NUCLEAR MEDICINE

PURPOSE

This procedure provides general instructions for developing, maintaining and documenting radiation protection procedures for preparation, calibration and administration of radio-pharmaceutical doses; for control of exposures to patients, visitors and staff members; and for control of radioactive and/or contaminated materials used in the Nuclear Medicine Division, Radiology Department, University of Utah.

POLICY

The **Radiation Safety Committee** is responsible for assuring that each individual who prescribes or uses any form of ionizing radiation in or on humans is properly qualified through training and experience that meets all regulatory requirements. Routine clinical uses of radionuclides for diagnosis or treatment are controlled by qualified physicians and are not subject to review or approval by the Radiation Safety Committee. Research or experimental applications of radiation to humans must be reviewed and approved by the Human Uses Subcommittee of the Radiation Safety Committee (RPR 40).

Radiation safety procedures for the use of radionuclides in nuclear medicine are prepared, implemented and supervised by the **Nuclear Medicine Technical Coordinator (NMTC)** with the concurrence of the **Nuclear Medicine Director (NMD)**. The **NMTC** submits a copy of all new or revised nuclear medicine procedures involving any aspect of radiation protection to the **Radiation Safety Officer (RSO)** for review and documentation. The **RSO** submits comments, suggestions or proposed changes to the **NMTC** for action. The **RSO** reports on the status and acceptability of the procedures to the **Radiation Safety Committee** at least annually.

MEDICAL EVENT

Procedures for the administration of procedures requiring written directives and medical events shall be in accordance with URC Rules in chapter R313-32 and based on recommendations in NRC NUREG 1556 Vol. 9, Appendix S. Medical Event (RPR 22) contains a general description of the required procedures.

RADIONUCLIDE HANDLING

All procedures for radionuclide handling (spill and emergency procedures, waste disposal, area surveys, etc.) shall be performed according to procedures in the University of Utah *Radiation Safety Manual and Procedures*, in compliance with URC Rules, and based on recommendations in the appropriate appendices of NUREG 1556 Vol 9.

CONTROL OF XENON-133

Xenon ventilation studies shall be performed using a commercial delivery system in a room with negative pressure compared to surrounding rooms. Patients are to be instructed in use of the breathing system using either a mask which completely covers the nose and mouth or a mouthpiece with the nose clamped. For each study, 10-15 mCi of xenon-133 gas will be injected into the delivery system and single-breath and equilibrium rebreathing images will be acquired using a nuclear medicine scintillation camera. After the patient has reached equilibrium, the delivery system will be switched to the wash-out phase with exhaust from the delivery system running into a charcoal trap. The patient will breathe in room air and exhale through the delivery system and xenon trap.

Effluent from the xenon trap shall be monitored and spill procedures shall be followed in accordance with URC Rules in chapter R313-32 and methods stated in Appendix O of Guide DRC MED, July 1996.

RADIONUCLIDE THERAPY ADMINISTRATION

All patients administered radioactive materials will be handled in accordance with URC Rules R313-32. Release of patients will be determined as per URC rules and NRC NUREG 1556 Vol 9., Appendix U.

CALIBRATION OF DOSE CALIBRATOR

Calibration of dose calibrators shall be performed in compliance with URC Rules in chapter R313-32. Calibration procedures shall be based on methods in NUREG 1556 Vol 13., Appendix O and on the method of linearity testing as described in the article by Davis, et al. (1981).

TRAINING

The **NMTC** and the **NMD** shall ensure that all Nuclear Medicine personnel and nurses involved in care of patients containing radionuclides for therapy or diagnosis have received appropriate radiation safety training. Documentation of radiation safety training for these personnel shall be provided to the Radiological Health Department.

All staff radiologists **must** be certified by the American Board of Radiology or meet the training requirements stated in chapter R313-32 of the URC Rules.

Nuclear medicine technologists who independently prepare or administer doses to patients **must** be Certified Nuclear Medicine Technologists or have equivalent training and experience.

SUPPORT SERVICES

The **RSO** shall be responsible for radiological evaluations, leak testing of sealed sources, and calibration of portable survey instruments in accordance with RADIOLOGICAL LABORATORY EVALUATIONS (RPR 50), LEAK TESTING OF SEALED SOURCES (RPR 51), and CALIBRATION AND USE OF PORTABLE SURVEY INSTRUMENTS (RPR 52).

REFERENCES

Davis, D.A. et al, "Dose Calibrator Activity Linearity Evaluations with ALARA Exposures," *Journal of Nuclear Medicine Technology, Vol. 9,* No. 4, 188-190, 1981.

International Commission on Radiological Protection:

Radiation Dose to Patients from Radiopharmaceuticals, ICRP Publication 53, 1987.

National Council on Radiation Protection and Measurements:

Precautions in the Management of Patients who have Received Therapeutic Amounts of Radionuclides, NCRP Report No. 37, 1970.

Protection in Nuclear Medicine and Ultrasound Diagnostic Procedures in Children, NCRP Report No. 73, 1983.

The Experimental Basis for Absorbed-Dose Calculations in Medical Uses of Radionuclides, NCRP Report No. 83, 1985.

General Concepts for the Dosimetry of Internally Deposited Radionuclides, NCRP Report No. 84, 1985.

Radiation Protection for Medical and Allied Health Personnel, NCRP Report No. 105, 1989.

US Nuclear Regulatory Commission:

Consolidated Guidance about Materials Licenses: Program Specific Guidance About Commercial Radiopharmacy Licenses. NUREG-1556 Vol. 13 1999

Consolidated Guidance about Materials Licenses: Program Specific Guidance about Licenses of Broad Scope. NUREG-1556 Vol.11, 1999

Consolidated Guidance about Materials Licenses: Program Specific Guidance About Medical Use Licenses. NUREG-1556 Vol. 9 2002.

Guide for the Preparation of Applications for Medical Use Programs, Reg. Guide 10.8, Rev. 2, 1987.

Principles and Practices for Keeping Occupational Radiation Exposures at Medical Institutions As Low As Reasonably Achievable, NUREG-0267, Rev. 1, 1982

Radiation Protection Training for Personnel Employed in Medical Facilities, NUREG-1134, 1985.

University of Utah, *Radiation Safety Manual and Procedures*, Radiation Procedures and Records.

Utah Department of Environmental Quality, Division of Radiation Control:

Guide DRC-MED, July 1996.

Utah Radiation Control Rules, Standards for Protection against Radiation, Chapter R313-15.

Utah Radiation Control Rules, Medical Use of Radioactive Material, Chapter R313-32.

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RPR 27A. NUCLEAR MEDICINE EVALUATION CHECK LIST

(Use in addition to RPR 50A.)

Responsible User: _____ Group No.: _____ Date:

Building: _____ Room(s):

EVALUATION CRITERIA	YES	NO
Surveys:		
1. Daily contamination surveys performed?	( )	( )
2. Weekly surveys of labs and storage areas?	( )	( )
a. Exposure rates measured?	( )	( )
b. Wipe surveys performed?	( )	( )
3. Records maintained and contain required data?	( )	( )
date of survey, plan of areas surveyed, trigger levels, detected dose rate in mrem/hr or removable contamination in dpm/100 cm^2, survey instrument used, model #, serial number, calibration date, surveyor initials		
4. Areas decontaminated if 2000 dpm/100 cm^2?	( )	( )
5. Xenon trap monitoring performed?	( )	( )
a. Records maintained and contain required data?	( )	( )
spill clearance time calculation and post-spill safety measures monthly collection system operation check and ventilation rate measurement every 6 mo.		
Waste Disposal:		
1. Hold for decay methods adequate (decay of 10 half-lives)?	( )	( )
2. Records of disposals maintained and contain required data?	( )	( )
date of disposal, date material was stored, radionuclides disposed, survey instrument used, serial number, calibration date, background dose rate, highest dose rate measured at surface, name of disposer		
Dose Calibrator:		
1. Daily constancy check performed?	( )	( )
a. Records maintained and contain required data?	( )	( )
dose calibrator model and serial number, identity of radionuclide in check source, date of check, activity measured, checker initials		
2. Annual accuracy tests performed?	( )	( )
a. Records maintained and contain required data?	( )	( )
dose calibrator model and serial number, serial number of check source, identity of radionuclide in check source and its activity, date of test, results of test, signature of on-site RSO (NMTC)		
3. Quarterly linearity tests performed?	( )	( )
a. Records maintained and contain required data?	( )	( )

dose calibrator model and serial number, calculated activities, measured activities, date of test, signature of on-site RSO (NMTC)

4. Patient doses measured prior to administration? ( ) ( )
    a. Records maintained and contain required data? ( ) ( )
    radiopharmaceutical name, prescription number, radionuclide, patient's name, measured activity of dosage, date and time of measurement, measurer's initials

Calibration and Reference Sources:

1. Sources requiring leak tests? ( ) ( )
    a. Additions? ( ) ( )
    b. Deletions? ( ) ( )

2. Other check sources? ( ) ( )
    a. Additions? ( ) ( )
    b. Deletions? ( ) ( )

3. Quarterly inventory performed? ( ) ( )
    a. Records maintained and contain required data? ( ) ( )
    model and serial number of source, radionuclide and its nominal activity, location of source, signature of on-site RSO (NMTC)

Bioassay:

1. Measurements performed monthly on all clinical workers? ( ) ( )
    a. Records maintained and contain required data? ( ) ( )
    Recorded on proper form, instrument and calibration data, date of assay and results, signed by worker
2. Measurements performed inside of 72 hours on personnel administering therapy doses? ( ) ( )

    (Note: 72 hour assay may also be counted as the monthly assay.)
    a. Records maintained and contain required data? ( ) ( )
    Recorded on proper form, instrument and calibration data, date of assay and results, signed by worker