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September 13, 1999

U. S. Nuclear Regulatory Commission
Region II, Atlanta Federal Center
61 Forsyth St SW Suite 23T85
Atlanta, GA 30303

Gentlemen and Ladies;

SUBJECT: REPORT OF LOSS OF LICENSED MATERIAL,
LICENSE NO. 45-23645-01NA

This report is submitted to describe the circumstances and actions taken regarding a shipment of radioactive material from the National Naval Medical Center on 13 August 1999. Operating under Navy Radioactive Material Permit No. 19-00168-21NP, the permittee inadvertently transferred waste awaiting decay-in-storage to Stericycle, Inc. in Baltimore, MD where it was incinerated.

The permittee identified several violations of NRC and DOT regulations. Navy Environmental Health Center will monitor the status of corrective actions during future inspections.

The information required by 10 CFR 20.2201(b) is provided in the first enclosure with details in the second enclosure. This is considered a final report and unless requested no further reports are forthcoming from this office.

Sincerely,

J. R. Pomerville
G. A. HIGGINS *for*

Commander, Medical Service
Corps, U. S. Navy
Executive Secretary,
Naval Radiation
Safety Committee

MC20

- Enclosures: 1. 30-day Written Report (10CFR20.2201)
2. NNMC RSO Investigation Report
3. Comply Code Calculations

Copy to: Bureau of Medicine and Surgery (MED-211)
Navy Environmental Health Center (OEM)
Commander, National Naval Medical Center
Maryland Department of Environment

30-Day Written Report
Loss of Licensed Material
NRC License No. 45-23645-01NA
NRMP No. 19-00168-21NP

Submitted pursuant to and formatted as in 10 CFR 20-2201(b):

(i) Description of the licensed material involved:
Waste, in the form of radioactive liquid residue inside vials and syringes, generated from standard nuclear medicine procedures. These estimates are considered to be maximum levels and represent a worse case scenario.

Radioisotope (physical and chemical form)	Estimate of Activity on 13 August 1999
Sr-89 (Strontium Chloride)	30 uCi
Cr-51 (Sodium Chromate)	30 uCi
In-111 (Labeled Oxyquinoline)	0 uCi
In-114m* (Labeled Oxyquinoline)	35 uCi
I-125 (Labeled Albumin)	20 uCi

*A long-lived contaminant of the In-111 production process.

(ii) Description of the circumstances under which the loss occurred:

At approximately 1600 on 17 August 1999, the National Naval Medical Center (NNMC) radiopharmacist informed the NNMC Radiation Safety Officer (RSO) that he believed radioactive material (RAM) designated as long-lived was released on 13 August 1999 as non-radioactive biohazard waste. This waste was being held in storage in the nuclear medicine department "hot locker" for transfer to NNMC's on-site long-term radioactive waste storage facility. The package had been transported to the biohazard waste cage for disposal.

(iii) Statement of the disposition of the licensed material:

The material was transported to the NNMC Public Works Center (PWC) biohazard waste facility and was picked up by Stericycle, Inc. of Baltimore MD, the contracted waste-

30-Day Written Report
Loss of Licensed Material
NRC License No. 45-23645-01NA
NRMP No. 19-00168-21NP

disposal company, on 13 August 1999 and incinerated that day.

(iv) Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas:

External exposure measurements using a Geiger-Mueller tube were made on the surface of the actual package at the time of transfer and more recently on a package simulating the one in question. All readings were at background levels.

Due to these low exposure readings it is not expected that any member of NNMC PWC staff or the waste disposal-company would have received exposures in excess of normal background. Since the packages were not opened prior to incineration (as stated by the contractor) the possibility of external or internal radioactive contamination of these personnel was low.

Internal dose estimates were made with Comply Code Version 1.5d using several different incinerator parameters all resulted in an effective dose equivalent of less than 1 millirem per year to a nearby individual.

(v) Actions that have been taken to recover the material:

Immediately upon discovery, the RSO contacted the PWC representative responsible for biohazardous waste disposal and was informed that it was very likely that the box was still onsite. Upon further investigation it was determined that there had been a pickup of waste by Stericycle, Inc. of Baltimore MD, the contracted waste disposal company, on 13 August 1999. The following morning NNMC was informed by a Stericycle representative that the shipment picked up from NNMC was incinerated on 13 August 1999.

30-Day Written Report
Loss of Licensed Material
NRC License No. 45-23645-01NA
NRMP No. 19-00168-21NP

(vi) Procedures or measures that have been adopted to ensure against a recurrence of the loss of licensed material:

The radiopharmacist and the RSO continue to routinely review the nuclear medicine waste disposal logs in order to quickly identify any improper actions.

The storage procedures for long-lived nuclear medicine radioisotope storage were modified to include notification of the RSO when working containers of long-lived radioactive waste are full. The containers will be immediately picked up for storage in the on-site long-term storage facility rather than stored in the nuclear medicine "hot locker" where short-lived decay-in-storage waste is held for routine disposal as biohazardous waste.

Training of all involved staff in the new waste disposal procedures has been accomplished.

NNMC RSO Investigation Report

1. Description of incident

At approximately 1600, on 17 August 1999, Mr. Dan Driver, the NNMC radiopharmacist informed me that he believed radioactive material (RAM) designated as long-lived was released on 13 August 1999 as non-radioactive biohazard waste. This waste, in the form of radioactive residue inside vials and syringes, is generated from standard nuclear medicine procedures. Based on the disposal log entries made by Mr. Driver and HM2 Bumgarner, an NNMC nuclear medicine technologist, it was concluded that a box containing I-125, Cr-51, Sr-89, and In-111, which was being held in storage in the nuclear medicine department "hot locker" for transfer to our on-site long-term radioactive waste storage facility, had been transported to the NNMC biohazard waste cage for disposal. I immediately contacted the PWC representative responsible for biohazard waste disposal and was informed that it was very likely that box may still be onsite. I then immediately contacted the Navy Environmental Health Center (NEHC) to inform them of our situation and that we were in the process of trying to locate the RAM. Notification of the chain-of-command was initiated.

Upon further investigation it was determined that there had been a pickup of bio-waste by Stericycle of Baltimore MD, the contracted waste-disposal company, on 13 August 1999. Due to the late hour, we were unable to contact the waste disposal company until the following morning where upon we were informed by a company representative that a shipment of bio-waste was picked up from NNMC and indeed incinerated on 13 August 1999. I then informed NEHC of the disposition of the RAM. I was asked by NEHC to confirm that the waste disposal company had been informed as to the reasons for inquiries concerning the bio-waste shipment. I then called Stericycle to ensure they were aware. I informed them that radioactive waste in low amounts and activities were mistakenly transported to the biohazard cage for disposal.

NNMC RSO Investigation Report

2. Estimates of radioactivity and radiation levels

Estimates of activity for each of the radioisotopes reportedly contained in the shipment was made by Mr. Driver and are listed in the table below. These estimates are considered to be maximum levels and represent a worst case scenario. The procedure for disposal of decayed bio-waste is to place the box containing the decayed waste into a larger box with packing material. The larger box has the dimensions of 18x18x23 inches. Calculations of dose rates on the surface of the outer box assumed that the radioisotopes were located in the center of the box and did not take into account attenuation from the glass of the vials, syringes, and packing containers.

Radioisotope	Estimate of Activity on 13 August 1999	Estimate of Activity on 20 August 1999	Half life	Γ constant $\frac{R}{cm^2}$ mCi hr	Prominent Photon energy	Maximum Beta Energy	Calculated mR/hr at surface of box
Sr-89	30 uCi	27.4uCi	52.7d			1463 KeV	0.0
Cr-51	30 uCi	25.2uCi	27.7d	0.16	320 KeV		0.2
In-114m*	35uCi	31.8uCi	50.0d	0.20	192 KeV		0.32
I-125	20uCi	18.4uCi	60.2d	0.70	35KeV		0.63

*A long-lived contaminant of In-111 production process
 Γ Constants obtained from Radiological Health Handbook (1970)

NNMC RSO Investigation Report

Measurements using an ANPDR/27 and an RM3C-4 with a DT-304 probe were made of a vial containing 60uCi Cr-51 and a syringe containing 20uCi I-125, which were placed in small inner box and then the outer shipping box. All readings were at background levels. The Log entry made by HM2 Bumgarner indicates his measurements of the surface on the outer box using an ANPDR/27 survey meter averaged 0.02 mR/hr (background). This would seem to be supported based on our measurements and calculations. The relatively low photon energy of I-125, which is greatly attenuated by the glass of the vials, syringes, and the metal of the ANPDR/27 detector probe still read background using the DT-304 probe.

Due to the low exposure reading and relatively low activities, it is not expected that any member of the waste disposal-company would have received exposures in excess of normal background. Further, since the packages are not opened prior to incineration as was reported the contractor; the possibility of radioactive contamination of personnel was low.

The forms of each radionuclide involved are:

Isotope	Chemical Form	Physical Form
Sr-89	Strontium Chloride	Liquid residue
Cr-51	Sodium Chromate	Liquid residue
I-125	Labeled to Albumin	Liquid residue
In-111	Labeled to Oxiquinoline	Liquid residue

NNMC RSO Investigation Report

3. Self-identified violations

- (1) 10 CFR 20.1801, failure to secure licensed material from unauthorized removal.
- (2) 10 CFR 20.1802, failure to maintain control and surveillance of licensed material.
- (3) 10 CFR 20.2001 (a)(1), transfer of radioactive waste to an unauthorized recipient.
- (4) 10 CFR 35.92 (a)(1), failure to hold byproduct material in storage for a minimum of 10 half-lives prior to disposal.
- (5) 49 CFR 173.421(a)(4), no "Radioactive" marking on the outside of the inner container.
- (6) 49 CFR 173.422(a)(1), no enclosed statement in or on package with the statement "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910".

4. Corrective actions taken

- (1) Modification of long-lived nuclear medicine radioisotope storage procedures to notify the Radiation Safety Office when long-lived radioactive working waste containers are full for immediate pickup and storage in the on-site long-term storage facility, thereby removing the step of storage in the nuclear medicine "hot locker".
- (2) Training of Nuclear Medicine and Radiation Safety staff in the new waste disposal procedures.
- (3) The radiopharmacist and the radiation safety officer routinely review the nuclear medicine waste disposal logs.

COMPLY: V1.5d.

9/ 3/99 10:46

40 CFR Part 61
National Emission Standards
for Hazardous Air Pollutants

REPORT ON COMPLIANCE WITH
THE CLEAN AIR ACT LIMITS FOR RADIONUCLIDE EMISSIONS
FROM THE COMPLY CODE, VERSION 1.5d

Prepared by:

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Prepared for:

U.S. Environmental Protection Agency
Office of Radiation Programs
Washington, D.C. 20460

Enclosure (3)

COMPLY: V1.5d.

8/27/99 9:41

Waste1

SCREENING LEVEL 2
-----DATA ENTERED:

Nuclide		Release Rate (curies/YEAR)
CR-51	Y	3.000E-05
SR-89	Y	3.000E-05
IN-114M	D	3.500E-05
I-125	D	2.000E-05

Release height 10 meters.

Building height 10 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 20 meters.

Building width 10 meters.

Default mean wind speed used (2.0 m/sec).

NOTES:

Input parameters outside the "normal" range:

None.

RESULTS:

Effective dose equivalent: 0.3 mrem/yr.

Effective dose equivalent: 0.2 mrem/yr due to Iodine.

*** Comply at level 2.

This facility is in COMPLIANCE.

It may or may not be EXEMPT from reporting to the EPA.

You may contact your regional EPA office for more information.

***** END OF COMPLIANCE REPORT *****

COMPLY: V1.5d.

9/ 3/99 10:04

RadWaste Incineration Incident - Stericyclic, Baltimore, MD

SCREENING LEVEL 2
-----DATA ENTERED:

Nuclide		Release Rate (curies/YEAR)
CR-51	Y	3.000E-05
SR-89	Y	3.000E-05
IN-114M	D	3.500E-05
I-125	D	2.000E-05

Release height 10 meters.

Building height 10 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 30 meters.

Building width 10 meters.

Default mean wind speed used (2.0 m/sec).

NOTES:

Input parameters outside the "normal" range:

None.

RESULTS:

Effective dose equivalent: 9.8E-02 mrem/yr.

Effective dose equivalent: 7.3E-02 mrem/yr due to Iodine.

*** Comply at level 2.

This facility is in COMPLIANCE.

It may or may not be EXEMPT from reporting to the EPA.

You may contact your regional EPA office for more information.

***** END OF COMPLIANCE REPORT *****

COMPLY: V1.5d.

9/ 1/99 5:16

Waste2

SCREENING LEVEL 2
-----DATA ENTERED:

Nuclide		Release Rate (curies/YEAR)

CR-51	Y	3.000E-05
SR-89	Y	3.000E-05
IN-114M	D	3.500E-05
I-125	D	2.000E-05

Release height 30 meters.

Building height 10 meters.

Distance from the source to the receptor is 50 meters.

Default mean wind speed used (2.0 m/sec).

NOTES:

Input parameters outside the "normal" range:

None.

RESULTS:

Effective dose equivalent: 6.6E-04 mrem/yr.

Effective dose equivalent: 4.9E-04 mrem/yr due to Iodine.

*** Comply at level 2.

This facility is in COMPLIANCE.

It may or may not be EXEMPT from reporting to the EPA.

You may contact your regional EPA office for more information.

***** END OF COMPLIANCE REPORT *****

COMPLY: V1.5d.

9/ 3/99 10:46

RadWaste Incineration Incident - Stericycle, Baltimore, MD

SCREENING LEVEL 2
-----DATA ENTERED:

Nuclide		Release Rate (curies/YEAR)
CR-51	Y	3.000E-05
SR-89	Y	3.000E-05
IN-114M	D	3.500E-05
I-125	D	2.000E-05

Release height 3 meters.

Building height 1 meters.

Distance from the source to the receptor is 3 meters.

Default mean wind speed used (2.0 m/sec).

NOTES:

Input parameters outside the "normal" range:

Building is unusually SHORT.

RESULTS:

Effective dose equivalent: 5.6E-02 mrem/yr.

Effective dose equivalent: 4.2E-02 mrem/yr due to Iodine.

*** Comply at level 2.

This facility is in COMPLIANCE.

It may or may not be EXEMPT from reporting to the EPA.

You may contact your regional EPA office for more information.

***** END OF COMPLIANCE REPORT *****