



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PA 19406-2713

June 3, 2015

Docket No. 07000398

License No. SNM-362

Richard F. Kayser Ph.D.
Chief Safety Officer
U.S. Department of Commerce
National Institute of Standards and Technology
100 Bureau Drive
Gaithersburg, MD 20899-1730

SUBJECT: NRC INSPECTION REPORT NO. 07000398/2014001, U.S. DEPARTMENT OF COMMERCE, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, GAITHERSBURG, MARYLAND AND NOTICE OF VIOLATION

Dear Dr. Kayser:

On August 26-28, 2014; January 12, 2015; and May 18, 2015; Robin Elliott, John Miller, and Elizabeth Ullrich of this office conducted a safety inspection at the above address of activities authorized by your NRC license. The inspection was an examination of your licensed activities as they relate to radiation safety and to compliance with the Commission's regulations and the license conditions. The inspection consisted of observations by the inspectors, interviews with personnel, and a selective examination of representative records. The findings of the inspection were discussed with yourself and members of your organization at the conclusion of the inspection during a teleconference on May 18, 2015. The enclosed report presents the results of this inspection.

Based on the results of this inspection and in accordance with the NRC Enforcement Policy, the NRC has determined that three Severity Level IV violations of NRC requirements occurred. The violations involved: 1) the failure to perform physical inventories and maintain inventory records; 2) the failure to submit an NRC Form 748 (National Source Tracking Transaction Report) on time after receiving a category 2 radioactive source; and 3) the failure to conduct operations so that the dose rate in a unrestricted area does not exceed 2 millirem in any one hour.

Violation 1 is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. The violation is being cited in the Notice because although the violation was identified by you, you had prior opportunity to identify the problem but failed to take action that would have prevented the event. Therefore the Notice is being issued consistent with Section 2.3.2 of the Enforcement Policy.

Violations 2 and 3 are considered non-cited violations (NCVs) in accordance with Section 2.3.2 of the Enforcement Policy because: (1) NIST identified the violations and either corrected or committed to correcting the violations within a reasonable period of time; (2) the violations were neither willful nor repetitive as a result of inadequate corrective action; and (3) the violations are assessed as Severity Level IV.

During our inspection exit teleconference on May 18, 2015, you indicated that you have taken corrective and preventative actions to address the violations and that U.S. Department of Commerce, National Institute of Standards and Technology is committed to radiation safety and to compliance with NRC regulations and licensed conditions. Further, you stated verbally that you have taken the following corrective and preventative actions:

- 1) You continue to look for radioactive material that is not in your current inventory and promptly characterize and incorporate the material into the radiation safety program;
- 2) You have implemented a separation from duty procedure that will bolster the transfer of radioactive material from one authorized user to another or to another licensee;
- 3) You have enhanced your inventory system such that multiple sources that are ordered at the same time are no longer assigned a single inventory number but instead each individual source will have a unique inventory number;
- 4) You have held town hall meetings with management where the source custodians and users have received training and the message that radioactive material inventory is critical; and
- 5) The Radiation Safety Division staff has initiated performing inventory spot checks on a quarterly basis to assure compliance with the physical inventory requirement.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC document 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, proprietary, or safeguards information so that it can be made available to the Public without redaction.

Current NRC regulations and guidance are included on the NRC's website at www.nrc.gov; select **Nuclear Materials; Med, Ind, & Academic Uses**; then **Regulations, Guidance and Communications**. The current Enforcement Policy is included on the NRC's website at www.nrc.gov; select **About NRC, Organizations & Functions; Office of Enforcement; Enforcement documents**; then **Enforcement Policy (Under 'Related Information')**. You may also obtain these documents by contacting the Government Printing Office (GPO) toll-free at 1-866-512-1800. The GPO is open from 8:00 a.m. to 5:30 p.m. EST, Monday through Friday (except Federal holidays).

R. Kayser

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Please contact John Miller at 610-337-5089 if you have any questions regarding this matter.

Sincerely,

/RA/

Blake D. Welling, Chief
Commercial, Industrial, R&D
and Academic Branch
Division of Nuclear Materials Safety

Enclosures:

1. Notice of Violation
2. Inspection Report No. 07000398/2014001

cc: Thomas O'Brien, C.H.P., Radiation Safety Officer
State of Maryland

R. Kayser

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Please contact John Miller at 610-337-5089 if you have any questions regarding this matter.

Sincerely,

/RA/

Blake D. Welling, Chief
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Division of Nuclear Materials Safety

Enclosures:

1. Notice of Violation
2. Inspection Report No. 07000398/2014001

cc: Thomas O'Brien, C.H.P., Radiation Safety Officer
State of Maryland

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OFFICE	DNMS/RI	N	DNMS/RI	DNMS/RI	DNMS/RI
NAME	RElliott/jjm f/		BUllrich/exu	JMiller/jjm	BWelling/bdw
DATE	05/29/15		05/22/15	05/28/15	06/03/15

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NOTICE OF VIOLATION

U.S. Department of Commerce
Gaithersburg, MD

Docket No. 07000398
License No. SNM-362

During an NRC inspection conducted on August 26-28, 2014; January 12, 2015; and May 18, 2015; one violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

10 CFR 74.19(a)(1) requires each licensee to keep records showing the receipt, inventory (including location and unique identity), acquisition, transfer, and disposal of all special nuclear material in its possession regardless of its origin or method of acquisition.

Condition 10 of License No. SNM-362, Amendment 5, requires, in part, that the licensed materials be used in accordance with statements, representations and conditions of the licensee's renewal application dated June 29, 2007 and revised on March 23, 2011.

The letter dated March 23, 2011, requires the NIST Health Physics department maintain inventory records for unsealed licensed sources with activity greater than 10 CFR 20, Appendix C quantities and all sealed sources requiring leak tests. The letter further requires Source Custodians to maintain inventory records for, and conduct an annual physical inventory of, all sealed and unsealed licensed sources under their responsibility that exceed the above stated criteria.

Contrary to the above, for a period of time estimated to begin in the 1980s until October 2014, NIST failed to keep records showing the receipt, inventory (including location and unique identity), acquisition, transfer, and disposal of all special nuclear material in its possession. Health Physics (GRSD) did not maintain inventory records and Source Custodians did not perform a physical inventory and maintain inventory records of all unsealed sources with activity greater than 10 CFR 20, Appendix C quantities under their responsibility. Specifically, from October 31, 2014 to December 10, 2014, the licensee identified unsealed licensed materials in quantities in excess of 10 CFR 20, Appendix C that were not included in their inventory nor had a Source Custodian inventoried these materials within the last year. A total of 31 samples of byproduct and special nuclear material were found, that included lead-210, uranium-235, americium-241 which contained quantities in excess of 10 CFR 20, Appendix C.

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

The NRC has concluded that information regarding the reason for the violations, the corrective actions taken and planned to address the violation and prevent recurrence, and the date when full compliance will be achieved is already adequately addressed on the docket. However, you are required to submit a written statement or explanation pursuant to 10 CFR 2.201 if the description therein does not accurately reflect your corrective actions or your position. In that case, or if you choose to respond, clearly mark your response as a "Reply to a Notice of Violation," and send it to the U.S. Nuclear Regulatory Commission, ATTN: Document Control

Notice of Violation
U.S. Department of Commerce

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Desk, Washington, D.C. 20555 with a copy to the Regional Administrator, Region I, 2100 Renaissance Boulevard, Suite 100, King of Prussia, PA, 19406, within 30 days of the date of the letter transmitting this Notice of Violation (Notice).

If you contest this enforcement action, you should also provide a copy of your response to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001. Under the authority of Section 182 of the Act, 42 U.S.C. 2232, any response which contests an enforcement action shall be submitted under oath or affirmation.

Your response will be placed in the NRC Public Document Room (PDR) and on the NRC Web site. To the extent possible, it should, therefore, not include any personal privacy, proprietary, or safeguards information so that it can be made publically available without redaction. However, if you find it necessary to include such information, you should clearly indicate the specific information that you desire not to be placed in the PDR, and provide the legal basis to support your request for withholding the information from the public.

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

Dated This 3rd day of June 2015

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Inspection No. 07000398/2014001

Docket No. 07000398

License No. SNM-362

Licensee: U.S. Department of Commerce
National Institute of Standards and Technology

Location: 100 Bureau Drive, Gaithersburg, Maryland 20899-1731

Inspection Dates: August 26-28, 2014, January 12, 2015, & May 18, 2015

Inspectors:

/RA/	05/28/15
_____	_____
Betsy Ullrich, Senior Health Physicist	date
Commercial, Industrial, R&D, and Academic Branch	
Division of Nuclear Materials Safety	
/J. J. Miller for/	05/29/15
_____	_____
Robin Elliott, Health Physicist	date
Commercial, Industrial, R&D, and Academic Branch	
Division of Nuclear Materials Safety	
/RA/	05/28/15
_____	_____
John Miller, Health Physicist	date
Commercial, Industrial, R&D, and Academic Branch	
Division of Nuclear Materials Safety	
/RA/	06/03/15
_____	_____
Blake Welling, Chief	date
Commercial, Industrial, R&D, and Academic Branch	
Division of Nuclear Materials Safety	

Approved By:

EXECUTIVE SUMMARY

U.S. Department of Commerce
National Institute of Standards and Technology
NRC Inspection Report Nos. 07000398/2014001

A routine, unannounced team inspection was conducted at the National Institute of Standards and Technology (NIST) facilities located at 100 Bureau Drive, Gaithersburg, Maryland on August 26-28, 2014; January 12, 2015; and May 18, 2015. The inspection was performed in accordance with U.S. Nuclear Regulatory Commission (NRC) Inspection Procedures 87122, 87125, and 87126, and reviewed activities associated with the use of licensed materials authorized by License Number SNM-362 (Research & Development Type A Broad). In addition, the inspection examined 3 events that were reported to the NRC: 1) the circumstances associated with the plutonium-239 source that was dropped and cleaved in half on August 29, 2014, 2) identification of radioactive material/sources that were not included in their inventory and when identified, and 3) the circumstance surrounding a lost 0.079 microcurie americium-241 source that was reported in writing to the NRC on January 16, 2015.

The NRC identified three Severity Level IV violations:

Severity Level IV - Failure to perform physical inventories and maintain inventory records.

Non-cited violation - Failure to submit an NRC Form 748 (National Source Tracking Transaction Report) on time after receiving a category 2 radioactive source.

Non-cited violation - Failure to conduct operations so that the dose rate in a unrestricted area does not exceed 2 millirem in any one hour.

REPORT DETAILS

1. **Organization and Scope of the Program**

a. Inspection Scope

A routine, unannounced team inspection was conducted at the Department of Commerce, NIST facilities located at 100 Bureau Drive, Gaithersburg, Maryland on August 26-28, 2014; January 12, 2015; and May 18, 2015. Additional information was received on December 23, 2014; January 26 & 28, 2015; and April 9, 2015. The inspection was performed in accordance with NRC Inspection Procedures 87122, 87125, 87126, and reviewed activities associated with the use of licensed materials authorized by License Number SNM-362 (Research & Development Type A Broad). The following focus areas were reviewed: (i) security and control of licensed material; (ii) shielding of licensed material; (iii) comprehensive safety measures; (iv) radiation dosimetry program; (v) radiation instrumentation and surveys; (vi) radiation safety training and practices; and (vii) management oversight. In addition, the inspection examined 3 events that were reported to the NRC: 1) the circumstances associated with the plutonium-239 source that was dropped and cleaved in half on August 29, 2014, 2) identification of radioactive material/sources that were not included in their inventory and when identified, and 3) the circumstance surrounding a lost 0.079 microcurie americium-241 source that was reported in writing to the NRC on January 16, 2015.

The inspectors conducted interviews with NIST personnel, observed day-to-day operations, toured NIST's facilities, and reviewed documents and procedures.

b. Observations and Findings

NIST is a large Type A broad scope licensee with a broad range of uses of byproduct, source, and special nuclear materials to support the needs of the country for radiation standards. The licensee routinely performs research and development using sealed and unsealed radioactive material, makes and distributes radioactive material standards for use with counting instrumentation, performs calibrations on instruments and transfer standards, maintains two old teletherapy units and operates one of them as an irradiator in accordance with 10 CFR 36. The licensee also maintains an underwater source irradiator of activity small enough that it is not required to meet the requirements of 10 CFR 36. The licensee has approximately 1500 registered sealed and unsealed sources of which activity is equal to or greater than the 10 CFR Appendix C quantities in their inventory. Some less than Appendix C quantities of material are not tracked. Since the previous inspection, the licensee has not used material off-site and has not shipped any special nuclear material to another facility. The site has approximately 90 laboratories designated for radioactive material work.

As a Type A broad scope licensee, NIST uses a Radiation Safety Committee (RSC) to oversee the radiation safety program and approve new users and uses of licensed materials. The radiation safety program is implemented by the Gaithersburg Radiation Safety Division (GRSD). The GRSD staff is part of the Office of Safety, Health, and

Environment which is headed by the Chief Safety Officer. The Radiation Safety Officer (RSO) is a Certified Health Physicist, and had authority delegated to him from the NIST Director to stop any activities that threaten safety and environment or cause non-compliance with regulatory requirements. The RSO is supported by approximately twelve health physicists and health physics technicians. The organization and scope of the program are as described in the license application.

c. Conclusions

No violations were identified.

2. Oversight of the Program

a. Inspection Scope

The inspectors reviewed the activities of the RSC and the GRSD staff to implement the radiation safety program described in the license application. The inspectors also reviewed the licensee's actions required by a Confirmatory Order issued March 1, 2010, related to oversight of the program.

b. Observations and Findings

The RSC is pro-active and involved with the radiation safety program. From August 1, 2013, to December 19, 2013, the RSC held nine meetings. During 2014, the RSC met eight times as of August 14, 2014. The RSC minutes were comprehensive and reflected their focus on topics germane to the radiation safety program and demonstrated a collegial relationship with the GRSD. The RSC consistently reviewed personnel monitoring results and other safety and compliance issues.

NIST's GRSD implements the radiation safety program. The RSO has years of operational experience that enable him to effectively manage the radiation safety program at NIST. The RSO is supported by a radiation safety staff whose size, training, and experience are commensurate with the scope and complexity of the radiation hazards at the site.

During a review of records, the inspectors identified the following issues which are considered non-cited violations.

- 1) NIST self-identified on December 12, 2013, the failure to submit an NRC Form 748 (National Source Tracking Transaction Report) on time after receiving a category 2 radioactive source. In response to the apparent violation, the licensee submitted the required report on December 16, 2013. To prevent recurrence, GRSD developed an instruction (procedure) that covers the reporting requirements of the NSTS transactions and provided personnel with training on NSTS procedures.
- 2) On February 10, 2014, GRSD personnel identified a dose rate in a public area that was in excess of 2 millirem in any one hour due to the placement of a recently delivered Yellow III labeled shipment of radioactive material. The radiation field was adjacent to

an exterior building door and the situation was caused because the package could not be placed in the usual storage location due to construction activity. The GRSD staff immediately moved the package so that the radiation levels in an unrestricted area were compliant with the regulations and NIST action levels. To prevent recurrence, GRSD issued an interim corrective action notice to their staff providing guidance and instruction on receiving and delivery of Yellow III packages. In addition, the licensee revised their receiving procedure and trained the staff on the requirement to survey unrestricted dose rates after storing a Yellow III package.

The NRC issued a Confirmatory Order to NIST in Colorado (NRC License No. 05-03166-05) on March 1, 2010. Many of the actions specified in the order were required to be performed by NIST in Gaithersburg, MD. The final action required by the Order was to perform a radiation safety program assessment in 2014 and submit it to the Director, Division of Nuclear Materials Safety, NRC Region IV. Two consultants, both Certified Health Physicists, performed the assessment of the Gaithersburg radiation safety program during the period from October 27, 2014, to December 1, 2014. NIST submitted the report to Region IV on January 23, 2015. The consultants concluded that the NIST program for radiation safety and regulatory compliance is effective and protects worker safety and health, the safety of the public and the environment. This assessment also met the requirements of 10 CFR 20.1101(c) to perform an annual review of the radiation safety program.

c. Conclusions

Two non-cited violations were identified.

Non-cited violation - Failure to submit an NRC Form 748 (National Source Tracking Transaction Report) on time after receiving a category 2 radioactive source.

Non-cited violation - Failure to conduct operations so that the dose rate in a unrestricted area does not exceed 2 millirem in any one hour.

3. Incidents

a. Inspection Scope

The inspectors reviewed three incidents reported to the NRC, as well as other events under the NIST radiation safety program that were not required to be reported. Inspectors interviewed staff involved and/or responding to the event, observed the locations of the event where appropriate, and reviewed records of follow-up activities.

b. Observations and Findings

Three events were reported to the NRC.

- 1) NIST reported August 30, 2014, that an employee dropped a 2190 Becquerel (59 nanocurie) Pu-239 source at the NG-6m experiment station (EN 50420). The incident occurred on August 29, 2014. The source was a vacuum deposit, with a

carbon/graphite covering, centered on an approximately 2" diameter silicon wafer substrate. Upon impact with the ground, the source cleaved into two pieces of about equal size. The source pieces were retrieved, stored in multiple bags and placed in the radioactive material storage safe. Smears on the exterior bags were at background levels.

The inspectors interviewed the health physicist (HP) on duty at the reactor who was the first responder to the incident. The HP indicated that the employee that dropped the source knew not to move to avoid disturbing any potential contamination. The HP stated that the first precaution he took was to secure the ventilation in the area. The HP confirmed that he verified he was successful minimizing the ventilation using a smoke stick. The HP proceeded to survey the area with a zinc sulfide scintillation detector probe and identified a small amount of contamination at the point of impact on the floor. No widespread contamination was identified with the hand held meter so he proceeded to collect wipe samples of the floor. When the situation was under control, the HP called his supervisor and alerted the other reactor HPs. The spot on the floor at the impact site was easily decontaminated. Personnel involved and in the vicinity of the incident were checked and found to be clear of contamination. The inspectors determined that the licensee's actions were timely, measured, and appropriate in response to this incident. No violations were identified.

- 2) On October 31, 2014, the RSO reported by telephone to the NRC Region I office that improperly labeled radioactive material and/or radioactive material not included in the NIST laboratory inventory were identified in laboratories not approved for work with radioactive material and not posted as radiation facilities. The licensee recognized that the radioactive material initially found was associated with an old research program that was completed in the late 1980s. The licensee believed the material associated with this project had been transferred to the Department of Energy's (DOE) New Brunswick Laboratory and it became apparent on October 31, 2014, that not all the material was transferred. In response to this discovery, the GRSD led a campus-wide search to identify any legacy materials that were not currently in GRSD's database. The last legacy radioactive material was identified on December 10, 2014. NIST submitted a spreadsheet summarizing the material to Region I on December 24, 2014. NIST submitted an updated list on March 2, 2015, reporting that 7 samples that were originally thought to be low enriched uranium and 4 samples initially believed to be high enriched uranium were tested and determined to be "dummy" sources that contained only natural uranium in the form of U_3O_8 , 99% purity.

GRSD took possession of the materials, properly labeled them and stored them in locations authorized for radioactive material. The licensee added these radioactive materials into their inventory. At no time were the possession limits in their license exceeded. GRSD personnel performed many radiation measurements and contamination surveys in areas where material was found to assess risk to personnel from exposure to radiation and radioactivity. No personnel exposure issues were identified. Many of the recovered radioactive

materials were tested to confirm the nature of the material, although full characterization of the remaining radioactive materials continues.

The licensee self-identified the root cause of the occurrence to be the failure of the licensee to properly manage changes in personnel, facility locations and some specific radiation safety program requirements. This occurred over several decades, and the current GRSD staff and senior staff continue to improve management of such changes. The licensee self-identified that some of the radioactive materials that were found from the period October 31, 2014, to December 10, 2014, were not labeled in accordance with 10 CFR 20.1904(a), were in laboratories not labeled in accordance with 10 CFR 20.1902(e), and were not controlled and secured in accordance with 10 CFR 20.1801 and 1802. The licensee also identified the failure to keep records showing the receipt, inventory (including the location and unique identity), acquisition, transfer, and disposal of the special nuclear material (SNM) during the 1980s and 1990s.

The inspectors concurred with the licensee's assessment of the root cause of possessing licensed material that was not subject to the radiation safety program at the NIST site. The failure to post laboratories, label radioactive material, and secure/control radioactive material is a manifestation of the poor inventory tracking and inadequate management of changes that occurred in the past.

One violation was identified. NIST failed to perform comprehensive physical inventories and maintain inventory records as required by the following:

10 CFR 74.19(a)(1) requires each licensee to keep records showing the receipt, inventory (including location and unique identity), acquisition, transfer, and disposal of all special nuclear material in its possession regardless of its origin or method of acquisition.

Condition 10 of License No. SNM-362, Amendment 5, requires, in part, that the licensed materials be used in accordance with statements, representations and conditions of the licensee's renewal application dated June 29, 2007, and revised on March 23, 2011.

The letter dated March 23, 2011, requires the NIST Health Physics department maintain inventory records for unsealed licensed sources with activity greater than 10 CFR 20, Appendix C quantities and all sealed sources requiring leak tests. The letter further requires Source Custodians to maintain inventory records for, and conduct an annual physical inventory of, all sealed and unsealed licensed sources under their responsibility that exceed the above stated criteria.

NIST failed to keep records showing the receipt, inventory (including location and unique identity), acquisition, transfer, and disposal of all special nuclear material in its possession. The NIST Health Physics Department (GRSD) and Source Custodians did not inventory and maintain inventory records of all unsealed sources with activity greater than 10 CFR 20, Appendix C quantities in their possession. Specifically, from October 31, 2014, to December 10, 2014, the

licensee identified unsealed licensed materials in quantities in excess of 10 CFR 20, Appendix C in locations not under the control of a Source Custodian and not in a room authorized for radioactive material use. In addition, the radioactive material identified was not included in the inventory records of a Source Custodian nor was it in the records for unsealed sources maintained by Health Physics. A total of 31 samples of byproduct and special nuclear material were found that contained quantities in excess of 10 CFR 20, Appendix C.

- 3) On December 17, 2014, NIST contacted the NRC Operations Center to report a missing 2.931 kBq (0.079 uCi) americium-241 source (NMED 150005). On January 16, 2015, the licensee submitted the written thirty-day follow-up report for the missing source that included all the required information. In an effort to locate the source, GRSD personnel determined that these sources were often used in a vacuum chamber. The licensee interviewed site personnel familiar with this practice and they were able to identify the vacuum chamber. The vacuum chamber had been out of service for many years and upon inspection, no source was found. The licensee reported that discussions with personnel familiar with the use of this source indicated that sometimes at the conclusion of the work, the sources were disposed of as radioactive waste. The licensee confirmed that they had radioactive waste manifests that listed americium-241 but the manifests did not reference the specific source. NIST concluded that the probable disposition of the source was as a radioactive waste. The inspectors reviewed the licensee's investigation of the missing americium-241 source and concluded it was comprehensive. Based on information gathered by the licensee, the inspectors concluded the licensee's assessment of the probable disposition of the material was reasonable. No violation was identified.

c. Conclusions

One Severity Level IV violation of NRC requirements was identified. Specifically:

10 CFR 74.19(a)(1) requires each licensee to keep records showing the receipt, inventory (including location and unique identity), acquisition, transfer, and disposal of all special nuclear material in its possession regardless of its origin or method of acquisition.

Condition 10 of License No. SNM-362, Amendment 5, requires, in part, that the licensed materials be used in accordance with statements, representations and conditions of the licensee's renewal application dated June 29, 2007, and revised on March 23, 2011.

The letter dated March 23, 2011, requires the NIST Health Physics department maintain inventory records for unsealed licensed sources with activity greater than 10 CFR 20, Appendix C quantities and all sealed sources requiring leak tests. The letter further requires Source Custodians to maintain inventory records for, and conduct an annual physical inventory of, all sealed and unsealed licensed sources under their responsibility that exceed the above stated criteria.

NIST failed to keep records showing the receipt, inventory (including location and unique identity), acquisition, transfer, and disposal of all special nuclear material in its possession. Health Physics and Source Custodians did not inventory and maintain inventory records of all unsealed sources with activity greater than 10 CFR 20, Appendix C quantities in their possession. Specifically, from October 31, 2014, to December 10, 2014, the licensee identified unsealed licensed materials in quantities in excess of 10 CFR 20, Appendix C in locations not under the control of a Source Custodian and not in a room authorized for radioactive material use. In addition, the radioactive material identified was not included in the inventory records of a Source Custodian nor was it in the records for unsealed sources maintained by Health Physics. A total of 31 samples of byproduct and special nuclear material were found that contained quantities in excess of 10 CFR 20, Appendix C.

4. Radiation Safety Training

a. Inspection Scope

The inspectors reviewed the licensee's radiation safety program to determine the effectiveness in provided instruction to workers in accordance with the requirements in 10 CFR 19.12 and SNM-362.

b. Observations and Findings

The licensee provided radiation safety training to all individuals who are involved with the radioactive materials program at NIST. The level of training provided was determined based on the individual's assigned duties and was provided prior to working with or near material and every two years thereafter. NIST's initial training program is a rigorous initial program for Source Custodians and Source Users, consisting of six on-line modules, each with problem sets, that were submitted to GRSD staff. In addition, the licensee required a full day lecture and lab practical with instrumentation, concluding with an exam that required an 80% passing grade. New users were supervised by senior lab members for a period of time until they were determined to be proficient and able to work unsupervised. Training was also provided to non-technical service personnel and irradiator personnel. NIST provided biennial refresher training as required. In the two year cycle for 2012-2013, they trained over 500 people. The inspectors interviewed several researchers, technicians, and receiving personnel. All personnel interviewed during the course of the inspection were knowledgeable of safe practices and regulatory requirements.

c. Conclusions

No violations were identified.

5. **Material Receipt, Use, Transfer, and Control**

a. Inspection Scope

The inspectors reviewed the licensee's inventory for compliance with the license limits, reporting to the National Source Tracking System (NSTS), and reporting to the Nuclear Materials Management and Safeguards System (NMMSS). The inspectors also reviewed the licensee's program for accountability of materials possessed under a general license pursuant to NRC regulations. The inspectors observed sources in storage, interviewed staff responsible for implementing inventory procedures, and reviewed inventory records.

b. Observations and Findings

The licensee maintained a database for materials considered as "active sources," and a separate inventory of materials considered as "waste." The database for active sources included sealed and unsealed materials. Any new material requested to be purchased is entered into the database, where the database calculates the current inventory plus the proposed new material, and compares it to the license limit. If the license limit would be exceeded, the purchase of the proposed materials is not authorized. Material is added to the database when it is actually received, and the inventory is updated. Outgoing shipments and other transfers of materials are subtracted from the inventory in the database.

The licensee performs an annual reconciliation of the active inventory, during which each source holder verifies if the actual inventory under the individual's control is the same as in the database. For most radionuclides, the inventory in the database is well below the license limit. For seven radionuclides, however, the current inventory was greater than 50% of the license limit with several greater than 70%.

Licensed material considered to be waste was removed from the active inventory when it was transferred for onsite storage. A separate inventory of the waste material was maintained, and the amount of material in waste was not part of the active sources database. In order to determine the actual total amount of material under the license during the inspection, the inspector summed the amount of material from the current inventory with the amount in waste and determined the licensee was within the limits for the license. The amount of licensed materials in waste was very small compared to the amount of material in the active sources database.

The inspectors also compared the licensee's inventory of nationally tracked sources to the current inventory in NSTS for the licensee and found them to be the same. The inspectors also compared the licensee's inventory of material required to be reported to the NMMSS and determined the material required to be reported under NRC regulations is the same as in the licensee's NMMSS inventory. The inspectors noted that the total amount of material possessed in the active sources database exceeds both the NSTS and the NMMSS inventory because only materials exceeding certain criteria are required to be reported to NMMSS.

The inspectors reviewed the licensee's accountability for radioactive materials possessed under a general license. The vast majority were devices possessed pursuant to 10 CFR 31.5 "Certain detecting, measuring, gauging or controlling devices and certain devices for producing light or an ionized atmosphere," such as nickel 63 in electron capture detectors, cesium 137 sources in liquid scintillation counters, or polonium 210 static eliminators. The items possessed under a general license were maintained on the same leak test and physical inventory system as other sealed sources under the specific license. A separate training program was provided for persons using materials under a general license.

The inspectors reviewed records of leak tests of sealed sources. The listing of sealed sources requiring leak testing included sources that were possessed under both the specific license and the general licenses. A random sample of sealed sources were selected for review. Leak test results were available for all sources in August 2012, March 2013, August 2013 and March 2014. Results of all leak tests were reviewed and no leaking sources were identified. The inspectors noted that all leak tests were analyzed using a liquid scintillation counter except for sources in use at the reactor facility, which were counted using a gas-flow proportional counter. The inspector noted that the liquid scintillation counter may not be appropriate for sealed sources that emit only gamma radiation.

c. Conclusions

The inspectors identified a Severity Level IV violation for failing to perform comprehensive physical inventories and maintain inventory records in this program area. The details are described in section 5 of the report.

No additional violations were identified.

6. Occupational Exposure

a. Inspection Scope

The inspectors reviewed dosimetry records for the calendar year 2013, and for the first quarter of calendar year 2014, to determine the typical doses received by workers under the license and to identify any unusual exposures. The inspectors also reviewed the licensee's procedures for assessing external dose in the event of a missing dosimeter and the licensee's methods for assessing internal dose. The inspector also reviewed the licensee's assessment of a skin contamination event.

b. Observations and Findings

External dosimetry was provided by the Department of the Army at Redstone Arsenal, a NVLAP provider. Thermoluminescent dosimeters are used for both whole body and extremity monitoring. Where applicable, correction factors were used to adjust the dose from neutrons, although these adjustments were typically required only for individuals working at the reactor, which is under a separate license. The RSC reviewed quarterly reports of dosimetry results, with special attention to those that exceeded internal

investigation criteria. The radiation safety staff assigned administrative doses in the few cases where dosimeters were missing. Administrative doses were based on the use of personal pocket ion chamber dosimeters assigned to the individuals, evaluation of the work performed, and dosimetry results of other workers performing the same tasks.

Approximately 250 whole body dosimeters were issued each quarter during the period reviewed to employees working with radioactive materials under this license. Whole body exposures were less than 50 millirem in a year for nearly all employees and did not exceed 100 millirem for anyone working under this license. Approximately 25 employees were issued extremity dosimeters. Of these, two individuals had extremity doses exceeding 10 rem in 2013. These individuals perform most of the preparation of calibration standards that are transferred to other licensees. The RSC reviewed these extremity doses when they exceeded internal investigation criteria. NRC inspectors observed these individuals performing standard preparation and concluded that adequate procedures were taken and appropriate equipment was available and used.

Based on a review of records for 2013 and 2014 to date, no internal doses exceeded 50 millirem in a year, so were not added to worker total dose. Although many workers have a baseline whole body count or thyroid count, only thyroid bioassays were required for a small number of workers handling iodine-123, iodine-125 and iodine-131. Worker exposures were below NRC limits.

c. Conclusions

No violations were identified.

7. Effluent Monitoring

a. Inspection Scope

The inspectors reviewed records of monitoring of effluents to determine if releases were within regulatory limits. The inspectors reviewed licensee calculations to determine release concentrations and discussed effluent monitoring with members of the radiation safety staff.

b. Observations and Findings

According to licensee staff members and records, the only effluent monitoring required to be performed is to assess if any releases of airborne radioiodines occurred. No releases of liquids to unrestricted areas are performed. Laboratory work with radioiodines, for which monitoring was performed, occurred 16 times in 2013 and 12 times as of the date of inspection in 2014. Samples were collected and counted appropriately. Licensee staff used appropriate efficiency values for the various radionuclides of iodine, performed appropriate calculations, and compared the results to the applicable concentration release limit in 10 CFR Part 20. Annual releases were within the NRC limits in 2013, and were within the limits in 2014 as of the date of the inspection.

c. Conclusion

No violations were identified.

8. Radiation Facilities Surveys and Audits

a. Inspection Scope

The inspectors evaluated the effectiveness of the licensee's survey and audit program by interviewing and observing appropriate personnel and examining records.

b. Observations and Findings

GRSD conducted radiological surveys and audits of the restricted areas to verify regulatory compliance and demonstrate implementation of ALARA practices. Surveys were conducted weekly in facilities where there is a likelihood of contamination or radiation fields; approximately 40 facilities meet this description. GRSD conducted quarterly audits of facilities approved and posted for use and storage of licensed radioactive sources that have a significant potential for radiation exposure or effluent releases in excess of 10 % of the applicable limits. All other facilities were audited annually. Audits included an assessment of radiological conditions and a review of security, posting, and labeling. In 2013, 2964 weekly surveys, 301 quarterly audits, and 167 annual audits (which includes x-ray facilities) were performed. In addition, surveys were conducted to verify compliance with the public dose limits surrounding building 245 on a monthly basis.

GRSD performed surveys of the fume hoods used for laboratory work in radiation facilities. It was noted during the inspection that the labels placed on the hoods by the safety department were expired. The GRSD staff indicated that they performed their own flow rate monitoring to assure the hoods are operating properly since the safety department is unable to maintain the required frequency for monitoring. The GRSD maintained an anemometer and verified the flow rate in these fume hoods quarterly. In 2013, they conducted 204 fume hood surveys.

GRSD also performed special surveys. These surveys included: surveys of equipment moved to other laboratories, laboratory areas that needed work by maintenance, (e.g. fume hoods, fans, or other contaminated equipment that requires access). The inspector reviewed these records and found that in these cases, the areas were appropriately decontaminated prior to allowing access to maintenance workers. The appropriate instrumentation was used and the records were thoroughly documented.

The inspectors accompanied a staff member while performing an audit and survey of a radiation facility. The audit was a thorough review of safety and security issues. It was efficiently performed and well documented. The inspectors also observed two researchers working with cobalt-57. The researchers used appropriate safety precautions by working on covered work surfaces, used personal protective equipment, remote handling equipment, shields, and the fume hood. The researchers wore

dosimetry properly and also surveyed their work area and their person throughout the procedures.

c. Conclusions

No violations were identified.

9. Radioactive Material Transfer, Receipt, and Transportation

a. Inspection Scope

The inspectors reviewed the licensee's processes for receiving and transferring radioactive material at their site. This review included an assessment of the licensee's safe opening procedure for incoming packages, shipping of radioactive material in accordance with Department of Transportation (DOT) regulations, and Hazmat training of personnel.

b. Observations and Findings

NIST shipped radioactive material to other licensed facilities on a regular basis. In 2013, 184 DOT regulated shipments were made. Trained researchers or GRSD staff prepared the packages. GRSD staff signed the manifests and selected an appropriate method for the material being shipped. All personnel involved in the shipment of material received DOT training every two years. The most recent training record on file was for calendar year 2013. Inspectors reviewed a sample of their shipment records for compliance with the license verification requirements per 10 CFR 30.41 (c) and proper shipping per 10 CFR 71.5 (a).

In 2013, NIST received 167 shipments of radioactive material packages in the main shipping and receiving area in Building 301. Trained workers inspected the packages for any damage, signed for the packages, and then placed the packages in the locked cage until transfer to the delivery truck. If a package could not fit in the cage, it remained on the loading dock, under supervision, until it was delivered. Trained workers notified GRSD staff by telephone when the packages arrived and informed GRSD staff whether the package was located on the loading dock or in the cage. The receiving staff committed to delivering the packages to GRSD within one hour of arrival. The inspectors visited the receiving area and interviewed the Receiving Manager to discuss one package delivered on August 8, 2014, that exceeded the delivery timeframe of 15 minutes. The manager confirmed that this was an isolated event. He stated that they are able to meet the requirement and that, if for some reason they are unable, they will contact GRSD and notify them so they can come and pick up the material.

Once GRSD obtained the material, GRSD staff performed the package surveys and contamination checks, assigned an inventory tracking number (RS#) and then delivered the package to the end user. Deliveries were made to authorized users by GRSD staff in a dedicated vehicle on private roads.

c. Conclusions

No violations were identified.

10. Radioactive Waste Management

a. Inspection Scope

The inspectors reviewed the licensee procedures for the disposal of radioactive waste. The inspectors interviewed staff and reviewed licensee documents related to radioactive waste management.

b. Observations and Findings

The radioactive waste program is managed by GRSD staff. Waste stored in the laboratories was labeled and inventoried. Researchers characterized the waste, providing that information on sheets used by the radiation safety staff to monitor the activity of the waste in storage and remove waste from the researcher's inventory. The waste storage area was located in the lower level of building 245. In this area, the waste was double-bagged and segregated according to type. Materials with half-life less than 120 days, such as fluorine-18 and iodine-131, were stored in a drum. GRSD staff held this waste for a minimum of 10 half-lives before disposal. Wastes awaiting shipment for disposal were placed into plastic totes on wheels that could easily be moved to the loading dock. From here, it was transferred by a dedicated truck to building 235 where it was packaged for shipment by a broker for disposal. Waste was shipped as low specific activity material to Perma-Fix in Florida. The broker prepared all shipping manifests from spreadsheets prepared by GRSD. All GRSD staff involved in the shipping process received hazardous material training and were tested in accordance with DOT requirements. The inspector performed radiation measurements in the Building 245 waste storage location of building, and noted that measurements were consistent with licensee posting, and did not exceed any regulatory limits.

At the time of this inspection, the GRSD staff was in the process of removing a large quantity of legacy sources from the campus. A request for proposal was solicited from several vendors for the contract to remove the sources. The work is expected to be completed by September 2015.

c. Conclusions

No violations were identified.

11. Financial Assurance and Decommissioning

a. Inspection Scope

The inspectors reviewed the licensee procedures for decommissioning of individual laboratories and equipment for release for unrestricted use. The inspectors interviewed staff and reviewed licensee documents related to decommissioning.

b. Observations and Findings

The inspectors determined that NIST did not decommission a single building or outdoor area; GRSD staff released only individual laboratories and equipment for unrestricted use. One member of the radiation safety staff had primary responsibility for surveys of facilities and equipment for release for unrestricted use. The inspectors noted that most surveys included 10-15 smears evaluated for removable contamination, and radiation level measurements using a portable survey instrument, usually an ion chamber or Geiger counter.

Criteria for release of the rooms and equipment was contained in the Radiation Safety Instruction D4-17, "Decommissioning Surveys" issued June 26, 2014. Table 1 of this procedure listed decommissioning screening values that are different than NRC screening values, and different from current NRC guidelines for release of equipment. In general, the values listed in Table 1 would be acceptable for most beta-gamma emitting radionuclides, but are greater than the NRC screening values for most alpha emitters. The table also lists values for volumetric contamination, for which NRC has only screening values for contaminated soil; all other release criteria for volumetrically-contaminated materials is approved on a case-by-case basis. The table is very similar to a table issued in an ANSI standard which was not yet reviewed for acceptance by the NRC. In addition, the procedure specifies a default number of samples to be collected in areas that would be considered Class 1 or Class 2 using the Multi-Agency Radiation Site Survey Investigation Manual (MARSSIM) guidance, which may be less than the number of samples needed if the survey was done following MARSSIM guidance when a facility is released for unrestricted use. Because the licensee has not released an entire building for unrestricted use, there is no violation of NRC regulations. However, these individual rooms may require additional surveys be performed when the building is released for unrestricted use in order to determine if they meet NRC criteria. The licensee maintained records of the decommissioning surveys of the individual rooms as part of their records important for decommissioning.

c. Conclusions

No violations were identified.

12. Irradiator Safety

a. Inspection Scope

The inspectors reviewed the licensee's radiation safety program associated with the irradiator to ensure that it provided the necessary protection for employees. The inspectors tested and verified many of the interlocks as well as interviewed staff and reviewed licensee documents related to the irradiator.

b. Observations and Findings

At the time of the inspection, NIST operated a refurbished teletherapy head as a panoramic dry-storage irradiator. This unit was required to comply with 10 CFR Part 36, however, there are several exemptions from Part 36 authorized in the license. The primary irradiator user demonstrated the safety features and interlocks associated with the irradiator. During the interview, the irradiator operator demonstrated a working knowledge of the irradiator safety features, interlocks, and procedures.

The license performed interlock and safety checks at the required frequencies specified in the regulations and license. The licensee maintained records of the checks. The Fire Department performed a smoke and heat detector check on July 3, 2014.

c. Conclusion

No violations were identified.

13. Exit Meeting

On May 18, 2015, the inspectors conducted a telephone exit with NIST senior management to discuss the inspectors' findings and the licensee's corrective actions.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

Cheri Smith – IT Specialist+
Mark Spurrier – Chief, Emergency Services+
John Claassen – Senior Health Physicist+
Rich Kayser – Chair, Ionizing Radiation Safety Committee+*
Tom O'Brien – Radiation Safety Officer+*
Manny Mejias – GRSD Group Leader+*
Janna Shupe – Health Physicist+
Thomas McGriff – GRSD Group Leader+*
Alan Thompson – Chair of the IRSC*

+Present at site debrief

*Participants on phone for exit meeting

ACRONYMS

DOT	Department of Transportation
GRSD	Gaithersburg Radiation Safety Division
HP	Health Physicist
MARSSIM	Multi-Agency Radiation Site Survey Investigation Manual
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
NSTS	National Source Tracking System
NMMSS	Nuclear Materials Management and Safeguards System
RSC	Radiation Safety Committee
RSO	Radiation Safety Officer
SNM	Special Nuclear Material