UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
WASHINGTON, D.C. 20555

September 17, 1990

NRC INFORMATION NOTICE NO. 90-59: ERRORS IN THE USE OF RADIOACTIVE IODINE-131

Addressees:

All medical licensees.

Purpose:

This information notice is intended to emphasize to medical use licensees the potential radiation dose levels resulting from errors in the administration of iodine-131 to humans. This issue was previously addressed in IE Information Notice No. 85-61, Suppliment 1: Misadministrations To Patients Undergoing Thyroid Scans (attached). Due to the significance and frequency of recurrence of these errors, NRC believes this issue should be readdressed. It is expected that licensees will review this information for application to their own procedures for the administration of iodine-131, distribute the notice to those responsible for radiation safety and quality assurance, and consider actions, if appropriate, to establish procedures to preclude the misadministration of iodine-131 at their facilities. However, suggestions contained in this notice do not constitute any new U.S. Nuclear Regulatory Commission (NRC) requirements, and no written response is required.

Description of Circumstances:

The following cases are recent events reported to NRC that have resulted in unintended radiation doses to humans, as a result of the administration of radioactive iodine:

Case 1: A patient with a history of thyroid cancer was scheduled for her yearly whole-body scan. Before the scan, the patient underwent a pregnancy test, with negative results. After the pregnancy test results were received, the technologist began to complete a departmental questionnaire to obtain information from the patient relative to the requested procedure. The questionnaire addressed the possibilities of pregnancy and lactation. However, before completing the questionnaire, the technologist was called away and did not return to complete the form before administration of the iodine-131. As a result, the patient was given the intended dosage of 4.89 millicuries of iodine-131. Approximately 48 hours later when the patient was scanned, there was considerable iodine-131 uptake in her breasts. When questioned by the physician, the patient indicated that she had given birth to a female infant two weeks earlier and had been nursing this infant for approximately the last 36 hours. The total body dose to the infant was estimated to be 17 rads, and the radiation dose to the infant's thyroid was estimated to be 30,000 rads. A synthetic thyroid hormone replacement has been prescribed for the child, with scheduled periodic follow-ups. The unintended dose to the mother's breasts was estimated to be 8.9 rads.

IDAR-11 C

Case 2: A patient to be scheduled for a thyroid scan was administered 3 millicuries of iodine-131 instead of the intended dosage of 300 microcuries of iodine-123. The patient's physician called in the request for a thyroid scan to the secretary of the nuclear medicine department, who inadvertently scheduled a whole-body scan. No written request from the physician was required. The dosage at this facility for a whole-body scan is 3 millicuries of iodine-131, whereas the dosage for a thyroid scan is 300 microcuries of iodine-123. The estimated dose to the patient's thyroid gland due to this error was 4700 rads.

Case 3: A patient was scheduled for an ectopic thyroid evaluation, with an intended dosage of 100 microcuries of iodine-131. In completing the Nuclear Medicine department referral sheet, the referring physician incorrectly requested a post-thyroidectomy neck scan. As a result, the patient was administered 1 millicurie of iodine-131, with an estimated dose to the thyroid of 1300 rads.

Case 4: A patient was scheduled for an ectopic thyroid evaluation, with an intended dosage of 50 to 100 microcuries of iodine-131. The technologist consulted the department procedure manual that listed prescribed dosages for specific scans, and the dosage was incorrectly listed as 4.5 millicuries. As a result, the patient was administered 4.3 millicuries. The estimated dose to this patient's thyroid gland was 4300 rads.

Case 5: A patient was administered a dosage of 15 microcuries of iodine-131. Almost immediately following the administration, the patient indicated to the technologist that she was approximately 4 to 5 weeks pregnant. The technologist failed to ask the patient if she was pregnant before the administration. The patient had arrived at the department with a baby in her arms, and the technologist assumed that the patient was not pregnant. The total body dose to the fetus was estimated to be 2 to 4 millirem. Since the fetal thyroid is incapable of concentrating iodine-131 until approximately 12 weeks of gestation, it was estimated that there was no additional dose to the fetal thyroid.

DISCUSSION:

All licensees are reminded of the importance of ensuring the safe performance of licensed activities, in accordance with NRC regulations, requirements of their licenses, and accepted medical practice. The forementioned cases illustrate: the lack of familiarity with appropriate thyroid studies and dosages; the necessity of consistently following quality control procedures; and a need to understand the significance of radiation doses that result from the administration of millicuries versus microcuries of radiopharmaceuticals containing radioiodine. Specifically, the radiation dose to the thyroid, resulting from a dosage of one millicurie rather than one microcurie of

iodine-131, is a one thousand-fold increase. In addition, the radiation dose received from an activity of iodine-131 is approximately 100 fold greater than the dose from the same activity of iodine-123. The following table illustrates the relationship between microcurie versus millicurie quantities of iodine-131, as well as the radiation dose differential between iodine-123 and iodine-131, for three different age groups, with a thyroid uptake of 15 percent.

TABLE: A Comparison of Isotopes and Radiation Doses for Various Age Groups Assuming 15% Uptake by the Thyroid*

	Rads per uCi		Rads per mCi	
	I-123	I-131	I-123	I-131
1 year old	0.07	7.40	70.3	7400
5 years old	0.04	4.07	40.0	4070
Adult	0.007	0.78	7.0	777

* Based on information from ICRP Publication No. 53

All workers should have a clear understanding of the significance of errors in scale when calculating and preparing diagnostic dosages versus therapeutic dosages of radiopharmaceuticals containing radioiodine. The threshold at which a diagnostic dosage becomes a therapeutic dosage is low, and depends on the age of the patient and the percent uptake by the patient's thyroid gland. Consequently, the potential for causing a significant, undesired radiation dose to a patient's thyroid gland must always be kept in mind when administering iodine radiopharmaceuticals.

Licensees are reminded that the package inserts provided by the manufacturers contain information pertinent to both proper dosages and radiation doses, and may be valuable resources when reviewing imaging policies and procedures for errors and inconsistencies. Nuclear medicine department procedures should include provisions for questioning female patients about the possibility of pregnancy or lactation. By attention to detail, and adherence to departmental policy and procedures, many incidents involving radioactive iodine-131 may be avoided.

No specific written response is required by this information notice. If you have any questions regarding this matter, please contact the appropriate regional office or this office.

Richard Cunningham, Director
Division of Industrial and
Medical Nuclear Safety
Office of Nuclear Material Safety
and Safeguards

Technical Contact: Sally Merchant, NMSS
(301) 492-0637

Attachments:
1. List of Recently Issued NMSS Information Notices.
2. List of Recently Issued NRC Information Notices.

LIST OF RECENTLY ISSUED NMSS INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to:
90-50	Minimization of Methane Gas in Plant Systems and Radwaste Shipping Containers	08/08/90	All holders of operating licenses or construction permits for nuclear power reactors
90-44	Dose-Rate Instruments	06/29/90	All NRC licensees
90-38	Requirements for Processing Financial Assurance Submittals for Decommissioning	05/29/90	All fuel facility and materials
90-35	Transportation of Type A Quantities of Non-Fissile Radioactive Materials	05/24/90	All U.S. Nuclear Regulatory Commission (NRC) Licensees
90-31	Update on Waste Form and High Integrity Container Topical Report Review Status, Identification of Problems with Cement Solidication, and Reporting of Waste Mishaps	05/04/90	All holders of operating licenses or construction permits for nuclear power reactors, fuel cycle licenses, and certain byproduct materials licenses
90-27	Clarification of the Recent Revisions to the Regulatory Requirements for Packaging of Uranium Hexafluoride (UF_6) for Transportation	04/30/90	All Uranium Fuel Fabrication and Conversion Facilities
90-24	Transportation of Model SPEC 2-T Radiographic Exposure Device	04/10/90	All NRC licensees authorized to use, transport, or operate radiographic exposure devices and source changers
90-20	Personnel Injuries Resulting from Improper Operation of Radwaste Incinerators	03/22/90	All NRC licensees who process or incinerate radioactive waste

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-58	Improper Handling of Ophthalmic Strontium-90 Beta Radiation Applicators	9/11/90	All NRC medical licensees.
90-57	Substandard, Refurbished Potter & Brumfield Relays Misrepresented As New	9/5/90	All holders of OLs or CPs for nuclear power reactors.
90-56	Inadvertent Shipment of A Radioactive Source In A Container Thought To Be Empty	9/4/90	All U.S. Nuclear Regulatory Commission (NRC) licensees.
90-55	Recent Operating Experience on Loss of Reactor Coolant Inventory While In A Shutdown Condition	8/31/90	All holders of OLs or CPs for nuclear power reactors.
83-44 Supp. 1	Potential Damage to Redundant Safety Equipment As A Result of Backflow Through the Equipment and Floor Drain System	8/30/90	All holders of OLs or CPs for nuclear power reactors.
90-54	Summary of Requalification Program Deficiencies	8/28/90	All holders of OLs or CPs for nuclear power reactors.
89-18 Supp. 1	Criminal Prosecution of Wrongdoing Committed by Suppliers of Nuclear Products or Services	8/24/90	All holders of OLs or CPs for nuclear power reactors.
90-53	Potential Failures of Auxiliary Steam Piping and the Possible Effects on the Operability of Vital Equipment	8/16/90	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

No specific written response is required by this information notice. If you have any questions regarding this matter, please contact the appropriate regional office or this office.

Original Signed By

Richard Cunningham, Director
Division of Industrial and
Medical Nuclear Safety
Office of Nuclear Material Safety
and Safeguards

Technical Contact: Sally Merchant, NMSS
(301) 492-0637

Attachments:
1. List of Recently Issued NMSS Information Notices.
2. List of Recently Issued NRC Information Notices.

E. Kraus/Tech. Ed.
8/21/90

OFFC: IMAB	: IMAB	: IMAB	: IMOB	:IMNS	: IMNS	
NAME:SMerchant:cv:	LCamper	: JGlenn	: JWHickey	:GSjoblom:	RECunningham:	
DATE:08/24/90	: 08/24/90	: 08/29/90	: 08/30/90	: 08/11/90:	08/09/90	

OFFICIAL RECORD COPY
131I