NM-PET QC Manual in Development

Beth A. Harkness, MS, FACR
Detroit, MI

1

Committee

- Beth Harkness, MS – Chair
- Osama Malawi, PhD – Chair of Physics Subcommittee for NM-PET accreditation
- Sheli Kritzman, MS
- Matthew Palmer, PhD
- Frank DiFillippo, PhD
- Mike Georgiou, PhD
- Rachel Bartlett, PhD
- Sharon White, PhD
- Mark Seltzer, MD
- Stefan Ahlgren, CNMT
- Dustin Gress, PhD
- Carolyn MacFarlane, MS, CNMT
- Helen Abernathy, CNMT
- Marlene Skoff, CNMT
- Wil Creech

2

Background

- NM Accreditation December 1999
  - Modality accredited/pending: 3,335/30
  - Units accredited/pending: 5,449/45
- PET Accreditation 2003
  - Modality accredited/pending: 1629/17
  - Units accredited/pending: 1769/17

Numbers are as of 5/25/2021

3

Goals

- Provide guidelines for the establishment of a comprehensive quality control program at accredited facilities.
- Define the roles and responsibilities for the different participants.
- Provide basic standard QC practices and annual testing procedures for programs to follow as part of the accreditation process.

4

Structure for manuals

- Introduction
- Definition of terms
- NM Specific QC Manual
  - Physician responsibility
  - Technologist QC
  - Physicist annual testing
- PET Specific QC Manual
  - Physician responsibility
  - Technologist QC
  - Physicist annual testing

5

Resources for Nuclear Medicine QC Manual

- AAPM TG 177 – Acceptance Testing and Annual Physics Survey Recommendations for Gamma Camera, SPECT, and SPECT/CT
- NEMA NU-1 2018 Standard for Performance Measurement of Gamma Cameras
- ACR–AAPM Technical Standard for Nuclear Medical Physics Performance Monitoring of Gamma Cameras
- ACR-AAPM Technical Standard for Nuclear Medical Physics Performance Monitoring of SPECT/CT Equipment

6

Resources for PET QC Manual

- AAPM Report No.126 – PET/CT Acceptance Testing and Quality Assurance
- NEMA NU2 2018 – Performance Measurements of Positron Emission Tomographs
- ACR–AAPM Technical Standard for Medical Physics Performance Monitoring of PET/CT Imaging Equipment

7

Timeline

- Draft due November 2021
- Review and comment December 2021
- Revisions January – May 2022
- Final Review June 2022
- Manual Release AAPM 2022

8

Changes to the Review of Accreditation Materials

- Historically the NM/PET program has allowed submission of materials that were acquired not following the phantom instructions.
- Instructions were not clear with regard to how some aspects of the phantom images were to be acquired.
- Resulted in great variability between reviewers and the accreditation outcome.
- Starting September 1, 2021, the planar and SPECT phantom images must be acquired following the ACR phantom instructions.

9

Planar Uniformity

- 256 matrix
- 10 million counts LFOV cameras; longest dimension > 32 cm
- 5 million counts for large and small circular FOV cameras and small rectangular; axial dimension < 32 cm
- No overlying graphics
- Windowed using a window range of <5%-100%
- Images must be clearly labeled with
  - detector
  - radionuclide if applying for more than one.
- **Intrinsic floods acquired using the Siemens point source holder will not longer be accepted.**

10

Planar Resolution

- Quadrant bar phantom
  - 512 matrix
  - 5 million counts for longest dimension > 32 cm
  - 3 million counts for any circular and longest dimension < 32 cm
  - Smallest bar size must be 2-2.5 mm
- Planar ACR
  - 256 matrix
  - 600 k counts
- For both methods, images must be clearly labeled with
  - detector
  - radionuclide if applying for more than one.

11

SPECT Phantom

- 128 matrix
- 32 million total counts for the large phantom
  - 120 steps/360 degrees ≈ 267,000 cts in the first image
  - 128 steps/360 degrees ≈ 250,000 cts in the first image
- 20 million total counts for the small phantom
- Images with 0.6-0.9 cm slice thickness
- A summed image (3-4 cm, ~12 slices) through the rod section
- A complete set of slices
- Secondary capture of the slices that has no more than 28 (4x7 images) slices/page and the slice fills 80% of the image frame.

12

PET Phantom

- Complete set of slices
- Slices must be submitted in DICOM format
- Submitting a secondary capture of the slices is optional.
- Secondary capture of SUV ROIs that includes the ROI statistics.

13

13

General Guidelines for Return without Review

- Wrong phantom
- Wrong matrix size
- Wrong number of counts
- Images not labeled with head and radionuclide
- Incomplete image submission
- Secondary capture images not windowed properly (<5-100%)
- Images too small (< 80% of the image frame)

14

14

Conclusions

- NM-PET manuals are in development and will hopefully be complete by Mid 2022.
- The process has necessitated a review of acceptable accreditation phantom submissions.
- Review the ACR phantom instructions prior to acquisition and submission of phantom images.

15

15

16