

U.S. NUCLEAR REGULATORY COMMISSION
REGION I
INSPECTION REPORT

Report No. 030-00761/96-001

Program Code 01100

Docket No. 030-00761

License No. 20-00882-03

Priority 2

Category F1A

Licensee: University of Massachusetts
Environmental Health and Safety
N414 Morrill Science Center
Amherst, Massachusetts 01003


Inspection Conducted: August 6, 1996 to September 13, 1996

Inspector:


James M. Bondick, Health Physicist

10/30/96
Date

Approved By:


John D. Kinneman, Chief
Nuclear Material Safety Branch 2
Division of Nuclear Materials Safety

10/30/96
Date

Inspection Summary: Reactive inspection to review a report to the NRC on July 29, 1996 of a spill which occurred on July 24, 1996. The spill occurred as the licensee staff, during an inventory, attempted to identify a vial containing less than 1 millicurie of Ac-227. Opening the container contaminated several spots on the floor of the source storage location and caused localized contamination on the individual's shoes. A nasal wipe taken immediately after the event was initially estimated to contain 0.04 nanocuries of Ac-227, resulting in a concern that an internal uptake had occurred.

The licensee sent a series of urine and fecal samples from the exposed individual for analysis for Ac-227. The results of bioassay samples, including a re-analysis of the nasal smear, several whole body and lung counts, analysis of the urine samples and fecal samples were negative for Ac-227 or any of its daughter products. The individual received no internal exposure greater than 0.001 ALI or 5 mrem based on an MDA of 5×10^{-10} microcuries per gram for the fecal samples.

Areas Inspected: Organization and scope of licensed activities, details of the event, extent of the contamination, assessment of the licensee's timeliness in responding to the event, actions taken to evaluate the airborne and contamination caused by the event,

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interviews with personnel, assessment of the root cause of the event, and review of selected licensee records.

Results: Two violations were identified: 1) timely and adequate radiological surveys of airborne radioactivity were not taken in response to the contamination, and 2) planning of the inventory task and entry into Room 17, Hasbrouck building was inadequate.

DETAILS

1. Persons Contacted

Donald Robinson, Director, Environmental Health and Safety
James Tocci, Radiation Safety Officer
Christopher C. Messier, EH & S Radiation Safety Associate
Linda Browning, Technologist (by teleconference)
Sharon Long, Asst. Professor, Civil & Environmental Engineering
Joseph Kunkel, Professor, Biology
Diana Blazis, Associate Dean, College of Natural Sciences and Mathematics
Dr. Kandula Sastry, Physics, Chairman, Radiation Use Committee
Margaret Delaro, Director, Animal Care, Graduate School
Chih-Ming Yin, Professor, Entomology

2. Organization and Scope of Licensed Activities

The University of Massachusetts at Amherst, Massachusetts holds an Academic Type A Broad license which authorizes the use of any licensed material with atomic numbers 3 through 83, inclusive, with half-lives of 120 days or less in any chemical or physical form not to exceed 100 millicuries per isotope and 10 curies total. In addition, the license authorizes the use of any byproduct material with atomic numbers 1 through 38 with half-lives greater than 120 days in any chemical or physical form, limited to 10^5 times the quantity specified in Appendix C to Part 20 and in accordance with the requirements of 10 CFR 30.35. The license also authorizes the use, in any form for the following radionuclides: P-32, 1500 millicuries; S-35, 1500 millicuries; Cr-51, 500 millicuries; I-125, 500 millicuries; and I-131, 200 millicuries. As sealed sources: Co-60, 800 millicuries; Ni-63, 200 millicuries; Cd-109, 50 millicuries; Cs-137, 450 millicuries; Am-241, 150 millicuries; Cf-252, 5 micrograms (Savannah River Model ALC or SALC), Pu as sealed neutron sources, not to exceed 32 grams encapsulated and 64 grams total; 600 millicuries of Cs-137 can be possessed in approved fixed gauges. As foils, the license authorizes H-3, 12 curies; and Am-241, 1200 millicuries. Up to 2 millicuries of Po-210 alpha sources can be possessed. The license includes the use of up to 3000 curies of RAMCO-50-ORNL sealed sources for use in a Radiation Machinery Company, Gammator 50B. The licensee possesses two irradiators of the Gammator 50 type. The license also authorizes the possession and use of Cs-137, 500 millicuries total, and Am-241, 900 millicuries total in approved nuclear gauges.

Licensed materials in the portable nuclear gauges can be used at temporary jobsites anywhere in the United States where the U.S. NRC maintains jurisdiction for regulating the use of licensed materials. All other licensed materials can be used at the following locations: the University of Massachusetts, Amherst, Massachusetts, Cranberry Station, E. Wareham Massachusetts, Gloucester Marine Station, Gloucester, Massachusetts, Waltham Field Station, Waltham, Massachusetts, and the Conte Anadromous Fish Research Center, 1 Migratory Way, Turner Falls, Massachusetts.

The most recent Amendment, No. 58, dated July 3, 1996, added the use of Am-241 and Cs-137 in portable nuclear gauges, and authorized their use at any temporary jobsite.

Inspection History

Review of the inspection history indicates that one violation was identified during an inspection conducted from September 25 - 26, 1991, where the licensee did not secure licensed material from unauthorized removal. The response letter was received on October 23, 1991 and the action was closed at the next inspection. No violations were observed during the next inspection conducted on September 21, 1993. During the following inspection from August 8 to August 10, 1995, two violations were observed. A 50 millicurie Am-241 source was only leak tested in November 1994 and again in May 1995, an interval exceeding three months. Condition 29.C. of the license, required the licensee to include in the records of disposal in ordinary trash subsequent to decay-in-storage, among other things, the background dose rate and the dose rate measured at the surface of each waste container. As of August 10, 1995, records of waste disposal were not in accordance with Condition 29 since they did not include the background dose rate nor the dose rate measured at the surface of each waste container. The licensee's corrective actions for these violations were not reviewed during this inspection.

A Commonwealth of Massachusetts inspector visited the site on August 1, 1996 to review the contamination event.

3. Notification of Event

On July 29, 1996, the RSO of the University of Massachusetts at Amherst, Massachusetts notified the NRC of an event that occurred in a basement laboratory of the Hasbrouck Building in Room 17 on July 24, 1996 while two radiation safety technicians were performing an inventory. Individual B took notes at the entry to the room while Individual A performed an inventory of radioactive material inside the room. While performing the inventory, Individual A opened a container of Ac 227, noticed an "organic odor", and became concerned that some personal contamination might have occurred. Individual A performed a frisk, and found contamination on the top of both shoes. One shoe was easily decontaminated. Surveys of the floor revealed contamination over an area of approximately one square foot. Individual A cleaned up the area. Due to a suspicion that some material might have been inhaled, Individual A took a nasal wipe of both nostrils. Preliminary evaluation of the nasal wipes indicated possible Ac-227 contamination.

Since the RSO was not at the site, Individual A immediately notified the owner of the material, who is also the acting chairman of the Radioisotope Use Committee (RUC). The RSO speculated that other natural radioactive materials stored in the room could have spilled in the process of opening the Ac-227 container. Room 17 was secured, and the RSO did not suspect contamination of the home or car of the individual, but neither had been checked. Urine and fecal sampling was initiated as a precaution, and a resource to analyze the samples was being sought. The RSO stated that, in his estimation, that he was not required to notify the NRC of the event by regulation, but was providing the information to the NRC as a courtesy. The RSO indicated that they were evaluating all available information to determine whether an internal exposure to Ac-227 had occurred.

5. Inspection of Room 17, Hasbrouck Building

On August 7, 1996, the inspector accompanied representatives of the licensee to Room 17 in the basement of the Morrill Science Center. Additional cleanup had not been attempted by the licensee following the cleaning at the time of the original event. The licensee and the inspector resurveyed the locations on the floor where the contamination had occurred on July 24, 1996. The inspector verified the location of the contamination spots and the survey readings taken by the licensee, and had the licensee take wipe samples for analysis by the NRC. The results of the independent wipe tests are elevated at one spot (location #5 on the licensee's drawing) inside the entry to the irradiator room. The remaining four wipes are approximately at, or below, the licensee's acceptance criteria. The results for the wipe of location #5 were: gross alpha 2490 ± 30 dpm, gross beta 1750 ± 30 dpm, and 431 ± 10 dpm for tritium.

6. Chronology of Event

During the inspection, interviews were conducted with the Radiation Safety Officer (RSO), the contaminated individual, and the Director of the Division of Health and Environmental services, and with the other individual present at the time of the event by a telephone interview on August 28, 1996. The inspector also reviewed selected related records of the licensee.

Based on review of records, interviews, and observations during this inspection, the following chronology was developed. Condition 19 of License No. 20-00882-03 requires the licensee to conduct inventories of sealed sources. The most recent inventory of sources in Room 17 was performed approximately 6 months previous to the event. Source containers were not opened during this previous inventory.

Prompted by discrepancies in the inventory, how sources were listed (e.g. "LBU", leak test before use), and the difficulty, at times, in locating sources to be identified, three memorandums were sent by management to the radiation safety staff. The first memorandum dated May 31, 1996, discusses the discrepancies of location, shielding/containment, and source data, and a closing statement which indicates that the licensee was planning to identify all sources in the next inventory.

A second memorandum dated June 3, 1996 to Individual A, who conducted the inventory on July 24, 1996, discusses the form used to record information concerning sealed sources.

A third memorandum, also addressed to Individual A, requests an updated sealed source inventory, and requests that information be obtained for any sources for which needed information was missing from the inventory records, the location of each source, and, identification of all listed items which are not actually sealed sources, and should, therefore, be removed from the list. A note on this memorandum states: "definition of sealed sources: does not include exempt quantity 'buttons', liquids, powders in small ampules, 'home made' foils, etc. Sealed means manufactured by a licensed company under NRC criteria." Neither of the memorandums include a plan of

action, and neither memorandum clarifies the specific actions to be taken or not to be taken with unsealed sources.

The referenced memorandums were interpreted by Individual A as instructions to specifically identify the presence and type of all sources when the inventory was performed in Room 17 Hasbrouck building on July 24, 1996.

Two individuals were tasked with performing the inventory. Individual B remained at the door to write down data, and individual A entered Room 17 after donning protective gloves and a laboratory coat at the exterior of Room 17.

Sources in Room 17 were stored in a lead castle constructed of two layers of lead bricks, open at the top, and stacked against the right wall inside the entry to the irradiator room. When the Ac-227 was to be checked, Individual A picked up the Ac-227 container, opened the outer lead container, and noticed that there was no liquid in the vial. Individual A also noted an odor which Individual A thought came from the Ac-227 container. A survey of the container indicated that it pegged the survey meter on all scales. The Ac-227 container was closed and returned to the lead castle. Individual A assumed there was a contamination problem. To check the floor, a wet smear was taken and pegged the meter when checked. A frisk of Individual A's shoes indicated that they were contaminated. One shoe remained contaminated, the other was able to be decontaminated. Some contamination was able to be removed from the floor, however, individual A was not able to decontaminate the entire area. The room was locked and posted because of the high level of contamination of several spots, one of which measured 25,000 counts with a Ludlum Model 3 equipped with pancake probe. When Individual A returned to the department laboratory, Individual A took a wipe of both nasal passages. Preliminary analysis of the nasal swab indicated 118 cpm greater than background. The shoe was frisked with a GM frisker. Individual A immediately notified the chairperson of the RUC who is the individual who owns the Ac-277, and later notified the RSO who was out of town.

A second entry into the room was made on July 25, 1996 by the RSO and Individual A to verify the location of the contaminated spots on the floor. Three direct frisk meter readings were taken, two of which indicate 2,500 cpm. The third meter reading has no data of the readings noted.

7. Probable Dose Commitment

The initial evaluation of the nasal wipe sample at the licensee's facility indicated the presence of 118 cpm greater than background. This meant that, if all the counts were attributable to Ac-227, that 0.04 nanocuries of Ac-227 might be present in the nasal wipe. The nasal wipe and the contaminated shoe were taken to a nearby nuclear power station for analysis using more sophisticated equipment. Individual A also had whole body counts at the power station on July 27, 1996 and again on August 31, 1996 and received a whole body count at the FDA/WEAC group on August 2, 1996, 10 days after the event.

Review of the counting data indicated that Individual A's shoe was contaminated with Ac-227. Photopeaks of Ac-227 daughters, Th-227 and Ra-223 were present in the

gamma ray spectrum of from the shoe. However, the nasal swab showed only photopeaks of Rn-222 daughters, Pb-214 and Bi-214, indicating no Ac-227 on the nasal swab. A one hour whole body count of Individual A on a Canberra Fastscan whole body counter, which uses NaI detectors, did not detect Ac-227. The LLD for this system is approximately 5 nanocuries based on the 352 keV photopeak of Bi-211.

The licensee had the urine and fecal samples analyzed, and forwarded the results to ORISE for review. The conclusions from the results forwarded to ORISE are as follows:

- 1) Ac-227 was present in the room where the event occurred.
- 2) The shoe of individual showed several peaks from Ac-227 daughters including Th-227, Ra-223 and Rn-219 as detected with a 20% Ge detector for a 40 minute count.
- 3) All other results for the individual including the nasal smear, several whole body and lung counts, urine samples and fecal samples are negative for identification of Ac-227 or any of its daughters.
- 4) Since fecal samples were not taken until five days after the event, the possible missed intake would have been $2.0 \times 10^6 \mu\text{Ci}$, which constitutes 0.001 ALI, corresponding to a possible missed dose of 0.005 rem (5 mrem).

7. Findings

At the time of the event the licensee only used survey meter readings to assess the degree of contamination on the floor of Room 17 in the Hasbrouck building. Wipe tests were taken but not immediately analyzed. Although the preliminary results of a nasal smear were positive, a sample was not taken to determine whether an airborne problem existed. Air samples should have been taken to investigate whether there might have been airborne contamination present. The first air sample was taken on August 1, 1996, eight days after the contamination, and may not have been representative of the airborne conditions at the time of the event.

This is a violation of 10 CFR 20.1501 and 1502.

A letter to the NRC dated December 27, 1990 states on page 3.1 of the Radionuclide Use Policy and Program, III Policy: "All operations involving the use of radionuclides in any chemical or physical form, will be conducted in such a manner as to ensure that exposure to radiation is as low as is reasonably achievable." "Operations involving the use of radioactive material shall be planned so that the limits established by the Nuclear Regulatory Commission for personnel exposure and radioactive effluent are not exceeded." The memorandums to the staff of the Environmental Health and Safety department dated May 31, 1996, and two memorandums June 3, 1996 do not constitute adequate planning for dealing with expected problems with unknown or unsealed sources.

This is a failure to comply with the commitments in Condition 30 of the license.

8. Current Status of the Facility

An air sample taken on August 1, 1996 by the licensee indicates that the results of an airborne problem did not exist on that date based on 305 counts detected on the air sample counted for 10 minutes and 343 counts determined from a background count for 10 minutes, at an efficiency of 13.4%. The results of wipe tests taken by the inspector on August 7, 1996, indicate that one remaining spot has a contamination level of 2490 ± 30 dpm gross alpha, and 1750 ± 30 dpm gross beta activity. The licensee has forwarded a current copy of the inventory of sources, and provided a list of corrective steps to be taken in a letter dated September 11, 1996, which includes a commitment to dispose of radioactive material now in storage in Room 17, Hasbrouck Building to a licensed vendor.

9. Exit Meeting

A preliminary meeting was held by John D. Kinneman with representatives of the licensee on August 6, 1996, and an exit meeting was held on August 7, 1996 attended by the persons listed in Item 1, above.