

# NUCLEAR MEDICINE PRINCIPAL USER

Annual Refresher Training  
Equine Medical Center (EMC)

# Radiation Safety Staff

Equine Medical Center Nuclear Medicine Laboratory Authority

Dr. Adams - (703) 771-6876 [mnadams@vt.edu](mailto:mnadams@vt.edu)

Supervisor, Diagnostic Imaging Department

Ann Masters-Stern - (301) 676-0253 [ammaste@vt.edu](mailto:ammaste@vt.edu)

Support on campus in Blacksburg, VA

University Radiation Safety Officer

Environmental, Health & Safety (EHS)

Donald Conner - (540) 231-5364 Mobile (540) 320-8305 [dcon@vt.edu](mailto:dcon@vt.edu)

Audits

Cynthia Strader - (540) 231-2699 [cynth@vt.edu](mailto:cynth@vt.edu)

Radiation Safety Office

Room 104, Health & Safety Building

675 Research Center Drive

Blacksburg, VA 24061 Mail Code 0423

<http://www.ehss.vt.edu>

# Program Review

It is important to take time to review the Nuclear Medicine program and associated standard operating procedures on an annual basis to support operations quality and to protect the health and safety of all involved. Refresher training is part of this review process and is required annually.

If you have any questions or would like further information on the items included in this training, please contact Donald Conner, EHS.

# Training Overview

- Program Review
  - Security
  - Dose Ordering and Receipt
  - Patient Notes
  - Recordkeeping
- Lessons Learned

# Security

In general, security for nuclear medicine involves procedures for procuring and receiving doses and protocols for contamination control.

- Restricting authorizations for ordering
- The use of secure delivery boxes for containers
- Documenting procedures for dose receipt and administrative recordkeeping
- Work areas must be secured and access controlled
- Documenting procedures for dose administration, patient handling and release, and waste disposal

# Dose Ordering

All orders are placed by EMC Nuclear  
Medicine Principal Users with Radiology  
Services of Northern Virginia

# Dose Receipt opening

- Doses are delivered to the lock box in A-barn treatment room. Empty 'cold' containers are placed in the box for return pick-up as new doses are delivered with their radiation cards inside.
- Personal Protective Equipment (PPE) must be worn before handling containers. This includes gloves, smock, and dosimeters - both body badges and ring badge.
- Visually inspect the container for any sign of damage before beginning.

# Dose Receipt package survey for external contamination

- Turn the Ludlum Model 3 counter on (hooked to the crystal detector inside of the lead shield chamber) and adjust the scale to the 'x 0.1' setting. Record the background (bkg) reading of the empty chamber on the appropriate form.
- Use one swipe for all external surfaces (before opening) of the dose container and place the swipe, 'dirty' side up, in the lead chamber for counting. At the same reading setting as background, packages usually read 200 - 300 cpm.
- Record dpm on log sheet and on packing slip label.

$$\text{dpm} = (\text{Pkg cpm} - \text{bkg cpm}) \times \text{meter multiplier factor}^*$$

\* multiplier is 16 (as of February 2016) for the lead chamber meter

*Swipe readings must be < 2000 dpm. If not, contact your supervisor or the Imaging Supervisor immediately.*



# Dose Receipt package survey for external dose

Use the handheld GM for package survey (before opening) to determine external dose readings.

- Use the same setting, 'x 0.1' and record the mR/hr at the surface of the package. Usually these values are between 0.03 & 0.1 mR/hr.
- Record this reading in two places: in the 'blue' notebook on the form for packages received and on the packing slip information label.
- Retain the packing slip with completed information label to copy later for filing and send a copy to Donald Conner, University RSO, in Blacksburg. This is required to keep activity inventory numbers accurate for the University's license.

*Survey limit for White I labeled radioactive packages is  $\leq 0.5$  mR/hr at surface. Notify your supervisor or the Imaging Supervisor immediately if this limit is exceeded.*

# Dose Receipt opening

- Open the container by cutting the plastic keeper using scissors kept in the workbench drawer.
- Remove the packing slip, place the information label on it, and fill out initial / date blanks.
- Check dose paperwork against order for accuracy.

*Any discrepancies in paperwork or signs of container damage must be reported to EMC Laboratory Authority or Imaging Supervisor immediately.*

# Isotope Handling

- ▣ Always double glove when handling isotope.
- ▣ Remember to change gloves frequently to avoid contamination.

# Dose Receipt

## opening

- Remove the dose from the container and place it behind the lead glass shield for further verification. The label must indicate the dose is for “skeletal imaging” and the calibration must be for the scheduled injection time.
- Remove the syringe and carefully place it into the lead syringe shield. Place the syringe and shield into the syringe case .

# Patient Notes

- Catheters are placed in the jugular vein by the doctor in charge or an LVT.
- Isotopes are injected in the stall for bone scan patients.
- “Caution Radioactive Materials” signs are posted on both stall doors and boots placed on horse’s feet to prevent the possibility of image artifacts from urine contamination. Patient information with time of scan and dose signs are also placed on the stall door.
- The dose syringe / needle is placed back in the lead syringe shield and returned to the shipping container. Syringes / needles are put into a shielded sharps container. The case is held 72 hours post injection in the camera room before surveying and returning to the pharmacy.

# Patient Notes

- No one may enter the stall after injection without authorization, dosimeter, and the required personal protective clothing: disposable gloves, plastic booties, and smock.
- After two to three hours, the horse is led out the back door of the stall, the boots removed, and feet picked if needed. Feet may be sprayed with Radiacwash if a boot(s) comes off in the stall.

# Patient Notes

- Sweep all bedding back into the stall and close the door.
- Open the garage door and lead the horse into the ready room. Using the handheld survey meter set at x10 or x100, take readings at the pectoral area and at the bladder. Record the highest of the values in the notebook.

# Patient Notes

- Soft tissue scan patients are injected once in position in the scan room. Scans begin two minutes after injection and continue at 4, 6, and 8 minutes post injection.
- After the scans are completed, Davis boots are placed on the horse's feet and the patient is moved to the stall.
- If a bone scan is also required, the patient will wait usually two to three hours before beginning the next scan as noted earlier .



# Patient Notes

- After scan is completed, the catheter may be pulled and the horse is led back to the stall.

*Note: Special care must be taken when handling the catheter as it is most likely highly contaminated.*

- All gloves, syringes, and catheters used on the patient are disposed of in the appropriate radioactive waste container in the scan room.

# Patient Release

Patients are checked after 24 hours (4 half lives) for release.

- Set the handheld meter to x 1.0 scale and take two readings: at surface of patient's skin and from about 1 meter away.
- Readings must be  $\leq 2.0$  mR/hr at skin surface or  $\leq 0.2$  mR/hr at one meter to be released into other areas of EMC or discharged from the facility.

# Stall and Waste

Essentially, most activity of an isotope is reduced to acceptable levels after 10 half lives. Release of patients is based on the half life of Tc-99m used for dosing and the readings obtained directly from the patients.

The half life of Tc-99m is 6 hours. So after 2.5 days, and based on the original dose amount of 200 mCi, approximately 200 uCi of activity remains. EMC release limit of 72 hours means there is a residual activity amount of 50 uCi possible left in the waste materials.

# Stall and Waste

- At EMC, patient stalls are considered 'hot' for 72 hours from the time of injection.
- After that time has elapsed, a survey reading will be taken of the stall and bedding. All radiation levels must be at background levels (usually  $<0.05$  mR/hr but must be determined) for release.
- Waste from the scan room (biohazard, paper trash, gloves, etc) must be scanned and determined to be at background before removing from the room and put into regular trash.

# Stall and Waste

Urine spills during scans are caught (if possible) in buckets containing bedding shavings.

If the rugs are contaminated, they are rolled up and placed out of the way in the receiving room until the survey reading is at background.

Wet (contaminated with urine) shavings from the bucket are dumped in the patient's stall. The bucket is then refilled with dry shavings and placed back in the scan room in an out of the way location.

# Early Stall Release

A stall may be cleaned prior to the 72 hour limit. The person cleaning the stall must wear PPE (boot covers, gloves, a smock) and their dosimeter badge.

Radioactive bedding material is placed in a secure dumpster for 72 hours post injection and until a meter survey indicates activity at background levels.

# Recordkeeping

Documenting the receipt, use, and disposal of radioisotopes is critical to contamination and exposure control. This includes dose information, survey and swipe data, patient details, postings, and dosimetry records.

- Dose receipt paperwork
- Information label completed
- Completed packing slip / information label sent to RSO at Blacksburg

# Recordkeeping

- Two notebooks in the scan room
- Patient information
  - Type of scan: bone / soft tissue
  - Dose amount: usually 200 mCi MDP
  - Calibration / time of injection
  - Highest value from chest and bladder survey readings at skin surface (typically 10 – 25 mR/hr) before scan
  - Release survey readings at 24 hours (if not releasable then, include readings until released)



# Recordkeeping

- Personnel contamination readings, trash readings, isotope information, and stall sanitation information pages follow.
- Personnel Radiation Survey: Technicians involved with the injection and scan are required to survey skin, shoes and clothing and record values (even if no activity is detected). If readings are  $> 2$  times background value, then clean and survey again.
- Waste Disposal: Waste from the scan room (biohazard, paper trash, gloves) are scanned prior to disposal and value recorded, must be at background before disposal (usually  $<0.05$  mR/hr)
- Radiation Survey: Daily surveys of areas where the patient is present are noted, including scan room, stall, hallway, etc. Use map to identify locations.

# Recordkeeping

- Contamination Survey, swipes, for dose receipt: completed after a dose is received and the associated scan(s) are finished.
  - Dose receipt counter swipe survey limit of  $\leq 2000$  dpm/100 cm<sup>2</sup>
  - Camera / associated surfaces swipe survey limit of  $\leq 2000$  dpm/100 cm<sup>2</sup>If either of these limits are exceeded, notify the Imaging Supervisor immediately.
- Radiation Survey, meter: weekly scan values for all areas where radioactive materials and patients were present. Done every Friday.
  - General Use or Unrestricted Areas limit of  $\leq 0.25$  mR/hr
  - Work Areas or Restricted Use limit of  $\leq 5$  mR/hrIf these limits are exceeded, notify the Imaging Supervisor immediately.

*Note: Readings > 5mR/hr require posting "Radiation Area" signs*
- Unit Dose Receipt: Date isotope ordered and administered.
  - Radio pharmaceutical is MDP, source is Tc99M
  - Lot number on packing slip
  - Ordered activity (usually 200 mCi)
  - Assay time
  - Site administered (always jugular vein)
  - Patient ID (number)
  - Disposal Date (72 hours post injection usually)

# Recordkeeping

- Sanitary/Septic System: Daily surveys of areas where the patient is present are noted
  - Patient and stall numbers
  - Type of scan, date
  - Time of injection
  - Clean date is defined as 72 hours after injection
  - Elapsed time is generally 72 hours (when stall is cleaned)
  - Stall GM survey reading must be documented before cleaning
  - Bedding / waste placed in secure dumpster GM survey reading
- Case Log: Patient and clinician information

# Lessons Learned

- ✓ As part of Good Laboratory Practices, remember to never use white out on official paperwork records. Corrections to records are made by drawing a line through the item and date / initial the change.
- ✓ Meter efficiencies may change after annual calibration. This can affect calculations.
- ✓ Survey meters should be checked before operation to verify batteries are good and calibration date is current. Take a quick reading from the source on the side of the instrument to verify meter is functioning.
- ✓ Refresher training is to be provided annually.

# Lessons Learned

- ✓ Meter surveys should be done slowly, moving no more than an inch or two per second, and keeping surface of pancake probe as close to the surface of the area being scanned as possible without touching anything.

## [Video demonstration](#)

Note: In the video, the GM shows 1000 cpm or 0.5 mR/hr when set on x 1 scale

- ✓ A plastic bag can be put over the probe to prevent possible contamination during stall / bedding surveys.
- ✓ Meter values include mR/hr and cpm. All cpm values should be converted to dpm before reporting.

# Lessons Learned

- ✓ Notify the EMC Imaging Supervisor and the RSO at the Virginia Tech campus in Blacksburg for the following conditions:
  - If a dose is received and noticeable damage / leaking is evident.
  - Any incident involving a spill of a dose volume.
  - Any unrestricted or general use areas exceeding 0.25 mR/hr.
  - Any spills involving patient urine
  - Any personnel contamination of skin or clothing

# Lessons Learned

- ✓ If surgery, or other potentially invasive therapeutic or diagnostic procedure is required on a patient after release but before skin values are at background, please follow these precautions:
  - All participants must wear dosimeters during the procedure.
  - All surgical supplies, instruments, equipment, that potentially come into contact with body fluids must be collected afterwards. A survey reading must be recorded and materials held until readings are at background levels. Record value when items are either released back to users or disposed of as trash.

*Note: Only principal users are authorized to survey patient and materials for documentation.*

# This completes the Principal User Refresher Training

Thank you for your time and participation.

Please continue with the quiz in order to complete the class.

If you have any questions, please contact Donald  
Conner, Radiation Safety Officer at the Virginia  
Tech campus in Blacksburg, VA.