U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No.: 94-01

Docket No.: 030-12031

License No.: 53-16991-01MD

Licensee: Pacific Radiopharmacy, Ltd.
347 North Kuakini Street
Honolulu, Hawaii 96817

Facility Name: Pacific Radiopharmacy

Inspection at: Pacific Radiopharmacy
Address Above

Castle Medical Center
640 Ulukahiki Street
Kailua, Hawaii

Honolulu Medical Group
550 South Beretania Street
Honolulu, Hawaii

Straub Clinic and Hospital
888 South King Street
Honolulu, HI

Inspection Conducted: February 11, 16-17, March 2, and March 7, 1994

Inspector: John M. Jacobson — John M. Jacobson, Radiation Specialist — 4/1/94 Date Signed

Inspector: David D. Skov — David D. Skov, Sr. Radiation Specialist — 4/1/94 Date Signed

Approved by: G. P. Yuhas — Gregory P. Yuhas, Chief, Radioactive Materials Safety Branch — 4/1/94 Date Signed

Summary:

Areas Inspected: This was an unannounced, special inspection of Pacific Radiopharmacy (PRP) to evaluate the licensee's shipment of radiopharmaceutical materials, technetium-99m generator elution procedures, and labeling of radiopharmaceuticals for compliance with NRC and Department of Transportation (DOT) requirements. Areas covered during the inspection included shipping

procedures, hazardous material packaging, package labeling and marking, shipping papers, generator elution procedures, and radiopharmaceutical labeling.

Results: Three apparent violations were identified during the inspection as well as a concern about accurately recording the specific activity and volume on technetium-99m methelyne diphosphonate radiopharmaceutical vials and associated bar codes. The apparent violations are:

1. Failure to transport radioactive materials in DOT 7A Type A approved shipping containers to two different nuclear medicine laboratories, as required by License Condition 22.A. Section 2. (94-01-01)

2. Failure to identify the contents of a hazardous material (iodine-131) on a shipping paper accompanying private carrier transport of the material to Straub Hospital, failure to include the name of the radionuclide (technetium-99m) on the same shipping paper, and failure to include the physical form of the material and the activity of technetium-99m contained in each package of a shipment to Honolulu Medical Group, as required by 10 CFR 71.5(a) and 49 CFR 172.203(d). Section 2. (94-01-02)

3. Failure to perform an aluminum ion concentration test on each elution of an Ultra-TechneKow FM technetium-99m generator as specified in the manufacturer's instructions in the package insert, as required by License Condition 14. Section 3. (94-01-03)

DETAILS

1. Persons Contacted

Licensee:

*Trent T. Phan, Ph.D., Radiopharmacist and Radiation Protection Officer (RPO), Pacific Radiopharmacy
John Tani, Driver, Pacific Radiopharmacy

Other Personnel:

Prudence Anich, Chief Nuclear Medicine Technologist, Castle Medical Center
Richard Smith, Nuclear Medicine Technologist, Castle Medical Center
Sandra Mazingo, Nuclear Medicine Technologist, Honolulu Medical Group
Martha Bien, Receptionist, Honolulu Medical Group
Leighton Yin, Nuclear Medicine Supervisor, Straub Clinic and Hospital
Nancy Cummings, Nuclear Medicine Technologist, Straub Clinic and Hospital

Other NRC Personnel:
*Gregory P. Yuhas, Chief Radioactive Materials Safety Branch, NRC Region V

*Present at initial exit briefing at licensee's facility on March 2, 1994

2. Transportation of Radioactive Material

The inspector reviewed selected licensee procedures for transporting radioactive materials to customer sites including, packaging, labeling, and use of shipping papers for compliance with NRC and DOT requirements.

The licensee acts as both a shipper and carrier of radiopharmaceutical material. Shielded vials containing single unit and multidose vials prepared by PRP are packaged daily for transport to nuclear medicine laboratories at several private hospitals and physician offices on the island of Oahu, including Castle Medical Center (CMC), Honolulu Medical Group (HMG), and Straub Clinic and Hospital. Each radionuclide is dispensed into a sealed vial and placed inside a lead shielded container, which is labeled with its radioactive contents. The shielded container for each vial is constructed of top and bottom parts which are either screwed together or are joined at the middle by masking tape. According to Straub and HMG representatives, vials containing either Tc-99m or liquid I-131 are typically secured inside lead shields held together by masking tape, while other radiopharmaceuticals such as strontium-89, thallium-210, and iodine-131 capsules are transported inside screw-on type lead shields. Previous NRC inspections of the licensee have determined that PRP routinely places the shielded vials inside an aluminum attache' case which serves as a DOT 7A Type A shipping package. The PRP driver then transports the package by automobile (private carrier shipment) one or more times each day to each of several client nuclear medicine facilities.

Based on discussions with HMC and Straub representatives on February 11, 1994, the inspector learned that PRP has routinely delivered radionuclides to HMC and Straub in a "small" attache' case or in an open cardboard container without any packing material. At 10:15 AM on February 11, 1994, the inspector observed a PRP driver making one such delivery to Straub's Nuclear Medicine Hot Laboratory. This delivery was the second one of the day following an earlier delivery at approximately 8:00 AM that same morning. The foam lined aluminum attache' case (approximate dimensions, 12 inch x 9 inch x 6 inch) carried by the driver contained two lead shielded, radioactively labeled vials. One vial contained 124 mCi of Tc-99m labeled technetium pertechnetate and the other, 62 mCi of Tc-99m labeled medronate material, for use in diagnostic nuclear medicine studies.

The inspector's observations and interview of the PRP driver indicated that radiopharmaceuticals prepared by PRP over the last several years have been packaged inside a foam lined attache' case of somewhat larger outside dimensions (18 inch x 13 inch x 7 inch). This larger case, transported in a motor vehicle for delivery to Straub and other clients, appeared to be marked and labeled in accordance with NRC/DOT shipping requirements. The PRP driver stated that upon arrival at the client's parking lot, he transfers the shielded containers from the large attache' case to either the smaller attache' case or to a small cardboard carton which is not closed or sealed at the top and is not filled with packing material. The smaller attache' case is most often used for both delivery of PRP radiopharmaceuticals and the return of a small number of empty lead containers from the previous daily shipment. However, the driver indicated that the small carton is used for convenience in delivering radiopharmaceuticals on some occasions when a larger number of empty lead containers, such as those accumulated from the previous week's shipments, must be picked up for return to PRP. The driver added that the heavy lead containers are easier to carry in a small carton than in the more bulky attache' case.

Paragraph 1, Items 10-28 and 10-30 of the application which was included with the letter dated April 5, 1989, and referenced in License Condition 22, requires that only an attache' case approved for use as a DOT 7A Type "A" shipping container, be used to transport radioactive materials. Such transportation activities are considered to include not only the carriage of radiopharmaceuticals by motor vehicle on public roads but the hand carriage and delivery of the material directly to each client nuclear medicine restricted area. The DOT 7A design specification (49 CFR 173.24) requires that a Type A package must withstand normal conditions of transport without loss or dispersal of the radioactive contents. Although the cardboard carton used by the driver was marked "USA DOT 7A Type A", the package was not sealed and did not contain absorbent material to prevent the loss or dispersal of its radiopharmaceutical contents. Consequently, the licensee's use of an open and unapproved carton to transport radioactive material is considered an apparent violation of License Condition 22. The use of the unapproved package to transport multi-millicurie quantities of radioactive material is

considered a safety concern because of the potential for accidental spillage of the contents in hospital and clinic unrestricted areas and the resulting risk of radiation exposure and/or contamination involving members of the public.

Further discussions with Straub's nuclear medicine supervisor, and the PRP driver and radiopharmacist indicated the licensee had routinely used open cartons to transport radionuclides since at least 1992. The radiopharmacist indicated that he first learned of the improper shipping practice from someone, whose name he could not remember, in approximately November 1993. The radiopharmacist stated that he then instructed the PRP driver to halt the use of open cartons and to use only the approved attache' case, and he had assumed the driver was following his instructions. However, the driver admitted that sometime in early 1993, he resumed using open cartons to deliver radiopharmaceuticals because of continuing problems with carrying the heavy lead containers. The driver said he did not inform the radiopharmacist about the change because he believed it was unimportant to do so. The radiopharmacist indicated that he did not check with the driver after November 1993, to ensure compliance with company and NRC shipping requirements, and he was unaware of the driver's use of open cartons to deliver radioactive material. The driver's failure to follow the RSO's instructions, and the failure of the RSO to ensure that radioactive material was being transported in accordance with the licensee's required procedures, is a significant concern.

The licensee's use of shipping papers to transport radioactive material was also examined during the inspection. The licensee routinely uses two different types of shipping papers. One type is prepared by PRP with the aid of a computer using a commercially available software program, Nuclear Medicine Information System (NMIS). For shipments to Straub, PRP uses the NMIS program to print a hard copy listing of the contents of each radiopharmaceutical in the shipment including the following information: radionuclide, chemical form, physical form, unit quantity, calibration time, calibrated activity, volume, and activity at time of shipment. PRP also includes the same information in the form of a bar code printed on a label accompanying each radiopharmaceutical in the shipment. The bar code information, entered by Straub directly into a small computer using duplicate NMIS software and a bar code reader, is used in preparing each patient radiopharmaceutical dosage.

Problems were noted with the shipping papers for three radioactive shipments to two nuclear medicine laboratories which either did not include certain DOT required information or incorrectly identified the presence of radioactive material not physically present. The inspector's interview of the radiopharmacist indicated that these problems were not isolated cases. For example, the licensee made two radiopharmaceutical shipments to Straub at approximately 8:00 AM and 10:00 AM on February 11, 1994. The shipping package for the 8:00 AM Straub delivery contained 9

separately shielded vials each containing an activity between 5 mCi and 99 mCi of either iodine-131 (I-131), technetium-99m (Tc-99m), or gallium-67, with a combined activity of approximately 450 mCi.

Although most DOT required information was completed, PRP failed to identify on the shipping paper the contents of a ninth vial in the shipment containing 15 mCi of liquid iodine-131 (Lot No. 27496), including such omitted information as the name of the radionuclide, the physical and chemical form of the material, and the activity of the iodine-131 in terms of curies, millicuries, or microcuries. Although this vial was actually delivered to Straub in the 8:00 AM shipment, PRP included the omitted information on the shipping paper used for the transport of two other radionuclides totaling 186 mCi that were delivered to Straub in the 10:00 AM shipment. Consequently, the shipping paper for the 10:00 AM shipment was also inaccurate because PRP incorrectly described the 15 mCi of liquid I-131 as part of the shipping package contents. The radiopharmacist indicated that he normally checks the shipping paper accompanying each package to ensure that all radiopharmaceuticals are properly accounted for, and that the omission of the required information in this case was due to an oversight. However, he added that similar omissions have occurred in the past due to interruptions from phone calls and other problems experienced during the early morning daily rush to prepare and package radiopharmaceuticals for shipment.

The inspector's review of the PRP prepared shipping papers disclosed other missing and incorrect information for both the February 11th 8:00 AM and 10:00 AM shipments to Straub, which are apparently caused by problems with the NMIS computer software. For example, the name of the radionuclide (Tc-99m) for six of nine shielded radioactive vials, representing a combined activity of 370 mCi among the contents of bot shipping packages, was omitted and incorrectly replaced by certain radiopharmaceutical names and initials (e.g. MAA, MDP, microlite, cardiolite and MAG3).

Radiopharmaceuticals sent to other nuclear medicine laboratories that are not equipped with the NMIS computer software and bar code readers have been shipped by PRP using a different hazardous materials shipping form. The inspector reviewed one such shipping paper for the February 11th shipment to HMG of three shielded vials totaling 194 mCi of Tc-99m, and a single vial containing 1 mCi of I-131. Although the radioactivity of each vial was numerically identified on the shipping paper, the activity units (e.g. mCi) and the physical form (e.g. solid, liquid) of each material in the package were omitted. In addition, the licensee lists all routinely prepared radiopharmaceuticals on this second shipping form regardless of whether each of the compounds are actually included in a shipment, which is ambiguous and potentially inaccurate.

The licensee's failure to include all required information on shipping papers used to transport radioactive material is considered an apparent violation of 10 CFR 71.5(a) and 49 CFR 172.203(d), which requires that the description for a shipment of radioactive material include the name

of each radionuclide, the physical and chemical form of the material, and the activity contained in each package of the shipment in terms of curies, millicuries, or microcuries.

The deficiencies noted above indicate the need for additional RPD and management oversight of the licensee's program for shipping and transporting radioactive material. The following apparent violations were identified during the inspection of this program area.

1. The failure to transport radioactive materials in an attache' case licensed for use as a DOT 7A Type A shipping container, as required by License Condition 22.A. (94-01-01)

2. The failure to completely and accurately include all DOT required information on shipping papers for the transport of radioactive material including the name of the radionuclides, the physical and chemical form of the material, and the activity in terms of curies, millicuries, or microcuries, as required by 49 CFR 172.203(d). (94-01-02)

3. Generator Elution

The inspector and Region V Branch Chief reviewed the licensee's procedure for testing eluates from Tc-99m generators for compliance with NRC requirements during an inspection at the licensee's facility on March 2, 1994.

During the inspection at the licensee's facility, the pharmacist was questioned about his daily procedures for testing eluates from the licensee's Ultra-TechneKow FM Tc-99m generators, which are manufactured by Mallinckrodt. The package insert which accompanies each generator (A100I0 R6/93) provides the instructions for eluting the generator. The section of the insert entitled "Directions for Use of the Ultra-TechneKow FM Generator," provides the steps to be followed for each elution. Step 8 states: "Determine the aluminum ion concentration of the eluate. The acceptable limit is not more than 10 micrograms per milliliter of eluate." The aluminum ion concentration test is performed by using an ion test kit and litmus paper. When the radiopharmacist was asked if he had performed the test on the eluate he had extracted from a generator that morning for his customers, he was unable to produce any litmus paper used for the test. When he was pressed further, he stated that he had not performed the aluminum ion test that day because he was in a rush to get out orders to customers and did not think the test was very important. He further stated that he often did not perform the test, but routinely did so for the first elution from a new generator as this was where he expected any contaminants to appear if there were problems with a generator. The inspectors noted that the aluminum ion indicator kit on hand (E.B. duPont de Nemours and Co., Lot No. 122B232 dated 12/87) had an expiration date of June 1, 1992. The radiopharmacist stated that this was the kit he had been using to perform his aluminum ion tests and had not noticed the kit was beyond its expiration date. Thus, any aluminum ion concentration tests performed by the licensee during the period from

June 1, 1992 to March 2, 1994, do not appear to have been valid tests. The radiopharmacist stated that the aluminum tests had to be done for each generator elution and that he would start performing them.

License Condition 14 requires, in part, that the licensee shall elute generators in accordance with instructions furnished by the manufacturer on the label attached to or in the leaflet or brochure that accompanies the generator. The licensee's failure to perform an aluminum ion concentration test with a current aluminum ion indicator kit each time an elution is made from the licensee's Ultra-Technekow FM Tc-99m generators in accordance with the instructions furnished in the leaflet (package insert) accompanying each generator is an apparent violation of License Condition 14. The failure of the licensee to conduct the aluminum ion concentration tests is of concern because it could potentially affect patient care.

One apparent violation was identified during the inspection of this program area.

1. The failure to perform an aluminum ion concentration test on each daily elution of an Ultra-TechneKow FM Tc-99m generator, as required by License Condition 14. (94-01-03)

4. Radiopharmaceutical Labeling

Based on discussions with nuclear medicine technologists during an inspection at Kaiser Foundation Hospital on March 2, 1994, one of the licensee's customers, the inspector and Region V Branch Chief learned that the technologists often had to draw more Tc-99m-labeled methelyne diphosphonate (MDP) than calculated by Kaiser's NMIS program for vials provided by the licensee. As noted earlier, NMIS is a computerized system used by technologists for entering the isotope, manufacturer, calibration time, isotope half-life, total activity, and volume for each vial sent from the radiopharmacy by scanning a bar code. The information is also included by the radiopharmacist on the vial label. NMIS then calculates the specific activity (total activity per unit volume) and calculates the volume for the technologist to draw by dividing the prescribed dose by the specific activity of the vial.

The radiopharmacist was questioned as to why technologists would often have to draw more Tc-99m MDP than the volume calculated by NMIS to get the correct dose (as measured in the dose calibrator). The radiopharmacist responded that for a number of years he had been adding saline solution to the vials of MDP he prepared for customers. Typically, the licensee prepares vials containing 100 millicuries (mCi) of Tc-99m MDP in 4 milliliters (ml) of solution for customers each morning. MDP is used for bone scans which are a very frequent type of diagnostic study and it is not uncommon for his customers to perform 4 scans with 25 mCi (1 ml) of Tc-99m MDP per injection on an average day, thus using the entire vial. Technologists typically use a 3-ml (3-cc) syringe to make the injection. However, the radiopharmacist stated that most technologists do not realize that when they draw a solution into a

3-ml syringe up to the 1-ml line, they are actually withdrawing 1.1 ml of radiopharmaceutical from the vial because the hub of the needle contains 0.1 ml. Therefore, after 3 "1-ml draws," the technologist has actually withdrawn 3.3 ml of MDP and does not have enough left for a fourth injection that day. The licensee stated that he perceived this to be a nuisance to his customers and so decided to add 0.4 ml of saline to each MDP vial so that technologists would have enough solution to make 4 injections from each vial. He stated that he did not record the correct volume (4.4 ml) on the vial label or bar code, however, because he was within the 10% error allowed to him by standard pharmacopeia practice. Instead, he recorded 100 mCi of Tc-99m in 4 ml of MDP for a specific activity of 25 mCi/ml. In actuality, the licensee has been providing 100 mCi of Tc-99m in 4.4 ml of MDP plus saline for a specific activity of 22.7 mCi/ml. When a customer such as Kaiser reads the incorrect volume (4 ml) into their NMIS, the software calculates a specific activity (25 mCi/ml) which is too high, and thus calculates volumes to be withdrawn which are too low.

The addition of saline solution to a radiopharmaceutical is not a random error, but rather a bias of 10% in the volume. The 10% error criteria should thus not be used by the licensee as justification for not recording the proper volume and specific activity on MDP vial labels and in the corresponding bar code. The pharmacist stated that he would draft a letter and make a telephone call to all of the licensee's customers stating that as of a certain date, he would only include 4 ml of MDP in each 100-mCi vial. Although the addition of saline solution to MDP and the improper recording of the volume and specific activity on the vial label is of concern because of the potential effects on patient care, no violations of NRC requirements were identified during the inspection of this program area.

5. Exit Briefing

An initial exit briefing for the inspection of generator elutions and labeling of radiopharmaceuticals was held with the RPO at Pacific Radiopharmacy's facility on March 2, 1994. The inspector and Region V Branch Chief discussed the apparent violation involving the licensee's failure to perform aluminum ion concentration tests on each elution of a generator. The radiopharmacist stated that the aluminum tests had to be done and he would perform them. In addition, they expressed their concern that the licensee provide accurate data on volumes and specific activities on all radiopharmaceutical vials, especially for Tc-99m MDP. The RPO and radiopharmacist stated that in the near future all vials of MDP would be labeled with the actual volume and specific activity. He stated that he would change labeling procedures as soon as he had contacted all the licensee's customers by letter and by telephone to inform them of the change.

An additional exit briefing concerning the inspection of the licensee's shipment of radiopharmaceuticals was held by phone with the RPO at the conclusion of the inspection on March 7, 1994. The inspector discussed the two apparent violations involving the use of unauthorized shipping

packages to transport radioactive material and the omission of certain DOT required information on shipping papers. The inspector also expressed a concern about the PRP driver's failure to always comply with the RPO's directive to not transport unapproved shipping packages, and the RPO's failure to ensure that radioactive materials were being transported in accordance with license requirements. The RPO stated that following the inspection, the driver was reinstructed about the shipping requirements. He also explained that pending NMIS software changes, the name of each radionuclide would be manually entered on each shipping paper as necessary. No proprietary information was provided by the licensee during the inspection.