

Society of Nuclear Medicine (SNM) is an international scientific and professional organization founded in 1954 to promote the science, technology and practical application of nuclear medicine. Its 16,000 members are physicians, technologists and scientists specializing in the research and practice of nuclear medicine. In addition to publishing journals, newsletters and books, the Society also sponsors international meetings and workshops designed to increase the competencies of nuclear medicine practitioners and to promote new advances in the science of nuclear medicine.

The SNM will periodically define new procedure guidelines for nuclear medicine practice to help advance the science of nuclear medicine and to improve the quality of service to patients throughout the United States. Existing procedure guidelines will be reviewed for revision or renewal, as appropriate, on their fifth anniversary or sooner, if indicated.

Each procedure guideline, representing a policy statement by the Society, has undergone a thorough consensus process in which it has been subjected to extensive review, requiring the approval of the Committee on SNM Guidelines, Health Policy and Practice Commission, and SNM Board of Directors. The procedure guidelines recognize that the safe and effective use of diagnostic nuclear medicine imaging requires specific training, skills, and techniques, as described in each document. Reproduction or modification of the published procedure guideline by those entities not providing these services is not authorized.

THE SNM PRACTICE GUIDELINE FOR SODIUM 18F-FLUORIDE PET/CT BONE SCANS 1.1

PREAMBLE

These guidelines are an educational tool designed to assist practitioners in providing appropriate care for patients. They are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care. For these reasons and those set forth below, the Society of Nuclear Medicine (SNM) cautions against the use of these guidelines in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the guidelines, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in the guidelines when, in the reasonable judgment of the practitioner, such course of action is indicated by the condition of the patient, limitations of available resources, or advances in knowledge or technology subsequent to publication of the guidelines.

SNM Guideline for Sodium ^{18}F -Fluoride PET/CT Bone Scans

The practice of medicine involves not only the science, but also the art of dealing with the prevention, diagnosis, alleviation, and treatment of disease. The variety and complexity of human conditions make it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment. Therefore, it should be recognized that adherence to these guidelines will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The sole purpose of these guidelines is to assist practitioners in achieving this objective.

I. INTRODUCTION

^{18}F -Fluoride is a highly sensitive bone-seeking PET tracer used for detection of skeletal abnormalities. (1) The uptake mechanism of ^{18}F -Fluoride resembles that of $^{99\text{m}}\text{Tc}$ -MDP with better pharmacokinetic characteristics including faster blood clearance and two-fold higher uptake in bone. Uptake of ^{18}F -Fluoride reflects blood flow and bone remodeling. The use of novel hybrid PET/CT systems, has significantly improved the specificity of ^{18}F -Fluoride imaging as the CT component of the study allows morphologic characterization of the functional lesion and more accurate differentiation between benign lesions and metastases.

II. GOALS

The purpose of this information is to assist health care professionals in performance, interpretation, and reporting the results of PET/CT bone scans performed with ^{18}F -Fluoride. Variable institutional factors and individual patient considerations make it impossible to create procedures applicable to all situations, or for all patients.

III. DEFINITIONS

^{18}F is a diagnostic molecular imaging agent used for identification of new bone formation. ^{18}F administered as i.v. Na^{18}F was approved by the United States Food and Drug Administration in 1972, but has been listed as a discontinued drug since 1984. In 2000, the FDA listed it in the Orange Book for discontinued drug products. The original approval in 1972 may be used as a basis to reapply for marketing approval via a New Drug Application (NDA) or Abbreviated New Drug Application (ANDA). Several clinical trials are currently using Na^{18}F with Investigational New Drug exemptions. The National Cancer Institute filed an NDA in December 2008, with a different potency and dose than the original NDA. At the present time, Na^{18}F is currently manufactured and distributed for clinical use by authorized user prescription under state laws of pharmacy. In December 2011, Na^{18}F for clinical use will have to be prepared under NDA or ANDA and meet the cGMP requirements of 21 CFR 212.

PET/CT is a molecular imaging technology that combines cross-sectional functional and anatomic imaging for diagnosis.

PET/CT may be limited to a single anatomic region such as head and neck, thorax, or abdomen and pelvis; may include the body between the skull base and middle of the thighs; or image the entire body from the top of the head to the toes.

IV. EXAMPLES OF CLINICAL AND RESEARCH INDICATIONS

- A. No appropriateness criteria have been developed to date for this procedure.
- B. PET/CT ¹⁸F bone scans may be used to identify skeletal metastases, including localization and determination of the extent of disease. (2-18)
- C. Insufficient information exists to recommend the following indications in all patients, but may be appropriate in certain individuals:
 - 1. Back pain (19,20) and otherwise unexplained bone pain (21)
 - 2. Child abuse (22,23)
 - 3. Abnormal radiographic or laboratory findings
 - 4. Osteomyelitis
 - 5. Trauma
 - 6. Inflammatory and Degenerative Arthritis
 - 7. Avascular Necrosis (24,25)
 - 8. Osteonecrosis of the mandible (26,27)
 - 9. Condylar hyperplasia (28,29)
 - 10. Metabolic bone disease (30)
 - 11. Paget's disease (31)
 - 12. Bone graft viability (32)
 - 13. Complications of prosthetic joints (33,34)
 - 14. Reflex sympathetic dystrophy.
 - 15. Distribution of osteoblastic activity prior to administration of therapeutic radiopharmaceuticals for treating bone pain.

V. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

*See Section V. of the SNM Procedure Guideline for General Imaging.
See SNM Procedure Guideline for Tumor Imaging with ¹⁸F-FDG PET/CT.*

VI. PROCEDURE/SPECIFICATION OF THE EXAMINATION

VI.A. Nuclear Medicine Request

The request for the examination should include sufficient medical information to demonstrate medical necessity, and should include the diagnosis, pertinent history, and questions to be answered.

SNM Guideline for Sodium ^{18}F -Fluoride PET/CT Bone Scans

The medical record should be reviewed. A history of trauma, orthopedic surgery, cancer, osteomyelitis, arthritis, radiation therapy and other localized conditions affecting the bony skeleton may affect the distribution of ^{18}F .

Relevant laboratory tests, such as prostate-specific antigen (PSA) in patients with prostate cancer, and alkaline phosphatase, should be considered.

The results of prior imaging studies should be reviewed, including plain film x-ray, CT, MR, bone scan, and FDG PET/CT. Relevant prior studies should be directly compared to current imaging findings when possible.

VI.B. Patient Preparation and Precautions

1. **Pregnancy and breastfeeding:** *See Section III of SNM Procedure Guideline for General Imaging.*
Exams involving ionizing radiation should be avoided in pregnant women, unless the potential benefits outweigh the radiation risk to the mother and fetus.
2. Patients should be well hydrated to promote rapid excretion of the radiopharmaceutical to decrease radiation dose and to improve image quality. Unless contraindicated, patients should drink two or more 8-ounce (224 mL) glasses of water within 1 hour prior to the examination, and another two or more 8-ounce glasses of water after administration of ^{18}F . Patients should be instructed to empty their bladder immediately before imaging. Appropriate precautions for proper disposal of radioactive urine should be taken in patients who are incontinent.
3. Patients do not need to fast, and may take all their usual medications.
The impact of treatments such as diphosphonates, anti-hormonal therapy, chemo- and radiotherapy on the uptake of ^{18}F and the role of ^{18}F PET/CT in monitoring response to therapy is yet to be determined (35, 36).

VI. C. Radiopharmaceutical

^{18}F -Fluoride is injected intravenously by direct venipuncture or intravenous catheter. The adult activity is 185-370 MBq (5-10 mCi). A higher activity (370 MBq, 10 mCi) may be used in obese patients. Pediatric activity should be weight-based (2.22 MBq/kg, 0.06 mCi/kg), using a minimum and maximum activity of 18.5 to 185 MBq (0.5 to 5 mCi).

VI.D. Protocol/Image Acquisition

See also the SNM Procedure Guideline for Tumor Imaging with ^{18}F -FDG PET/CT.

1. Patient positioning

See also the SNM Procedure Guideline for Tumor Imaging with ^{18}F -FDG PET/CT.

Arm position during scanning depends on the indications for the study. The arms may be by the sides for whole body imaging, or elevated when only the axial skeleton is scanned.

2. Protocol for CT imaging

See the SNM Procedure Guideline for Tumor Imaging with ^{18}F -FDG PET/CT.

CT may be performed for attenuation correction of emission images and localization of scintigraphic findings. Optimized CT may also be performed for radiographic characterization of skeletal abnormalities. The CT protocol depends on the indications for the study, and the likelihood that radiographic findings will add diagnostic information. The need for additional diagnostic information should always be weighed against the increased radiation exposure from CT. Dose parameters should be consistent with the principles of ALARA (as low as reasonably achievable).

Several reports (4-9) have shown an improvement in sensitivity of the NaF PET over planar $^{99\text{m}}\text{Tc}$ bone scintigraphy in patients with metastatic osteoblastic metastases. The addition of CT also appears to improve the specificity of NaF PET(4,5). Due to the high bone to soft tissue activity ratio of ^{18}F bone scans, high quality images may be obtained without CT for attenuation correction. It is possible to survey the whole body with emission-only images, and then acquire additional images, as needed, using PET/CT of a limited area. The diagnostic accuracy of this approach has not been studied.

3. Protocol for PET emission imaging

- a. Emission images of the axial skeleton may begin as soon as 30-45 minutes after administration of the radiopharmaceutical in patients with normal renal function, due to the rapid localization of ^{18}F in the skeleton and rapid clearance from the circulation. There have not been any studies looking at image quality or accuracy with a longer delay. It is necessary to wait longer to obtain high quality images of the extremities, with a start time of 90-120 minutes for whole body imaging, or imaging limited to the arms or legs.
- b. Images may be acquired in 2D or 3D mode. 3D mode is recommended for whole body imaging because higher count rates compensate for short acquisition times required for imaging a large area.
- c. Acquisition time per bed position will vary depending on the amount of injected radioactivity, decay time, body mass index, and camera factors. Typical acquisition times are 2-5 minutes per bed position.

In a patient with normal body mass index, good images of the axial skeleton may be obtained with an acquisition time of 3 minutes/bed position starting 45 minutes after injection of 185 MBq (5 mCi) of ^{18}F . Good whole body images may be obtained with an acquisition time of 3 minutes/per bed position starting 2 hours after injection of 370 MBq (10 mCi) of ^{18}F .

4. Intervention

Intense urinary bladder tracer activity degrades image quality and can confound interpretation of findings in the pelvis. Hydration and a loop diuretic, without or with bladder catheterization, may be used to reduce accumulated urinary tracer activity in the bladder.

5. Processing

See SNM Procedure Guideline for Tumor Imaging with ^{18}F -FDG PET/CT 1.0 and reference (37).

Images are typically acquired in a 128 x 128 matrix, although a 256 x 256 matrix may be advantageous if processing times are reasonable. Commercially available software packages for iterative reconstruction are widely available. The optimal number of iterations and subsets, filters, and other reconstruction parameters will depend on patient and camera factors. In general, the same reconstruction protocols used for imaging ^{18}F -fluorodeoxyglucose PET may be used for ^{18}F . Maximum intensity projection (MIP) images should be generated to help facilitate lesion detection.

Combination imaging with simultaneous ^{18}F -FDG and ^{18}F injection has been reported (38-40) although there is not enough evidence to support its use in routine clinical practice, and there is some suggestion that it may lead to confusion in interpretation due to uncertainty in separating the contribution of each radiopharmaceutical, e.g. in post-therapy “flare” phenomenon, in patients on colony-stimulating factor medications, and in patients with marrow metastases in which ^{18}F -FDG uptake may be obscured by adjacent cortical ^{18}F activity. (41)

VI.E. Interpretation Criteria

See also the SNM procedure Guideline for Bone Scintigraphy.

^{18}F is normally distributed throughout the entire skeleton. The major route of excretion is the urinary tract. Kidneys, ureters, and bladder should be visible in the absence of renal insufficiency. The degree of localization in the urinary tract depends on renal function, state of hydration, and interval between administration of ^{18}F and imaging. Renal insufficiency will decrease localization in the urinary tract. Urinary outflow obstruction will increase localization proximal to the site of obstruction. Chronic severe obstruction, however, may reduce localization. Soft tissue activity reflects the amount of circulating ^{18}F in the blood pool at the time of imaging, and should be minimal. Local or regional hyperemia may cause increased visualization of the soft tissues.

^{18}F localization in the skeleton is dependent on regional blood flow, as well as new bone formation. ^{18}F is substituted for hydroxyl groups in hydroxyapatite, and covalently bonds to the surface of new bone. Uptake is higher in new bone (osteoid) due to higher

availability of binding sites. Local or regional hyperemia may also cause increased localization in the skeleton.

Physiologic ^{18}F uptake in the skeleton is generally uniform in adults. Normal growth causes increased localization in the metaphyses of children and adolescents. Symmetrical uptake between the left and right sides is generally observed in individuals of all ages, except in periarticular sites where ^{18}F uptake can be variable.

Nearly all causes of increased new bone formation cause increased localization of ^{18}F . The degree of increased localization is dependent on many factors including blood flow, and amount of new bone formation. Processes that result in minimal osteoblastic activity, or primarily osteolytic activity, may not be detected.

In general, the degree of ^{18}F uptake does not differentiate benign from malignant processes. The pattern of ^{18}F uptake, however, may be suggestive or even characteristic of a specific diagnosis. Correlation with skeletal radiographs and other anatomic imaging is essential for diagnosis. The CT component of PET/CT, even when performed primarily for attenuation correction and anatomic registration, also provides diagnostic information.

Any degree of ^{18}F uptake that is visibly higher or lower than uptake in adjacent bone, or uptake in the corresponding contralateral region, indicates an alteration in bone metabolism. Due to the higher resolution of PET/CT compared to single photon imaging, physiologic variability is more prominent.

Subclinical joint disease commonly causes increased periarticular ^{18}F uptake that may be asymmetric, and occurs anywhere in the body, especially in the small bones of the spine and the hands and feet. Dental disease commonly causes increased periodontal ^{18}F uptake. Subclinical injury (especially the ribcage and costochondral junctions) may cause increased ^{18}F uptake.

The use of quantitative indices, such as standardized uptake value (SUV), has not been validated, and their value in clinical studies is undefined. Quantitative assessment of bone metabolism using kinetic modeling has been described, but requires dynamic imaging of the skeleton at one bed position up to one hour post-injection.

Accurate interpretation requires correlation with clinical history, symptoms, prior imaging studies, and other diagnostic tests.

VII. DOCUMENTATION/REPORTING

VII. A. Goals of a report

See Section VII. A of the SNM Procedure Guideline for General Imaging.

VII.B. Direct Communication

See Section VII. B of the SNM Procedure Guideline for General Imaging.

Significant abnormalities should be verbally communicated to the appropriate health care provider if a delay in treatment might result in significant morbidity. An example of such an abnormality would be a lesion with a high risk of pathologic fracture. An abnormality suggesting a high likelihood of unexpected malignancy should also be communicated verbally.

Reporting of abnormalities requiring urgent attention should be consistent with the policy of the interpreting physician's local organization.

VII.C. Written Communication

*See ACR Practice Guidelines for Communication of Diagnostic Imaging Findings.
See Section VII. C of the SNM Procedure Guideline for General Imaging.*

Written documentation of verbal reporting should be made in the medical record, usually as part of the PET/CT report.

VII.D Contents of the report

See Section VII. D of the SNM Procedure Guideline for General Imaging

1. Study identification

The report should include the full name of the patient, medical record number, and date of birth. The name of the examination should also be included, with the date and time it is performed. The electronic medical record provides this data, as well as a unique study number.

2. Clinical information

At a minimum, the clinical history should include the reason for referral, and the specific question to be answered. If known, the diagnosis and a brief treatment history should be provided. The results of relevant diagnostic tests and prior imaging findings should be summarized.

3. Procedure description

The type and date of comparison studies should be stated. If no comparison studies are available, a statement should be made to that effect.

Study specific information should include the name of the radiopharmaceutical (sodium ^{18}F -fluoride), dose in megabecquerels (MBq) or millicuries (mCi), route of administration

(intravenous), as well as the date and time of administration. The site of administration is optional. The name, dose, and route of administration of non-radioactive drugs and agents should also be stated. The type of camera should be specified, but specific equipment information is optional.

A description of the procedure should include the time the patient was scanned, or the time interval between administration of ¹⁸F and the start time of the scan. The part of the body that is scanned should be described from the starting to the ending point. The position of the patient (supine or prone), and the position of the arms (elevated or by the sides) should be stated if non-standard.

Description of the CT part of the examination may be limited to a statement that CT was performed for attenuation correction and anatomic registration of the emission images. If CT was optimized for diagnosis, then a more complete description of the protocol should be provided.

Routine processing parameters are usually not stated in the report, but any special circumstances requiring additional processing, such as motion correction, should be described.

4. Description of the findings

Significant findings should be described in a logical manner. Findings may be grouped by significance, or described by body region. An integrated PET/CT report is preferred, although CT optimized for diagnosis may be reported separately.

The location and extent of significant findings should be described. The information should include the name of the bone. At a minimum, extent should be described as focal or diffuse. Designation of the involved anatomic subdivision of a bone should be included, if appropriate. The appearance of the corresponding finding on CT should be described (e.g., normal, sclerotic, lucent, lytic, blastic, or mixed). The size of focal lesions measured on CT should be reported in at least one axial dimension if this information is clinically important. The description of significant abnormalities may also include a description of the relative level of ¹⁸F uptake, but there is no standard nomenclature. Standardized uptake value (SUV) may be used as a purely descriptive means of reporting, but the measurement should not be used to render a specific diagnosis.

Uptake in the urinary tract and soft tissues should be described. Significant non-skeletal CT findings should also be described as fully as possible.

Limitations should be addressed. Where appropriate, identify factors that can limit the sensitivity and specificity of the examination.

The report should address or answer any pertinent clinical questions raised in the request for imaging examination.

Comparisons with previous examinations and reports, when possible, should be a part of the imaging consultation and report. Integrated PET/CT studies are more valuable when correlated with previous diagnostic CT, previous PET, previous PET/CT, previous MRI, and all appropriate imaging studies and clinical data that are relevant.

5. Impression

- a. A precise diagnosis should be given whenever possible.
- b. A differential diagnosis should be given when appropriate.
- c. When appropriate, recommend follow-up and additional diagnostic studies to clarify or confirm the impression.

VIII. EQUIPMENT SPECIFICATIONS

See SNM Procedure Guideline for Tumor Imaging with ^{18}F -FDG PET/CT.

See ACR section on “Equipment specifications” and “Quality Control” from the ACR Practice Guideline for the Performance of Computed Tomography of the Extracranial Head and Neck in Adults and Children, ACR Practice Guideline for the Performance of Pediatric and Adult Thoracic Computed Tomography (CT), ACR Practice Guideline for the Performance of Computed Tomography (CT) of the Abdomen and Computed Tomography (CT) of the Pelvis.

IX. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION CONCERNS

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR and SNM Policies on Quality Control, and Patient Education where appropriate.

In all patients, the lowest exposure factors should be chosen that would produce images of diagnostic quality.

Equipment performance monitoring should be in accordance with ACR Technical Standards for Medical Nuclear Physics Performance Monitoring of PET/CT Imaging Equipment.

See SNM Procedure Guideline for General Imaging.

See SNM Procedure Guidelines for Use of Radiopharmaceuticals.

See SNM Procedure Guidelines for Tumor Imaging with ^{18}F -FDG PET/CT

X. RADIATION SAFETY IN IMAGING

See also Section X of the SNM Procedure Guideline for General Imaging.

The effective dose for ¹⁸F is 0.024 mSv/MBq (0.089 mrem/mCi). For a typical activity of 370 MBq (10 mCi), the effective dose is 10 mSv (1 rem).

For comparison, the effective dose for ^{99m}Tc-methylene diphosphonate (MDP) is 0.0057 mSv/MBq (0.021 rem/mCi). For a typical activity of 925 MBq (25 mCi), the effective dose is 5.3 mSv (0.53 rem).

Thus, the radiation dose to patients is approximately 70% higher using ¹⁸F-fluoride (370 MBq x 0.024 mSv/MBq = 8.9 mSv) compared to ^{99m}Tc-MDP.

Table 1: Radiation Dose Comparison between ¹⁸F-fluoride and ^{99m}Tc-MDP

Patient	Intravenous Administered Activity MBq (mCi)	Organ Receiving the Largest Radiation Dose mGy per MBq (rad per mCi)	Effective Dose mSv per MBq (rem per mCi)
¹⁸F-Fluoride			
Adult	185-370 MBq (5-10 mCi)	0.22 mGy/MBq Bladder* (0.81 rad/mCi)	0.024 mSv/MBq (0.089 rem/mCi)
Child (5 y old)	2.22 MBq/kg (0.06 mCi/kg)	0.61 mGy/MBq Bladder* (2.3 rad/mCi)	0.086 mSv/MBq (0.32 rem/mCi)
^{99m}Tc-MDP			
Adult	740-1,110 MBq 20-30 mCi	0.063 mGy/MBq Bone Surfaces (0.23 rad/mCi)	0.0057 mSv/MBq (0.021 rem/mCi)
Child (5 y old)	7-11 MBq/kg (0.2-0.3 mCi/kg)	0.22 mGy/MBq Bone Surfaces (0.81 rad/mCi)	0.025 mSv/MBq (0.092 rem/mCi)

* Voiding interval 3.5 h. The changes in bladder wall dose are approximately linear with changes in the void interval: therefore for a voiding interval of 2.0 h the dose to the bladder wall would change by a factor 2/3.5.

Data are from the International Commission on Radiological Protection (42, 43).

The Pregnant or Potentially Pregnant Patient

¹⁸F-fluoride: Dose estimates to the fetus were provided by Russell et al. (44). No information about possible placental crossover of this compound was available.

Stage of Gestation	Fetal Dose	Fetal Dose
	mGy/MBq (rad/mCi)	mGy (rad)
Early	0.022 (0.081)	4.1-8.1 (0.41-0.81)
3 months	0.017 (0.063)	3.1-6.3 (0.31-0.63)
6 months	0.0075 (0.028)	1.4-2.8 (0.14-0.28)
9 months	0.0068 (0.025)	1.3-2.5 (0.13-0.25)

^{99m}Tc-MDP: Dose estimates to the fetus were provided by Russell et al. (44). Information about possible placental crossover of this compound was available and was considered in estimates of fetal doses.

Stage of Gestation	Fetal Dose	Fetal Dose
	mGy/MBq (rad/mCi)	mGy (rad)
Early	0.0061 (0.023)	1.1-2.3 (0.11-0.23)
3 months	0.0054 (0.020)	1.0-2.0 (0.10-0.20)
6 months	0.0027 (0.010)	0.5-1.0 (0.050-0.10)
9 months	0.0024 (0.0089)	0.44-0.89 (0.044-0.089)

The Breastfeeding Patient

ICRP Publication 106, Appendix D does not provide a recommendation about interruption of breastfeeding for ¹⁸F-fluoride; the authors recommend that no interruption is needed for breastfeeding patients administered ^{99m}Tc-phosphonates.

Issues Related to the CT Radiation Dose from PET/CT

With PET/CT, the radiation dose to the patient is the combination of the radiation dose from the PET radiopharmaceutical and the radiation dose from the CT portion of the study. Radiation dose in diagnostic CT has attracted considerable attention in recent years, in particular for pediatric examinations. It can be very misleading to quote a 'representative' dose for a CT scan because of the wide diversity of applications, protocols and CT systems. This also applies to the CT component of a PET/CT study. For example, a body scan may include various portions of the body using protocols

aimed to reduce the radiation dose to the patient or aimed to optimize the CT for diagnostic purposes. The effective dose could range from approximately 5 to 80 mSv (0.5 to 8.0 rem) for these options. It is therefore advisable to estimate CT dose specific to the CT system and protocol.

Pediatric and adolescent patients should have their CT examinations performed at an mAs appropriate for patient size, since radiation dose to the patient increases significantly as the diameter of the patient decreases.

The effective dose for a typical adult whole body CT scan performed for attenuation correction and registration of emission images is 3.2 mSV (0.32 rem), using the following parameters: voltage 120 keV, current 30 mA, rotation 0.5 sec, pitch 1.

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XIII. BOARD OF DIRECTORS APPROVAL DATES

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Version 1.1 December 3, 2010