from the LA submitted on December 23, 2016 and additional information submitted on October 31, 2017. Additionally, the NRC staff participated in a site visit and focused discussions on physical security on May 16, 2017.

### **10.2.1 Fixed Site Security**

The provisions in 10 CFR 73.40 require that the licensee provide physical protection at a fixed site, or contiguous sites where licensed activities are conducted, against radiological sabotage, or against theft of SNM, or against both, in accordance with the applicable sections of this part for each specific class of facility or material license. If applicable, the licensee must establish and maintain physical security in accordance with security plans approved by the NRC.

The NRC staff has reviewed the applicant's description of the physical protection of SNM in Section 9.4 of the license application and finds that the information provided meets the requirements of 10 CFR 73.40.

More specifically, the provisions of 10 CFR 73.67(a) require that the licensee establish and maintain a physical protection system that will minimize the possibilities for unauthorized removal of SNM consistent with the potential consequences of such actions and facilitate the location and recovery of missing SNM. To achieve these objectives, the physical protection system must provide:

- i. early detection and assessment of unauthorized access or activities by an external adversary within the controlled access area containing SNM;
- ii. early detection of removal of SNM by an external adversary from a controlled access area;
- iii. assure proper placement and transfer of custody of SNM; and
- iv. respond to indications of an unauthorized removal of SNM and then notify the appropriate response forces of its removal in order to facilitate its recovery.

The NRC staff reviewed the applicant's description of the physical protection of SNM in Sections 7.2, 9.2, 9.3, and 9.4 of the LA, as well as the response to RAI 1 in the October 31, 2017, submittal. The response to RAI 1 provided additional detail to Section 7.2 of the LA which clarified the AU's responsibilities for maintaining radioactive materials under their custody as well as the training provided concerning physical security. Specific topics covered in the training include procedures for removing and returning material to the VTR, line of sight custodial responsibilities, requirements for establishing a temporary CAA, custodial responsibilities during emergencies, and physical security notifications. The NRC staff find that the information provided meets the requirements of 10 CFR 73.67(a).

The provisions of 10 CFR 73.67(f) require that the licensee (1) store or use the material only within a CAA; (2) monitor with an intrusion alarm or other device or procedures the controlled access areas to detect unauthorized penetrations or activities; (3) assure that a watchman or offsite response force will respond to all unauthorized penetrations or activities; and (4) establish and maintain response procedures for dealing with threats of thefts or thefts of this material. The licensee must also retain a copy of the current response procedures as a record for 3 years after the close of the period for which the licensee possesses the SNM under each license for which the procedures were established. Copies of superseded material must be retained for 3 years after each change.

The NRC staff reviewed the applicant's description of the physical protection of SNM in Sections 9.2, 9.3, and 9.4 of the LA, as well as the response to RAI 2 in the October 31, 2017. The response to RAI 2 provided additional detail to Section 9.4 of the LA. The applicant described the issuance and control of response procedures which call for APL's onsite security force, Maryland State Police Officers, and if needed local law enforcement to respond to indications of unauthorized removal of SNM. Incidents addressed in the response procedures include: possible situations that could lead to theft of SNM, entry of unauthorized persons, failure of a security system, or discovery of material that is unaccounted for. The NRC staff finds that the information provided meets the requirements of 10 CFR 73.67(f).

#### 10.2.2 Transportation Security

The provisions in 10 CFR 73.67(g)(1) require that each licensee who transports or who delivers to a carrier for transport SNM of low strategic significance must: (i) provide advance notification to the receiver of any planned shipments specifying the mode of transport, estimated time of arrival, location of the nuclear material transfer point, name of carrier and transport identification; (ii) receive confirmation from the receiver prior to commencement of the planned shipment that the receiver will be ready to accept the shipment at the planned time and location, and acknowledges the specified mode of transport; (iii) transport the material in a tamper indicating sealed container; (iv) check the integrity of the containers and seals prior to shipment; and (v) arrange for the in-transit physical protection of the material in accordance with the requirements of 10 CFR 73.67(g)(3), unless the receiver is a licensee and has agreed in writing to arrange for the in-transit physical protection.

The NRC staff reviewed the applicant's description of the transportation security of SNM in Section 10.9 of the LA, as well as the response to RAI 6 in the October 31, 2017, submittal. The applicant's implementing documents of its quality assurance program ensure that advance notification and receiver confirmation will be provided prior to each shipment of material. Additionally, each shipping container is sealed with a mechanism or system that helps detect tampering and each shipment is inspected to ensure the integrity of the seals prior to shipment. Lastly, JHU/APL's implementing documents of its quality assurance program ensure that the appropriate in-transit physical protection is provided. The NRC staff finds that the information provided meets the requirements of 10 CFR 73.67(g)(1).

The provisions in 10 CFR 73.67(g)(2) require that each licensee who receives quantities and types of SNM of low strategic significance must: (i) check the integrity of the containers and seals upon receipt of the shipment; (ii) notify the shipper of receipt of the material as required in 10 CFR 74.15; and (iii) arrange for the in-transit physical protection of the material in accordance with the requirements of 10 CFR 73.67(g)(3), unless the shipper is a licensee and has agreed in writing to arrange for in-transit physical protection.

The responses to RAI's 6 and 7 provided additional detail to Section 10.9 of the LA, describing in-transit physical protection and commitments prior to a shipment as well as upon receipt of the shipment, specifically advance notification, receiver confirmation, tamper indication, inspection, and in-transit physical protection.

The NRC staff reviewed the applicant's description of the transportation security of SNM in Section 10.9 of the LA, as well as the response to RAI 7 in the October 31, 2017, submittal and finds that the information provided meets requirements of 10 CFR 73.67(g)(2).

The provisions in 10 CFR 73.67(g)(3) require that each licensee, shipper or receiver who arranges for the physical protection of SNM of low strategic significance while in transit or who takes delivery of such material free on board the point at which it is delivered to a carrier for transport must: (i) establish and maintain response procedures for dealing with threats or thefts of this material and retain a copy of the response procedures as a record for 3 years after the close of the period for which the licensee possesses the SNM; (ii) make arrangements to be notified immediately of the arrival of the shipment at its destination, or of any such shipment that is lost or unaccounted for after the estimated time of arrival at its destination; and (iii) conduct immediately a trace investigation of any shipment that is lost or unaccounted for after the estimated arrival time and notify the NRC Operations Center within 1 hour after the discovery of the loss of the shipment and within 1 hour after recovery of, or accounting for, the lost shipment in accordance with the provisions of 10 CFR 73.71.

The NRC staff reviewed the applicant's description of the transportation security of SNM in Section 10.9 of the LA, as well as the response to RAI 8 in the October 31, 2017, submittal. The response to RAI 8 provided additional detail to Section 10.9 of the LA, describing procedures regarding threats of theft or diversion of a shipment. Specifically, JHU/APL describes response procedures, their development, maintenance, control and storage. The NRC staff finds that the information provided meets the requirements of 10 CFR 73.67(g)(3).

#### 10.2.3 Reporting of Safeguards Events

The provisions of 10 CFR 73.71(a) require that the licensee notify the NRC Operations Center within 1 hour after discovery of the loss of any shipment of SNM or spent fuel, and within 1 hour after recovery of or accounting for such lost shipment.

Additionally, the provisions of 10 CFR 73.71(b) require that the licensee: (1) notify the NRC Operations Center within 1 hour of discovery of the safeguards events described in paragraph I(a)(1) of Appendix G to 10 CFR Part 73; and (2) this notification must be made in accordance with the requirements of paragraphs (a)(2), (3), (4), and (5) of 10 CFR 73.71.

The NRC staff reviewed the applicant's description of the physical protection of SNM in Section 9.4 of the LA, as well as the response to RAI 3 in the October 31, 2017, submittal. The response to RAI 3 provided additional detail to Section 9.4 of the LA, describing security response procedures and commitments to initiate a response based on any identified safeguards event, including notification of the NRC Operations Center within 1 hour and recording safeguards events in the security event log. The NRC staff finds that the information provided meets the requirements of 10 CFR 73.71(b).

### **10.3 Evaluation Findings**

The physical security program description outlined in JHU/APL's LA, dated December 23, 2016, and supplemental information, dated October 31, 2017, satisfies the performance objectives, systems capabilities, and reporting requirements specified in 10 CFR 73.40, 73.67, and 73.71 and provides the content described in RG 5.59. Therefore, the NRC staff finds the JHU/APL physical security program is acceptable and provides reasonable assurance that the requirements for the physical protection of SNM of low strategic significance will be met. The NRC staff's review of the applicant's physical security program contains information that has been marked as "Official Use Only – Security - Related Information" by the applicant, and is, therefore, withheld from public disclosure.

## **11.0 MATERIAL CONTROL AND ACCOUNTING**

### **11.1 Regulatory Requirements**

Consistent with 10 CFR 70.22(b), JHU/APL is not required to submit a Fundamental Nuclear Material Control Plan because 10 CFR 70.22(b) exempts applications for use of SNM in the form of sealed sources from submitting this plan. Since the licensed material for JHU/APL is in the form of sealed sources, the requirements in 10 CFR 70.22(b) do not apply to JHU/APL's proposed operations.

The applicable requirements to maintain SNM inventory and reporting requirements are contained in 10 CFR 74.11, 74.13, 74.15, and 74.19. Section 74.11 of 10 CFR requires the licensee to notify the NRC Operations Center in the event of any lost, stolen, or unlawfully diverted SNM, including attempts, within 1 hour of discovery. Section 74.13 of 10 CFR requires licensees to prepare Material Balance Reports concerning SNM that the licensee has received, produced, possessed, transferred, consumed, disposed or lost. Section 74.15 of 10 CFR requires a licensee who transfers or receives SNM in certain quantities, or who adjusts its inventory of SNM, to submit a Nuclear Material Transaction Report. Section 74.19 of 10 CFR requires a licensee to maintain records of the receipt, inventory, acquisition, transfer and disposal of all SNM. This section also requires a licensee to perform an annual physical inventory of the SNM in its possession.

### **11.2 Staff Review and Analysis**

The information to support this review was obtained from the LA. Additionally, supplemental information was submitted in February 2018, and a teleconference was held with the applicant to discuss the supplemental information. The following discussion identifies each of the applicable MC&A requirements and summarizes the NRC staff's evaluation as to whether the information provided by the applicant meets the requirement.

In accordance with 10 CFR 70.22(b), current applicants requesting a license to possess SNM must submit a full description of their program for the control and accounting of SNM in the applicant's possession and to show compliance with 10 CFR 74.31, 74.33, 74.41, or 74.51, as applicable. However, the requirements in 10 CFR 70.22(b) contain an exclusion for licensees governed by 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," including non-power production and utilization facilities (e.g., research and test reactors), and for uses of SNM as sealed sources. The same exclusions are contained in the MC&A requirements in 10 CFR 74.31, 74.33, 74.41, and 74.51, which contain specific control and accounting requirements for certain licensees, depending on the different types and quantities of SNM in possession.

In Section 5.1, "Licensed Material Description," and Section 5.5, "License Expiration," of the LA, the applicant states that all of the SNM objects are encapsulated (sealed) sources and will be maintained in that form. The sealed sources under the requested license would be for the general use in analytical or scientific research and development at the facility.

Therefore, the MC&A requirements in 10 CFR 74.31, 74.33, 74.41, and 74.51 do not apply. The MC&A requirements applicable to JHU/APL are contained in 10 CFR Part 74, Subpart B, "General Reporting and Recordkeeping Requirements." Licensees who possess, transfer or receive SNM in a quantity of one gram or more of contained  $^{235}\text{U}$ ,  $^{233}\text{U}$ , or Pu are subject to the general reporting and recordkeeping requirements of 10 CFR 74.11, 74.13, 74.15, and 74.19. The following discussion identifies each of the applicable MC&A requirements and summarizes the NRC staff's evaluation as to whether the information provided by the applicant meets the requirement.

#### 11.2.1 Reports of Loss or Theft or Attempted Theft

In accordance with 10 CFR 74.11, each licensee who possesses one gram or more of contained  $^{235}\text{U}$ ,  $^{233}\text{U}$ , or Pu must notify the NRC Operations Center within 1 hour of discovery of any loss or theft or other unlawful diversion of SNM which the licensee is licensed to possess, or any incident in which an attempt has been made to commit a theft or unlawful diversion of SNM. In Section 9.4, "Physical Protection and Physical Security," of the license application, the applicant states that the security posture and physical security features in the use and storage of the SNM described in previous sections constitute the main elements of the physical protection used to secure the SNM possessed by JHU/APL. Furthermore, as provided in the supplemental information, the applicant affirms that safeguards events, such as a loss or theft or attempted theft of its SNM, will be reported to the NRC within one hour of discovery.

The NRC staff reviewed the applicant's description of its security response activities as provided in the application and supplemental information. On the basis of the review, the NRC staff has determined that the applicant's security practices include procedures to ensure that the NRC is notified within 1 hour of discovery of a loss or theft or attempted theft of its SNM. Therefore, the NRC staff finds that the applicant meets the requirement of 10 CFR 74.11.

#### 11.2.2 Material Status Reports

In accordance with 10 CFR 74.13, each licensee possessing SNM in a quantity totaling 1 gram or more of contained  $^{235}\text{U}$ ,  $^{233}\text{U}$ , or Pu must complete and submit, in computer-readable format, Material Balance Reports concerning SNM that the licensee has received, produced, possessed, transferred, consumed, disposed, or lost.

In Section 10.3, "Material Receipt and Accountability," of the LA, the applicant affirms that the MC&A program utilizes procedures to ensure all Material Balance Reports and Physical Inventory Listings are filed and retained in accordance with 10 CFR Part 74 requirements.

The NRC staff reviewed the description for material status reports. The application has provided a description of the actions that are taken concerning Material Balance Reports and Inventory Listing Reports. On the basis of the review, the NRC staff has determined that the applicant's MC&A practices include procedures to ensure that material balances and physical inventory listings are reported as required. Therefore, the NRC staff finds that the applicant meets the requirement of 10 CFR 74.13.

### 11.2.3 Nuclear Material Transaction Reports

In accordance with 10 CFR 74.15, each licensee who transfers or receives SNM in a quantity of 1 gram or more of contained  $^{235}\text{U}$ ,  $^{233}\text{U}$ , or Pu must complete, in computer-readable format, a Nuclear Material Transaction Report. In addition, each licensee who adjusts the inventory in any manner, other than for transfers and receipts, must submit a Nuclear Material Transaction Report, in computer-readable format, to coincide with the submission of the Material Balance Report. Each licensee who transfers SNM must submit a Nuclear Material Transaction Report no later than the close of business the next working day. Each licensee who receives SNM must submit a Nuclear Material Transaction Report within 10 days after the material is received.

In Section 10.3, “Material Receipt and Accountability,” of the LA, the applicant affirms that the MC&A program utilizes procedures to ensure all Nuclear Material Transaction Reports (NRC/DOE Form 741) are filed and retained in accordance with 10 CFR Part 74 requirements. Furthermore, as provided in the supplemental information, the applicant affirms that documentation for receipts, shipments, and inventory adjustments are completed and filed in accordance with site procedures.

The NRC staff reviewed the applicant’s description of its Nuclear Material Transaction Report activities as provided in the application and supplemental information. On the basis of the review, the NRC staff has determined that the applicant’s MC&A practices include procedures to ensure that Nuclear Material Transaction Reports are completed and submitted as required.

### 11.2.4 Recordkeeping

In accordance with 10 CFR 74.19(a), each licensee must keep records showing the receipt, inventory (including location and unique identity), acquisition, transfer, and disposal of all SNM in its possession regardless of its origin or method of acquisition. Each record relating to material control or material accounting must be maintained and retained for the period specified by the appropriate regulation or license condition. Each record of receipt, acquisition, or physical inventory of SNM must be retained as long as the licensee retains possession of the material and for 3 years following transfer or disposal of the material. Each record of transfer of SNM to other persons must be retained by the licensee who transferred the material until the Commission terminates the license authorizing the licensee’s possession of the material.

In Section 10.3, “Material Receipt and Accountability,” of the LA, the applicant affirms that records of receipt, transfer, and disposal of licensed material are maintained. Furthermore, as provided in the supplemental information (JHU/APL, 2018), the applicant affirms that documentation for receipts, shipments, inventory adjustments, Material Balance Reports, and physical inventory listings are completed and filed in accordance with site procedures.

The NRC staff reviewed the applicant’s description for material control records as provided in the LA and supplemental information. The description included completing all of the material balance, inventory listing, and material transaction reports, and maintaining records of receipt, transfer, and disposal of licensed material. On the basis of the review, the NRC staff has determined that the applicant’s MC&A practices include procedures to ensure that material control records are completed and maintained as required. Therefore, the NRC staff finds that the applicant meets the requirement of 10 CFR 74.19(a).

### **11.2.5 Physical Inventory**

In accordance with 10 CFR 74.19(c), certain licensees who are authorized to possess SNM in a quantity greater than 350 grams of contained  $^{235}\text{U}$ ,  $^{233}\text{U}$ , or Pu, must conduct a physical inventory of all SNM in its possession under license at intervals not to exceed 12 months. The results of these physical inventories must be retained in records by the licensee until the Commission terminates the license authorizing the possession of the material.

In Section 10.3, "Material Receipt and Accountability," of the LA, the applicant affirms that physical inventories of all SNM to be authorized under the requested license and JHU/APL Agreement State license are conducted at intervals not to exceed 6 months.

The NRC staff reviewed the applicant's description of the actions that are taken concerning physical inventory of its SNM. The description included the minimum inventory frequency and completion and submittal of all required material balance and inventory listing reports. On the basis of the review, the NRC staff has determined that the applicant's MC&A practices include procedures to ensure physical inventories of its SNM are completed within the required frequency and the results are reported. Therefore, the NRC staff finds that the applicant meets the requirement of 10 CFR 74.19(c).

## **11.3 Evaluation Findings**

Based on the review of the LA and the supplemental information submitted by JHU/APL, the NRC staff finds that the applicant's MC&A practices as described provides assurance that the applicant will satisfy the applicable requirements found in 10 CFR 74.11, 74.13, 74.15, and 74.19 during the requested license term. Therefore, the NRC staff finds that the applicant's MC&A practices are acceptable.

## **12.0 National Environmental Policy Act Review**

In accordance with 10 CFR 51.22(a), licensing, regulatory, and administrative actions eligible for categorical exclusion are those actions that belong to a category of actions which the Commission, by rule or regulation, has declared to be a categorical exclusion, after first finding that the category of actions does not individually or cumulatively have a significant effect on the human environment. Paragraph 51.22(c)(14)(v) of 10 CFR provides a categorical exclusion for the category actions under the JHU/APL license. The NRC has determined that the issuance of materials licenses issued under 10 CFR Parts 30 or 70, for research and development and for educational purposes, does not individually or cumulatively have a significant effect on the human environment.

Therefore, because the JHU/APL license is a categorically excluded action, the preparation of an EA or EIS is not required.

## **III. CONCLUSION**

Based on the review provided above, the NRC staff concludes that the information provided by JHU/APL in their LA provide reasonable assurance of adequate safety and security of the proposed operations. The NRC staff concludes that the proposed operations at JHU/APL 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, 51, 70, 73, and 74.

Therefore, the staff recommends granting the SNM license for a 10-year period in accordance with the LA. It is also recommended that the exemption requested by JHU/APL from the requirements for a CAAS be granted.

#### **IV. PRINCIPAL CONTRIBUTORS**

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