



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

REGION IV  
1600 EAST LAMAR BOULEVARD  
ARLINGTON, TEXAS 76011-4511

April 2, 2021

EA-20-134  
EA-18-153  
EA-17-206  
EA-16-033

Dr. Kevin Satterlee, President  
Idaho State University  
921 S. 8<sup>th</sup> Ave., Stop 8130  
Pocatello, ID 83209-8130

SUBJECT: NRC INSPECTION REPORT 030-32322/2020-001; 030-38726/2020-001;  
070-01374/2020-001; AND NOTICE OF VIOLATION

Dear Dr. Satterlee:

This letter refers to the announced team inspection conducted on March 9-13, 2020, at your facilities in Pocatello and Idaho Falls, Idaho, with in-office review through March 29, 2021. The purpose of the inspection was to: (1) examine activities conducted under your licenses as they relate to safety and compliance with the U.S. Nuclear Regulatory Commission's (NRC's) rules and regulations and with the conditions of your license; (2) review your corrective actions related to violations previously cited by the NRC; and (3) assess your completed actions related to the May 2, 2019, Confirmatory Order (Order) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19122A123).

The team performed routine inspections of licensed activities under Idaho State University's (ISU's) NRC licenses 11-27380-01, 11-27380-04, and SNM-1373. Although an inspection of ISU's NRC License R-110 was not performed, the inspectors reviewed certain materials possessed under license R-110 for the purpose of assessing licensee compliance with specific accounting and reporting criteria. Within the areas inspected, the inspection consisted of a selected examination of procedures and representative records, observations of licensed activities, independent radiation measurements, and interviews with personnel. Enclosures 3 and 4 present the results of the inspection. Enclosure 3 is publicly available. Enclosure 4 is not publicly available because it contains Security-Related Information. The preliminary inspection findings were discussed with Dr. Scott Snyder, outgoing Vice President for Research, Dr. Donna Lybecker, incoming Vice President for Research, and other staff members at the conclusion of the onsite inspection.

**Enclosures 2 and 4 contain Sensitive Unclassified Non-Safeguards Information. When separated from Enclosures 2 and 4, this cover letter, Enclosure 1, and Enclosure 3 are decontrolled.**

K. Satterlee

2

Based on the results of this inspection, five apparent violations were identified and are being considered for escalated enforcement action in accordance with the NRC Enforcement Policy. The current Enforcement Policy is included on the NRC's Web site at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. The apparent violations involved: (1) two failures of the ISU Radiation Safety Committee and Reactor Safety Committee to provide oversight of, and written procedures for, two high-risk significance licensed activities; (2) a failure to comply with the provisions of the Order; and (3) two failures related to ISU's special nuclear material inventory and reporting to the Nuclear Materials Management and Safeguards System.

The circumstances surrounding these apparent violations, the significance of the issues, and the need for lasting and effective corrective action were discussed with Dr. Donna Lybecker and other members of your staff during the telephonic exit meeting on March 29, 2021.

Before the NRC makes its enforcement decision regarding these apparent violations, we are providing you an opportunity to request a predecisional enforcement conference (PEC) with the NRC. If a PEC is held, it will be open for public observation and the NRC may issue a press release to announce the time and date of the conference. If you decide to participate in a PEC, please contact Dr. Lizette Roldán-Otero at 817-200-1455 within 10 days of the date of this letter. A PEC should be held within 30 days of the date of this letter.

If you choose to request a PEC, the conference will afford you the opportunity to provide your perspective on these matters and any other information that you believe the NRC should take into consideration before making an enforcement decision. The decision to hold a PEC does not mean that the NRC has determined that a violation has occurred or that an enforcement action will be taken. This conference would be conducted to obtain information to assist the NRC in making an enforcement decision. The topics discussed during the conference may include information to determine whether a violation occurred, information to determine the significance of a violation, information related to the identification of a violation, and information related to any corrective actions taken or planned. In presenting your corrective actions, you should be aware that the promptness and comprehensiveness of your actions will be considered in assessing any civil penalty for the apparent violations. The guidance in NRC Information Notice 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," may be helpful in preparing your response (ADAMS Accession No. ML061240509).

Please be advised that the number and characterization of apparent violations described in Enclosure 3 may change as a result of further NRC review. You will be advised by separate correspondence of the results of our deliberations on this matter.

In addition to the apparent violations listed above, and as a result of the inspection, the NRC has determined that four non-escalated Severity Level IV violations of NRC requirements occurred. Three Severity Level IV violations involve matters that are not associated with Security-Related Information and are cited in the publicly available Notice of Violation (Notice), Enclosure 1. One Severity Level IV violation involves a matter that is associated with Security-Related Information and is cited in the non-publicly available Notice, Enclosure 2. The violations were evaluated in accordance with the NRC Enforcement Policy, which can be found at the NRC's Web site at [www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html](http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html). The violations are being cited in the enclosed Notices because they were identified by the NRC during the inspection. The Severity Level IV violations and the requirement to provide a written

K. Satterlee

3

response were discussed with Dr. Donna Lybecker and other members of your staff during the telephonic exit meeting on March 29, 2021.

You are required to respond to the Notices in Enclosure 1 and Enclosure 2 and should follow the instructions specified in the enclosed Notices when preparing your response. As previously discussed, the guidance in NRC Information Notice 96-28 may be helpful in preparing your response. Information regarding the reason for the violations, the corrective actions taken and planned to correct the violations and prevent recurrence, and the date when full compliance will be (or was) achieved should be addressed. The NRC's review of your response to the Notices will determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

To the extent possible, your response to the Notice in Enclosure 1 should not include any personal privacy or proprietary information so that it can be made available to the public without redaction. Because Security-Related Information may be necessary to provide an acceptable response to the Notice in Enclosure 2, as appropriate, please mark your entire response Security-Related Information in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390(d)(1) and follow the instructions for withholding in 10 CFR 2.390(b)(1). In accordance with 10 CFR 2.390(b)(1)(ii), the NRC is waiving the affidavit requirements for your response.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter, and Enclosures 1 and 3, will be made available electronically for public inspection in the NRC Public Document Room and from the NRC's ADAMS, accessible from the NRC website at <http://www.nrc.gov/reading-rm/adams.html>. Enclosures 2 and 4 contain Security-Related Information and will not be made available electronically for public inspection in the NRC Public Document Room or from the NRC's ADAMS.

If you have any questions concerning this matter, please contact Dr. Lizette Roldán-Otero of my staff at 817-200-1455.

Sincerely,

/RA/

Mary C. Muessle, Director  
Division of Nuclear Materials Safety

K. Satterlee

4

Docket Nos.: 030-32322, 030-38726, 070-01374, 050-00284

License Nos.: 11-27380-01, 11-27380-04, SNM-1373, R-110

Enclosures:

1. Notice of Violation (public)
2. Notice of Violation (non-public)
3. NRC Inspection Report 030-32322/2020-001; 030-38726/2020-001; 070-01374/2020-001 and Attachment (public)
4. NRC Inspection Report 030-32322/2020-001; 030-38726/2020-001; 070-01374/2020-001 and Attachment (non-public)

cc w/Enclosures:

Dr. Donna Lybecker  
Vice President for Research  
Idaho State University  
921 S. 8<sup>th</sup> Ave., Stop 8130  
Pocatello, ID 83209-8130

John Longley  
Radiation Safety Officer  
Idaho State University  
Idaho Accelerator Center  
1500 Alvin Ricken Drive  
Pocatello, ID 83209

Mark Dietrich  
Radiation Control Program Director  
Idaho Department of Environmental Quality  
1410 North Hilton Drive  
Boise, ID 83706

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5

NRC INSPECTION REPORT 030-32322/2020-001; 030-38726/2020-001; 070-01374/2020-001;  
AND NOTICE OF VIOLATION - DATED APRIL 2, 2021

Distribution

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ADAMS ACCESSION NUMBER – PUBLIC: LETTER AND ENCLOSURES 1 AND 3: ML21092A132

<b>Cover Letter (w/o Enclosures 2 &amp; 4)</b>		ADAMS		<input checked="" type="checkbox"/> Publicly Available		<input checked="" type="checkbox"/> Non-Sensitive		Keyword:
<input checked="" type="checkbox"/> SUNSI Review by: <b>JFK</b>		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Non-Publicly Available		<input type="checkbox"/> Sensitive		NRC-002
OFFICE	RIV:MIB	RIV MIB	NMSS	TTC	R1 DNMS	NRR	C MIB	
NAME	JFKatanic	ABBolger	MShoemaker	NJGriffis	MCreichard	CHBassett	DSBradley	
SIGNATURE	/RA/	/RA/	/RA/	/RA/	/SA MCR/	/RA/	/RA/	
DATE	1/22/21	1/25/21	2/2/21	1/22/21	01/20/21	1/20/21	2/1/21	
OFFICE	ACES:TL	RC	OE	NMSS	OGC	D: DNMS		
NAME	JRGroom	DMCylkowski	JDPeralta	RSun	TSSteineldt	MCMuessle		
SIGNATURE	/RA/	/RA/	/RA/	/RA/	/NLO/	/RA/		
DATE	2/4/21	2/4/21	3/5/21	2/23/21	3/19/21	4/2/21		

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NOTICE OF VIOLATION

Idaho State University  
Pocatello, Idaho

Docket Nos. 030-32322, 070-01374  
License Nos. 11-27380-01, SNM-1373  
EA-20-134

During an NRC inspection conducted March 9-13, 2020, at the licensee's facilities in Pocatello and Idaho Falls, Idaho, with continued in-office review through March 29, 2021, three violations of NRC requirements were identified. In accordance with the NRC Enforcement Policy, the violations are listed below:

- A. License Condition 9 of NRC Special Nuclear Material (SNM) License No. 1373 (SNM-1373), Amendment No. 5, dated February 27, 2019, states, in part, that licensed SNM is authorized for use in accordance with the statements, representations, and conditions specified in the licensee's application supplement dated February 14, 2011.

License application supplement dated February 14, 2011, Section 3, "The Place and Plan for Carrying Out the Activity," states, in part, that the licensed material will be stored in a locked steel storage container in a designated room of the Lillibridge Engineering Laboratory building.

Contrary to the above, on March 12, 2020, the licensee failed to store licensed material in a locked steel storage container in the designated room of the Lillibridge Engineering Laboratory building. Specifically, a uranium-235 fission counter authorized by SNM-1373, Item 6.B - 8.B, was not stored in the locked steel storage container in the designated room of the Lillibridge Engineering Laboratory building.

This is a Severity Level IV violation (NRC Enforcement Policy Section 6.3.d.9).

- B. License Condition 30 of NRC Materials License 11-27380-01, Amendment No. 37, dated February 4, 2019, requires, in part, that the licensee conduct its program in accordance with the statements, representations, and conditions specified in the Idaho State University (ISU) Radiation Safety Manual.

The ISU Radiation Safety Manual, Revision 13, dated December 5, 2019, Section 16.1, "Portable Survey Instruments," requires, in part, that calibration of instruments shall be done using NUREG-1556, Volume 11, Revision 1, dated February 2017, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Licenses of Broad Scope," Appendix H, "Radiation Monitoring Instrument Specifications and Model Radiation Survey Instrument and Air Sampler Calibration Program."

NUREG-1556, Volume 11, Revision 1, dated February 2017, Appendix H, Section "Model Radiation Survey Instrument Calibration Program," states, in part, that: (1) the calibration source should be well-collimated, and the calibration area should be designed to minimize scatter of radiation, which could affect the calibration process; (2) routine maintenance of radiation measurement instruments should be performed as recommended by the manufacturer; (3) calibration fields from gamma sources should be known with an accuracy when compared to secondary or primary national standards of 5 percent for dose rates greater than or equal to 0.1 millirad/hour (mrad/h) and 10 percent for dose rates less than 0.1 mrad/h; (4) for linear readout instruments, instrument readings should be within  $\pm x$  of the conventionally true value for the following

Enclosure 1

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ranges: Background to 1.0 mrad/h;  $\pm x = \pm 30$  percent, 1.0 mrad/h to 100 mrad/h;  $\pm x = \pm 20$  percent, 100 mrad/h to 1,000 Rad/h;  $\pm x = \pm 10$  percent.

Contrary to the above, from December 5, 2019, through March 9, 2020, the licensee failed to perform calibration of instruments in accordance with the guidance in NUREG-1556, Volume 11, Revision 1, dated February 2017, Appendix H, Section "Model Radiation Survey Instrument Calibration Program."

Specifically, (1) in the calibration area, calibration sources and calibration apparatus were placed adjacent to a concrete wall that was not designed to minimize scatter of radiation, and instrument calibrations did not account for scatter produced by the wall; (2) routine maintenance of Ludlum Model 9-3 ion chamber radiation measurement instruments were not performed as recommended by the manufacturer, including the failure to check and replace desiccants inside the instrument; (3) calibration fields from gamma sources was not known by the licensee with an accuracy within the accuracies described in NUREG-1556, Volume 11, Revision 1, Appendix H, and its calibration apparatus had changed since the gamma sources were last compared to secondary national standards in 1996; and (4) for the linear readout instruments that were calibrated during this time period, the instrument readings for the 100 mrad/h to 1,000 Rad/h were not within  $\pm 10$  percent of the conventionally true value.

This is a SL IV violation (NRC Enforcement Policy 6.3.d).

- C. 10 CFR 20.1904(a) requires, in part, that the licensee shall ensure that each container of licensed material bears a durable, clearly visible label that must provide sufficient information (such as the radionuclides present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass enrichment) to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

Contrary to the above, from March 9-13, 2020, the licensee failed to ensure that each container of licensed material bore a durable, clearly visible label that provided sufficient information (such as the radionuclides present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass enrichment) to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

Specifically, (1) the SADZ container which contained an approximately 27 curie plutonium-241 source, (2) a metal paint can which contained 74 uranium-235 fission foils, and (3) a metal cabinet which contained uranium-235 reactor fuel rodlets did not have durable, clearly visible labels that provided sufficient information (such as the radionuclides present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass enrichment) to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

This is a SL IV violation (NRC Enforcement Policy 6.3.d).

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Pursuant to 10 CFR 2.201, ISU is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copy mailed to the Director, Division of Nuclear Materials Safety, U.S. Nuclear Regulatory Commission Region IV, 1600 East Lamar Boulevard, Arlington, Texas 76011, and emailed to [R4Enforcement@nrc.gov](mailto:R4Enforcement@nrc.gov), within 30 days of the date of this letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a “Reply to a Notice of Violation; EA-20-134” and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or Severity Level; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken; and (4) the date when full compliance will be achieved.

Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued requiring information as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

Your response will be made available electronically for public inspection in the NRC Public Document Room or in the NRC’s Agencywide Documents Access and Management System (ADAMS), accessible from the NRC website at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy or proprietary information so that it can be made available to the public without redaction.

If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information).

In accordance with 10 CFR 19.11, you are required to post this Notice within two working days of receipt.

Dated this 2nd day of April 2021

**U.S. NUCLEAR REGULATORY COMMISSION  
REGION IV**

Docket Nos.: 030-32322  
030-38726  
070-01374  
050-00284

License Nos.: 11-27380-01  
11-27380-04  
SNM-1373  
R-110

Inspection Report Nos.: 030-32322/2020-001  
030-38726/2020-001  
070-01374/2020-001

Enforcement Action Nos.: EA-20-134  
EA-18-153  
EA-17-206  
EA-16-033

Event Notification Nos.: EN-46225  
EN-53012

Licensee: Idaho State University (ISU)

Locations Inspected: ISU Main Campus  
Pocatello, Idaho

William M. and Karin A. Eames Advanced Technical  
Education and Innovations Complex (EAMES)  
1999 Alvin Ricken Drive  
Pocatello, Idaho

Idaho Accelerator Center (IAC)  
1500 Alvin Ricken Drive  
Pocatello, Idaho

Center for Advanced Energy Studies (CAES)  
995 University Boulevard  
Idaho Falls, Idaho

ISU/University of Idaho (UI) Center for Higher Education  
1776 Science Center Drive  
Idaho Falls, Idaho

Inspection Dates: Onsite March 9-13, 2020, with in-office review through  
March 29, 2021

Exit Meeting Date: March 29, 2021

Enclosure 3

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Inspectors: Janine F. Katanic, PhD, CHP, Inspection Team Leader  
Senior Health Physicist  
Materials Inspection Branch  
Division of Nuclear Materials Safety, Region IV

Allyce B. Bolger  
Health Physicist  
Materials Inspection Branch  
Division of Nuclear Materials Safety, NRC Region IV

Michael C. Reichard  
Health Physicist  
Commercial, Industrial, R&D, and Academic Branch  
Division of Nuclear Materials Safety, NRC Region I

Mirabelle O. Shoemaker  
International Safeguards Analyst  
Material Control and Accounting Branch  
Office of Nuclear Material Safety and Safeguards

N. Jeff Griffis, CHP  
Senior Health Physicist  
Specialized Technical Training & Support Branch  
Office of the Chief Human Capital Officer

Craig H. Bassett  
Reactor Inspector (Research and Test Reactor)  
Office of Nuclear Reactor Regulation

Support from: Xiosong Yin  
Project Manager (Non-Power Reactor)  
Office of Nuclear Reactor Regulation

Osiris Siurano-Perez  
Project Manager  
Office of Nuclear Material Safety and Safeguards

Kevin M. Ramsey  
Senior Project Manager  
Office of Nuclear Material Safety and Safeguards

Approved by: Daniel S. Bradley  
Chief, Materials Inspection Branch  
Division of Nuclear Materials Safety, Region IV

Attachment: Supplemental Inspection Information

**EXECUTIVE SUMMARY**

**Idaho State University  
U.S. Nuclear Regulatory Commission Inspection Report  
Nos. 030-32322/2020-001; 030-38726/2020-001; and 070-01374/2020-001**

During March 9-13, 2020, the U.S. Nuclear Regulatory Commission (NRC) conducted an announced team inspection at the licensee's facilities located in Pocatello and Idaho Falls, Idaho. The objectives of the team inspection included but were not limited to: (1) reviewing the licensee's corrective actions related to enforcement actions from previously issued NRC inspection reports; (2) assessing the licensee's completed actions related to a May 2, 2019, Confirmatory Order (Order) EA-18-153; and (3) performing a routine inspection of activities under NRC licenses 11-27380-01, 11-27380-04, and SNM-1373.

The inspection team reviewed the licensee's corrective actions related to 11 Severity Level (SL) IV violations identified in NRC Inspection Report 030-32322/2018-001 and Notice of Violation, EA-18-153 (ADAMS Accession No. ML19011A015). The inspection team concluded that based on the licensee's corrective actions, all 11 SL IV violations could be closed. However, in reviewing these violations, the inspection team identified two new SL IV violations regarding the licensee's failure to: (1) ensure that three specific containers of licensed material bore a durable, clearly visible label that provided sufficient information to comply with NRC requirements; and (2) calibrate radiation survey instruments in accordance with licensee procedures.

As a result of the inspection, five apparent violations were identified. The apparent violations involved: (1) two failures of the ISU Radiation Safety Committee and Reactor Safety Committee to provide oversight of, and written procedures for, two high-risk significance licensed activities; (2) a failure to comply with the provisions of the Order; and (3) two failures related to ISU's special nuclear material (SNM) inventory and reporting to the Nuclear Materials Management and Safeguards System.

The inspectors reviewed the licensee's compliance with the May 2, 2019, Order issued by the NRC (ADAMS Accession No. ML19122A123). The licensee had completed many of the Order requirements, including: having an audit performed by a third-party person; performing a causal evaluation of the audit findings and previously issued NRC enforcement actions; developing a corrective action plan and schedule for completion; developing an ISU management oversight procedure; and performing an effectiveness review of the implemented corrective actions.

One apparent violation was identified regarding Condition A of the Order, which required that the licensee complete a 100 percent source inventory. The source inventory submitted to the NRC on July 25, 2019, pursuant to the Order, failed to account for licensed material in the licensee's possession under NRC licenses SNM-1373 and R-110.

The inspectors reviewed the licensee's possession and use of SNM. One SL IV violation was identified involving the licensee's failure to store certain SNM in the designated room identified on the license. Two SL III violations from previous NRC enforcement actions were closed involving the licensee's failure to: (1) secure licensed material from unauthorized removal or access; and (2) provide complete and accurate information regarding plutonium-239 in Material Balance Reports submitted to the Nuclear Materials Management and Safeguards System (NMMSS).

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Based on the results of the inspection, three apparent violations involving the licensee's possession and use of SNM were identified. One apparent violation in this area was related to the licensee's failure to have its Reactor Safety Committee review and approve plans and procedures for the usage of high-risk significance licensed materials in the subcritical assembly. The other two apparent violations in this area related to the licensee's failure to: (1) perform a physical inventory that consisted of a determination on a measured basis for the quantity of SNM on hand at a given time; and (2) provide complete and accurate information regarding uranium-235 in Material Balance Reports submitted to the NMMSS.

The inspectors reviewed the licensee's possession and use of an americium-241/beryllium (AmBe) source and an incident that occurred involving the AmBe source in which the drum that contained the source fell several feet to the bottom of its underground storage shaft. One apparent violation was identified involving the licensee's failure to establish appropriate administrative procedures, including written operating and emergency procedures, to assure safe use of the AmBe source, a high-risk significance licensed activity.

The inspectors reviewed the licensee's activities under its NRC license for radionuclide production using an accelerator. No violations were identified associated with the specific licensed activities performed under the radionuclide production license.

In a separate Security-Related Inspection Report, Enclosure 4, one SL IV violation was identified regarding licensee commitments for certain security measures.

## REPORT DETAILS

### 1 Program Overview (Inspection Procedure (IP) 87126, 87125)

#### 1.1 Program Scope

Idaho State University (ISU or licensee) is authorized under four different U.S. Nuclear Regulatory Commission (NRC) licenses to possess and use byproduct, source, and special nuclear material (SNM) for various activities authorized under the respective NRC licenses. The broad scope license, NRC License 11-27380-01, authorizes various licensed activities associated with research and development as well as academic instruction. The production license, NRC License 11-27380-04, authorizes various licensed activities associated with research and development, production, possession, and use of radiochemicals. Certain activities associated with SNM are authorized under NRC License SNM-1373. The licensee operates a research and test reactor under NRC License R-110.

Executive responsibility and authority for the administration of radiation safety at ISU is assigned to the President of ISU. The ISU President has delegated the responsibility and authority to oversee the implementation and management of radiation safety to the Vice President of Research. The Vice President of Research appoints the Chairman and other members of the Radiation Safety Committee. The Vice President of Research is also a member of the Radiation Safety Committee. Activities associated with the research and test reactor and certain activities associated with SNM are under the purview of the licensee's Reactor Safety Committee.

At the time of the inspection, the licensee had 11 Authorized Users that had been reviewed and approved by the Radiation Safety Committee, including the Radiation Safety Officer (RSO), the Director of the IAC, and the Reactor Administrator. The Radiation Safety Committee had approved 13 permits authorizing the use of radioactive material. Permits specified the Authorized User; permitted use locations; permitted radionuclides, form, and activity limits; and permitted uses and restrictions. Permits ranged in complexity from the use of a hand-held x-ray fluorescence analyzer, to research, to peptide iodination experiments, to the use of a subcritical assembly.

#### 1.2 Inspection Scope

During March 9-13, 2020, the NRC conducted an announced routine team inspection of the licensee's activities under NRC licenses 11-27380-01, 11-27380-04, and SNM-1373. Although an inspection of NRC License R-110 was not performed, the inspectors reviewed certain SNM possessed under license R-110 for the purpose of assessing licensee compliance with accounting and reporting criteria related to SNM. The team inspection was performed by five experienced and qualified NRC inspectors from various NRC offices and one NRC subject matter expert in SNM reporting and accountability.

The objectives of the team inspection included but were not limited to: (1) reviewing the licensee's corrective actions related to enforcement actions from previously issued NRC inspection reports; (2) assessing the licensee's completed actions related to a May 2, 2019, Confirmatory Order Modifying License (Order); and (3) performing routine inspections of activities under NRC licenses 11-27380-01, 11-27380-04, and SNM-1373.

The inspectors observed licensed activities at the licensee's facilities; reviewed records, procedures, and documents maintained by the licensee; performed independent radiation measurements; and interviewed licensee personnel. The inspectors also obtained and reviewed additional documents provided by the licensee following the onsite inspection.

## **2 Status of Previous Inspection Findings (IP 87126, IP 87124)**

### **2.1 Inspection Scope**

The inspectors reviewed the licensee's corrective actions related to previously issued NRC enforcement actions. This included a review of the licensee's corrective actions taken to restore compliance and an evaluation as to whether the corrective actions were sufficient to prevent recurrence.

The inspectors specifically reviewed the licensee's corrective actions to address:

- (1) NRC Inspection Report 030-32322/2015-001, EA-16-033 (ADAMS Accession No. ML16099A199). This inspection report included security-related violations. The inspectors' review of these violations is addressed in a separate security-related inspection report.
- (2) NRC Inspection Report 030-32322/2017-001, EA-17-206 (ADAMS Accession No. ML18123A498). The inspectors' review of two SL III violations from this Inspection Report is addressed in Section 4.3.3 below.
- (3) NRC Inspection Report 030-32322/2018-001, EA-18-153 (ADAMS Accession No. ML19011A015). The inspectors' review of this enforcement action is provided in Section 2.2 below.

### **2.2 Observations and Findings**

NRC Inspection Report 030-32322/2018-001, EA-18-153, described 11 SL IV violations and one apparent violation that was considered for escalated enforcement action in accordance with the NRC Enforcement Policy. The NRC and ISU engaged in alternative dispute resolution (ADR) to address the apparent violation. As a result of the ADR mediation, ISU agreed to take certain actions that are described in Section 3 of this report. The NRC agreed to not issue a Notice of Violation (NOV) for the apparent violation.

#### **2.2.1 Security of Portable Nuclear Gauges**

The apparent violation that was considered for escalated enforcement in NRC Inspection Report 030-32322/2018-001, EA-18-153, but ultimately not cited by the NRC based on the outcome of ADR, involved the licensee's failure to secure two portable nuclear density gauges with a minimum of two independent physical controls to prevent unauthorized removal (030-32322/2018-001-01).

For completeness, during the current inspection, the inspectors reviewed the licensee's portable nuclear gauge activities. The inspectors found that the licensee no longer possessed any portable nuclear gauges. Two CPN Model 503 portable nuclear gauges

were transferred by the licensee to Instrotek, Inc., an authorized recipient, on September 24, 2018. Two Troxler Model 3440 portable nuclear gauges were transferred by the licensee to Qal-Tek Associates, an authorized recipient, on December 19, 2018. And finally, one Seaman Model C-200 was transferred by the licensee to Seaman Nuclear Corporation, an authorized recipient, on January 24, 2019.

## 2.2.2 Labeling of Radioactive Materials

Inspection Report 030-32322/2018-001 cited a SL IV violation for the licensee's failure to ensure that each container of licensed material bore a durable, clearly visible label with the required information. The description of the violation in Inspection Report 030-32322/2018-001 is indicative of a widespread labeling issue that was observed throughout multiple licensee facilities.

During the current inspection, the inspection team observed licensed materials at multiple licensee facilities, including the main campus laboratories in the Biology, Engineering, Pharmacy, and Physics Buildings; the Shipping & Receiving and Hazardous Waste Storage Facilities; in the IAC White Hall, White Room, Copper Laboratory, main hall, vault storage area, and storage freight container; in the Research and Test Reactor Facility in the Lillibridge Engineering Laboratory; and in multiple laboratories in the Center for Advanced Energy Studies (CAES) facility. The inspectors observed that in response to the violation, the licensee had undertaken an extensive effort across its campus and multiple facilities to ensure that licensed materials were properly labeled. The inspectors observed that the containers used to store licensed materials included a clearly visible label bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL." The labels also provided information on the radionuclide(s) present, an estimate of the quantity of radioactivity, and other details to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures. For certain containers that housed several sources or multi-nuclide sources, ISU also posted inventory sheets with details on all the radionuclides that were present in the container.

Although the licensee had made these substantial efforts to label licensed materials, the inspectors observed three specific instances where licensed materials were not labeled as required. The inspection team determined that the licensee's efforts to address the violation were sufficient to address the programmatic issue of labeling and determined that based on the inspectors' observations of the licensee's corrective actions, Violation 030-32322/2018-001-02 is considered closed. However, the inspectors did identify three isolated occurrences involving labeling of licensed materials and determined that a new SL IV violation occurred.

### **Violation of Title 10 of the Code of Federal Regulations (10 CFR) 20.1904(a)**

Title 10 of the *Code of Federal Regulations* (10 CFR) 20.1904(a) requires, in part, that the licensee shall ensure that each container of licensed material bears a durable, clearly visible label that must provide sufficient information (such as the radionuclide(s) present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass enrichment) to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

Contrary to the above, from March 9-13, 2020, the licensee failed to ensure that each container of licensed material bore a durable, clearly visible label that provided sufficient information (such as the radionuclide(s) present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass enrichment) to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

Specifically, (1) the SADZ container which contained an approximately 27 curie plutonium-241 source, (2) a metal paint can which contained 74 uranium-235 fission foils, and (3) a metal cabinet which contained uranium-235 reactor fuel rodlets did not have durable, clearly visible labels that provided sufficient information (such as the radionuclide(s) present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass enrichment) to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

The licensee's failure to ensure that each container of licensed material bore a durable, clearly visible label that provided sufficient information was identified as a SL IV violation of 10 CFR 20.1904(a). (030-32232/2020-001-01; 070-01374/2020-001-01)

### 2.2.3 Inventory of Sealed Sources Under NRC Broad Scope License

Inspection Report 030-32322/2018-001 cited a SL IV violation for the licensee's failure to conduct a physical inventory every six months to account for all sealed sources possessed under the licensee's broad scope license, as required by license condition.

During the current inspection, the inspectors reviewed the licensee's radiation safety program activities and concluded that the licensee performed a physical inventory every six months to account for sealed sources possessed under the ISU NRC broad scope license. The licensee completed its first inventory under its revised inventory procedure in December 2019. The licensee's practices included observing individual sealed sources rather than accounting for groups of sealed sources within a container or location.

The inspection team determined that the licensee's efforts to address the violation with respect to sealed sources possessed under the broad scope license were sufficient and determined that based on the licensee's corrective actions, Violation 030-32322/2018-001-03 is considered closed. However, the inspectors did identify issues associated with the licensee's performance of physical inventories for materials not possessed under the broad scope license. Specifically, issues with inventory were identified regarding: (1) the conduct of a physical inventory as required by the Order; and (2) the conduct of an inventory as defined in 10 CFR Part 74, for uranium-235 possessed under the SNM and Research and Test Reactor licenses. These issues are discussed in detail in Section 3.2.1 and Section 4.3.4 below.

#### 2.2.4 Posting of and Access to Contamination Areas

Inspection Report 030-32322/2018-001 cited two SL IV violations for the licensee's failures to: (1) limit access to contamination areas when those individuals were not under the supervision of senior safety personnel; and (2) to properly post contamination areas.

As corrective actions, the licensee implemented changes to its radiation safety program regarding posting and controls for contaminated areas. The ISU Radiation Safety Manual was revised with Revision 13, dated December 5, 2019. This revision redefined contamination areas to be consistent with routine industry practices and standards. The revised ISU Radiation Safety Manual no longer specifically required supervision by senior Environmental Health and Safety Department personnel for access to contamination areas. Instead, specific requirements for contamination areas, such as access controls, monitoring, and personal protective equipment, are to be determined individually and described in Radiation Work Permits (RWPs) for work in those contamination areas.

At the time of the current inspection, there were no areas in any of the laboratories under the NRC broad scope license that were posted and controlled as contamination areas. The inspectors observed one room in the William M. and Karin A. Eames Advanced Technical Education and Innovations (EAMES) Complex that contained a glove box that had historically been used to handle unsealed radioactive material. The area around the glove box had been previously controlled by the licensee as a contamination area. Licensee staff had decontaminated the outside surfaces of the glove box, as well as the equipment and surfaces in the room, to background levels and had removed the contamination area posting for the room. The glove box itself was observed to be sealed off and posted as internally contaminated. No work activities were observed to be ongoing within or around the glove box. Access to the room that contained the glove box was controlled through key access and was limited to licensee radiation safety staff.

The inspectors observed other campus laboratories where radioactive materials were handled and interviewed users regarding potentially contaminated areas within their laboratories, such as surfaces inside fume hoods and absorbent pads on benchtop work areas. The inspectors observed that areas and surfaces potentially contaminated with radioactive material were clearly indicated with radiation safety warning tape and proper postings. Radioactive materials users demonstrated that these areas were surveyed for radioactive contamination in accordance with requirements in the licensee's Radiation Safety Manual and compared to licensee action levels. The inspectors also performed independent radiation surveys in these areas; no surveys identified radioactive contamination above background levels.

Under the ISU NRC production license, within the IAC, the inspectors observed two contamination areas: the target exchange area in the White Room, and the fume hood in the Copper Laboratory. Both areas were clearly and properly posted as contamination areas and access was restricted to appropriately trained and authorized individuals in accordance with the licensee's Radiation Safety Manual. Requirements for personal protective equipment (PPE) and survey requirements were defined in the applicable RWPs. At the IAC, the RWPs for the contamination areas included requirements for double gloves, double shoe covers, laboratory coat, and safety glasses. An inspector observed licensed activities in both contamination areas and determined

that the licensee met applicable requirements for these areas, including PPE use, radiation surveys, access control, and postings.

The inspection team determined that the licensee's corrective actions to address the violations with respect to posting of and access to contamination areas were sufficient to consider Violations 030-32322/2018-001-04 and 030-32322/2018-001-08 closed.

#### 2.2.5 Decommissioning Procedures

Inspection Report 030-32322/2018-001 cited a SL IV violation for the licensee's failure to follow licensee decontamination and decommissioning procedures. The violation pertained to an off-campus remote licensee radioactive materials laboratory in Meridian, Idaho. In this case, the researcher had retired, and the laboratory was no longer in use, but licensee radiation safety staff were not contacted regarding decontaminating and decommissioning the laboratory. Although licensee staff performed radiation surveys within the laboratory, it has not been formally decommissioned in accordance with licensee procedures, which resulted in the violation.

As immediate corrective actions, licensee radiation safety staff performed and documented a close out radiation survey for the laboratory. The licensee determined that the causal factors associated with the failure pertained to the remote location of the laboratory from the main campus and a lack of understanding that licensee radiation safety staff were required to be notified that the laboratory was no longer in use.

As comprehensive corrective actions, the licensee's Radiation Safety Manual and its Decommissioning Procedure were revised. The licensee compiled a complete list of all areas of radioactive materials use or storage and all radioactive materials users. Radioactive materials users were trained on their responsibilities to notify radiation safety staff of changes in the status of radioactive materials use, including cessation of licensed activities within a laboratory. The inspectors reviewed the training materials and found that they contained information consistent with the licensee's Radiation Safety Manual and its decontamination and decommissioning procedures.

The inspection team determined that the licensee's corrective actions to address the violation with respect to following decommissioning procedures were sufficient to consider Violation 030-32322/2018-001-05 closed.

#### 2.2.6 Transfer of Licensed Materials

Inspection Report 030-32322/2018-001 cited a SL IV violation for the licensee's failure to follow its procedures for transfer of licensed materials to other authorized entities. The violation was specifically related to transfers of licensed materials from the CAES facility in Idaho Falls to other licensed or authorized entities. The transfers did not follow licensee procedures in that the documentation for the transfer was not being signed by the former RSO as required. The former RSO was aware of the transfers prior to occurrence but was not signing the documentation as specified in the licensee's procedure.

The inspection team reviewed activities involving the licensee's transfer of licensed materials from the CAES facility to other licensed or authorized entities. As corrective actions to address the violation, the licensee's Radiation Safety Manual was revised to

clarify the transfer process. In the revised process, the radioactive materials user must complete the transfer form and submit it to the RSO. The form was revised to include a signature block for the RSO. Licensed materials are only authorized to be transferred after the form has been approved by the RSO. Additionally, a member of the licensee's radiation safety staff with U.S. Department of Transportation Hazmat training has been providing increased oversight of these transfer activities from the CAES facility and has been assisting with the packaging and preparation of the licensed materials for shipment.

The inspection team determined that the licensee's corrective actions were sufficient to address the violation involving the licensee's failure to follow its procedures for transfer of licensed materials to other authorized entities and consider Violation 030-32322/2018-001-06 closed.

#### 2.2.7 Posting of Radioactive Materials Use and Storage Areas

Inspection Report 030-32322/2018-001 cited a SL IV violation for the licensee's failure to post rooms or areas used to store licensed material in accordance with NRC requirements.

The inspection team reviewed the licensee's compliance with the posting requirements in 10 CFR 20.1902(e). Inspectors observed all areas on the ISU main campus where licensed materials under the ISU NRC broad scope license were used or stored, including laboratories in the Physics, Biology, Engineering, and Pharmacy Buildings that contained radioactive material exceeding 10 times the quantity of such material specified in Appendix C to 10 CFR Part 20. In addition, the inspection team observed the areas and rooms in the Physics Building that were used by the radiation safety staff to analyze campus survey samples, store various licensed sources and radioactive waste, and calibrate portable radiation survey meters. The inspection team also observed all radioactive materials storage and use areas at the CAES facility. The inspection team observed the EAMES Complex and the ISU/UI Center for Higher Education where inactive radioactive materials laboratories were undergoing decommissioning.

The inspection team observed all areas of licensed materials use or storage associated with the ISU production license, including the White Hall, White Room, Copper Laboratory, main hall, high bay area, vault storage area, and a storage freight container.

Inspectors observed all areas of licensed materials use or storage associated with the ISU SNM license, including the AGN-201 Research and Test Reactor facility and the SNM storage areas located in the Lillibridge Engineering Laboratory building.

All rooms and areas that contained radioactive material exceeding 10 times the quantity of such material specified in Appendix C to 10 CFR Part 20 were observed to be properly posted with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)." The inspection team also observed that additional posting materials were available to support situations where such supplemental postings would be necessary for certain processes, such as during accelerator operation activities. The licensee inspects postings during its semi-annual audits of laboratories that use or store licensed materials.

The inspection team determined that the licensee's corrective actions were sufficient to address the violation involving the licensee's failure to post rooms or areas used to store licensed material in accordance with NRC requirements and consider Violation 030-32322/2018-001-07 closed.

#### 2.2.8 Conduct of Radiological Surveys

Inspection Report 030-32322/2018-001 cited two SL IV violations for the licensee's failure to conduct routine radiological surveys, evaluate potential exposures, ensure that external exposure rate surveys were performed, and to conduct surveys for control and monitoring of external exposure.

The inspection team interviewed licensee employees and reviewed licensee procedures and records related to various types of radiation surveys performed of: (1) areas on the ISU main campus where radioactive material was actively being used or stored, including laboratories in the Physics, Biology, Engineering, and Pharmacy Buildings, (2) areas and rooms in the Physics Building used by the radiation safety staff to analyze campus survey samples, store various sources and radioactive waste, and calibrate portable radiation survey meters; (3) areas in the EAMES Complex and ISU/UI Center for Higher Education where inactive laboratories were undergoing decommissioning; (4) the White Hall, White Room, Copper Laboratory, main hall, high bay area, vault storage area, and a storage freight container at the IAC; (5) the AGN-201 research and test reactor facility and the SNM storage areas located in the Lillibridge Engineering Laboratory building; (6) areas in the CAES facility where radioactive materials were being used or stored; and (7) the Environmental Monitoring Laboratory.

The inspectors observed that radiation survey maps were posted at the entryways into areas of licensed materials use or storage. The radiation survey maps had been completed by the radiation safety staff in accordance with the ISU Radiation Safety Manual and contained all the required information to inform workers of the hazards present in the area. The inspectors confirmed that surveys for radiation dose rates and radiological contamination were completed at the required frequency. Radiation surveys were also found to have been conducted at the required frequency for areas where dispersible radioactive materials were used. Inspectors interviewed student radiation workers and radioactive materials users to confirm that the required user surveys were being performed in accordance with Radioactive Materials Use Permits for the selected laboratories.

For all areas reviewed, the inspectors determined that the licensee's radiation safety staff conducted routine radiological surveys to evaluate the strength of any radiation fields present and for the potential presence of any radiological contamination. Surveys were performed no less than the frequency specified in the licensee's Radiation Safety Manual. Routine radiation surveys were used by the licensee to evaluate potential exposures to aid in controlling exposures to licensee employees. Users of radioactive materials were found to be performing the appropriate types of radiation surveys within their laboratories at the required frequency.

The inspection team determined that the licensee's corrective actions to address the violations with respect to the conduct of radiation surveys were sufficient to consider Violations 030-32322/2018-001-09 and 030-32322/2018-001-10 closed.

During the review of these violations, the inspection team also reviewed the licensee's instrument calibration program. The licensee was performing its own calibrations for all dose rate survey instruments that were used on the ISU main campus. Licensee radiation safety staff performed these calibrations using two J.L. Shepherd instrument calibration devices that were housed in a concrete vault in the basement of the Physics Building. The licensee had recently revised its Radiation Safety Manual on December 5, 2019, to reflect that instrument calibrations would be performed using the guidance in NUREG-1556, Volume 11, Revision 1, Appendix H. On January 23, 2020, the licensee issued Procedure RS-12, "Instrument Calibration," Rev. 0, to provide more detailed guidance regarding survey instrument calibration. Inspectors reviewed these procedures, observed the calibration vault, and interviewed radiation safety staff who were approved to perform survey instrument calibrations. In addition, inspectors reviewed the calibration records for all radiation survey instruments that had been calibrated by the licensee since December 5, 2019, and discussed these calibrations with licensee radiation safety personnel.

### **Violation of License Condition 30, License 11-27380-01**

License Condition 30 of NRC Materials License 11-27380-01, Amendment No. 37, dated February 4, 2019, requires, in part, that the licensee conduct its program in accordance with the statements, representations, and conditions specified in the ISU Radiation Safety Manual.

The ISU Radiation Safety Manual, Revision 13, dated December 5, 2019, Section 16.1, "Portable Survey Instruments", requires, in part, that calibration of instruments shall be done using NUREG-1556, Volume 11, Revision 1, dated February 2017, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Licenses of Broad Scope," Appendix H, "Radiation Monitoring Instrument Specifications and Model Radiation Survey Instrument and Air Sampler Calibration Program."

NUREG-1556, Volume 11, Revision 1, dated February 2017, Appendix H, Section "Model Radiation Survey Instrument Calibration Program", states, in part, that: (1) the calibration source should be well-collimated, and the calibration area should be designed to minimize scatter of radiation, which could affect the calibration process; (2) routine maintenance of radiation measurement instruments should be performed as recommended by the manufacturer; (3) calibration fields from gamma sources should be known with an accuracy when compared to secondary or primary national standards of 5 percent for dose rates greater than or equal to 0.1 millirad/hour (mrad/h) and 10 percent for dose rates less than 0.1 mrad/h; (4) for linear readout instruments, instrument readings should be within  $\pm x$  of the conventionally true value for the following ranges: Background to 1.0 mrad/h;  $\pm x = \pm 30$  percent, 1.0 mrad/h to 100 mrad/h;  $\pm x = \pm 20$  percent, 100 mrad/h to 1,000 Rad/h;  $\pm x = \pm 10$  percent.

Contrary to the above, from December 5, 2019, through March 9, 2020, the licensee failed to perform calibration of instruments in accordance with the guidance in NUREG-1556, Volume 11, dated February 2017, Appendix H, Section "Model Radiation Survey Instrument Calibration Program." Specifically, (1) in the calibration area, calibration sources and calibration apparatus were placed adjacent to a concrete wall that was not designed to minimize scatter of radiation and instrument calibrations did not account for scatter produced by the wall; (2) routine maintenance of Ludlum Model 9-3 ion chamber radiation measurement instruments were not performed as recommended

by the manufacturer, including the failure to check and replace desiccants inside the instrument; (3) calibration fields from gamma sources was not known by the licensee with an accuracy within the accuracies described in NUREG-1556, Volume 11, Revision 1, Appendix H, and its calibration apparatus had changed since the gamma sources were last compared to secondary national standards in 1996; and (4) for the linear readout instruments that were calibrated during this time period, the instrument readings for the 100 mrad/h to 1,000 Rad/h were not within  $\pm 10$  percent of the conventionally true value.

The licensee's failure to follow its radiation survey instrument calibration procedures was identified as a SL IV violation. (030-32232/2020-001-02)

#### 2.2.9 Testing of Fume Hoods

Inspection Report 030-32322/2018-001 cited a SL IV violation for the licensee's failure to test fume hoods at least annually.

The licensee had developed a list of all fume hoods used for licensed materials use or storage, and the date of the most recent testing for those hoods. The licensee radiation safety staff inspects the functionality of fume hoods on a semi-annual basis when performing audits of laboratories.

The inspectors observed laboratories on the ISU main campus, at the IAC, at the CAES facility, at the IAC/UI Center for Higher Education, and at the EAMES Complex that contained a fume hood designated for radioactive materials use. Some fume hoods that were in laboratories undergoing decommissioning were posted to indicate that they were not to be used for radioactive materials use or storage. For the fume hoods in laboratories with active licensed materials use or storage, the inspectors verified that the fume hoods had been tested in accordance with the licensee's Radiation Safety Manual, which requires that fume hoods be tested for airflow at least annually.

The inspection team determined that the licensee's corrective actions to address the violation with respect to the testing of fume hoods annually were sufficient to consider Violation 030-32322/2018-001-11 closed.

#### 2.2.10 Reviews of Radiation Protection Program

Inspection Report 030-32322/2018-001 cited a SL IV violation for the licensee's failure to periodically, at least annually, review its radiation protection program content and implementation.

In response to NRC's Confirmatory Order Modifying License, issued May 2, 2019, the licensee developed and implemented a procedure "Radiation Safety Oversight, EHS-19-01, Revision 0." This is further described in Section 3.2.6 below. The procedure specifies the levels of oversight of the radiation safety program to be provided by the RSO and by the Radiation Safety Committee.

In August 2019, the Chairman of the Radiation Safety Committee led the Radiation Safety Committee's assessment of the radiation safety program. The assessment described the personnel changes that had occurred during the previous fiscal year at the RSO position and at the Vice President for Research position. The assessment further

described the enforcement actions that had been issued by the NRC and the actions taken and planned by ISU to address them. As described in the licensee's oversight procedure, the Radiation Safety Committee shall review a subset of licensed activities on an annual basis. The inspectors confirmed that the Chairman performed an overview of a subset of licensed activities, which included reviews of records, interviews with users, and physical inspection of facilities. The Chairman identified specific findings that warranted attention or correction by the radiation safety staff. The overall assessment by the Chairman was that the radiation safety program was significantly improved from 2018, and that additional corrective action efforts and improvements were ongoing. The Chairman provided the results of the formal radiation program assessment to the ISU Vice President of Research.

In September 2019, the RSO completed an assessment of the radiation safety program. The assessment covered the previous fiscal year. The RSO specifically reviewed licensed activities conducted under various permits issued under the broad scope license, including for the Environmental Measurement Laboratory, the EAMES Complex, and the CAES facility. The RSO's assessment consisted of a review of records, interviews with radioactive materials users, and physical inspections of areas of authorized radioactive materials use or storage. As a result of the assessment, the RSO identified specific items that warranted corrective actions. The assessment provided a general overview of program changes that had occurred under the broad scope, production, SNM, and research and test reactor licenses. Topics reviewed included access control, security of licensed materials, receipt and transfer, sealed source leak tests, training and instruction to workers, radiation protection, radioactive waste management, decommissioning, transportation activities, notifications and reports, posting and labeling, and dose to members of the public.

Additionally, the May 2, 2019, Order required that a third-party person complete an audit of all four NRC licenses issued to ISU. The audit report made 18 recommendations, which were defined as areas for improvement based on industry experience, best practices, or industry standards. This is further described in Section 3.2.3 below.

The inspection team determined that the licensee's corrective actions to address the violation with respect to the licensee's failure to periodically, at least annually, review its radiation protection program content and implementation, were sufficient to consider Violation 030-32322/2018-001-12 closed.

The inspection team also reviewed the Radiation Safety Committee's oversight of changes to the radiation safety program and to procedures. NRC Inspection Report 030-38726/2015-001 and NOV identified a SL IV violation regarding the licensee making program changes and changes to procedures that were not in accordance with the NRC license (ADAMS Accession No. ML15132A740). Specifically, the licensee is allowed to make program changes, and changes to procedures that were previously approved by the NRC and incorporated into the license, without prior NRC approval, as long as: (1) the proposed revision is documented, reviewed, and approved by the licensee's Radiation Safety Committee in accordance with established procedures prior to implementation, (2) the revised program is in accordance with regulatory requirements, will not change license conditions, and will not decrease the effectiveness of the radiation safety program, (3) licensee staff are trained in the revised procedures prior to implementation, and (4) the licensee's audit program evaluates the effectiveness of the change and its implementation.

During the 2015 inspection, it was identified that several procedures had been revised by the licensee and implemented without Radiation Safety Committee review and approval. It was also identified that the licensee had changed a license commitment for the Radiation Safety Committee to meet not less than once per calendar quarter to not less than four times per calendar year. The NRC's review determined that this change decreased the effectiveness of the radiation safety program.

In its response to the NOV, the licensee acknowledged that Radiation Safety Committee meetings need to occur at least quarterly to assure the effectiveness of the committee, and that the issue would be brought up for a vote at the next committee meeting. The licensee also stated that they would institute a "compliance cover sheet" to formally document compliance with the NRC license for changes to the radiation protection program and to procedures previously approved by the NRC and incorporated into the license (ADAMS Accession No. ML15160A754).

At the time that the violation was issued, ISU Radiation Safety Manual, Revision 11, dated September 2014 was in effect. Revision 12, issued March 2018, a second version of Revision 12, issued June 2018, and Revision 13, issued December 2019, did not incorporate the changes the licensee committed to perform in order to correct the previously issued violation. The inspectors determined that the licensee was not effective in correcting the violation and did not have a formal mechanism to ensure that changes to the radiation safety program and procedures were in accordance with the license and that these changes would be evaluated as part of the licensee's audit program. This was discussed with the licensee, who attributed this breakdown and deficiency to the multiple changes in radiation oversight personnel over the past several years.

The inspectors also reviewed the licensee's safety culture program. In 2014, the licensee voluntarily put a safety culture program in place, which consisted of educating ISU staff and students regarding the traits of a positive safety culture, and emphasized the ability for anyone to raise safety concerns or report non-compliances to their supervisor, the RSO, the Chairman of the Radiation Safety Committee, any member of the Radiation Safety Committee, the radiation safety staff, the State of Idaho, or to the NRC. At the time, the licensee instituted an anonymous means for individuals to call a toll-free number or make an anonymous report through the My Safe Campus website. In January 2015, the licensee evaluated its safety culture and identified areas for improvement.

During the current inspection, the inspection team inquired as to the status of the licensee's safety culture program. An evaluation of the safety culture program had not been performed by the licensee for several years. The inspectors confirmed that even though the licensee's oversight of its safety culture program had diminished, training for radioactive materials users contained ISU's commitment to a strong safety culture and provided information for reporting concerns in confidence and without prejudice.

### 2.3 Conclusions

The inspection team reviewed the licensee's corrective actions related to 11 SL IV violations identified in NRC Inspection Report 030-32322/2018-001, EA-18-153 (ADAMS Accession No. ML19011A015). The inspection team concluded that all 11 SL violations could be closed. However, the inspection team identified two new SL IV violations

regarding the licensee's failure to: (1) ensure that three specific containers of licensed material bore a durable, clearly visible label that provided sufficient information to comply with 10 CFR 20.1904(a), and (2) calibrate radiation survey instruments in accordance with licensee procedures.

### **3 Status of Licensee Compliance with Confirmatory Order Modifying License (IP 92703)**

#### **3.1 Inspection Scope**

The inspectors reviewed the licensee's compliance with the May 2, 2019, Order. The inspectors reviewed records, procedures, and documents related to the licensee's compliance with the Order, including documents that were required to be submitted to the NRC pursuant to the Order. The inspectors also observed licensed facilities and activities, and interviewed personnel regarding compliance with the Order.

#### **3.2 Observations and Findings**

On January 10, 2019, the NRC issued Inspection Report 030-32322/2018-001, EA-153 (ADAMS Accession No. ML19011A015). The Inspection Report identified one apparent violation that was being considered for escalated enforcement action in accordance with the NRC Enforcement Policy. In response to the NRC's January 10, 2019, letter and Inspection Report, ISU requested ADR to address the apparent violation.

As a result of a successful ADR mediation session, commitments were made as part of a settlement agreement between ISU and the NRC. At the ADR mediation session, ISU agreed that an Order would be issued in settlement of a disputed claim in order to avoid further action by the NRC. Accordingly, on May 2, 2019, the Order was issued to ISU (ADAMS Accession No. ML19122A123). The legally binding Order required that ISU take certain actions by established dates. The Order was issued against all four NRC licenses held by ISU.

##### **3.2.1 Order Condition A**

Condition A of the Order required, in part, that one or more third-party person(s) selected by ISU will complete a 100 percent source inventory within 90 days of the issuance of the Order and submit the results in writing to the NRC. The Order was issued on May 2, 2019; therefore, Condition A was due to the NRC by July 31, 2019. The inventory was completed by the third-party person on July 24, 2019, and submitted to the NRC on July 25, 2019. The inventory report contained Sensitive Unclassified Non-Safeguards Information and is not publicly available.

When the inventory report was received by the NRC, it was reviewed. However, the NRC could not fully comprehend the document because the inventory provided contained limited information about the materials possessed by the licensee. The inspectors were able to complete their review of the inventory during the onsite inspection. During the onsite inspection, the inspectors were able to cross reference the radioactive materials listed on the licensee's July 24, 2019, third-party inventory against the licensee's inventory in its inventory tracker, called "HP Assist." The inspectors were also able to perform physical spot-checks of the radioactive materials listed in the licensee's July 24, 2019, third-party inventory against the actual physical radioactive

materials possessed by the licensee. The licensee noted that in order for the third-party person to perform the inventory, they were assisted by members of the licensee's radiation safety staff.

The inspectors determined that the third-party inventory was not performed comprehensively across all four of ISU's NRC licenses. Specifically, the inventory was not complete and did not account for radioactive material possessed under the ISU SNM license and the ISU Research and Test Reactor license.

### **Apparent Violation of Order Dated May 2, 2019**

The Order EA-18-153, dated May 2, 2019, Section V, "Third-Party Audit and Causal Evaluation," Condition A, requires, in part, that within 90 days of the issuance date of the Order, one or more third-party person(s) selected by ISU will complete a 100 percent source inventory and submit the results in writing to the NRC and the independent auditor.

Contrary to the above, from July 31, 2019, to March 9, 2020, the third-party person selected by ISU failed to complete a 100 percent source inventory. Specifically, the inventory performed by the third-party person and submitted to the NRC on July 25, 2019, failed to account for licensed material in the licensee's possession under NRC licenses SNM-1373 and R-110.

The licensee's failure to perform a complete inventory of all material possessed by the licensee under its four NRC licenses was identified as an apparent violation of the NRC Order issued May 2, 2019. (030-32232/2020-001-03; 030-38726/2020-001-01; 070-01374/2020-001-02)

The licensee could not implement immediate corrective actions to address the identified discrepancy because immediately following the NRC's onsite inspection, the ISU campus shut down due to the COVID-19 Public Health Emergency. After the campus partially reopened, between May 27- June 10, 2020, ISU personnel performed a detailed physical inventory of the licensed materials possessed under the R-110 and SNM-1373 licenses.

### 3.2.2 Order Condition B

Condition B of the Order required, in part, that within 30 days of the issuance date of the Order, ISU will submit to the NRC for approval the resumé of one or more third-party persons knowledgeable in the various types of licensed activities at ISU. The Order specified that the person(s) must also have appropriate experience and knowledge of performing audits of the various licensed activities at ISU, performing causal analyses, and development of corrective action plans based on the audit findings and the cause evaluations. The Order was issued on May 2, 2019; therefore, Condition B was due by June 2, 2019.

On May 30, 2019, the licensee submitted the resumé of the proposed third-party person to the NRC. The NRC reviewed the resumé and on June 18, 2019, requested additional information regarding the third-party person. The requested information was provided on June 18, 2019. On June 20, 2019, the NRC approved the resumé provided by the third-party person (ADAMS Accession No. ML19179A006).

3.2.3 Order Condition C.1.

Condition C.1. of the Order required, in part, that within 150 days of the NRC's approval of the third-party person, that ISU complete an audit of all four NRC licenses and submit to the NRC. The Order specified that the audit will include, at a minimum: observation of activities; knowledge interviews of ISU personnel; records review; a review of Radiation Safety Committee activities; and approvals of Authorized Users and uses of licensed material. The third-party person was approved by the NRC on June 20, 2019; therefore, the audit was due to the NRC by November 18, 2019.

On November 11, 2019, the licensee submitted the third-party audit of the ISU radiation safety program to the NRC. The audit contained Sensitive Unclassified Non-Safeguards Information and is not publicly available. The audit was reviewed by the inspectors and found to have included field observation of licensed activities, interviews of ISU personnel including those involved in licensed activities, a review of various licensee records related to its radiation safety program, a review of Radiation Safety Committee activities, and a review of Authorized Users and uses of licensed material.

The audit report stated that the auditors did not identify any findings or deficiencies. The audit report defined "findings" as items that indicated a fundamental and significant breakdown in the licensee's radiation safety program that would likely result in regulatory concerns. The audit report defined "deficiencies" as a departure from specified requirements, procedures, or guidance.

The audit report made 18 recommendations, which were defined as areas for improvement based on industry experience, best practices, or industry standards. For example, recommendations were made to enhance administrative and recordkeeping practices, and to enhance or clarify existing licensee practices or procedures.

3.2.4 Order Condition C.2.

Condition C.2. of the Order required that within 60 days of completing Order Condition C.1., the licensee must complete a causal evaluation of the audit findings and NRC enforcement actions from January 1, 2017, to the date of the Order on May 2, 2019. Since C.1. was completed on November 4, 2019, Condition C.2. was due to the NRC by January 3, 2020.

On January 4, 2020, the licensee's third-party person completed the causal evaluation. The licensee submitted the third-party causal evaluation to the NRC on January 8, 2020. The causal evaluation contained Sensitive Unclassified Non-Safeguards Information and is not publicly available.

The causal evaluation was reviewed by the inspectors. The third-party person reviewed the NRC enforcement actions issued between January 1, 2017, to May 2, 2019. The review included:

- Two SL III violations issued on May 3, 2018, EA-17-206 (ADAMS Accession No. ML18123A498). The violations involved failures to: (1) secure from unauthorized removal or access material stored in a controlled or unrestricted area, and the failure to maintain constant surveillance of licensed material that was in a controlled or

unrestricted area that was not in storage; and (2) provide information to the NRC that was complete and accurate in all material respects.

- Eleven SL IV violations issued, and one apparent violation described in NRC Inspection Report 030-32322/2018-001, EA-18-153 (ADAMS Accession No. ML19011A015).

The third-party causal evaluation examined each violation and the apparent violation and determined an immediate and root cause for each. The evaluation stated that the immediate causes were reviewed to determine what types of fundamental breakdowns existed. The third-party causal evaluation determined that the root causes of violations could be summarized into three categories: inadequate procedures, inadequate training, and inadequate staffing. This information was then used by the third-party person to determine the root cause of all the violations.

The third-party causal evaluation concluded that “upper management problems resulted in inadequate staff levels which led to inadequate procedures and inadequate training.” Because the evaluation did not further describe what was meant by “upper management problems,” it was unclear to the inspectors that the licensee’s proposed corrective actions would be sufficient to address the root cause of the violations and to prevent recurrence. The NRC will review the licensee’s completed corrective actions during future inspection activities.

### 3.2.5 Order Condition D

Condition D of the Order required that within 60 days of receiving the third-party person causal evaluation and recommended corrective actions, ISU shall submit to the NRC its corrective action plan with a schedule for completion of the actions it takes. It further specified that if ISU determined that it will not adopt one or more recommended corrective actions from the third-party person, ISU must identify to the NRC, in its plan, the basis for not accepting the third-party recommendation(s). All corrective actions must be completed by ISU within 18 months of the corrective action plan submittal to the NRC.

On January 4, 2020, the licensee’s third-party person completed the causal evaluation and provided it to ISU. Therefore, Condition D was due to the NRC within 60 days of January 4, 2020, which was March 4, 2020. The licensee provided the corrective action plan to the NRC on March 6, 2020 (ADAMS Accession No. ML20087K756).

The corrective action plan described programmatic corrective actions, which included a renewed ISU senior management commitment to the radiation safety program, addressing radiation safety program staffing issues, and developing new and/or revising existing radiation safety policies and procedures. Corrective actions also included updating and expanding radiation safety training, making improvements to the tracking of radioactive materials, performing radiation safety program evaluations, and making enhancements to tracking radiation safety tasks.

The corrective action plan also included specific corrective actions that were taken to address previously issued violations from earlier NRC enforcement actions. In addition, the corrective action plan specifically addressed corrective actions related to the 18 recommendations from the audit from Order Condition C.1.

The licensee provided a table to the NRC noting the high-level corrective actions and the expected completion date. The Order specifies that all corrective actions must be completed within 18 months of the corrective action plan submittal to NRC. Since the corrective action plan was submitted to the NRC on March 6, 2020, the corrective actions must be completed by 18 months from that date, which is September 6, 2021. The NRC will review the licensee's completed corrective actions during future inspection activities.

### 3.2.6 Order Condition E

Condition E of the Order required that within 90 days of the issuance date of the Order, ISU shall develop a procedure to enhance management oversight by requiring Radiation Safety Committee members to participate in radiation safety program audits. The Order was issued May 2, 2019; therefore, Condition E was due by July 31, 2019.

On June 24, 2019, the licensee finalized its procedure number 19-01, "Radiation Safety Program Oversight." The licensee provided the procedure, which is not publicly available, to the NRC on July 25, 2019.

The inspectors reviewed the procedure and found that it defined the roles and responsibilities for the ISU Vice President for Research, the RSO, the Radiation Safety Committee Chairperson, and the Radiation Safety Committee members. The procedure further described management oversight of the radiation safety program and outlined specific subsets of the radiation safety program that would be assessed and reviewed on a routine periodic basis.

### 3.2.7 Order Condition F

Condition F of the Order required that within 6 months after submitting the corrective action plan to the NRC and every 6 months thereafter, subject to Condition G, ISU will perform an effectiveness review of its corrective actions. As specified in the Order, the review must include at least one independent third-party person on the assessment team. Within 30 days of completion of the effectiveness review, ISU will submit a report to the NRC with the results of its review, the status of the corrective action plan, and the revisions/modifications to the corrective action plan to address any findings.

The corrective action plan was submitted to the NRC on March 6, 2020; therefore, the licensee was required to perform the effectiveness review by September 6, 2020, and then submit it to the NRC within 30 days of completion and then every 6 months thereafter. On September 29, 2020, the licensee submitted its first effectiveness review (ADAMS Accession No. ML20309A287). The licensee's next effectiveness review is due in March 2021.

The inspectors reviewed the licensee's first effectiveness review. The effectiveness review provided a status for each corrective action item or category as either: complete, in progress, or "complete (routine)." The licensee used "complete (routine)" to indicate that the corrective action or program change is complete, but the continued implementation is part of the ongoing routine ISU radiation safety program. Of the 36 corrective action items or categories described in the effectiveness review, the licensee identified that 14 were complete, 14 were "complete (routine)" and had been incorporated into the ongoing radiation safety program, and 8 were in progress.

Corrective actions that were in progress included addressing staffing issues, further developing radiation safety program documents and procedures, and providing radiation safety training. Some delays in implementing certain corrective actions were attributed to disruptions caused by the COVID-19 Public Health Emergency.

### 3.2.8 Order Condition G

Condition G of the Order requires that within 6 months after completion of all corrective actions, ISU will perform a final effectiveness review and submit the report to the NRC. The due date for this item is to be determined.

### 3.3 Conclusions

The inspectors reviewed the licensee's compliance with the May 2, 2019, Order issued by the NRC. The licensee had completed many of the Order requirements, including: having an audit performed by a third-party person; performing a causal evaluation of the audit findings and previously issued NRC enforcement actions; developing a corrective action plan and schedule for completion; developing ISU management oversight procedures; and performing an effectiveness review of the implemented corrective actions.

One apparent violation was identified regarding Condition A of the Order, which required that the licensee complete a 100 percent source inventory. The source inventory submitted to the NRC on July 25, 2019, pursuant to the Order, failed to account for licensed material in the licensee's possession under NRC licenses SNM-1373 and R-110.

## 4 **ISU Possession and Use of SNM**

### 4.1 Inspection Scope

On March 9-13, 2020, the inspection team performed an announced, routine inspection of the licensee's activities involving the possession and use of SNM. Activities involving SNM were conducted under the ISU broad scope license 11-27380-01, the ISU SNM license SNM-1373, and under the ISU Research and Test Reactor license R-110. The inspectors reviewed records, procedures, and documents maintained by the licensee, observed licensed facilities, materials, and activities, performed independent radiation measurements, and interviewed personnel. The inspectors also reviewed the licensee's corrective actions related to previously issued violations involving the possession and use of SNM. The licensee's reports to the Nuclear Materials Management and Safeguards System (NMMSS) were also reviewed, and the inspectors conducted a physical inventory of the licensee's SNM in an attempt to reconcile the information reported by the licensee to the NMMSS.

### 4.2 Background

The licensee is authorized to possess and use SNM under three of its NRC licenses: ISU broad scope license 11-27380-01; ISU SNM license SNM-1373; and ISU Research and Test Reactor license R-110. The specific SNM possessed under each license is subject to the terms and conditions of the specific NRC license it is authorized to be possessed under. The type and uses of SNM by ISU are wide ranging and include SNM

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used for research, academic instruction, and research and test reactor operation. Some SNM possessed by the licensee is in storage and not utilized. All SNM possessed by ISU must be accounted for through the NMMSS.

The NMMSS is an NRC and U.S. Department of Energy (DOE) sponsored system to track and account for SNM within the United States. In accordance with 10 CFR Part 74, all licensees who possess SNM in a quantity of one gram or more are required to make reports to the NMMSS. Specifically, ISU is required to perform a physical inventory of all SNM in its possession at intervals not to exceed 12 months, and to submit a materials status report to the NMMSS within 60 days of the physical inventory. Reports submitted to the NMMSS are made through an assigned Reporting Identification Symbol (RIS) and not by individual NRC license numbers. Accordingly, all SNM possessed by ISU across all of its NRC licenses is reported under the same RIS.

The licensee has faced some historical challenges with respect to the control and accounting for SNM. In 2010, during a routine inventory of certain SNM possessed under the broad scope license, a discrepancy was discovered by the licensee. The licensee had possessed 14 nuclear accident dosimeters (NAD) that each contained approximately 1 gram of plutonium-239. An inventory performed by the licensee identified that two NAD sources were missing. This loss was reported to the NRC on September 2, 2010 (Event Notification (EN) 46225). The licensee implemented corrective actions which included: utilizing new storage containers, implementing a new procedure that required two-person verification of all NAD source use, and enhancing ISU management and Radiation Safety Committee attention regarding the NAD sources. In April 2011, the two missing NAD sources were subsequently found by the licensee in a garbage bag in a source storage area. Additional details regarding the event and NRC's response can be found in NRC Inspection Report 030-32322/2010-001, dated February 22, 2012 (ADAMS Accession No. ML12053A232).

In October 2017, during a routine inventory of the 14 NAD sources, a discrepancy was noted by the licensee between the ISU internal inventory and the inventory that ISU had reported to the NMMSS. The NMMSS report indicated the licensee had 14 NAD sources of approximately 1 gram of plutonium-239 each, whereas the licensee's physical inventory could only account for 13 NAD sources. The loss of material was reported to the NRC on October 13, 2017 (EN 53012).

As a result of the NRC's review of the matter, the licensee was issued a \$8,500 civil penalty and two SL III violations. The violations involved failures to: (1) secure from unauthorized removal or access material stored in a controlled or unrestricted area, and the failure to maintain constant surveillance of licensed material that was in a controlled or unrestricted area that was not in storage; and (2) provide information to the NRC in NMMSS Material balance Reports that was complete and accurate in all material respects. The licensee's corrective actions included: revisions in inventory practices, proposing a reduction in the inventory of licensed materials possessed, and establishing methods to more clearly link the ISU internal inventory to the NMMSS. Additional details regarding the event and NRC's response can be found in NRC Inspection Report 030-32322/2017-001, dated February 7, 2018 (ADAMS Accession No. ML18017A373), and in NOV and Proposed Imposition of Civil Penalty - \$8,500, dated May 3, 2018 (ADAMS Accession No. ML18123A498).

Because of these past licensee challenges with respect to the possession of SNM, members of the inspection team focused their inspection efforts on the licensee's inventory and accounting of SNM across ISU's NRC licenses. An inspection team member who was a subject matter expert in the NMMSS provided additional support to review the licensee's reporting to the NMMSS.

#### 4.3 Observations and Findings

##### 4.3.1 Storage of SNM

The inspectors reviewed the facilities that were used by the licensee for the storage of SNM. With one exception, SNM was found to be stored in appropriate containers and properly secured to prevent unauthorized access. The inspectors observed that a uranium-235 fission counter authorized under license SNM-1373 was stored in a different room than the room authorized in the license. Although the source was secure, it was not in the location authorized by license SNM-1373.

#### **Violation of License Condition 9, License SNM-1373**

License Condition 9 of License SNM-1373, Amendment No. 5, dated February 27, 2019, states, in part, that licensed SNM is authorized for use in accordance with the statements, representations, and conditions specified in the licensee's application dated February 27, 2009, and supplement dated February 14, 2011.

License Application supplement dated February 14, 2011, Section 3, "The Place and Plan for Carrying Out the Activity," states, in part, that the licensed material will be stored in a locked steel storage container in a designated room of the Lillibridge Engineering Laboratory building.

Contrary to the above, on March 12, 2020, the licensee failed to store licensed material in a locked steel storage container in the designated room of the Lillibridge Engineering Laboratory building. Specifically, a uranium-235 fission counter authorized by SNM-1373, Item 6.B - 8.B, was not stored in the locked steel storage container in the designated room of the Lillibridge Engineering Laboratory building.

The licensee's failure to store certain SNM licensed under SNM-1373 in the designated room was identified as SL IV violation of License Condition 9 of NRC License SNM-1373. (070-01374/2020-001-03)

When the inspectors identified the deficiency, the licensee took immediate corrective actions to relocate the SNM to the license-designated storage location.

##### 4.3.2 Use of SNM

The inspectors reviewed the various uses of SNM at ISU. In particular, the inspectors examined the licensee's use of a subcritical assembly, which is considered by the NRC to be a risk significant licensed activity under NRC License SNM-1373. The subcritical assembly is used for the purpose of education, training, and research, and most frequently is used in an undergraduate laboratory class to facilitate experiments demonstrating the approach to criticality in a nuclear reactor.

Through interviews with individuals associated with the use of the subcritical assembly, the inspectors determined that there were no written operating procedures associated with the subcritical assembly. Although the licensee had a seven-step undergraduate laboratory instruction checklist to set up the subcritical assembly for academic instruction, the checklist did not address many of the necessary safety and criticality commitments made by the licensee in its license application.

The inspectors questioned the lack of formal written operating procedures for the subcritical assembly because in its license application for SNM-1373, ISU indicated that they understood what procedures and protocols were necessary to ensure the safe use of the subcritical assembly. Although the subcritical assembly has been in use by the licensee for several decades, the inspectors were unable to identify any previous or current operating procedures that were reviewed and approved by the licensee's Reactor Safety Committee for the use of the subcritical assembly. Even though the term "subcritical assembly" implies a level of inherent safety, the NRC requires proper operating procedures to ensure the specifications for the subcritical assembly, as provided during licensing, remain in place. Without formal written operating procedures, the subcritical assembly could result in significant consequences, including a criticality incident.

#### **Apparent Violation of License Condition 9, License SNM-1373**

License Condition 9 of NRC License SNM-1373, Amendment No. 5, dated February 27, 2019, states, in part, that licensed SNM is authorized for use in accordance with the statements, representations, and conditions specified in the licensee's application supplement dated February 14, 2011.

License application supplement dated February 14, 2011, Section 9, "Material Control and Accountability", Subsection (b), "Administrative controls", states in part, that the Reactor Safety Committee shall review and approve all plans and procedures for the use of the licensed materials in the subcritical assembly.

Contrary to the above, from May 19, 2015, to March 9, 2020, the Reactor Safety Committee failed to review and approve plans and procedures for the usage of the licensed materials in the subcritical assembly. Specifically, the licensee failed to have written procedures that were reviewed and approved by the Reactor Safety Committee for the usage of the licensed materials in the subcritical assembly that included: loading the neutron source into the subcritical assembly; handling the subcritical assembly fuel plates; use of radiation measuring and monitoring instruments; and restrictions and prohibitions regarding superior moderator or reflector materials to prevent inadvertent criticality.

The licensee's failure of its Reactor Safety Committee to review and approve plans and procedures for the usage of the licensed materials in the subcritical assembly was identified as an apparent violation of License Condition 9 of NRC License SNM-1373. (070-01374/2020-001-04)

As corrective actions, the licensee developed a new procedure "Subcritical Assembly Procedure for the ISU Reactor." The procedure was provided by the licensee to its Reactor Safety Committee for review and comment and was approved by the Reactor Safety Committee on or about October 19, 2020.

#### 4.3.3 Status of Previous Inspection Findings

NRC Inspection Report 030-32322/2017-001 cited two SL III violations regarding the licensee's loss of a 1-gram plutonium-239 NAD source described in Section 4.2. As described above, the first violation was related to the licensee's failure to secure the licensed material from unauthorized removal or access, and the second violation was related to the licensee's failure to provide information required by regulation (NMMSS reports) to the Commission that was complete and accurate in all material respects.

To address the violations, the licensee performed an investigation and identified that corrective actions were needed related to its inventory practices. These changes included revising the ISU Radiation Safety Manual to clarify responsibilities for the addition and removal of sealed sources from their internal inventory system and linking the internal ISU inventory database with the NMMSS reportable inventory. The licensee also planned to reduce its inventory of licensed material in storage through transfer or disposal of licensed materials.

The licensee's changes to inventory accountability as described in the ISU Radiation Safety Manual and Procedure EHS-09-16, "Radioactive Material Inventory," specified that only radiation safety staff and trained Authorized Users can "virtually delete" licensed material that has been transferred off-site or disposed. The virtual deletion process is used to ensure that records remain in the licensee's database describing the disposition method (e.g. shipping confirmation and destination) for removed materials. Accordingly, through a review of the virtual deletion process, the inspectors concluded that the licensee was able to clearly account for licensed material no longer in its possession.

The inspection team observed a representative sample of ISU's radioactive material inventory possessed under all four NRC licenses to assess whether those materials were secured against unauthorized removal or access. The inspectors compared the observed licensed materials against the licensee's internal inventory database. The inspectors also randomly selected licensed materials from the licensee's internal inventory database and verified that they were in the possession of the licensee. The inspectors did not identify any examples of lost or missing licensed materials and did not identify any licensed materials that were not secured from unauthorized removal or access.

The inspection team determined that the licensee's corrective actions to address the violation with respect to securing licensed material from unauthorized removal or access were sufficient to consider Violation 030-32322/2017-001-01 closed.

On July 11, 2018, ISU transferred the remaining 13 plutonium-239 NAD sources to an authorized DOE recipient. The licensee's transfer and removal of 13 grams of plutonium was reported to the NMMSS, as required. The inspectors reviewed ISU's current internal inventory of plutonium as authorized to be possessed under the broad scope license against the quantity of plutonium reported to the NMMSS and did not identify any deficiencies. The licensee had also taken corrective actions to create itemized inventory spreadsheets linking the licensee's broad scope inventory database to the NMMSS reports. These itemized inventory spreadsheets provided the licensee with a secondary check in confirming that reports to the NMMSS regarding SNM possessed under the broad scope license were complete and accurate.

The inspection team determined that the licensee's corrective actions to address the violation with respect to providing information regarding plutonium-239 required by regulation (NMMSS reports for plutonium) to the Commission that were complete and accurate in all material respects were sufficient to consider Violation 030-32322/2017-001-02 closed.

However, in reviewing the licensee's corrective actions to address the violation, the inspection team identified that ISU's practice of material control and accounting for SNM did not take a holistic approach across all of its NRC licenses that authorized SNM. As a result, the licensee's corrective actions focused on the broad scope license and were not fully realized or extended to SNM possessed under licenses R-110 and SNM-1373. Further, the inspectors identified that there was still a disconnect between the licensee's physical inventory practices and the reporting to the NMMSS. Although the licensee's corrective actions were sufficient to address the violation with respect to SNM possessed under the broad scope license, and to rectify the plutonium-239 discrepancy in the NMMSS, the corrective actions were not sufficient to address SNM possessed under the SNM and Research and Test Reactor licenses. As a result, additional failures were identified in this area and are described in Section 4.3.4 below.

#### 4.3.4 Special Nuclear Material Control and Accounting

The inspectors began their review of this area by comparing the data currently reported under ISU's RIS in the NMMSS against the licensee's internal inventory records. At the start of the onsite inspection, when comparing the quantity of uranium-235 possessed under licenses R-110 and SNM-1373 to the licensee's reported value in NMMSS, the inspectors noted that the licensee's internal inventory documented approximately eight grams more uranium-235 than they had reported in NMMSS.

The inspectors attempted to ascertain the source of the eight gram uranium-235 discrepancy. The inspectors did not identify any missing or outstanding transaction reports (e.g. receipts or disposals) from the licensee to NMMSS that would explain the eight gram discrepancy of uranium-235. Since there were no outstanding transaction reports, the source of the discrepancy was potentially the result of inaccuracies in the licensee's physical inventory of the uranium-235 possessed under the R-110 and SNM 1373 licenses.

To address this issue, the inspectors and licensee representatives commenced a complete visual verification of each SNM component or grouping of items possessed under the R-110 and SNM-1373 licenses, except for the uranium loaded in the research and test reactor core. Despite these extensive efforts, at the conclusion of the onsite inspection, the source of the eight gram uranium-235 discrepancy could not be identified. This matter was discussed with the licensee at the conclusion of the onsite inspection and the inspectors requested additional information to support their continued in-office review of this discrepancy.

The licensee could not implement immediate corrective actions to address the identified discrepancy because immediately following the NRC's onsite inspection, the ISU campus shut down due to the COVID-19 Public Health Emergency. After the campus partially reopened, between May 27- June 10, 2020, ISU personnel performed a detailed physical inventory of the uranium-235 possessed under the R-110 and SNM-1373 licenses. The physical inventory included mass measurements to quantify the exact

quantity of uranium-235 possessed. Historical data including NMMSS transaction reports, initial inventory records, and a safety analysis of the research and test reactor core were also reviewed for comparison against the mass measurements. Using this data, ISU provided the inspection team with an updated physical inventory with the revised quantity of uranium-235 for each component or grouping of items under the under the R-110 and SNM-1373 licenses. However, the licensee did not provide a calculation of the total quantity of uranium-235 possessed to compare to the value reported by the licensee in NMMSS. When the inspectors performed the calculation, the inspectors noted that the licensee's revised inventory documented approximately one gram less uranium-235 than they had reported in NMMSS.

Since quantity of uranium-235 possessed by the licensee as documented in its revised inventory was one gram less than that reported by the licensee in NMMSS, it raised the question as to whether the material was missing or if there was an inaccuracy in the quantity reported by the licensee to NMMSS.

The inspectors re-reviewed the licensee's NMMSS transaction reports. The inspectors identified that there were three transaction reports regarding the uranium-235 possessed under licenses R-110 and SNM-1373. The inspectors determined that there had not been any removals of uranium-235 from this inventory that would account for the one gram discrepancy. The inspectors noted that the quantity of uranium-235 for each transaction was reported by the licensee as a rounded-up whole numerical value per NMMSS reporting practices, which could possibly account for the one gram discrepancy.

If the licensee concludes that the reporting practice (i.e. rounding adjustment) is the source of the one gram uranium-235 discrepancy, they need to provide a revised transaction report to NMMSS pursuant to 10 CFR Part 74. If the licensee concludes that the one gram uranium-235 discrepancy is due to missing material, they would need to make an appropriate report to the NRC pursuant to 10 CFR Part 20 and provide a revised transaction report to NMMSS pursuant to 10 CFR Part 74.

Based on the results of the inspection, the inspectors concluded that the licensee's: (1) physical inventories of SNM were not performed in accordance with the regulations in 10 CFR Part 74, and (2) reports made by the licensee to NMMSS regarding uranium-235 were not accurate. Specifically, a *physical inventory* is defined in 10 CFR Part 74 as the determination on a measured basis of the quantity of SNM on hand at a given time. However, ISU procedure EHS-09-16, "Radioactive Material Inventory," calls for an itemized inventory, checking to confirm that various components are in the possession of the licensee. Since the quantities of uranium-235 for each component or group of items possessed by the licensee were not accurately maintained, the licensee's itemized inventory failed to meet the physical inventory requirement of 10 CFR Part 74. Furthermore, because the licensee failed to perform a physical inventory consistent with 10 CFR Part 74, its reports to NMMSS for uranium-235 were inaccurate.

### **Apparent Violation of 10 CFR 74.19(c)**

Title 10 CFR 74.19(c) requires, in part, that each licensee who is authorized to possess SNM, at any one time and site location, in a quantity greater than 350 grams of contained uranium-235, uranium-233, or plutonium, or any combination thereof, shall conduct a physical inventory of all SNM in its possession under license.

Title 10 CFR 74.4 defines *physical inventory*, in part, as the determination on a measured basis of the quantity of SNM on hand at a given time.

Contrary to the above, on March 9, 2020, the licensee failed to conduct a physical inventory of all SNM in its possession, where the licensee was authorized to possess SNM in a quantity greater than 350 grams of contained uranium-235, uranium-233, or plutonium. Specifically, the licensee failed to perform a physical inventory that consisted of a determination on a measured basis for the quantity of uranium-235 on hand at a given time.

The licensee's failure to perform a physical inventory that consisted of a determination on a measured basis for the quantity of SNM on hand at a given time was identified as an apparent violation of 10 CFR 74.19. (030-32232/2020-001-04; 070-01374/2020-001-05)

### **Apparent Violation of 10 CFR 70.9**

Title 10 CFR 70.9 requires, in part, that information provided to the Commission by a licensee shall be complete and accurate in all material respects.

Title 10 CFR 74.13, requires, in part, that each licensee possessing or who had possessed in the previous reporting period, at any one time and location, SNM in a quantity totaling one gram or more of contained uranium-235 shall complete and submit Material Balance Reports concerning SNM that the licensee has received, produced, possessed, transferred, consumed, disposed, or lost.

Contrary to the above, on March 9, 2020, the licensee failed to provide information to the Commission that was complete and accurate in all material respects. Specifically, information provided to the Commission on the Material Balance Report submitted by the licensee to the NRC in accordance with 10 CFR 74.13 was not complete and accurate in all material respects, including that for uranium-235 authorized by NRC License Nos. R-110 and SNM-1373 there is a one gram difference between the quantity possessed by the licensee and the quantity reported to the NMMSS.

The licensee's failure to provide complete and accurate information regarding uranium-235 in Material Balance Reports submitted to the NMMSS was identified as an apparent violation of 10 CFR 70.9 and 10 CFR 74.13. (070-01374/2020-001-06)

#### 4.4 Conclusions

The inspectors reviewed the licensee's possession and use of SNM under ISU broad scope license 11-27380-01; ISU SNM license SNM-1373; and ISU Research and Test Reactor license R-110. One SL IV violation was identified involving the licensee's failure

store certain SNM licensed under SNM-1373 in the designated room identified on the license.

Two SL III violations from previous NRC inspections were closed involving the licensee's failure to: (1) secure licensed material from unauthorized removal or access, and (2) provide complete and accurate information regarding plutonium-239 in Material Balance Reports submitted to the NMMSS.

Three apparent violations were identified involving the licensee's failure to: (1) have its Reactor Safety Committee review and approve plans and procedures for the usage of the licensed materials in the subcritical assembly; (2) perform a physical inventory that consisted of a determination on a measured basis for the quantity of SNM on hand at a given time; and (3) provide complete and accurate information regarding uranium-235 in Material Balance Reports submitted to the NMMSS.

Based on the information obtained during the onsite inspection and information provided by the licensee following the onsite inspection, an approximate one gram discrepancy of uranium-235 existed between the licensee's actual physical inventory and the quantity of uranium-235 reported by the licensee to the NMMSS. The inspectors determined that the discrepancy may potentially be attributed to a compounded rounding effect, as described above in Section 4.3.4; however, the licensee still needs to provide accurate data to the NMMSS regarding the quantity of uranium-235 determined during the physical inventory, in order to reconcile the quantity of uranium-235 currently reported by the licensee in the NMMSS.

## **5 ISU Broad Scope License 11-27380-01**

### **5.1 Inspection Scope**

On March 9-13, 2020, the inspection team performed an announced, routine inspection of the licensee's activities under NRC License 11-27380-01 for authorized broad scope activities. The inspectors reviewed records, procedures, and documents maintained by the licensee, observed licensed facilities and activities, performed independent radiation measurements, and interviewed personnel.

### **5.2 Observations and Findings**

As an Academic Type A Broad Scope licensee, the NRC grants significant decision-making authority to ISU through the license. The broad scope license issued to ISU authorizes the possession and use of a wide range of radioactive materials, including byproduct materials and certain SNM. Type A licenses of broad scope are typically large licensed programs and encompass a broad range of uses and locations of use. Type A broad scope licensees use a Radiation Safety Committee, an RSO, and criteria approved by the NRC during the licensing process to review and approve all uses of radioactive material and Authorized Users. The requirements for issuance of a Type A broad scope license are described in 10 CFR 33.13, "Requirements for the Issuance of a Type A Specific License of Broad Scope." Type A broad scope licensees must establish administrative controls and provisions related to organization and management, procedures, recordkeeping, material control and accounting, and management review as necessary to ensure safe operations.

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The inspectors reviewed the licensee's possession and use of a sealed americium-241/beryllium (AmBe) sealed source. The AmBe source contained a category 2 quantity of radioactive material and is one of the most risk significant sources possessed by the licensee in terms of health, safety, and security significance. The source is possessed under the broad scope license and is used primarily as part of research, development, and academic instruction. The AmBe source has been in the licensee's possession since 1965 and the Sealed Sources & Devices Registry certification for the source indicates that the leak test frequency is 6 months.

The neutron emitting AmBe source is stored inside of a PVC "cradle" for ease of handling. The source cradle is a short piece of PVC pipe that is capped on both ends. The source cradle sits within a larger diameter PVC pipe that is located at the center of a paraffin filled 55-gallon steel drum. The top cap of the cradle allows for a threaded aluminum rod to be inserted into the cap in order to manually lift the source from the drum.

The drum containing the source is normally stored at the bottom of an approximately 20-foot deep and 5-foot wide metal lined concrete shaft. The shaft has an approximately 700-pound metal cover at the surface. Rigging can be attached to the shaft cover, and the shaft cover can be removed from the top of the shaft using an overhead bridge crane.

Toward the lower portion of the shaft, there is an inner metal liner that is dimensionally smaller than the outer metal liner of the shaft. As designed, the drum containing the AmBe source is situated within this inner liner, allowing for various experimental projects to be placed for irradiation within the area between the inner shaft liner and the outer metal shaft liner. For other uses of the AmBe source and for leak testing the AmBe source, the paraffin filled 55-gallon drum must be lifted from the shaft and placed on the surface.

During the inspection, the inspectors learned that on December 4, 2019, an incident occurred involving the AmBe source during the performance of routine leak testing. The incident was poorly documented by the licensee, so the inspectors identified the individuals that were involved and interviewed them in order to obtain additional, detailed information.

The inspectors learned that on December 4, 2019, one individual operated the crane and another individual was present to act as a spotter and to perform the leak test of the AmBe source. The shaft cover was removed using the crane and set aside. The drum containing the AmBe source was lifted from the shaft using a grapple-type drum lifter with 3-point contact lifting arms. The drum was then placed on the surface adjacent to the shaft opening. In order to access the PVC pipe with the AmBe source cradle, tension was released from the drum grapple, which was then removed from the drum and set aside. One individual, the crane operator, removed the plastic plug from the top of the PVC pipe within the paraffin filled drum, inserted the threaded aluminum rod into the PVC source cradle cap, and lifted the AmBe source cradle from the drum. The second individual obtained the leak test sample for analysis. It was reported to the inspectors that a radiation survey meter was nearby either on a table or on the floor, but it is unclear whether it was turned on or if any surveys were performed during the leak test activity. After the leak test sample was obtained, the AmBe source cradle was lowered to the bottom of the PVC pipe, the threaded aluminum rod was removed, the

plastic plug was replaced, and the drum grapple was reattached. The crane operator then proceeded to use the overhead crane to return the drum to the bottom of the shaft. During the process of lowering the drum, the crane operator was in an elevated position where due to the observation angle, they could not observe the drum as it descended into the shaft. The crane operator was reliant on the individual at the surface to act as a spotter and provide direction.

Through interviews, the inspection team learned that as the drum containing the AmBe source was being lowered, at a point where it was below the surface, but not yet at the bottom of the shaft, the spotter observed that it was not centered in the shaft and that it was too close to the inner metal liner. The spotter leaned over the open shaft and attempted to use their body weight and their locked arms to guide the descending drum toward the center of the shaft.

Based on the description provided to the inspectors, it appeared that as the drum was being lowered, one of the lifting arms on the drum grapple either contacted the side of the shaft, or the inner shaft liner, or perhaps was not firmly seated on the drum and under continuous tension. The lifting arm disengaged from the drum, causing the other two lifting arms to disengage from the drum due to the lack of uniform tension on the grapple. The drum containing the AmBe source fell approximately 4 feet to the bottom of the shaft. As it fell, the drum was askew and ended up wedged at an angle at the bottom of the inner shaft liner. The individuals visually observed the drum from the surface and saw no damage to the observable portions of the drum. The lid was replaced onto the shaft. One of the individuals informed a supervisor for the facility regarding the incident, but because this incident occurred in the late afternoon, a message was left for the RSO to inform him of the incident.

The following day, on December 5, 2019, the RSO met with relevant personnel to discuss the incident and to commence planning recovery operations. Over the next few weeks, a detailed plan was developed, new drum lifting equipment was procured, and the confined space entry plan was developed and approved by the ISU Environmental Safety & Health Department.

On February 27, 2020, after checking for any hazardous atmospheres, the RSO used a ladder to descend into the confined space of the shaft to commence recovery operations. The RSO checked the opening of the PVC pipe in the paraffin filled drum for radioactive contamination. After no evidence of radioactive contamination was indicated, the RSO evaluated the visible condition of the drum and placed a new lasso-type ratcheting strap drum sling around the drum to use as a lifting mechanism instead of the drum lifter grapple device. After the new sling was in place, the RSO vacated the shaft. The drum with its new sling was lifted from the shaft using the crane and placed on the surface.

Once at the surface, the licensee reported that a visual inspection revealed no significant damage to the drum. The plastic plug was removed from the top of the PVC pipe and the aluminum rod was used to lift the AmBe source cradle from the drum. Radiation surveys performed with a neutron dose rate survey meter indicated 1,100 millirem per hour at 30 centimeters from the AmBe source cradle. A leak test sample was obtained and analyzed. It indicated no evidence of radioactive contamination. The AmBe source cradle was returned to the PVC pipe within the paraffin filled drum and the drum was successfully lowered back to the bottom of the shaft without incident. Based on

information provided by the licensee, there were no exposures in excess of NRC's regulatory limits as a result of the December 4, 2019, incident or the subsequent February 27, 2020, recovery efforts.

Through their review of the incident, the inspectors determined that prior to December 4, 2019, the drum containing the AmBe source had been successfully lifted out of and returned to the bottom of the shaft many times without incident using the grapple-type drum lifter. However, the licensee had no written procedures to perform this activity or to use the AmBe source. Instead, knowledge of how to perform the activity and how to handle the AmBe source was informally and verbally passed down from staff to staff over the years.

Although the licensee maintained a list of the high radiation areas that existed or were possible to exist either on the ISU main campus or at the IAC, the list did not include the high radiation area that would exist each time the AmBe source cradle was removed from the paraffin filled drum. Individuals who were interviewed by the inspectors were aware that the AmBe source was a significant radiation safety concern but acknowledged that there were no written procedures to address not only the radiation safety considerations but also the industrial safety considerations for this activity. Radiation safety considerations should have included, for example, the necessary radiation safety training or qualifications to perform the activity, the number of personnel necessary to safely perform the activity, the need for appropriate and calibrated radiation monitoring equipment for the neutron field and high radiation area, requirements for appropriate personnel dosimetry, and the performance and documentation of radiation surveys during these activities. Industrial considerations should have included, for example, hazards involving work activities around an open shaft, fall protection, potential for crushing injuries, and crane operation/spotter training.

Except for security-related events, the licensee had no written procedures to address other incidents, events, or emergencies involving the AmBe source. As a result, when the December 4, 2019, incident occurred, it was not well communicated or documented. No radiation surveys were taken at the surface of the shaft either after the incident or in the days that followed, to ensure that the source remained in its position within the paraffin filled drum. Incident reports were not generated by individuals involved with the incident. The licensee's Radiation Safety Committee was not informed of the incident at the time of its occurrence. The RSO briefly discussed the incident at its January 21, 2020, Reactor Safety Committee meeting; however, the recovery plan was not provided to either the Reactor Safety Committee or the Radiation Safety Committee for review or approval prior to implementation.

#### **Apparent Violation of 10 CFR 33.13(c)(3)(ii)**

Title 10 CFR 33.13(c)(3)(ii) requires, in part, that the licensee establish administrative controls and provisions relating to procedures and management review that are necessary to assure safe operations, including the establishment of administrative procedures to assure the completion of safety evaluations of proposed uses of byproduct material which take into consideration such matters as the adequacy of equipment, training and experience of the user, and the operating or handling procedures.

Contrary to the above, from September 25, 2018, to March 9, 2020, the licensee failed to establish appropriate administrative procedures to assure completion of safety evaluations of proposed uses of byproduct material which took into consideration such matters as the adequacy of equipment, training and experience of the users, and the operating or handling procedures. Specifically, for the use of a category 2 AmBe source, the licensee failed to establish written operating and emergency procedures that took into consideration the necessary: training and experience of the users; equipment and training for removing and returning the source storage container from the storage shaft, radiation monitoring and detection equipment for radiation surveys and personnel monitoring; handling procedures for removing the AmBe source from the storage container; procedures for the establishment and control of high radiation areas; and emergency procedures.

The licensee's failure to establish appropriate administrative procedures to assure completion of safety evaluations of proposed uses of byproduct material was identified as an apparent violation of 10 CFR 33.13(c)(3)(ii). (030-32232/2020-001-05)

As corrective actions, following the inspection, the licensee developed a written procedure for the use of the AmBe source. The procedure was reviewed and approved by the licensee's Reactor Safety Committee in July 2020 and by the Radiation Safety Committee in August 2020. The procedure included, but was not limited to, the minimum personnel needed for access and requirements for those personnel to participate in the licensed activity, personnel dosimetry requirements, required equipment for radiation safety and industrial safety considerations, steps to lift the AmBe source drum from the shaft, steps to handle the AmBe source, and steps to return the drum to the shaft.

### 5.3 Conclusions

The inspectors reviewed the licensee's possession and use of a category 2 AmBe source under ISU broad scope license 11-27380-01. The inspectors also reviewed the licensee's actions related to an incident that occurred involving the AmBe source in which the drum that contained the AmBe source fell several feet to the bottom of its underground storage shaft. One apparent violation was identified involving the licensee's failure to establish appropriate administrative procedures, including written operating and emergency procedures, to assure safe use of the AmBe source.

## **6 ISU Production License 11-27380-04**

### 6.1 Inspection Scope

On March 9-13, 2020, the inspection team performed an announced, routine inspection of the licensee's activities under NRC License 11-27380-04 for radionuclide production using an accelerator. The inspectors reviewed records, procedures, and documents maintained by the licensee, observed licensed facilities and activities, performed independent radiation measurements, and interviewed personnel.

### 6.2 Observations and Findings

The activities conducted under NRC License 11-27380-04 involve research and development, as well as the production, handling, storage, possession, packaging, and

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distribution of radiochemicals for transfer of those radiochemicals to licensed and authorized recipients. Activities conducted under the license occur at the IAC.

The primary licensed activity involves the production of copper-67 chloride. Only one of the licensee's accelerators is used to produce copper-67. In addition to the accelerator room there are areas for chemical processing. The inspectors reviewed the copper-67 production process from target bombardment and activation, to dry chemistry sublimation, to wet chemistry chemical separation, to quality assurance and quality control, to packaging and preparation for shipment. The process was driven by Standard Operating Procedure IAC-011-SOP, "Accelerator Irradiation of Zn target, Rev. 1.1." A "Run Traveler" was used for each stage in the process, following step by step check offs, or blanks to be completed.

The inspectors observed the licensee run the accelerator with a dummy target. The inspectors observed the licensee's radiation safety procedures and processes during various operational stages, including the performance of ambient, personnel, and radioactive contamination surveys, and the use of PPE, step off pads, dosimeters, warning lights, proper radiation safety postings, and safety interlocks. Gamma and neutron area monitors were also utilized in various operational areas. The licensee possessed operable and calibrated hand-held survey instruments for both neutron and gamma detection. Independent gamma surveys performed by the inspection team were consistent with licensee measurements.

The inspectors then progressed through the licensee's processing stages to produce copper-67 chloride. Throughout the process, licensee personnel were observed to follow appropriate radiation safety practices that took ALARA considerations into account. During dry chemistry sublimation operations, the operator receives the activated target, measures its weight, heats it in a furnace to the point where copper sublimates, and the measures the mass difference. The process moves to wet chemistry chemical separation where the copper is dissolved in acid through multiple stages to yield high purity (>99.9 percent) copper-67. Radioactive purity is measured with high purity germanium detector. Samples are extracted for quality assurance/quality control and for chemical purity analysis. After the samples are analyzed, the copper-67 chloride is prepared for shipping to licensed and authorized recipients. The license conservatively tracks effluent releases throughout the process.

The licensee maintains training requirements for personnel involved in various stages of copper-67 production. The licensee utilizes RWPs for certain maintenance activities and other high radiation dose rate operations.

The inspectors reviewed three incidents that had occurred since the previous NRC routine inspection. The first incident involved the inadvertent release of 1 microcurie of cobalt-60. The second incident involved a copper-67/zinc hot particle, which was found by the licensee in a controlled area adjacent to the processing lab. The third incident involved a worker intake of copper-67, which was estimated by the licensee to have resulted in a radiation dose of less than 1 millirem to the individual. The inspectors determined that the licensee was correct in its assessment that none of the incidents required reporting to the NRC. The actions taken by the licensee in response to the incidents, as well as the corrective actions implemented by the licensee, were found to be appropriate.

The inspectors examined the licensee's transportation activities associated with copper-67. Shipping logs indicated that most shipments were categorized as UN2915, Type A, non-special form, non-fissile, and others were either UN2910, limited quantity, or UN2912, LSA-1. Individuals involved with the preparation of packages and documents related to shipping had required training. The licensee utilized a checklist to properly prepare packages and documentation for shipping. Packaging materials and containers used by the licensee were appropriate for the quantity and type of materials being shipped and were prepared with required labels and markings. The licensee performed and documented surveys of packages prepared for shipping as appropriate.

The inspectors reviewed the licensee's inventory as it relates to radioisotopes from activation in the accelerator. Activated items included components of the accelerator and a parts inventory. Although not all activated items have been precisely characterized by the licensee for radioactive content, the licensee used conservative upper bounds and still was within their possession limits. When materials are ready for disposal, the licensee performs more precise characterization.

### 6.3 Conclusions

The inspectors reviewed the licensee's activities under NRC License 11-27380-04 for radionuclide production using an accelerator. The inspectors reviewed records, procedures, and documents maintained by the licensee, observed licensed facilities and activities, performed independent radiation measurements, and interviewed personnel. No violations were identified associated with the specific activities performed under NRC License 11-27380-04.

## 7 **Exit Meeting Summary**

On March 29, 2021, a final telephonic exit meeting was conducted with Dr. Donna Lybecker, Vice President for Research; Mr. John Longley, CHP, RSO; Mr. Jon Stoner, Chairperson of the Radiation Safety Committee; and Mr. Kermit Bunde, PE, Chairperson of the Reactor Safety Committee, to discuss the inspection findings. Regarding the apparent violations, the NRC representatives described the NRC's enforcement process and the options for the licensee to request a PEC with the NRC. Regarding the SL IV violations that were identified, the NRC representatives described the licensee's requirement to provide a written response. The inspectors discussed the content of the Inspection Report; the licensee did not identify any proprietary information.

**Supplemental Inspection Information**

PARTIAL LIST OF PERSONS CONTACTED

Scott Snyder, PhD, Interim Vice President for Research  
Donna Lybecker, PhD, Interim Vice President for Research  
John Longley, CHP, Radiation Safety Officer  
Mason Jaussi, Assistant Radiation Safety Officer  
Jon Stoner, Radiation Safety Committee Chairperson, Director of the IAC  
Mary Lou Dunzik-Gougar, PhD, Reactor Administrator  
Jonathan Scott, Reactor Supervisor  
Kristi Moser-McIntire, CAES Safety Officer  
Ted Pollock, Senior Reactor Operator  
Carl Crome, Radiation Safety Technician  
Nathan Jerred, Doctoral Candidate

INSPECTION PROCEDURES USED

87126 Industrial/Academic/Research Programs  
87125 Materials Processor/Manufacturer Programs  
87124 Fixed and Portable Gauge Programs  
92703 Followup of Confirmatory Action Letters or Orders  
IMC 2800 Revision dated March 2, 2020, Enclosure 2 – Information for the Inspection of Licensees Holding NMMSS Accounts

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

030-32232/2020-001-01 070-01374/2020-001-01	VIO	Failure to ensure that each container of licensed material bore a durable, clearly visible label that provided sufficient information. (10 CFR 20.1904(a))
030-32232/2020-001-02	VIO	Failure to calibrate radiation survey instruments in accordance with licensee procedures. (NRC License No. 11-27380-01, Amendment No. 37, License Condition 30)
030-32232/2020-001-03 030-38726/2020-001-01 070-01374/2020-001-02	AV	Failure to perform a complete inventory of all material possessed by the licensee under its four NRC licenses. (NRC Order issued May 2, 2019)
070-01374/2020-001-03	VIO	Failure to store certain SNM licensed under SNM-1373 in the designated storage location. (NRC License No. SNM-1373, License Condition 9)

Attachment

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070-01374/2020-001-04	AV	Failure of the Reactor Safety Committee to review and approve plans and procedures for the usage of the licensed materials in the subcritical assembly. (NRC License No. SNM-1373, License Condition 9)
030-32232/2020-001-04 070-01374/2020-001-05	AV	Failure to perform a physical inventory that consisted of a determination on a measured basis for the quantity of SNM on hand at a given time. (10 CFR 74.19)
070-01374/2020-001-06	AV	Failure to provide complete and accurate information regarding uranium-235 in Material Balance Reports submitted to the NMMSS. (10 CFR 70.9; 10 CFR 74.13)
030-32232/2020-001-05	AV	Failure to establish appropriate administrative procedures to assure completion of safety evaluations of proposed uses of byproduct material. (10 CFR 33.13(c)(3)(ii))

Closed

030-32232/2018-001-02	VIO	Failure to ensure that each container of licensed material bore a durable, clearly visible label that provided sufficient information. (10 CFR 20.1904(a))
030-32232/2018-001-03	VIO	Failure to ensure that sealed sources possessed under the broad scope license were inventoried every six months. (License No. 11-27380-01, Amendment 35, License Condition 24)
030-32232/2018-001-04	VIO	Failure to follow licensee procedures for controlling access to contamination areas. (License No. 11-27380-01, Amendment 35, License Condition 30.B)
030-32232/2018-001-05	VIO	Failure to follow licensee decontamination and decommissioning procedures. (License No. 11-27380-01, Amendment 35, License Condition 30.M)
030-32232/2018-001-06	VIO	Failure to follow licensee procedures for transfer of licensed materials to other authorized entities. (License No. 11-27380-01, Amendment 35, License Condition 30.B)
030-32232/2018-001-07	VIO	Failure to post rooms or areas used to store licensed material in accordance with NRC requirements. (10 CFR 20.1902(e))
030-32232/2018-001-08	VIO	Failure to follow licensee procedures for posting contamination areas. (License No. 11-27380-01, Amendment 35, License Condition 30.B)

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030-32232/2018-001-09	VIO	Failure to conduct routine radiological surveys as required by licensee procedures. (License No. 11-27380-01, Amendment 35, License Condition 30.B)
030-32232/2018-001-10	VIO	Failure to follow licensee procedures regarding evaluating radiation exposures. (License No. 11-27380-01, Amendment 35, License Condition 30.B)
030-32232/2018-001-11	VIO	Failure to follow licensee procedures regarding the testing of fume hoods. (License No. 11-27380-01, Amendment 35, License Condition 30.B)
030-32232/2018-001-12	VIO	Failure to periodically review the radiation protection program content and implementation. (10 CFR 20.1101(c))
030-32232/2017-001-01	VIO	Failure to secure licensed material from unauthorized removal or access. (10 CFR 20.1801, 10 CFR 20.1802)
030-32232/2017-001-02	VIO	Failure to provide information required by regulation to the Commission that was complete and accurate in all material respects. (10 CFR 70.9, 10 CFR 74.13)

LIST OF ACRONYMS USED

ADAMS	Agencywide Documents Access and Management System
ADR	Alternative Dispute Resolution
AmBe	Americium-241/Beryllium
AV	Apparent Violation
CAES	Center for Advanced Energy Studies
CFR	<i>Code of Federal Regulations</i>
DOE	U.S. Department of Energy
EA	Enforcement Action
EAMES	William M. and Karin A. Eames Advanced Technical Education and Innovations Complex
EN	Event Notification
IAC	Idaho Accelerator Center
IP	Inspection Procedure
ISU	Idaho State University
NAD	nuclear accident dosimeter
NMMSS	Nuclear Materials Management and Safeguards System
NRC	U.S. Nuclear Regulatory Commission
Order	Confirmatory Order
PEC	Predecisional Enforcement Conference
RIS	Reporting Identification Symbol
RSO	Radiation Safety Officer
RWP	radiation work permit
SL	Severity Level
SNM	Special Nuclear Material
UI	University of Idaho
VIO	Violation

LIST OF INSTRUMENTATION USED

<u>Manufacturer</u>	<u>Model</u>	<u>Serial Number</u>	<u>Calibration Due Date</u>
Thermo	RadEye PRD	31893	December 17, 2020
Thermo	RadEye G	378	April 20, 2020
Thermo	RadEye G	13427	April 20, 2020
Thermo	RadEye G	13421	April 20, 2020
Ludlum	Model 3	45729	July 19, 2020
	44-9 probe	PR287607	
Ludlum	Model 3-IS	257009	August 8, 2020
	44-9 probe	PR 287618	
Ludlum	Model 14-C	83477	September 10, 2020
	44-9 probe	Not available	
Bicron	Microrem	A903X	January 30, 2021