



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

REGION III
2443 WARRENVILLE RD. SUITE 210
LISLE, IL 60532-4352

June 10, 2016

EN 51673
NMED No. 160043 (Closed)

Mr. Gary L. Ward
Vice Chancellor, Operations
The Curators of the University of Missouri
Environmental Health and Safety
8 Research Park Development Building
Columbia, MO 65211

SUBJECT: NRC ROUTINE INSPECTION REPORT NO. 03002278/2016001(DNMS)
THE CURATORS OF THE UNIVERSITY OF MISSOURI

Dear Mr. Ward:

On April 11, 2016, through April 15, 2016, an inspector from the U.S. Nuclear Regulatory Commission (NRC) conducted a routine inspection at your institution, with continued in-office review through June 1, 2016. The purpose of the inspection was to review activities performed under your NRC license to ensure that activities were being performed in accordance with NRC requirements. The inspection included a review of your report of a leaking nickel-63 source that your radiation safety staff identified during a routine research laboratory audit. The in-office review included further evaluation of your report of a leaking nickel-63 source. Ms. Deborah A. Piskura of my staff conducted a final exit meeting by telephone with Mr. Jack Crawford of your staff on June 1, 2016, to discuss the inspection findings. The enclosed inspection report presents the results of the inspection.

During this inspection, the NRC staff examined activities conducted under your license related to public health and safety. Additionally, the staff examined your compliance with the Commission's rules and regulations as well as the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel. The inspector reviewed one leaking source event that occurred since the last routine inspection.

Based on the results of this inspection, the NRC has determined that two Severity Level IV violations of NRC requirements occurred. The violations were evaluated in accordance with the NRC Enforcement Policy. The current Enforcement Policy is included on the NRC's website at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. Detailed information concerning the violations is in the enclosed inspection report.

The first violation concerned the failure to use a nickel-63 source in accordance with the terms and conditions of a permit issued by your Radiation Safety Committee, as required by the policies and procedures referenced in your license renewal application and by License Condition 31. The second violation concerned the failure to secure licensed material within one

of your research laboratories, as required by Title 10 of the *Code of Federal Regulations* (CFR) Section 20.1801. These non-repetitive, non-willful, licensee-identified, and corrected violations are being dispositioned as non-cited violations, consistent with Section 2.3.2 of the NRC Enforcement Policy.

The NRC has concluded that information regarding the reasons for the violations, the corrective actions taken and planned to correct the violations and prevent recurrence, and the date when full compliance was achieved, is already adequately addressed on the docket in the enclosed inspection report. 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 Inspection Report No. 03002278/2016001(DNMS)" and send it to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to the Regional Administrator, Region III, within 30 days of the date of this letter.

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's Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC's 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 publicly available without redaction.

Please feel free to contact Ms. Piskura of my staff if you have any questions regarding this inspection. Ms. Piskura can be reached at 630-829-9867.

Sincerely,

/RA/

Aaron T. McCraw, Chief
Materials Inspection Branch
Division of Nuclear Materials Safety

Docket No. 030-02278
License No. 24-00513-32

Enclosure:
IR No. 03002278/2016001(DNMS)

cc w/encl: Willie (Jack) M. Crawford, M.S.,
Radiation Safety Officer
Silvia Jurisson, Ph.D., Chair,
Radiation Safety Committee
State of Missouri

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State of Missouri

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Letter to Gary Ward from Aaron McCraw dated June 10, 2016.

SUBJECT: NRC ROUTINE INSPECTION REPORT NO. 03002278/2016001(DNMS)
THE CURATORS OF THE UNIVERSITY OF MISSOURI

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**U.S. Nuclear Regulatory Commission
Region III**

Docket No. 030-02278

License No. 24-00513-32

Report No. 03002278/2016001(DNMS)

Event No. 51673

Licensee: The Curators of the University of Missouri

Facility: Various buildings and departments
Columbia, Missouri campus

Inspection Dates: April 11, 2016 - April 15, 2016, with continued
in-office review through June 1, 2016

Exit Meeting Date: June 1, 2016

Inspector: Deborah A. Piskura, Senior Health Physicist

Approved By: Aaron T. McCraw, Chief
Materials Inspection Branch
Division of Nuclear Materials Safety

Enclosure

EXECUTIVE SUMMARY

The Curators of the University of Missouri NRC Inspection Report 03002278/2016001(DNMS)

On April 11-15, 2016, with continued in-office review through June 1, 2016, an inspector from the U.S. Nuclear Regulatory Commission (NRC) conducted routine inspection, at the Curators of the University of Missouri, Columbia, Missouri, campus. The inspector focused on the licensee's academic research program and reviewed several program areas including management oversight, internal audits, facilities and equipment, training, and radiation protection. The inspection included a review of the licensee's report of a leaking nickel-63 (Ni-63) source that it identified during a routine laboratory audit.

Two violations of NRC requirements were identified during this inspection. The violations involved the licensee's failures to: (1) use a Ni-63 source in accordance with the terms and conditions of a permit issued by the licensee's Radiation Safety Committee (RSC), as required by the policies and procedures outlined for the RSC described the license renewal application dated December 30, 2013, and referenced in License Condition 31.B.; and (2) secure licensed material stored within a research laboratory (a controlled area) as required by Title 10 of the *Code of Federal Regulations* (CFR) Part 20.1801. The licensee's radiation safety staff identified the violation of License Condition 31.B. during their review of a leaking source/contamination incident in a research laboratory. The violation involving the failure to secure licensed material was identified by the radiation safety staff during an audit of the same research laboratory on March 10, 2016.

The licensee's corrective actions for the security violation included repairing the lock/strike plate mechanism, providing instruction to the staff on the importance of securing licensed material, writing a violation to the laboratory, and discussing this audit finding during the April 14, 2016, RSC meeting. In response to the violation identified for License Condition 31.B., the licensee temporarily suspended the researcher's use of licensed materials to permit the characterization and decontamination efforts of the laboratory and equipment. The radiation safety office staff re-instructed the laboratory personnel on the terms and conditions of the permit requiring use of its nickel-63 within the glove box. The licensee increased its audit frequency for this laboratory until the research staff demonstrate improved performance.

The NRC is dispositioning these non-repetitive, non-willful, licensee-identified, and corrected violations as non-cited violations (NCVs), consistent with Section 2.3.2 of the NRC Enforcement Policy.

REPORT DETAILS

1 Program Overview and Inspection History

The Curators of the University of Missouri (the licensee) operated a large Type A medical/academic and research broadscope program under the authority of NRC byproduct materials License No. 24-00513-32. The license authorized, in part, the possession of: (1) any byproduct material with atomic numbers between 3 and 96 in any form, for research and development pursuant to 10 CFR 30.4, including animal studies; (2) numerous specifically listed cesium-137 and americium-241 sealed sources for use in analytical instruments and gauging devices, and for instrument calibrations; and (3) select actinides, in any form, for laboratory research and development. Research and development activities were conducted under the supervision of approximately 150 individuals (authorized users or principal investigators) who have been approved by the licensee's RSC. Approximately 1,150 individuals functioned as radiation workers who used licensed material under the supervision of the principal investigators. Use of radioactive material was conducted in approximately 380 laboratories located in over 50 different buildings throughout the campus. This inspection focused on the licensee's academic research and development activities and included a review of the licensee's report of a leaking nickel-63 source used in one of its research laboratories.

The last routine inspection on September 8-12, 2014 (with continued in-office review through September 30, 2014), resulted in no violations of NRC requirements. The previous inspection conducted on November 4-8, 2013 (with continued in-office review through November 19, 2013), identified two NCVs of License Conditions 20. and 21., involving the licensee's storage of radioactive wastes that exceeded the maximum time limit for storage of the radioactive wastes.

2 Organization, Management Oversight, and Staffing

2.1 Inspection Scope

The inspector reviewed the licensee's organization and management controls for the radiation protection program, including the organizational structure, the RSC's involvement and oversight, radiation safety office staffing, and the effectiveness of the procedures and management oversight in implementation of the program. The inspector reviewed select records including RSC meeting minutes and user applications and permits issued by the RSC. The inspector interviewed select members of management and members of the RSC. The inspector attended a RSC meeting on Thursday, April 14, 2016.

2.2 Observations and Findings

The radiation safety program was managed by a dedicated, full-time radiation safety officer (RSO) and an assistant RSO, supported by two health physicists and three health physics technicians. The RSO reported to the Director of Environmental Health and Safety; the director reported to the Vice Chancellor of Operations. The radiation safety office staff audited all areas of use and storage at frequencies based on the amount of material processed/used. Each member of the radiation safety staff served as a principle auditor or project manager for select research laboratories. The radiation

safety office also performed confirmatory surveys (monthly or quarterly based on amount of material and use) of these areas to ensure compliance with its NRC license and regulations. The licensee implemented a computer-based tracking system that provides immediate status of user information, training, inventory, waste disposal, permit information, etc. The licensee also developed an Internet web page (<http://www.ehsmisouri.edu/rad>) that provides additional information regarding the licensee's radiation protection program to its users.

The licensee established a RSC to review and approve all users and uses of licensed material. Each authorized user performed his research under a permit issued by the RSC; the user must renew the permit every 3 years. The RSC provided program direction and oversight through its established policies and procedures. The RSC met on a bimonthly basis to conduct business. The inspector attended the RSC meeting on Thursday, April 14, 2016, and observed the RSC review and discuss several protocol approvals, status of decommissioning projects, the annual radiation safety program audit, and radiation safety audits of laboratories.

The RSC reviewed the radiation safety program on an annual basis, last completed on December 10, 2015. The results of the review were provided to the Vice Chancellor in a written report. The inspector noted that the scope of the review and the follow up on deficiencies identified during the audit were adequate to ensure safe operations.

2.3 Conclusions

The inspector identified no violations of NRC requirements in this program area.

3 **Leaking Ni-63 Source: Sequence of Events and Licensee Investigation**

3.1 Inspection Scope

The inspector reviewed the licensee's investigation of the reported leaking Ni-63 source. The inspector interviewed select licensee personnel, reviewed select records, and observed related equipment and facilities.

3.2 Observations and Findings

On January 22, 2016, the RSO contacted the NRC Operations Center to report a leaking Ni-63 source. The Ni-63 source was a small electroplated foil source used by a researcher for battery studies. The researcher's experimental set up consisted of a matrix with the Ni-63 source connected to clamps to the electrical current source. The researcher's laboratory contained a glove box, maintained with an inert atmosphere, and vented with a HEPA filtration system.

On January 19, 2016, the radiation safety office conducted a routine laboratory audit that included a routine leak test of this Ni-63 source. The health physicist noted that the experimental set up was outside of the researcher's glove box, the designated area where the researcher committed to use this source, and instead placed on a wooden desktop. The health physicist collected a leak test sample and proceeded to conduct the laboratory audit. Upon analysis of the leak test sample, the radiation safety staff identified that the Ni-63 source was leaking. The staff immediately notified the researcher and returned to the lab to conduct additional surveys. The radiation safety

staff identified contamination confined to the desk top and equipment used in the experimental set up. The staff isolated the leaking source and other equipment used in the experimental set up within the glove box. The licensee intended to transfer the source to the manufacturer for disposal. The RSO isolated the desk and covered it with plastic sheeting to prevent the spread of contamination. The RSO notified the researcher and his staff that their use of radioactive materials was immediately suspended until the leaking source incident was reviewed by the RSC.

The radiation safety staff interviewed the researcher and his staff, reviewed the terms and conditions of the user's permit issued by the RSC, and the Sealed Source and Device Registry Sheet for the Ni-63 source. The RSO determined the root cause of the leaking source incident to the manner in which the researcher conducted his experiments. The researcher connected clamps directly to the source surface and ran an electrical current through the source which most likely caused a failure in the electroplating of the source resulting in leakage. The RSO determined that the researcher violated the terms and conditions of his permit issued by the RSC because the experimental set up was located outside of the glove box. According to the researcher's permit application dated May 19, 2015 (approved by the RSC on August 5, 2015), the battery research using the Ni-63 source was only to be performed within the glove box. The RSO asserted that any contamination generated from the experiment would have been sufficiently contained within the glove box.

Condition 31.B. of License No. 24-00513-32 requires, in part, that licensed material be possessed and used in accordance with statements, representations, and procedures contained in application dated December 30, 2013. Item 7B-1, lists the duties of the Radiation Safety Committee (RSC). Item a. states, "review and approve/deny the uses of radioactive material by University personnel, except for medical uses." On August 8, 2015, the RSC reviewed and approved permit authorization no. 01030 for this laboratory based on statements and procedures described in the researcher's application, dated May 19, 2015. The researcher's permit application, dated May 19, 2015, (Authorization No. 01030) specified in Section "Use of Radioactive Material," stated, in part, "we will keep [the Ni-63 source] in a thick metal container in the glove box at all time[s] and will take it out of the container only when we need to test our battery in the glove box." The licensee's failure to use a Ni-63 source in accordance with the terms and conditions of a permit issued by the RSC, as required by the policies and procedures referenced in the licensee's renewal application dated December 30, 2013, is a violation of License Condition 31. The NRC is dispositioning this non-repetitive, non-willful, licensee-identified, and corrected violation as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy.

The licensee convened a special RSC meeting on February 5, 2016, and required the researcher to appear before the committee to present his corrective actions. The RSO increased the audit frequency of this laboratory in response to the leaking source/contamination incident.

The inspector toured this researcher's laboratory and observed that the leaking source was securely stored within the glove box, pending transfer to the manufacturer for disposal. The laboratory staff confirmed that further experiments with the replacement Ni-63 source would only be performed within the glove box.

3.3 Conclusions

One violation of NRC requirements was identified for the licensee's failure to confine its use of licensed material to the terms and conditions of a permit issued by the Radiation Safety Committee as required by License Condition 31. The licensee identified this item of noncompliance and discussed the leaking source and subsequent contamination incident during a RSC meeting on February 5, 2016. The research laboratory continues to operate under heightened oversight by the radiation safety office. This non-repetitive, non-willful, licensee-identified, and corrected violation is being dispositioned as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy.

4 Licensee Notifications and Reports

4.1 Inspection Scope

The inspector reviewed the licensee's notifications to the NRC. In addition, the inspector reviewed the licensee's written report dated February 19, 2016.

4.2 Observations and Findings

On January 22, 2016, the licensee notified the NRC Operations Center of the leaking source (Event Number 51673). The RSO notified the researcher and removed the source from the experimental set up; the RSO isolated the source within the researcher's glove box. The licensee submitted its written report of the leaking source to the NRC in a letter dated February 19, 2016, detailing the cause of the leaking source and the University's corrective actions. The report included the information required by 10 CFR 30.50(c)(2).

4.3 Conclusions

The licensee made all of the notifications and reports as required by 10 CFR 30.50 within the specified time period. The licensee's written report included all of the required information.

5 Internal Laboratory Audits and Security of Licensed Materials

5.1 Inspection Scope

The inspector reviewed the licensee's internal audit program with focus on the licensee's ability to identify and correct items of non-compliance. The inspector reviewed a select sample of audit reports and interviewed select members of the radiation safety staff.

5.2 Observations and Findings

The radiation safety office performed auditing of the University's NRC-licensed program by two principal mechanisms: (1) routine audits and surveillances of each laboratory that used or stored radioactive materials and (2) health physics assessments of selected program areas.

The radiation safety office conducted audits of all laboratories using and/or storing radioactive material. Audits were conducted at least quarterly, with the exception of the

actinide lab and poor performing labs, which were subject to more frequent audits. The laboratory audit and surveillance program consisted of a visit to each lab to interview staff, observe practices including security, evaluate procedures, equipment and postings, conduct surveys and review records of receipt, use, transfer and surveys. Researchers were promptly informed in writing of issues identified by the radiation safety staff. The researcher was required to respond in writing to any issues and provide corrective actions.

During a laboratory audit on March 10, 2016, the radiation safety staff identified a violation of NRC's security requirements. As the staff health physicist approached the door to the research laboratory, he noted that the door was not fully closed or locked; none of the research staff was in the area. According to the research staff, the lock had not been working properly and a repair request with campus facilities was filed; the room was unsecured for approximately one to two hours. The auditor noted that the door was functional and only required effort to ensure that the locking mechanism was fully engaged. The inspector reviewed inventory of the licensed material within the research lab and noted the quantities were less than 1,000 times Appendix C to 10 CFR Part 20.

Title 10 CFR 20.1801 required that the licensee secure from unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas. The failure to secure licensed material within a research laboratory on March 10, 2016, is a violation of 10 CFR 20.1801. The licensee's corrective actions included repairing the strike plate on the doorjamb so that the lock can fully engage, training the staff on the importance of securing licensed material, writing a violation to the research lab, and discussing this audit finding during the April 14, 2016, RSC meeting. This non-repetitive, non-willful, licensee-identified, and corrected violation is being dispositioned as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy.

5.3 Conclusions

The licensee's internal audit program was comprehensive and sufficiently identified and corrected deficiencies in the licensee's overall radiation safety program. One violation of NRC requirements was identified by the licensee for the licensee's failure to secure its licensed material within one research laboratory as required by 10 CFR 20.1801. This non-repetitive, non-willful, licensee-identified, and corrected violation is being dispositioned as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy.

6 Independent Measurements, Facility Tours, and Observations

6.1 Inspection Scope

The inspector toured approximately 20 select research laboratories, the radiation safety department, the Veterinary Medical Building, and the Waste Management Facility. The tours included observations of activities in progress, interviews with select staff, review of select records and independent measurements.

6.2 Observations and Findings

The inspector toured various laboratories, including an iodination laboratory, and two actinide laboratories, veterinary clinics and animal housing facilities, and the waste storage and processing center. The inspector observed several instances of use of

licensed material including the administration of a tin-117m therapy dosage to a canine patient.

The inspector noted all areas of use and storage were posted with caution signs, NRC-3 forms and license documents in accordance with 10 CFR Parts 19 and 20. Radiation levels in unrestricted areas were found to be within Part 20 limits. The licensee maintained adequate security of its laboratories and storage areas. The inspector interviewed several research personnel who demonstrated their knowledge of the licensee's radiation safety requirements.

The inspector observed the licensee personnel followed the following radiation safety practices during this inspection:

1. All licensee personnel wore their assigned dosimetry;
2. Staff performed personal surveys prior to leaving the restricted areas;
3. Staff wore gloves and lab coats and used tongs while handling radioactive material;
4. Staff utilized shields while preparing and dispensing radiopharmaceuticals for veterinary patients;
5. Staff confined the use of licensed material to designated areas; and
6. No evidence of eating or drinking in the restricted areas.

6.3 Conclusions

Based on record review, interviews with personnel, and the observations described above, the inspector determined that no violations of NRC requirements were identified.

7 **Other Areas Inspected**

7.1 Inspection Scope

The inspector reviewed other radiation safety program areas including: bioassay and personnel monitoring, survey instrument calibration, ordering, receipt and transfer of licensed material, portable gauge use, and radioactive waste disposal. The inspector interviewed select individuals, toured the licensee's facilities, and reviewed select records.

7.2 Observations and Findings

The RSO evaluated radiation exposures and provided personnel monitoring. Select individuals received routine thyroid bioassays to monitor for iodine-125. The inspector reviewed bioassay and dosimetry reports and noted no worker exceeded the regulatory limits.

At the time of this inspection, the licensee possessed numerous survey meters calibrated annually utilizing its in-house calibration source or the services of a licensed calibration firm. The licensee maintained copies of the calibration certificates on file. The inspector found a sampling of these survey meters to be calibrated within the required frequency and operable.

Requisitions of radioactive material were placed by the researcher/requestor. The vendors verified the order with the RSO prior to payment by and shipment to the University. All radioactive material packages were received by the radiation safety office and subsequently distributed to the requestor.

The licensee possessed two portable gauges that were used during the Fall Semester for student instruction purposes. The inspector noted that the gauges were secured in accordance with the requirements of 10 CFR 30.34(i).

The licensee's waste disposal methods consisted of transfer of long-lived solid and liquid wastes to contractors for subsequent disposal and decay-in-storage of short-lived material. The RSO collected waste from researchers for processing at the University's waste handling facility. The licensee ceased its incineration of radioactive waste during July 2014; only decayed short-lived materials were incinerated.

7.3 Conclusions

Based on record reviews, interviews with licensee personnel, and the observations described above, the inspector determined that no violations of NRC requirements were identified.

8 **Exit Meeting Summary**

The NRC inspector presented the final inspection findings via telephone on June 1, 2016. The inspector confirmed that none of the potential report input discussed was considered proprietary. The licensee acknowledged the findings presented.

LIST OF PERSONNEL CONTACTED

#Felicity J. Beckfield, M.S., Assistant Radiation Safety Officer
Andrew Behrle, Ph.D., Post Doc
#+Willie (Jack) Crawford, M.S., Radiation Safety Officer
#Ronald Dobey, CHP, Radiation Safety Officer, MURR
Kenneth Finley, Finance
Scott Furst, Environmental Health Technician / Radiation Safety
Eskil Hudson, Health Physics Professional
#Bryan Higgins, Health Physics Professional
#Todd Houts, Director, Environmental Health & Safety
#Silvia Jurisson, Ph.D., Chair, Radiation Safety Committee
Duane Keisler, Ph.D., Professor of Animal Science
Jimmy Lattimer, DVM, Associate Professor Veterinary Medicine and Surgery
Kevin Lunceford, Supervisor, Radiology, Veterinary Medicine
Michelle Kenett, Assistant Vice Chancellor, Office of Research
Baek Hyun Kim, Ph.D., Post Doc
Jaewan Kwon, Ph.D., Associate Professor, Electrical & Computer Engineering
Ashley Milligan, CNMT, Supervisor Nuclear Medicine
Amolak Singh, M.D., Professor of Radiology (Authorized User, nuclear medicine)
#Gary Ward, Vice Chancellor of Operations & Chief Operating officer
Jacob White, Environmental Health Technician

Numerous laboratory and professional staff members were also contacted as part of this inspection

#Attended exit meeting on April 15, 2016
+Individuals contacted on June 1, 2016 for final telephonic exit meeting

INSPECTION PROCEDURES USED

IP 87103 "Inspection of Material Licensees Involved in an Incident or Bankruptcy Filing"
IP 87126 "Industrial/Academic/Research Programs"