

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report No. 030-02640/97001(DNMS)

Licensee: The Ohio State University

Location: The Ohio State University
Columbus, Ohio campus

Dates of Inspection: April 28-30, 1997

Inspector: Wayne Slawinski, Senior Radiation Specialist
Division of Nuclear Materials Safety

Approved By: John R. Madera, Chief, Nuclear Materials Inspection Branch 1
Division of Nuclear Materials Safety

EXECUTIVE SUMMARY

Ohio State University NRC Inspection Report No. 030-02640/97001(DNMS)

This routine, unannounced safety inspection was conducted to review aspects of the university's NRC-licensed broadscope program, limited to radwaste characterization, storage and disposal, and ordering, receipt, and distribution of radioactive material. The inspection included a review of two lost radioactive material package incidents that occurred in February and March 1997, while the packages were processed by the university's Receiving Department. Laboratory security was also reviewed to a limited extent.

Radwaste characterization, storage and disposal was found to be considerably improved, as was the material condition of the university's two primary radwaste storage areas. Large volumes of unidentified radwaste were characterized and disposed since significant problems were last identified by the NRC in July 1996. Laboratory security was also found to be significantly improved since the last NRC inspection in December 1996.

The current process for ordering, receipt and distribution of radioactive material was found to be adequate; however, weaknesses were identified with previous practices. These weaknesses contributed to the loss of radioactive material packages on two separate occasions. One apparent violation was identified for failure to secure from unauthorized removal and control and maintain constant surveillance of radioactive material packages during the receipt and delivery process.

Packages containing radioactive material were lost because the licensee had not implemented the necessary security and controls for receipt and delivery of unlabeled radioactive material packages. Although the licensee was aware that improvements in its radioactive material receipt and delivery program were necessary, planned improvements were delayed pending additional staff and other resource allocations to the radiation safety office.

REPORT DETAILS

1.0 Inspection History and Purpose

1.1 Inspection History

Previous inspections were conducted at Ohio State University (OSU) in June-July 1996 and December 1996, to evaluate activities authorized under two of the university's NRC licenses. Activities conducted under a medical, academic/research broadscope license and wet storage cobalt-60 irradiator license were reviewed during those previous inspections. The June-July 1996 inspection identified several apparent violations in the overall implementation of the university's radiation safety program, including repetitive problems in the areas of laboratory security, radioactive material inventory and its accountability and characterization, storage and disposal of radwastes. The December 1996 inspection was conducted to review the actions taken by the licensee to correct the problems identified during the June-July 1996 inspection. The December 1996 followup inspection determined that corrective actions were underway for most of the problems identified earlier that year; however, exceptions were noted in some areas.

Findings from the June-July 1996 and December 1996 inspections were combined and are documented in Inspection Reports No. 030-02640/96003(DNMS) and No. 030-31605/96001(DNMS), transmitted to the licensee on January 27, 1997.

1.2 Purpose of Inspection

This routine inspection was conducted primarily to review: (1) the licensee's efforts in characterizing previously unidentified radioactive wastes, disposing of these wastes and improving the inventory control and material condition of its two principal radwaste storage areas; and (2) radioactive material ordering, receipt and distribution practices.

The inspection included a review of two licensee reported incidents involving lost packages of radioactive material that occurred in February and March 1997. Laboratory and associated radioactive material security was also reviewed to a limited extent.

2.0 Radioactive Waste Characterization, Storage and Disposal

2.1 Inspection Scope

The inspector reviewed the licensee's actions to address previous problems in the areas of radwaste characterization, storage and disposal, and to improve the material condition of its two principal waste storage areas. The inspection focused on actions taken by the licensee since approximately November 1996, when it began disposing of radwastes previously characterized by a contractor.

2.2 Observations and Findings

As reported in Inspection Report No. 030-02640/96003(DNMS) and No. 030-31605/96001(DNMS), over 750 cubic feet of unidentified waste stored in the Bulk Chemical Warehouse (BCW) and Corrosive Bunkers (CB) was characterized by a licensee contractor in July and August 1996. Much of this waste was transferred to a waste vendor for disposal at the Barnwell Low Level Waste facility in South Carolina in November and December 1996. However, certain mixed wastes, unidentified chemical wastes and transuranic sources remained in storage.

Subsequent to contractor waste characterization, the licensee discovered other uncharacterized wastes stored in the BCW and CB, which may have been overlooked and not identified by the contractor. The additional uncharacterized wastes included about 40 five-gallon containers of liquid, several thousand liquid scintillation vials, numerous pieces of contaminated metal, several sealed sources housed in lead shielded containers and other miscellaneous materials.

For several months beginning in about December 1996, the licensee expended considerable effort to complete the characterization of unknown radioactive materials, properly dispose of the material and improve the material condition and inventory control system in the BCW and CB. By February 1997, all radwaste previously stored in the CB was relocated to the BCW and with limited exception, characterized and disposed. The CB was cleaned and surveyed by the licensee and determined to be releasable for unrestricted use in accordance with NRC guidelines, except for one of the six bunkers which had isolated areas of fixed contamination. A decontamination plan is being prepared by the licensee for the contaminated bunker. The ultimate fate of the bunkers has not yet been determined by the licensee.

From November 1996 through April 1997, approximately 2000 cubic feet of solid and liquid radwaste was transferred to various vendors for disposal or processing incident to disposal at the Barnwell Low Level Waste facility. As of June 1, 1997, all sealed sources and other radwastes previously stored in the CB and BCW had been characterized and with some exceptions, have been disposed at the Barnwell site. The exceptions are eight americium-241 sealed sources, two cesium-137 and one lead-210 sealed source. The latter three sources are planned for disposal at Barnwell in June 1997. The licensee submitted a license amendment request for storage of the americium-241 sealed sources beyond the limitations of License Conditions No 19 and 20, until special arrangements can be made for disposal of these transuranic sources. NRC action on this request is pending.

Other positive initiatives recently undertaken by the licensee to improve previous radwaste storage and control problems include the development of procedures for waste handling and processing in the BCW, implementation of a housekeeping and maintenance program for this area, and the phasing in of improved methods for the collection of researcher generated wastes and its orderly storage in the BCW.

Inspector tours of the CB and BCW revealed the material condition of the areas to be significantly improved. Identification, accountability and control systems for waste in the BCW has likewise improved.

2.3 Conclusions

The licensee expended considerable effort over the last several months to improve radwaste characterization, storage and disposal problems which previously existed for many years in the BCW and CB. Procedures and other control systems have been recently established to ensure the radwaste storage and disposal program does not degrade to its previous condition and is properly maintained.

3.0 **Ordering, Receipt and Distribution of Licensed Material**

3.1 Inspection Scope

The inspector evaluated aspects of the licensee's program for ordering, receipt and distribution of licensed materials intended for use by researchers, focusing on recent changes made to the program as a result of two incidents involving lost radioactive material packages. The lost package incidents are described in Section 4.

3.2 Observations and Findings

The process for ordering and approving radioactive material purchases remains as previously described in Inspection Report No. 030-02640/96003(DNMS) and No. 030-31605/96001(DNMS). Radioactive material packages, however, are no longer delivered to the university's Receiving Department on Kenney Road and distributed by receiving department personnel. These tasks were undertaken by the Radiation Safety Office (RSOF) staff in April 1997, after two incidents occurred involving packages that were lost by the receiving department. Radioactive material package receipt and delivery practices were not changed until the incidents occurred, despite weaknesses identified by the NRC in these areas during the June-July 1996 inspection. As described further in Section 4, the licensee was slow in changing its receipt and distribution practices because of budgetary and therefore resource limitations. Also, the licensee did not believe that immediate changes were needed because its receiving department had not previously lost radioactive material packages.

All radioactive material packages other than those for the University and Arther James Cancer Hospitals are currently received at the RSOF, where they are processed and delivered to the requestor by RSOF technicians. The revised receipt and delivery process was selectively reviewed and found to be adequate. Package transportation problems disclosed during a previous inspection, as described in Inspection Report No. 030-02640/96003(DNMS) and No. 030-31605/96001(DNMS), have been rectified. Specifically, packages transported by the RSOF are properly braced within the transport vehicle and shipping papers are stowed as required. Previous concerns regarding acceptance of

packages delivered to laboratories has been addressed by limiting receipt only to Authorized Supervisors or their laboratory radiation workers.

3.3 Conclusions

Previous weaknesses in radioactive material package receipt and distribution led to two incidents involving lost packages. These weaknesses were corrected in April 1997, at which time responsibility for package receipt and delivery was transferred to the RSOF. Current receipt and delivery practices appear adequate.

4.0 **Followup of Two Incidents Involving Lost Radioactive Material Packages**

4.1 Inspection Scope

The inspector reviewed two separate, similar incidents reported to the NRC by the licensee, involving the loss of a package containing radioactive material that occurred on February 26, 1997 and March 28, 1997.

The inspector reviewed the circumstances surrounding each incident, evaluated root and contributing causes and the licensee's corrective actions.

4.2 Observations and Findings

(a) First Lost Package Incident

Overview

All goods and materials ordered by the university, including radioactive materials, were delivered to the central receiving department and subsequently delivered to the requestor by two different methods.

Radioactive material packages labeled to satisfy DOT criteria prescribed by 49 CFR 172.403, were segregated by receiving department personnel and secured in locked storage at the receiving dock where they would await daily pickup by an RSOF technician. These packages would be delivered to the requestor by the RSOF technician, provided results of package surveys satisfied prescribed limits.

Unlabeled radioactive material packages such as those containing limited quantities of radioactive material pursuant to 49 CFR 173.421, were not secured from unauthorized removal while at the receiving department and subsequently delivered directly to the requestor by receiving department personnel. Unlabeled radioactive material packages were processed by the receiving department similar to non-hazardous material packages and goods.

About 500 packages were received daily at the university's central receiving department, including up to approximately 50 packages containing

radioactive material. Approximately one-half of all radioactive material packages received at the receiving department were unlabeled.

On March 4, 1997, the licensee notified NRC Region III that a package containing a vial of 250 microcuries (9.26 MBq) of liquid phosphorus-32, delivered to the university by common carrier on February 26, 1997, was missing. The NRC Operations Center was notified by the licensee on March 25, 1997, within 30-days after discovery of the loss, as required by 10 CFR 20.2201(a). The licensee submitted its written report of the incident to the NRC dated March 24, 1997, in accordance with 10 CFR 20.2201(b). The lost package was not labeled to indicate its contents was radioactive material, because it contained 250 microcuries of phosphorus-32, a limited quantity, which does not require labeling under DOT regulations.

Packages containing merchandise of higher value and most unlabeled radioactive material packages, which are shipped overnight airfreight because of refrigeration requirements, are processed as "special delivery" packages by the receiving department. These packages are generally processed by receiving department personnel expeditiously, and delivered the same day as received. Over 50 packages per day are usually handled special delivery, including about 10-15 packages of unlabeled radioactive materials. Special delivery packages are tracked by the receiving department through purchase order documentation. The documentation tracks each package from the time of initial receipt at the dock until delivered to the requestor by delivery personnel.

Details

The 250 microcurie phosphorus-32 package was delivered to the receiving department docks by Federal Express at approximately 10:30 am on February 26, 1997, and logged in by a receiving department clerk minutes later. The package, along with about 50 other special delivery packages received that morning, was then moved to another area of the receiving dock area, where it remained for about two and one-half hours as is the usual practice. The package was not secured from unauthorized removal or under constant surveillance during this time period.

Beginning approximately 1:00 pm on February 26, 1997, the special delivery packages were sorted along with their associated purchase order paperwork. The paperwork consists of a one page purchase order document generated by the receiving department that provides a description of the package contents, the location (laboratory) the package is to be delivered, time and date of receipt at the receiving dock and a purchase order number used for tracking purposes. During the sorting process, the driver matches up each package with its corresponding purchase order document. Afterwards, packages are loaded by the driver on the delivery vehicle.

Packages of various kinds were delivered to 33 campus locations by the special delivery driver on February 26, 1997, including delivery of radioactive materials to eight different research buildings. At the completion of the special deliveries that day, the driver realized that one package was not delivered because its corresponding paperwork lacked a receipt signature, which is required to be provided by the person accepting delivery of the package.

The special delivery driver was interviewed during the inspection and indicated that the rollup door of the transport truck was not locked during deliveries. According to the driver, the delivery vehicle may be unattended for approximately five to fifteen minutes while a delivery is made to a particular location. Theft of the delivery truck's contents is therefore easily accomplished. The driver indicated that the delivery stop for the lost package was one of the final deliveries to be made that day.

10 CFR 20.1801 requires that the licensee secure from unauthorized removal or access licensed materials that are stored in unrestricted areas. 10 CFR 20.1802 requires that the licensee control and maintain constant surveillance of licensed material that is in controlled or unrestricted areas and that is not in storage. As defined in 10 CFR 20.1003, unrestricted area means an area, access to which is neither limited nor controlled by the licensee.

Notwithstanding the security requirements, a package containing a 250 microcurie vial of phosphorus-32 was left unsecured in the university's receiving dock area for nearly three hours, an unrestricted area, along with other packages and goods. The package apparently was then loaded onto a delivery truck which was also left unsecured periodically throughout the afternoon of February 26, 1997, while deliveries were made to various campus locations. The package was likely misplaced or stolen during the time it was under the control of the Receiving Department for an approximate six hour period on February 26, 1997. During this time period, the licensee did not secure from unauthorized removal or limit access to the package, nor did the licensee properly control and maintain constant surveillance of the material. The failure to secure from unauthorized removal or otherwise control and maintain constant surveillance of licensed material that is in controlled or unrestricted areas is an apparent violation of 10 CFR 20.1801 and 20.1802.

The Receiving Department failed to notify the RSOF of the loss until March 3, 1997, because it was unaware of any reporting requirements. Between March 3-6, 1997, radiation safety personnel conducted physical searches of the receiving department and dock areas, and of the 33 locations where special delivery packages were delivered on February 26, 1997. On March 14, 1997, the search was expanded to all areas where any deliveries were made by receiving department personnel on February 26, 1997. About 60 locations were visited in the expanded search. The trash

dumpster outside the receiving dock was also searched on March 14, 1997. According to the licensee, the dumpster had not been emptied for several weeks. On March 13, 1997, the RSOF informed all its Authorized Supervisor researchers, over 250 individuals, about the missing package and requested they search their respective labs. None of these search efforts were successful.

Corrective Actions

On March 11, 1997, the RSOF provided training to receiving department personnel, covering topics equivalent to that required by 10 CFR 19.12. The instruction focused on the handling of damaged radioactive material packages and the importance of notifying the RSOF immediately upon discovery of a lost or damaged package. The training, however, did not address package security and control during the receipt and delivery process. Approved supervisors were informed via newsletter and in ensuing monthly Radiation Safety Short Courses, to notify the RSOF immediately if a radioactive material package is not received when expected.

Weaknesses in radioactive material package security and control appear to be the direct cause of the lost package. Consequently, although the licensee's search for the missing package was extensive, its corrective actions did not adequately address the problems that caused the loss.

(b) Second Lost Package Incident

Overview

On April 8, 1997, the licensee notified NRC Region III that a package containing a vial of 250 microcuries (9.26 MBq) of liquid phosphorus-32, delivered to the university by common carrier on March 28, 1997, was missing. The NRC Operations Center was notified by the licensee on April 18, 1997, within 30-days after the discovery of the loss, as required by 10 CFR 20.2201(a). The licensee submitted its written report of the incident to the NRC dated May 9, 1997, in accordance with 10 CFR 20.2201(b).

The type of package and circumstances surrounding its loss were nearly identical to the incident that occurred on February 26, 1997.

Details

The package was delivered by Airborne Express to the university receiving dock at approximately 11:25 am on March 28, 1997, and logged in by a receiving department clerk minutes later. The package contained a limited quantity of radioactive material pursuant to 49 CFR 173.421 and therefore bore no radioactive material labeling. The package was designated as a special delivery package along with about 40 others to be delivered that day.

After receipt at the dock, the package was relocated to the special delivery package staging area, and a couple hours later sorted and matched up with its corresponding paperwork and loaded into the delivery truck. The package was not secured from unauthorized removal or under constant surveillance while it remained in the staging area. In this instance, the special delivery driver, the same individual involved in the previous incident, was assisted by a newhire driver trainee. Although paperwork completed by the involved drivers shows that the missing package was accounted for during the sorting process and should have been loaded into the transport vehicle, neither driver recalls loading the package.

After completing the special deliveries, the drivers realized that receipt signatures were not available for three packages, one of which was the package containing the phosphorus-32. The other missing packages were non-radioactive laboratory chemicals. Each of the three lost packages was destined for delivery to a different research building.

Similar to the first incident, the driver indicated that the rollup door on the back of the delivery truck was not locked during the approximate three hour delivery process. Also, the radioactive material package was left unsecured in the receiving dock area from the time it was received at about 11:30 am until special delivery packages were sorted about two hours later. Similar to the first incident, the package was likely misplaced or stolen during the time it was under the control of the Receiving Department for about a five hour period on March 28, 1997. During this period, the licensee did not secure from unauthorized removal or limit access to the package, or maintain it under constant surveillance. The failure to secure from unauthorized removal or limit access to the package and control and maintain constant surveillance of it during the receipt and delivery process, is the second occurrence of an apparent violation of 10 CFR 20.1801 and 20.1802.

The licensee performed extensive searches throughout all areas of the university campus where the package could reasonably have been lost, without success. The searches were initiated promptly after the loss was identified the afternoon of March 28, 1997.

Corrective Actions

Beginning April 2, 1997, the receipt and distribution of all radioactive material packages, with limited exception, was transferred from the receiving department to the RSOF. The exceptions pertain to radioactive material packages designated for University Hospital and the Arthur James Cancer Hospital. Packages for the hospitals are typically delivered directly to these facilities by the carrier. While in the possession of the RSOF, packages are either physically secured from unauthorized removal or access, or maintained under constant surveillance and control of RSOF staff. These corrective actions appear to be adequate.

4.3 Conclusions

Based on the information obtained during the inspection, and that gathered by the licensee during its followup, the location of the missing packages could not be definitively determined. Three scenarios exist for the probable disposition of the lost packages, as follows:

- (1) The packages were stolen from the back of the delivery truck between delivery stops.
- (2) The first lost package may have been left on the loading dock or moved to another area of the receiving department and mistakenly disposed in the normal trash dumpster. (The dumpster was not searched until sixteen days after the package was lost)
- (3) The packages were stolen or intentionally misplaced by a receiving department worker.

The university police initiated an investigation after the second incident, but were unable to develop evidence to support the third scenario.

While the information obtained during the inspection suggests that the packages may have been stolen from the transport vehicle because the vehicle was left unsecured, it is unlikely that thieves would only take one or two small boxes from a delivery truck and leave more expensive computer and electronic equipment untouched. Nevertheless, packages were lost because the licensee had poor security and control over unlabeled radioactive material packages during the receipt and delivery process. The licensee allowed radioactive material packages to be processed by its Receiving Department, similar to non-hazardous materials and goods.

Potential weaknesses in its package receipt and delivery program were known by the licensee since at least July 1996, when brought to their attention during a previous NRC inspection, as documented in Inspection Report No. 030-02640/96003(DNMS) and No. 030-31605/96001(DNMS). The licensee was aware that improvements in certain of its radioactive material receipt and delivery practices were desirable to prevent lost packages; however, the licensee did not believe immediate attention was required since it had no history of radioactive material packages lost by the receiving department. The licensee planned to transfer responsibility for radioactive material package receipt and delivery to the RSOF, but delayed its implementation pending the allocation of additional resources to the RSOF. The change was planned to take place in July 1997, at which time its fiscal year budget is issued. Consequently, the root cause of the lost packages appears to be the licensee's failure to promptly address known weaknesses with its radioactive material receipt and distribution program due, in part, to resource limitations.

Each lost vial of phosphorus-32 is housed in a shielded container, packaged within a styrofoam insert and cardboard box. Consequently, the package does not represent a radiological hazard provided its integrity is maintained. Phosphorus-32 is a relatively short half-life material and has an Annual Limit of Intake of 600 microcuries. Therefore, it likewise does not represent a significant radiological hazard.

5.0 Other Areas Inspected

5.1 Inspection Scope

The inspector performed a limited review of laboratory security and also reviewed the transportation training recently provided to university staff involved in the use of portable moisture/density gauges. Previous problems were identified in both these areas, as reported in Inspection Report No. 030-02640/96003(DNMS) and No. 030-31605/96001(DNMS).

5.2 Observations and Findings

The RSOF has taken several positive steps since July 1996 to improve laboratory security, including off-hours laboratory audits and an accelerated enforcement program. Although a period of transition was apparently needed for security policy changes and expectations to be fully understood by the research community, these changes and the detection and deterrent program implemented by the RSOF appear to have strengthened the program.

The inspector toured two research buildings and visited several laboratories during the evening of April 29, 1997. Based on these tours, laboratory and associated radioactive material security was found to be significantly improved.

The inspector confirmed through record review and discussion with RSOF staff that appropriate transportation training was provided to university staff involved in the use of moisture/density gauges. The training was provided by the RSOF in March 1997.

5.3 Conclusions

Significant improvements were made in laboratory security over the last several months due in large part to the attention devoted to this area by the RSOF, and support of the Radiation Safety Committee. Tours of research buildings and individual laboratories revealed no security problems. Previous poor habits generally appear to have been broken and in some cases attitudes toward laboratory security changed.

Exit Meeting Summary

The inspector discussed the preliminary findings described in greater detail in this report with licensee management and other representatives, during an exit meeting at the university on April 30, 1997. Additional and clarifying information was obtained from the licensee subsequent to the site inspection and the findings further discussed with RSOF staff during telecons with the inspector on June 3 & 6, 1997.

The inspector summarized the possible scenarios relative to the two lost radioactive material packages and the apparent violation leading to the loss. The inspector expressed concern that previously identified weaknesses in radioactive material package receipt and distribution were not adequately addressed by the licensee until after the second incident occurred.

PARTIAL LIST OF PERSONS CONTACTED

- * Vincent Burkes, Health Physicist
- * Eric Denison, Radiation Safety Technician
- * Tim Governor, Director, Occupational Health & Safety
Eric Hurd, Driver
- * Andrew Karam, Health Physicist
Joanne Markiewicz, Director of Purchasing, Receiving & Stores
- * Steven Marsh, Health Physicist
Emmett McAfee, Driver
- * Jeanne McGuire, Health Physicist
- * Robert Peterson, Jr., Radiation Safety Officer
- * Phil Pendergast, Compliance Officer
- * Jo Nell Pohl, Radiation Safety
- * John Reilly, Associate Legal Counsel
Joseph Rhodes, Receiving Clerk
Donald Riddick, Manager, Receiving Department
- * Cecil Smith, Associate Vice President, Environmental Health & Safety
- * Michael St. Clair, Environmental Manager
Robbie Suttle, Driver
- * Heather Woodyard, Radiation Safety Technician

* Denotes those attending the Exit Meeting on April 30, 1997

The inspector also contacted other members of the Office of Environmental Health and Safety and laboratory researchers.

INSPECTION PROCEDURES USED

IP 87100	Licensed Materials Program
IP 87103	Inspection of Incidents at Nuclear Materials Facilities

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
MBq	Megabequerel
DOT	Department of Transportation
RSOF	Radiation Safety Office
OSU	Ohio State University
BCW	Bulk Chemical Warehouse
CB	Corrosive Bunkers