



# The ASRT Practice Standards for Medical Imaging and Radiation Therapy

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## Table of Contents

Preface .....	3
Format.....	3
Definition .....	5
Introduction .....	5
Education and Certification .....	11
Introduction .....	11
Medical Imaging and Radiation Therapy Scope of Practice.....	17
Standards .....	22
Standard One – Assessment .....	22
Standard Two – Analysis/Determination.....	26
Standard Three – Education.....	29
Standard Four – Performance.....	32
Standard Five – Evaluation.....	38
Standard Six – Implementation.....	41
Standard Seven – Outcomes Measurement.....	43
Standard Eight – Documentation.....	45
Standard Nine – Quality.....	48
Standard Ten – Self-Assessment.....	50
Standard Eleven – Collaboration and Collegiality.....	52
Standard Twelve – Ethics .....	54
Standard Thirteen – Research, Innovation and Professional Advocacy .....	56
Advisory Opinion Statements .....	58
Guidance for the Communication of Clinical and Imaging Observations and Procedure Details by Radiologist Assistants to Supervising Radiologists .....	59
Medication Administration in Peripherally Inserted Central Catheter Lines or Ports With a Power Injector*† .....	62
Medication Administration Through New or Existing Vascular Access*† .....	64
Placement of Personnel Radiation Monitoring Devices .....	66
Use of Postexposure Shuttering, Cropping and Electronic Masking in Radiography .....	68
Glossary.....	71

## Preface

These practice standards serve as a guide for the medical imaging and radiation therapy profession. These standards define the practice and establish general criteria to determine compliance. Practice standards are authoritative statements established by the profession, through evidentiary documentation, for evaluating the quality of practice, service and education provided by individuals within the profession.

Practice standards can be used by individual facilities to develop job descriptions and practice parameters. Those outside the profession can use the standards as an overview of the role and responsibilities of individuals within the profession.

The medical imaging and radiation therapy professional and any individual who is legally authorized to perform medical imaging or radiation therapy must be educationally prepared and clinically competent as a prerequisite to professional practice. The individual should, consistent with all applicable legal requirements and restrictions, exercise individual thought, judgment and discretion in the performance of the procedure. Federal and state statutes, regulations, accreditation standards and institutional policies could dictate practice parameters and may supersede these standards.

### Format

The ASRT Practice Standards for Medical Imaging and Radiation Therapy are divided into five sections:

- *Introduction* – defines the practice and the minimum qualifications for the education and certification of individuals in addition to an overview of the specific practice.
- *Medical Imaging and Radiation Therapy Scope of Practice* – delineates the parameters of the specific practice.
- *Standards* – incorporate patient assessment and management with procedural analysis, performance and evaluation. The standards define the activities of the individual responsible for the care of patients and delivery of medical imaging and radiation therapy procedures; in the technical areas of performance, such as equipment and material assessment safety standards and total quality management; and in the areas of education, interpersonal relationships, self-assessment and ethical behavior.
- *Advisory Opinion Statements* – provide explanations of the practice standards and are intended for clarification and guidance for specific practice issues.
- *Glossary* – defines terms used in the practice standards document.

The standards are numbered and followed by a term or set of terms that describes the standards. The next statement is the expected performance of the individual when performing the procedure or treatment. A rationale follows and explains why an individual should adhere to the particular standard of performance.

- *Criteria* – used to evaluate an individual's performance. Each standard is divided into two parts: the general criteria and the specific criteria. Both should be used when evaluating performance.

- *General Criteria* – written in a style that applies to medical imaging and radiation therapy professionals and should be used for the appropriate area of practice.
- *Specific Criteria* – meet the needs of the individuals in the various areas of professional performance. Although many areas of performance within medical imaging and radiation therapy are similar, others are not. The specific criteria were developed with these differences in mind.

Within this document, all organizations are referenced by their abbreviation and spelled out within the glossary.

## Definition

### Introduction

The medical imaging and radiation therapy profession comprises health care professionals identified as a bone densitometry technologist, cardiac-interventional and vascular-interventional technologist, computed tomography technologist, limited x-ray machine operator, magnetic resonance technologist, mammographer, medical dosimetrist, nuclear medicine technologist, quality management technologist, radiation therapist, radiographer, radiologist assistant or sonographer who are educationally prepared and clinically competent as identified by these standards.

Furthermore, these standards apply to health care employees who are legally authorized to perform medical imaging or radiation therapy and who are educationally prepared and clinically competent as identified by these standards.

Medical imaging and radiation therapy professionals are vital members of a multidisciplinary team that forms a core of highly trained health care professionals, who each bring expertise to the area of patient care. They play a critical role in the delivery of health services as new modalities emerge and the need for medical imaging and radiation therapy procedures increases.

Medical imaging and radiation therapy integrates scientific knowledge, technical competence and patient interaction skills to provide safe and accurate procedures with the highest regard to all aspects of patient care. A medical imaging and radiation therapy professional recognizes elements unique to each patient, which is essential for the successful completion of the procedure.

Medical imaging and radiation therapy professionals are the primary liaison between patients, licensed practitioners and other members of the health care team. These professionals must remain sensitive to the needs of the patient through communication, assessment, monitoring and patient care. As members of the health care team, medical imaging and radiation therapy professionals participate in quality improvement processes and continually assess their professional performance.

Medical imaging and radiation therapy professionals think critically and use independent, professional and ethical judgment in all aspects of their work. They engage in continuing education to include their area of practice to enhance patient care, safety, public education, knowledge and technical competence.

### ***Bone Densitometry***

The practice of bone densitometry is performed by health care professionals responsible for the administration of ionizing radiation for diagnostic, therapeutic or research purposes. A bone densitometry technologist performs bone densitometry procedures and acquires and analyzes data needed for diagnosis at the request of and for interpretation by a licensed practitioner.

Bone densitometry technologists independently perform or assist the licensed practitioner in the completion of densitometric procedures.

### ***Cardiac-Interventional and Vascular-Interventional***

The practice of cardiac-interventional and vascular-interventional is performed by health care professionals responsible for the administration of ionizing radiation for diagnostic, therapeutic or research purposes. A cardiac-interventional and vascular-interventional technologist performs radiographic, fluoroscopic and other procedures and acquires and analyzes data needed for diagnosis at the request of and for interpretation by a licensed practitioner.

Cardiac-interventional and vascular-interventional technologists independently perform or assist the licensed practitioner or radiologist assistant in the completion of cardiac-interventional and vascular-interventional procedures. Cardiac-interventional and vascular-interventional technologists prepare, administer and document activities related to medications and radiation exposure in accordance with federal and state laws, regulations, or lawful institutional policy.

### ***Computed Tomography***

The practice of computed tomography is performed by health care professionals responsible for the administration of ionizing radiation for diagnostic, therapeutic or research purposes. A computed tomography technologist performs computed tomography and molecular imaging procedures and acquires and analyzes data needed for diagnosis, interpretation and the performance of interventional and therapeutic procedures at the request of and for interpretation by a licensed practitioner.

Computed tomography technologists independently perform or assist the licensed practitioner or radiologist assistant in the completion of computed tomography and molecular imaging procedures. Computed tomography technologists prepare, administer and document activities related to medications and radiation exposure in accordance with federal and state laws, regulations, or lawful institutional policy.

### ***Limited X-ray Machine Operator***

The operation of x-ray equipment in a limited scope is performed by health care employees responsible for the administration of ionizing radiation for diagnostic purposes. A limited x-ray machine operator performs radiographic procedures within the limited scope of practice and acquires and analyzes data needed for diagnosis at the request of and for interpretation by a licensed practitioner.

Limited x-ray machine operators are individuals other than a radiographer who perform static diagnostic radiographic images on selected anatomical sites. Limited x-ray machine operators perform their duties under the direction of a licensed practitioner, radiographer or, when indicated, a medical physicist.

### ***Magnetic Resonance***

The practice of magnetic resonance is performed by health care professionals responsible for the use of radiofrequencies within a magnetic field for diagnostic, therapeutic or research purposes. A magnetic resonance technologist performs magnetic resonance and molecular imaging procedures and acquires and analyzes data needed for diagnosis at the request of and for interpretation by a licensed practitioner.

Magnetic resonance technologists independently perform or assist the licensed practitioner or radiologist assistant in the completion of magnetic resonance and molecular imaging procedures. Magnetic resonance technologists prepare, administer and document activities related to medications in accordance with federal and state laws, regulations, or lawful institutional policy.

### ***Mammography***

The practice of mammography is performed by health care professionals responsible for the administration of ionizing radiation and multi-frequency sound waves for diagnostic, therapeutic or research purposes. A mammographer performs breast imaging procedures and acquires and analyzes data, including mammographic and sonographic images needed for diagnosis, at the request of and for interpretation by a licensed practitioner.

Mammographers independently perform or assist the licensed practitioner or radiologist assistant in the completion of mammographic and sonographic breast imaging procedures. Mammographers prepare, administer and document activities related to medications and radiation exposure in accordance with federal and state laws, regulations, or lawful institutional policy.

### ***Medical Dosimetry***

The practice of medical dosimetry is performed by health care professionals responsible for designing a treatment plan for use in the administration of ionizing radiation for the purpose of treating diseases, primarily cancer. Medical dosimetrists independently perform duties and complete responsibilities under the supervision of qualified medical physicists and radiation oncologists. Medical dosimetrists generate an optimal treatment plan and ensure the appropriate transfer of data that the radiation therapist will use to treat the patient.

Medical dosimetrists must maintain a high degree of accuracy, thoroughness and safety in treatment planning optimization, treatment techniques and positioning. Medical dosimetrists assist the radiation oncologist in localizing the treatment area, generate a treatment plan and communicate with the radiation oncology team to enable and ensure the appropriate transfer of information.

### ***Nuclear Medicine***

The practice of nuclear medicine is performed by health care professionals responsible for the administration of ionizing radiation (radioactive material and computed tomography), nonionizing radiation and adjunctive medications for diagnostic, therapeutic, radiotheranostics or research purposes. Radioactive materials, medications and imaging and nonimaging equipment are used in nuclear medicine and molecular imaging to study various organs, body systems and samples to aid in the diagnosis, treatment, radiotheranostics and treatment planning of various pathological conditions. A nuclear medicine technologist performs nuclear medicine and molecular imaging procedures, radiotheranostics or therapies, and acquires and analyzes data at the request of and for interpretation by a licensed practitioner and under the supervision of an authorized user. Nuclear medicine technologists also administer the prescribed radionuclide therapy to the patient at the request and under the supervision of an authorized user.

Nuclear medicine technologists independently perform or assist the licensed practitioner or radiologist assistant and authorized user in the completion of nuclear medicine and molecular imaging procedures, radiotheranostics and treatments. Nuclear medicine technologists prepare, administer and document activities related to ionizing radiation (radioactive material and computed tomography), nonionizing radiation, medications and radiation exposure in accordance with federal and state laws, regulations, or lawful institutional policy.



## ***Quality Management***

The practice of quality management is performed by health care professionals responsible for the identification, measurement, control and improvement of the various core processes that will ultimately lead to improved medical imaging and radiation therapy department performance.

Today's medical imaging and radiation therapy departments involve multiple modalities, creating an interdisciplinary team. The quality management technologist is a member of the health care team, which includes clinicians, management, support staff and customers.

Quality management has four main components: quality planning, quality control, quality assurance and quality improvement. Quality management focuses on the means to achieve image and service quality. A quality management technologist combines all of these components to ensure efficient and effective patient care.

Quality management technologists independently perform or assist the medical physicist in the completion of quality control procedures. Quality management technologists prepare, administer and document activities related to all facets of quality management in accordance with federal and state laws, regulations, or lawful institutional policy.

## ***Radiation Therapy***

The practice of radiation therapy is performed by health care professionals responsible for the administration of high doses of ionizing radiation for the purpose of treating diseases, primarily cancer. A radiation therapist acquires and analyzes data in preparation for patient treatment, uses various imaging technologies to localize the treatment area, participates in treatment planning and performs radiation therapy procedures as prescribed and supervised by a radiation oncologist.

Radiation therapists are the primary liaison between patients and other members of the radiation oncology team. They also provide a link to other health care providers, such as social workers and dietitians. Radiation therapists must remain sensitive to the needs of the patient through communication, patient assessment, patient monitoring and patient care skills. Radiation therapy often involves daily treatments extending over several weeks using highly sophisticated equipment. It requires thorough initial planning as well as constant patient care and monitoring.

## ***Radiography***

The practice of radiography is performed by health care professionals responsible for the administration of ionizing radiation for diagnostic, therapeutic or research purposes. A radiographer performs a full scope of radiographic and fluoroscopic procedures and acquires and analyzes data needed for diagnosis at the request of and for interpretation by a licensed practitioner.

Radiographers independently perform or assist the licensed practitioner or radiologist assistant in the completion of radiographic and fluoroscopic procedures. Radiographers prepare, administer and document activities related to medications and radiation exposure in accordance with federal and state laws, regulations, or lawful institutional policy.

### ***Radiologist Assistant***

A radiologist assistant practices under the supervision of a radiologist and enhances patient care in radiology services. As a member of the radiologist-led team, the radiologist assistant performs invasive and noninvasive procedures at the request of and for interpretation by a radiologist.

Radiologist assistants act as liaisons between patients, radiographers, radiologists and other members of the health care team. Radiologist assistants remain sensitive to the physical, cultural and emotional needs of patients through communication, comprehensive patient assessment, continuous patient monitoring and advanced patient care skills.

Radiologist assistants maintain their radiographer credentials; therefore, both the radiologist assistant and radiography sections of the practice standards should be consulted when seeking practice information for the radiologist assistant. The clinical activities are delegated by the supervising radiologist in accordance with federal and state laws, regulations, and lawful institutional policies.

### ***Sonography***

The practice of sonography is performed by health care professionals responsible for the administration of multi-frequency sound waves and other techniques for diagnostic, therapeutic or research purposes. A sonographer performs sonographic and molecular imaging procedures and acquires and analyzes data needed for diagnosis at the request of and for interpretation by a licensed practitioner.

Sonographers independently perform or assist the licensed practitioner or radiologist assistant in the completion of sonographic and molecular imaging procedures. Sonographers prepare, administer and document activities related to medications in accordance with federal and state laws, regulations, or lawful institutional policy.

## **Education and Certification**

### **Introduction**

Medical imaging and radiation therapy professionals must be educationally prepared and clinically competent as a prerequisite to professional practice. Only medical imaging and radiation therapy professionals who have completed the appropriate education and training as outlined in these standards should perform medical imaging and radiation therapy procedures. Individuals working in more than one modality must meet these requirements in the specific modalities they are responsible to perform.

Medical imaging and radiation therapy professionals should be registered by certification agencies recognized by the ASRT. Individuals performing diagnostic or therapeutic procedures in more than one modality will adhere to the general and specific criteria for each area of practice.

To maintain certification(s), medical imaging and radiation therapy professionals must complete appropriate continuing education requirements to sustain their expertise and awareness of changes and advances in practice.

Medical imaging and radiation therapy professionals performing multimodality hybrid procedures should meet certification requirements for the diagnostic or therapeutic portion of the procedure and must be educationally prepared and clinically competent in the specific modality for which they perform attenuation correction or anatomical localization.

Medical imaging and radiation therapy professionals performing multimodality hybrid procedures should be registered by certification agencies recognized by the ASRT in the modality for the diagnostic or therapeutic portion of the procedure. Individuals performing multimodality hybrid procedures will adhere to the specific criteria for the diagnostic or therapeutic portion of the procedure.

Medical imaging and radiation therapy professionals performing multimodality hybrid procedures should complete continuing education requirements in the modality used for the diagnostic or therapeutic portion of the procedure and maintain education and clinical competence in the modality used for attenuation correction or anatomical localization.

### ***Bone Densitometry***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform bone densitometry procedures.

Bone densitometry technologists prepare for their roles on the interdisciplinary team by meeting postprimary examination eligibility criteria as determined by the ARRT.

Those who have passed the ARRT bone densitometry postprimary examination use the additional credential (BD).

The ISCD is another certifying agency. Individuals with a primary medical imaging or radiation therapy certification who have passed the ISCD certified bone densitometry technologist examination use the additional credential CBDT.

### ***Cardiac-Interventional and Vascular-Interventional***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform cardiac-interventional and vascular-interventional procedures.

Cardiac-interventional and vascular-interventional technologists prepare for their roles on the interdisciplinary team by meeting postprimary examination eligibility criteria as determined by the ARRT or CCI.

Those who have passed the ARRT cardiac-interventional, cardiovascular-interventional or vascular-interventional radiography postprimary examinations use the additional credentials (CI), (CV) or (VI), respectively.

CCI is another certifying agency. Individuals with primary certification in radiography who have passed the CCI cardiovascular invasive specialist examination as a postprimary certification use the additional credential RCIS.

### ***Computed Tomography***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform computed tomography and molecular imaging procedures.

Computed tomography technologists prepare for their roles on the interdisciplinary team by meeting postprimary examination eligibility criteria as determined by the ARRT or NMTCB.

Those who have passed the ARRT or NMTCB computed tomography postprimary examination use the additional credential (CT).

### ***Limited X-ray Machine Operator***

Limited x-ray machine operators prepare for their roles on the interdisciplinary team in several ways. Various education and training programs for limited x-ray machine operators exist throughout the United States.

Many states require the completion of a program of study prior to administering a state licensure exam for limited x-ray machine operators. Several states use some or all of the Limited Scope of Practice in Radiography state licensing exams developed by the ARRT. States that administer an exam and issue a license or certification may use various terminologies to designate a limited x-ray machine operator. Limited x-ray machine operators shall only perform ionizing radiation procedures within their limited scope of practice.

### ***Magnetic Resonance***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform magnetic resonance and molecular imaging procedures.

Magnetic resonance technologists prepare for their role on the interdisciplinary team by meeting primary or postprimary examination eligibility criteria as determined by the ARRT.

Those who have passed the ARRT magnetic resonance primary examination use the credential R.T.(MR).

Those who have passed the ARRT magnetic resonance postprimary examination use the additional credential (MR).

### ***Mammography***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform mammography and breast sonography procedures.

Mammographers prepare for their roles on the interdisciplinary team by meeting postprimary examination eligibility criteria as determined by the ARRT.

Those who have passed the ARRT mammography postprimary examination use the additional credential (M).

Those who have passed the ARRT breast sonography postprimary examination use the additional credential (BS).

### ***Medical Dosimetry***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform medical dosimetry procedures.

Medical dosimetrists prepare for their roles on the interdisciplinary team by meeting the examination eligibility criteria established by the MDCB.

Those who have passed the medical dosimetry examination use the credential CMD.

### ***Nuclear Medicine***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform nuclear medicine and molecular imaging procedures, radiotheranostics or therapies.

Nuclear medicine technologists prepare for their roles on the interdisciplinary team by meeting examination eligibility criteria as determined by the ARRT or NMTCB.

Those who have passed the ARRT examination use the credential R.T.(N).

Those who have passed the NMTCB examination use the credential CNMT.

Those who have passed the NMTCB nuclear cardiology, positron emission tomography or radiation safety specialty examinations use the additional credentials NCT, PET or NMTCB (RS), respectively.

### ***Quality Management***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform quality management procedures.

Quality management technologists prepare for their roles on the interdisciplinary team by meeting postprimary examination eligibility criteria as determined by the ARRT.

Those who have passed the ARRT quality management postprimary examination use the additional credential (QM).

HQCC is another certifying agency. Individuals with a primary medical imaging or radiation therapy certification who have passed the Certified Professional in Healthcare Quality examination use the additional credential CPHQ.

### ***Radiation Therapy***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform radiation therapy procedures.

Radiation therapists prepare for their roles on the interdisciplinary team by meeting examination eligibility criteria as determined by the ARRT.

Those who have passed the ARRT radiation therapy examination use the credential R.T.(T).

### ***Radiography***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform radiographic and fluoroscopic procedures.

Radiographers prepare for their roles on the interdisciplinary team by meeting examination eligibility criteria as determined by the ARRT.

Those who have passed the ARRT radiography examination use the credential R.T.(R).

### ***Radiologist Assistant***

Only radiographers who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform radiologist assistant procedures.

Radiologist assistants prepare for their roles in medical imaging by meeting examination eligibility criteria as determined by the ARRT.

Those who have passed the registered radiologist assistant examination use the additional credential R.R.A.

## ***Sonography***

Only medical imaging and radiation therapy professionals who have completed the appropriate education and obtained certification(s) as outlined in these standards should perform sonographic and molecular imaging procedures.

Sonographers prepare for their roles on the interdisciplinary team by meeting primary or postprimary examination eligibility criteria as determined by the ARDMS, ARRT or CCI.

Those who have passed the ARDMS examination(s) use the credentials RDCS, RDMS, RMSKS or RVT.

Those who have passed the ARRT primary examination use the credential R.T.(S) or R.T.(VS).

Those who have passed the CCI examination(s) use the credentials RCCS, RCS, RPhS or RVS.

Those who have passed the ARRT breast sonography, sonography or vascular sonography postprimary examinations use the additional credentials (BS), (S) or (VS), respectively.



## Medical Imaging and Radiation Therapy Scope of Practice

Scopes of practice delineate the parameters of practice and identify the boundaries for practice. A comprehensive procedure list for the medical imaging and radiation therapy professional is impractical because clinical activities vary by the practice needs and expertise of the individual. As medical imaging and radiation therapy professionals gain more experience, knowledge and clinical competence, the clinical activities may evolve.

The scope of practice of the medical imaging and radiation therapy professional includes:

- Administering medications enterally, parenterally, through new or existing vascular access or through other routes as prescribed by a licensed practitioner.\*†
- Administering medications with an infusion pump or power injector as prescribed by a licensed practitioner.\*†
- Applying principles of ALARA to minimize exposure to patient, self and others.
- Applying principles of patient safety during all aspects of patient care.
- Assisting in maintaining medical records while respecting confidentiality and established policy.
- Corroborating a patient's clinical history with the procedure and ensuring information is documented and available for use by a licensed practitioner.
- Educating and monitoring students and other health care providers.\*
- Evaluating images for proper positioning and determining if additional images will improve the procedure or treatment outcome.
- Evaluating images for technical quality and ensuring proper identification is recorded.
- Identifying and responding to emergency situations.
- Identifying, calculating, compounding, preparing and/or administering medications as prescribed by a licensed practitioner.\*†
- Performing ongoing quality assurance activities.
- Performing point of care testing as prescribed by a licensed practitioner.†
- Performing venipuncture as prescribed by a licensed practitioner.\*†
- Postprocessing data.
- Preparing patients for procedures.
- Providing education.
- Providing input for equipment and software purchase and supply decisions when appropriate or requested.
- Providing optimal patient care.
- Receiving, relaying and documenting verbal, written and electronic orders in the patient's medical record.
- Selecting the appropriate protocol and optimizing technical factors while maximizing patient safety.
- Starting, maintaining and/or removing intravenous access as prescribed by a licensed practitioner.\*†
- Verifying archival storage of data.
- Verifying informed consent for applicable procedures.\*

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry

### ***Bone Densitometry***

- Performing bone densitometry procedures as prescribed by a licensed practitioner.

### ***Cardiac-Interventional and Vascular-Interventional***

- Assisting licensed practitioner or radiologist assistant with fluoroscopic and specialized interventional radiography procedures.
- Maintaining intra-arterial access as prescribed by a licensed practitioner.
- Panning the procedure table during image production.
- Participating in physiologic monitoring of patients.
- Performing diagnostic/interventional procedures as prescribed by a licensed practitioner.
- Performing manual and mechanical hemostasis, including the use of vascular closure devices, as prescribed by a licensed practitioner.
- Performing noninterpretive fluoroscopic procedures as prescribed by a licensed practitioner.
- Placing, maintaining and removing peripherally inserted central catheters as prescribed by a licensed practitioner.

### ***Computed Tomography***

- Assisting a licensed practitioner or radiologist assistant with interventional computed tomography procedures.
- Performing computed tomography and molecular imaging procedures as prescribed by a licensed practitioner.

### ***Limited X-ray Machine Operator***

- Assisting a licensed practitioner or radiographer during static radiographic procedures.
- Performing diagnostic radiographic procedures within the limited scope of practice as prescribed by a licensed practitioner.

### ***Magnetic Resonance***

- Applying principles of magnetic resonance safety to minimize risk to patient, self and others.
- Assisting the licensed practitioner or radiologist assistant with magnetic resonance interventional procedures.
- Performing magnetic resonance and molecular imaging procedures as prescribed by a licensed practitioner.
- Selecting appropriate pulse sequences with consideration given to established protocols and other factors influencing data acquisition parameters.

### ***Mammography***

- Imaging pathologic breast specimens as prescribed by a licensed practitioner.
- Performing breast ultrasound procedures as prescribed by a licensed practitioner.
- Performing mammographic procedures per facility policy or as prescribed by a licensed practitioner.
- Performing or assisting with clinical breast examination.

### ***Medical Dosimetry***

- Designing and generating optimal treatment plans in collaboration with a radiation oncologist.
- Evaluating treatment plans for accuracy.
- Monitoring doses to normal tissues within the irradiated volume to ensure tolerance levels are not exceeded.
- Obtaining and incorporating patient data from medical imaging procedures or manual methods to be used in simulation, treatment planning, treatment delivery and quality assurance.
- Participating in brachytherapy treatment planning and delivery.
- Participating in simulation under the supervision of a radiation oncologist.
- Performing dosimetric calculations.
- Performing or assisting with the fabrication of patient immobilization and other treatment devices.
- Transferring and documenting treatment planning data according to departmental policy.

### ***Nuclear Medicine***

- Applying principles of magnetic resonance safety to minimize risk to patient, self and others when performing PET-MR.
- Assembling, calibrating, maintaining, eluting and administering radiopharmaceuticals from the radionuclide infusion system and the generator while complying with standards and as prescribed by a licensed practitioner and under the supervision of an authorized user.
- Performing hybrid imaging, including PET-CT, PET-MR and SPECT-CT for emission, transmission, attenuation correction, anatomical location and for use in radiation therapy treatment planning when performed within hybrid imaging as prescribed by a licensed practitioner and under the supervision of an authorized user.
- Performing nuclear medicine and molecular imaging procedures, radiotheranostics or therapies as prescribed by a licensed practitioner and under the supervision of an authorized user.
- Procuring, identifying, calculating, preparing and/or administering ionizing radiation (radioactive material and computed tomography) and nonionizing radiation as prescribed by a licensed practitioner and under the supervision of an authorized user.

### ***Quality Management***

- Coordinating, performing and monitoring quality control procedures for all types of equipment.
- Creating policies and procedures to meet regulatory, accreditation and fiscal requirements.
- Ensuring adherence to accreditation, federal, state and local regulatory requirements.
- Facilitating change through appropriate management processes.
- Facilitating performance improvement processes.
- Facilitating the department's quality assessment and improvement plan.
- Monitoring exposure factors and/or procedural protocols in accordance with ALARA principles and age-specific considerations.
- Performing physics surveys independently on general radiographic and fluoroscopic equipment, with medical physicist oversight.
- Providing assistance to staff for image optimization, including patient positioning, proper equipment use and image critique.
- Providing practical information regarding techniques and tools for process improvement.
- Serving as a resource regarding regulatory, accreditation and fiscal requirements.
- Supporting and assisting a medical physicist with modality physics surveys.

### ***Radiation Therapy***

- Constructing/preparing immobilization, beam directional and beam-modification devices.
- Delivering radiation therapy treatments as prescribed by a radiation oncologist.
- Detecting and reporting significant changes in patients' conditions and determining when to withhold treatment until the radiation oncologist is consulted.
- Monitoring doses to normal tissues within the irradiated volume to ensure tolerance levels are not exceeded.
- Participating in brachytherapy procedures.
- Performing simulation, localization, treatment planning procedures and dosimetric calculations as prescribed by a radiation oncologist.
- Using imaging technologies for the explicit purpose of simulation, treatment planning and treatment delivery as prescribed by a radiation oncologist.

### ***Radiography***

- Assisting the licensed practitioner or radiologist assistant with fluoroscopic and specialized radiologic procedures.
- Performing diagnostic radiographic and noninterpretive fluoroscopic procedures as prescribed by a licensed practitioner.

### ***Radiologist Assistant***

- Assessing, monitoring and managing patient status, including patients under minimal and moderate sedation.
- Assisting with data collection and review for clinical trials or other research.
- Communicating the supervising radiologist's report to the appropriate health care provider consistent with the ACR Practice Guidelines for Communication of Diagnostic Imaging Findings.
- Completing patient history and physical.
- Emphasizing patient safety and verifying procedure appropriateness by analyzing and incorporating evidenced-based practices for optimal patient care.
- Evaluating images for completeness and diagnostic quality and recommending additional images.
- Identifying and administering radioactive materials as prescribed by a supervising radiologist and under the supervision of an authorized user.
- Identifying variances that may influence the expected outcome through preprocedural evaluation as part of the radiologist-led team.
- Obtaining images necessary for diagnosis and communicating initial observations to the supervising radiologist. The radiologist assistant does not provide image interpretation as defined by the ACR.
- Participating in or obtaining informed consent.
- Participating in quality assurance activities within the radiology practice.
- Performing or assisting with invasive or noninvasive procedures as delegated by the radiologist who is licensed to practice and has privileges for the procedure being performed by the radiologist assistant.
- Providing follow-up patient evaluation.

### ***Sonography***

- Collaborating with a licensed practitioner or radiologist assistant in the performance of sonographic interventional procedures.
- Ensuring equipment parameters for diagnostic and interventional procedures are of optimal technical and administrative quality as requested by a licensed practitioner.
- Performing diagnostic, interventional and molecular imaging sonographic procedures as prescribed by a licensed practitioner or during appropriate educational activities.

## Standards

### Standard One – Assessment

The medical imaging and radiation therapy professional collects pertinent data about the patient, procedure, equipment and work environment.

#### *Rationale*

Information about the patient's health status is essential in providing appropriate imaging and therapeutic services. The planning and provision of safe and effective medical services relies on the collection of pertinent information about equipment, procedures and the work environment.

The medical imaging and radiation therapy professional:

#### *General Criteria*

- Assesses and maintains the integrity of medical supplies and medications, properly disposing when indicated.
- Assesses any potential patient limitations for the procedure.
- Assesses factors that may affect the procedure.
- Assesses patient lab values, medication list and risk for allergic reaction(s) prior to procedure and administration of medication.\*†
- Confirms that equipment performance, maintenance and operation comply with the manufacturer's specifications.
- Determines that services are performed in a safe environment, minimizing potential hazards.
- Maintains restricted access to controlled areas.
- Obtains and reviews relevant previous procedures and information from all available resources and the release of information as needed.
- Recognizes signs and symptoms of an emergency.
- Verifies appropriateness of the requested or prescribed procedure, in compliance with the clinical indication and protocol.
- Verifies patient identification.
- Verifies that protocol and procedure manuals include recommended criteria and are reviewed and revised.
- Verifies that the patient has consented to the procedure.
- Verifies the patient's pregnancy status.

#### *Specific Criteria*

### **Bone Densitometry**

- Assesses patient compliance with prescribed treatment as it relates to the procedure.

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry

## ***Cardiac-Interventional and Vascular-Interventional***

Refer to general criteria.

### ***Computed Tomography***

- Verifies that a registered technologist is physically present at the CT console to perform a remote CT procedure.

### ***Limited X-ray Machine Operator***

- Develops and maintains standardized exposure technique guidelines for all equipment.
- Maintains and performs quality control on radiation safety equipment.

### ***Magnetic Resonance***

- Assesses patient for factors that may contribute to anxiety or claustrophobia.
- Identifies and removes items that may affect safety, damage the equipment or affect the image quality.
- Screens patient and others for potential magnetic resonance contraindications, either within the body or on their person, prior to entering the magnet room.
- Verifies that a registered technologist with MR Level 2 Personnel training is physically present at the MR console throughout a remote MR procedure.

### ***Mammography***

- Assesses the need for alternative procedures based on the patient's age, hormonal status and the presence of surgical implants.
- Assists in setting policy and procedures in the facility to meet certification and accreditation standards specific to breast imaging.
- Establishes all required quality assurance and quality control test criteria.

### ***Medical Dosimetry***

- Assesses the patient's need for information and reassurance.
- Reviews patient history for previous therapeutic treatments.

### ***Nuclear Medicine***

- Complies with regulations and federal and state laws to minimize radiation exposure levels.
- Maintains and performs quality control on radiation safety equipment, radionuclide infusion systems and generators according to regulatory agencies.
- Identifies and removes items that may affect safety, damage the equipment or affect the image quality when performing PET-MR.
- Performs area monitoring and surveys to assess radiation exposure levels and contamination sites.
- Reviews theranostic protocol criteria and assesses contraindications and conditions that may affect the therapy.
- Screens patient and others for potential magnetic resonance contraindications, either within the body or on their person, prior to entering the magnet room when performing PET-MR.
- Verifies the patient's lactation or breastfeeding status.
- Verifies the patient's menstrual cycle.

### ***Quality Management***

- Assesses policies, protocols and guidelines to improve safety, efficiency and patient care, and identify the potential impact to the facility.
- Identifies the customers served by medical imaging and radiation therapy.
- Identifies the processes used in customer service.

### ***Radiation Therapy***

- Assesses the patient's need for information and reassurance.
- Identifies and/or removes objects that could interfere with prescribed treatment.
- Inspects beam modifying and immobilization devices prior to use.
- Monitors and assesses patients throughout the treatment course and follow-up visits.
- Monitors doses to normal tissues.
- Monitors side effects and reactions to treatment.
- Monitors treatment unit operation during use.
- Recognizes the patient's need for referral to other care providers, such as a social worker, nurse or dietitian.
- Reviews beam shaping devices prior to treatment delivery.
- Reviews treatment protocol criteria and assesses conditions affecting treatment delivery.
- Reviews treatment record prior to treatment or simulation.

### ***Radiography***

- Develops and maintains standardized exposure technique guidelines for all equipment.
- Maintains and performs quality control on radiation safety equipment.



### ***Radiologist Assistant***

- Assesses the patient's level of anxiety and pain and informs the supervising radiologist.
- Interviews patient to obtain, verify and update medical history.
- Observes and assesses a patient who has received minimal and moderate sedation.
- Performs a history and physical examination, analyzes data, and reports findings as part of a radiologist-led team.
- Performs area monitoring and surveys to assess radiation exposure levels and contamination sites.
- Verifies the patient's lactation or breastfeeding status.

### ***Sonography***

Refer to general criteria.

## **Standard Two – Analysis/Determination**

The medical imaging and radiation therapy professional analyzes the information obtained during the assessment phase and develops an action plan for completing the procedure.

### *Rationale*

Determining the most appropriate action plan enhances patient safety and comfort, optimizes diagnostic and therapeutic quality and improves efficiency.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Consults appropriate medical personnel to determine a modified action plan.
- Determines that all procedural requirements are in place to achieve a quality procedure.
- Determines the appropriate type and dose of contrast media to be administered based on established protocols.\*†
- Determines the course of action for an emergent situation.
- Determines the need for and selects supplies, accessory equipment, shielding, positioning and immobilization devices.
- Develops methods for minimizing hazards associated with medical imaging and radiation therapy procedures.
- Employs professional judgment to adapt procedures to improve diagnostic quality or therapeutic outcomes.
- Evaluates and monitors services, procedures, equipment and the environment to determine if they meet or exceed established guidelines and revises the action plan.
- Selects the most appropriate and efficient action plan after reviewing all pertinent data and assessing the patient's abilities and condition.

### *Specific Criteria*

#### ***Bone Densitometry***

Refer to general criteria.

#### ***Cardiac-Interventional and Vascular-Interventional***

- Analyzes and determines action plans in conjunction with the cardiovascular team.

#### ***Computed Tomography***

- Reviews the patient's medical record and the licensed practitioner's request to determine optimal scanning protocol for clinical indication.

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry

### ***Limited X-ray Machine Operator***

- Develops, maintains and makes available optimal exposure technique guidelines for all radiographic equipment.

### ***Magnetic Resonance***

- Reviews the patient's medical record and licensed practitioner's request to determine optimal protocol and imaging parameters for clinical indications.
- Selects appropriate imaging coil.

### ***Mammography***

Refer to general criteria.

### ***Medical Dosimetry***

- Gathers and analyzes pertinent data relevant to the treatment planning and delivery process.
- Participates in reviewing patient treatment parameters and dose records to ensure treatment does not exceed the prescribed dose or normal tissue tolerances.
- Recommends the appropriate immobilization devices and positioning aids for simulation and treatment.
- Recommends when to hold treatment until a radiation oncologist is notified.
- Reviews the treatment record and verifies calculations before and/or after treatment delivery.
- Verifies the treatment summary and the mathematical accuracy of the prescription.

### ***Nuclear Medicine***

- Determines radiopharmaceutical dosage based on protocol, patient's age, weight, medical and physical status.
- Evaluates results of quality control testing on radioactive material.
- Reviews the patient's medical record and the examination request to determine optimal procedure parameters for clinical indications.
- Selects appropriate data acquisition equipment and accessories to perform the procedure.

### ***Quality Management***

- Assesses and prioritizes the current processes to improve quality while focusing on issues needing immediate response.
- Assesses proposed changes to minimize organizational disruption during implementation.
- Clarifies current steps in a process to minimize redundancy, reordering and improving service flow.
- Creates an effective action plan after reviewing all pertinent data while assessing possible options, fiscal impact and ease of implementation.
- Develops monitoring metrics.
- Establishes benchmarks and quality indicators to assess quality management issues.
- Monitors and develops methods to improve customer satisfaction.

### ***Radiation Therapy***

- Determines when to contact the radiation oncologist or licensed practitioner regarding patient side effects or questions.
- Determines when to withhold treatment until a radiation oncologist is contacted.
- Ensures the appropriate imaging technique is chosen for image-guided radiation therapy procedures.
- Participates in decisions about appropriate simulation techniques and treatment positions.
- Reviews doses daily to ensure that treatment does not exceed prescribed dose, normal tissue tolerance or treatment protocol constraints.
- Reviews patient treatment plan and prescription prior to initial treatment delivery.
- Reviews patient treatment records prior to each treatment for prescription or treatment procedure changes.
- Reviews treatment record, calculations and/or treatment plan for accuracy prior to treatment delivery.
- Reviews verification images prior to treatment.
- Verifies the mathematical accuracy of the prescription and the daily treatment summary.
- Verifies treatment planning and machine quality assurance has been performed prior to each treatment.

### ***Radiography***

- Develops, maintains and makes available optimal exposure technique guidelines for all radiographic and fluoroscopic equipment.

### ***Radiologist Assistant***

- Reviews the patient's medical record and the licensed practitioner's request to determine optimal imaging procedure for clinical indications.

### ***Sonography***

- Monitors the patient's need for information and reassurance throughout the procedure.
- Selects appropriate equipment and scanning techniques to optimize the procedure.

## **Standard Three – Education**

The medical imaging and radiation therapy professional provides information about the procedure and related health issues according to protocol; informs the patient, public and other health care providers about procedures, equipment and facilities; and acquires and maintains current knowledge in practice.

### *Rationale*

Education and communication are necessary to establish a positive relationship and promote safe practices. Advancements in the profession and optimal patient care require additional knowledge and skills through education.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Advocates for and participates in continuing education related to area of practice to maintain and enhance clinical competency.
- Advocates for and participates in vendor specific applications training to maintain clinical competency.
- Educates the patient, public and other health care providers about procedures, the associated biological effects and radiation protection.
- Elicits confidence and cooperation from the patient, the public and other health care providers by providing timely communication and effective instruction.
- Explains effects and potential side effects of medications.\*†
- Maintains credentials and certification related to practice.
- Maintains knowledge of the most current practices and technology used to optimize patient exposure while producing quality images.
- Provides accurate explanations and instructions at an appropriate time and at a level the patient and their care providers can understand; addresses questions and concerns regarding the procedure.
- Provides information on certification or accreditation to the patient, other health care providers and the public.
- Provides information to patients, health care providers, students and the public concerning the role and responsibilities of individuals in the profession.
- Provides pre-, peri- and post-procedure education.
- Refers questions about diagnosis, treatment or prognosis to a licensed practitioner.

### *Specific Criteria*

#### ***Bone Densitometry***

Refer to general criteria.

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry

### ***Cardiac-Interventional and Vascular-Interventional***

- Maintains competency in the use of diagnostic and interventional devices.

### ***Computed Tomography***

Refer to general criteria.

### ***Limited X-ray Machine Operator***

Refer to general criteria.

### ***Magnetic Resonance***

- Provides magnetic resonance safety education.

### ***Mammography***

- Displays MQSA certificate(s) of compliance.
- Educates the patient about the need for adequate compression to achieve a quality mammogram and instructs the patient to communicate if the compression becomes intolerable.
- Educates the patient about the risk factors for breast cancer and the benefits of early detection.
- Educates the patient about the value and use of additional projections and alternative breast imaging procedures.

### ***Medical Dosimetry***

- Explains the role and function of the medical dosimetrist in the overall treatment course.
- Reviews the treatment plan with the patient as requested by a radiation oncologist.

### ***Nuclear Medicine***

- Ensures radiation safety instruction information and limitations are provided to the patient and others during and following radiotheranostics and therapeutic procedures.
- Provides instruction to the patient and others regarding the reduction of radiation exposure during and after the procedure.
- Provides magnetic resonance safety education when performing PET-MR.

### ***Quality Management***

Refer to general criteria.

### ***Radiation Therapy***

- Anticipates a patient's need for information and provides it throughout the treatment course.
- Instructs other health care providers about radiation protection procedures.
- Instructs patient in the maintenance of treatment markings.
- Provides information and instruction on proper skin care, diet and self-care procedures.

### ***Radiography***

Refer to general criteria.

### ***Radiologist Assistant***

- Provides precare and postcare instructions to the patient as part of the radiologist-led team.

### ***Sonography***

- Educates patients and other health care professionals of the potential exposure risks associated with nonmedical entrepreneurial or entertainment 2D/3D/4D sonographic procedures.
- Educates patients and other health care professionals that the use of 2D/3D/4D sonography for nonmedical entrepreneurial or entertainment purposes is an unethical practice.

## Standard Four – Performance

The medical imaging and radiation therapy professional performs the action plan and quality assurance activities.

### *Rationale*

Quality patient services are provided through the safe and accurate performance of a deliberate plan of action. Quality assurance activities provide valid and reliable information regarding the performance of equipment, materials and processes.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Adheres to radiation safety rules and standards.
- Administers contrast media and other medications only when a licensed practitioner is immediately available to ensure proper diagnosis and treatment of adverse events.\*†
- Administers first aid or provides life support.†
- Applies principles of aseptic or sterile technique.
- Assesses and monitors the patient's physical, emotional and mental status.
- Consults with medical physicist or engineer in performing and documenting quality control tests and in reviewing of quality assurance.
- Explains to the patient each step of the action plan as it occurs and elicits the cooperation of the patient.
- Immobilizes patient for procedure.
- Implements an action plan.
- Maintains current information on equipment, materials and processes.
- Modifies the action plan according to changes in the clinical situation.
- Monitors the patient for reactions to medications.\*†
- Participates in ALARA, patient and personnel safety and risk management activities.
- Performs ongoing quality assurance activities and quality control testing.
- Performs procedural timeout.
- Positions patient for anatomic area of interest, respecting patient ability and comfort.
- Supports and implements the safe use of new technologies and procedures.
- Uses accessory equipment.
- Uses an integrated team approach.
- When appropriate, uses personnel radiation monitoring device(s) as indicated by the RSO or designee.
- Works aseptically in the appropriate environment while preparing, compounding and dispensing sterile and nonsterile medication.\*†

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry



## *Specific Criteria*

### ***Bone Densitometry***

- Applies the concepts of accuracy and precision in bone densitometry.
- Confirms patient position matches the selected scan parameters.
- Scans alternate sites when indicated.

### ***Cardiac-Interventional and Vascular-Interventional***

- Coordinates and manages the collection and labeling of tissue and fluid specimens.
- Monitors ECG, blood pressure, respiration, oxygen saturation, level of consciousness and pain pre-, peri- and post-procedure.

### ***Computed Tomography***

- Adheres to protocol scan length to optimize patient dose.
- Confirms patient position matches the selected scanning orientation parameters.
- Coordinates and manages the collection and labeling of tissue and fluid specimens.
- Determines optimum placement of ECG electrodes and correctly identifies ECG wave trigger.
- Optimizes technical factors to minimize radiation exposure to the patient while maintaining diagnostic image quality.
- Performs a remote CT procedure when a registered technologist is physically present with the patient.
- Uses radiation shielding devices.
- Utilizes isocentering of the anatomy of interest to optimize dose.

### ***Limited X-ray Machine Operator***

- Reviews patient exposure records and reject analyses as part of the quality assurance program.
- Uses appropriate uniquely identifiable pre-exposure radiopaque markers for anatomical and procedural purposes.
- Uses pre-exposure collimation and proper field-of-view selection.

### ***Magnetic Resonance***

- Ensures that anyone who is pregnant is not in the magnetic resonance scanner bore or scan room during actual data acquisition or scanning, unless medically necessary.
- Identifies appropriate cardiac or respiratory triggers.
- Monitors the patient's specific absorption rate and other factors related to patient heating.
- Performs a remote MR procedure when a registered technologist with MR Level 2 Personnel training is physically present with the patient.
- Positions imaging coil.
- Provides hearing protection to patient and others.
- Uses appropriate positioning and/or insulation materials to protect the patient from excessive heating and burns.

### ***Mammography***

- Applies appropriate radiopaque markers to the breast to indicate anatomic landmarks, including nipples, scars and lumps.
- Coordinates and manages the collection and labeling of tissue and fluid specimens.
- Ensures correct annotation of images.
- Exercises clinical judgment in the application of adequate compression to acquire a quality mammographic image.
- Informs the patient of the right to receive a lay summary result in accordance with MQSA.

### ***Medical Dosimetry***

- Adheres to established best practice protocols, guidelines and radiation oncologist directives.
- Calculates treatment unit parameters and doses to treatment volumes and points of interest.
- Collaborates with the radiation therapist, medical physicist and radiation oncologist regarding the simulation and treatment processes and procedures.
- Demonstrates safe handling, storing and disposal of brachytherapy sources.
- Develops a treatment plan as prescribed by a radiation oncologist.
- Ensures an independent machine-setting check is completed before treatment is delivered.
- Makes the recommendation to discontinue patient treatment until equipment is operating properly.
- Prepares or assists in preparing brachytherapy sources and equipment.
- Reviews treatment planning data for accuracy and appropriateness prior to input into the patient's treatment record and initial treatment.

## ***Nuclear Medicine***

- Administers radioactive material enterally, parenterally or through new or existing vascular access devices or through other routes as prescribed by a licensed practitioner and under the supervision of an authorized user.
- Coordinates and manages the collection and labeling of tissue and fluid specimens, including radiolabeling.
- Demonstrates safe handling, receipt, storage and disposal of radioactive materials.
- Determines optimum placement of ECG electrodes and correctly identifies ECG wave trigger and/or pattern.
- Ensures that anyone who is pregnant is not in the magnetic resonance scanner bore or scan room during actual data acquisition or scanning, unless medically necessary when performing PET-MR.
- Follows aseptic technique in the appropriate environments while preparing, compounding, dispensing and repackaging sterile and nonsterile radiopharmaceuticals in compliance with USP and FDA standards.
- Follows appropriate USP standards for beyond-use date and vial puncture standard.
- Follows USP standards for immediate use of sterile radiopharmaceuticals.
- Maintains security of radioactive material to reduce radiation exposure to patients, personnel and general public.
- Manipulates a radiopharmaceutical unit dose and performs dose pooling.
- Monitors for internal exposure when applicable including bioassays, blood and urine collection as directed by RSO or designee.
- Monitors shielding effectiveness.
- Provides hearing protection to patient and others when performing PET- MR.
- Uses appropriate positioning and/or insulation materials to protect the patient from excessive heating and burns when performing PET-MR.
- Uses radiation detecting equipment.
- Uses radiation shielding devices.
- Wears a ring badge on the dominant hand, with the label facing the radiation source.

## ***Quality Management***

- Assesses process flow.
- Collects and analyzes data using standard tools.
- Identifies variables and implements changes to improve performance.
- Investigates adverse events and continuously monitors outcomes to minimize risk.
- Uses knowledge to modify current practices.

### ***Radiation Therapy***

- Achieves precision patient alignment using imaging and external markings.
- Assists the radiation oncologist in determining the optimum treatment field to cover the target volume.
- Calculates monitor units and treatment times.
- Consults with medical physicist and/or engineer in performing and documenting the quality assurance checks.
- Creates and manages simulation and verification images.
- Demonstrates safe handling, storage and disposal of brachytherapy sources.
- Exports data to treatment planning systems.
- Makes the decision to discontinue patient treatment until equipment is operating properly.
- Monitors the patient visually and aurally during treatment.
- Monitors the treatment console during treatment.
- Obtains radiation oncologist's approval of simulation images prior to initiation of treatment.
- Performs clinically indicated treatment imaging and motion management techniques.
- Performs quality assurance checks on simulator, treatment unit and appropriate equipment.
- Prepares or assists in the preparation of brachytherapy sources and equipment.
- Uses knowledge of biological effects of ionizing radiation on tissue to minimize radiation dose to normal tissues.
- Verifies that only the patient is in the treatment room prior to initiating treatment or any imaging procedures.

### ***Radiography***

- Coordinates and manages the collection and labeling of tissue and fluid specimens.
- Reviews patient exposure records and reject analyses as part of the quality assurance program.
- Uses appropriate uniquely identifiable pre-exposure radiopaque markers for anatomical and procedural purposes.
- Uses pre-exposure collimation and proper field-of-view selection.

### ***Radiologist Assistant***

- Administers medications as approved by the supervising radiologist.
- Administers minimal and moderate sedation as prescribed by the supervising radiologist.
- Collects and documents tissue and fluid specimens.
- Demonstrates safe handling and disposal of radioactive materials.
- Maintains security of radioactive material to reduce radiation exposure to patients, personnel and general public.
- Monitors patient's physical condition during the procedure and responds to changes in patient vital signs, hemodynamics and level of consciousness.
- Participates in quality reporting measures for the purpose of improved patient care.
- Recognizes and responds to medical emergencies, activates emergency response systems and provides advanced life support intervention.
- Uses radiation detecting equipment.
- Uses radiation shielding devices when handling radiopharmaceuticals.

### ***Sonography***

- Coordinates and manages the collection and labeling of tissue and fluid specimens.
- Recognizes sonographic appearance of normal and abnormal tissue structures and physiological data.

## **Standard Five – Evaluation**

The medical imaging and radiation therapy professional determines whether the goals of the action plan have been achieved, evaluates quality assurance results and establishes an appropriate action plan.

### *Rationale*

Careful examination of the procedure is important to determine that expected outcomes have been met. Equipment, materials and processes depend on ongoing quality assurance activities that evaluate performance based on established guidelines.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Communicates the revised action plan to appropriate team members.
- Completes the evaluation process in a timely, accurate and comprehensive manner.
- Confirms data is accurate and complete.
- Develops a revised action plan to achieve the intended outcome.
- Evaluates images for optimal demonstration of anatomy of interest.
- Evaluates quality assurance results.
- Evaluates the patient, equipment and procedure to identify variances that might affect the expected outcome.
- Identifies exceptions to the expected outcome.
- Measures the procedure against established policies, protocols and benchmarks.
- Validates quality control testing conditions and results.

### *Specific Criteria*

#### ***Bone Densitometry***

- Evaluates and identifies unexpected serial bone mineral density changes.
- Reviews previous scan(s) and reanalyzes as necessary.
- Reviews T-scores and Z-scores to modify the action plan.

#### ***Cardiac-Interventional and Vascular-Interventional***

- Evaluates access site for complications requiring intervention or further treatment.

#### ***Computed Tomography***

Refer to general criteria.

#### ***Limited X-ray Machine Operator***

- Evaluates images for the purpose of monitoring radiation exposure.
- Evaluates images to determine the use of appropriate imaging parameters.
- Verifies that exposure indicator data for digital radiographic systems has not been altered or modified and is included in the DICOM header and on images exported to media.

## ***Magnetic Resonance***

Refer to general criteria.

## ***Mammography***

- Collaborates with the lead interpreting physician and medical physicist to maintain equipment and comply with federal and state regulations and guidelines.
- Evaluates required quality control tests before breast imaging is performed.
- Reviews the inspection and medical physicist's reports to assess the quality of the breast imaging equipment's performance.

## ***Medical Dosimetry***

- Acquires data necessary to perform accurate patient protocol plans and participates in implementation of the plan.
- Ensures treatment parameters have been transferred correctly to the oncology information system.
- Reviews treatment calculations and ensures the validity of the treatment plan.
- Reviews treatment variances and assists in determining possible causes and solutions.

## ***Nuclear Medicine***

- Consults with a licensed practitioner to confirm procedural completeness.
- Reviews procedure to determine if additional images or data will enhance the diagnostic value.

## ***Quality Management***

- Evaluates customer satisfaction.
- Evaluates measured processes and results against established policies, protocols, guidelines and benchmarks.
- Evaluates adverse events to minimize risk.

## ***Radiation Therapy***

- Checks treatment calculations and/or treatment plan.
- Compares verification images to simulation images using anatomical landmarks or fiducial markers.
- Evaluates the patient daily for any side effects, reactions and therapeutic responses.
- Performs treatment chart checks.
- Reviews treatment discrepancies, determines causes and assists with the action plan.
- Reviews verification images for quality and accuracy.
- Verifies the accuracy of the patient setup prior to treatment delivery.
- Verifies treatment console readouts and settings prior to initiating treatment and upon termination of treatment.

***Radiography***

- Evaluates images for the purpose of monitoring radiation exposure.
- Evaluates images to determine the use of appropriate imaging parameters.
- Verifies that exposure indicator data for digital radiographic systems has not been altered or modified and is included in the DICOM header and on images exported to media.

***Radiologist Assistant***

Refer to general criteria.

***Sonography***

Refer to general criteria.



## **Standard Six – Implementation**

The medical imaging and radiation therapy professional implements the revised action plan based on quality assurance results and achievement of goals from the initial action plan.

### *Rationale*

It may be necessary to make changes to the action plan based on quality assurance results and achievement of goals from the initial action plan to promote safe and effective services.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Adjusts imaging parameters, patient procedure or additional factors to improve the outcome.
- Bases the revised plan on the patient's condition and the most appropriate means of achieving the expected outcome.
- Implements the revised action plan.
- Notifies the appropriate health care provider when immediate clinical response is necessary, based on procedural findings and patient condition.
- Obtains assistance to support the quality assurance action plan.
- Takes action based on patient and procedural variances.

### *Specific Criteria*

#### ***Bone Densitometry***

Refer to general criteria.

#### ***Cardiac-Interventional and Vascular-Interventional***

Refer to general criteria.

#### ***Computed Tomography***

Refer to general criteria.

#### ***Limited X-ray Machine Operator***

Refer to general criteria.

#### ***Magnetic Resonance***

Refer to general criteria.

#### ***Mammography***

- Initiates procedures only when breast imaging equipment meets quality assurance and quality control requirements, and results are in compliance.

### ***Medical Dosimetry***

- Develops additional treatment plans to achieve an optimal dose distribution.
- Ensures accuracy in the transfer and documentation of treatment parameters, according to departmental policies.
- Reviews and implements treatment field changes indicated on simulation or verification images as directed by a radiation oncologist.

### ***Nuclear Medicine***

- Employs devices to minimize radiation levels.
- Manages radioactive contamination and uses decontamination procedures.
- Performs additional images or data collections as needed.

### ***Quality Management***

- Develops policies, protocols and guidelines in collaboration with other health care providers.

### ***Radiation Therapy***

- Collaborates with radiation oncologists, medical physicists and medical dosimetrists to compensate for treatment inaccuracies.
- Establishes congruence between verification images and simulation images, digitally reconstructed radiographs and/or treatment volumes as defined by the radiation oncologist.
- Formulates recommendations for process improvements to minimize treatment discrepancies.
- Implements treatment plan or treatment field changes as directed by the radiation oncologist.
- Reports deviations from the standard or planned treatment.

### ***Radiography***

Refer to general criteria.

### ***Radiologist Assistant***

- Manages radioactive contamination and uses decontamination procedures.

### ***Sonography***

Refer to general criteria.

## **Standard Seven – Outcomes Measurement**

The medical imaging and radiation therapy professional reviews and evaluates the outcome of the procedure according to quality assurance standards.

### *Rationale*

To evaluate the quality of care, the medical imaging and radiation therapy professional compares the actual outcome with the expected outcome. Outcomes assessment is an integral part of the ongoing quality management action plan to enhance services.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Assesses the patient's physical, emotional and mental status prior to discharge.
- Evaluates the process and recognizes opportunities for future changes.
- Measures and evaluates the results of the revised action plan.
- Reviews all data for completeness and accuracy.
- Reviews and evaluates quality assurance processes and tools for effectiveness.
- Reviews the implementation process for accuracy and validity.
- Uses evidence-based practice to determine whether the actual outcome is within established criteria.

### *Specific Criteria*

#### ***Bone Densitometry***

Refer to general criteria.

#### ***Cardiac-Interventional and Vascular-Interventional***

Refer to general criteria.

#### ***Computed Tomography***

Refer to general criteria.

#### ***Limited X-ray Machine Operator***

Refer to general criteria.

#### ***Magnetic Resonance***

Refer to general criteria.

#### ***Mammography***

- Prepares the annual medical outcomes audit and provides results to the lead interpreting physician.

***Medical Dosimetry***

Refer to general criteria.

***Nuclear Medicine***

Refer to general criteria.

***Quality Management***

- Assesses differences between expected and actual outcomes.
- Assesses implemented changes for improvement.
- Develops methods to demonstrate continuous improvement.
- Develops strategies for maintaining improvement.
- Evaluates the effectiveness of and supports changes to processes.
- Performs procedural analysis.

***Radiation Therapy***

- Monitors patient status during procedures, throughout the treatment course and for follow-up care.

***Radiography***

Refer to general criteria.

***Radiologist Assistant***

- Performs follow-up patient evaluation and communicates findings to the supervising radiologist.

***Sonography***

Refer to general criteria.

## **Standard Eight – Documentation**

The medical imaging and radiation therapy professional documents information about patient care, procedures and outcomes.

### *Rationale*

Clear and precise documentation is essential for continuity of care, accuracy of care and quality assurance.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Archives images or data.
- Documents diagnostic, treatment and patient data in the medical record in a timely, accurate and comprehensive manner.
- Documents medication administration in patient's medical record.\*†
- Documents procedural timeout.
- Documents unintended outcomes or exceptions from the established criteria.
- Maintains documentation of quality assurance activities, procedures and results.
- Provides pertinent information to authorized individual(s) involved in the patient's care.
- Records information used for billing and coding procedures.
- Reports any out-of-tolerance deviations to the appropriate personnel.
- Verifies patient consent is documented.

### *Specific Criteria*

#### ***Bone Densitometry***

Refer to general criteria.

#### ***Cardiac-Interventional and Vascular-Interventional***

- Documents administered medications.
- Documents or assists in documenting patient medical history related to the procedure.
- Documents radiation exposure parameters and initiates further action as needed.
- Documents use of sedation.
- Maintains documentation for tracking implantable devices.

#### ***Computed Tomography***

- Archives or documents radiation exposure.
- Documents the use of shielding devices and proper radiation safety practices.

#### ***Limited X-ray Machine Operator***

- Documents radiation exposure.
- Documents the use of shielding devices and proper radiation safety practices.

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry

### ***Magnetic Resonance***

Refer to general criteria.

### ***Mammography***

- Documents and provides evidence of quality assurance and quality control outcomes according to established guidelines.

### ***Medical Dosimetry***

- Reports any treatment variances in accordance with departmental, institutional and national quality assurance guidelines.

### ***Nuclear Medicine***

- Documents dose and route of administered radiopharmaceutical or radionuclide therapy in the patient medical record.
- Documents instrumentation quality testing procedures and maintains results for review.
- Documents radioactive materials quality testing procedures and maintains results for inspection.
- Documents the implementation, evaluation and modification of the radiation safety plan under the authority of the RSO.
- Maintains records of the receipt, administration and disposal of radioactive materials.

### ***Quality Management***

- Documents goals and outcomes based on data analysis.
- Documents process flow variances and justifies exceptions.
- Documents steps used to improve processes.
- Updates institutional policies, protocols and guidelines to ensure continuous compliance with regulatory requirements.
- Provides reports as required by institutional policy, accrediting bodies and federal and state regulations.

### ***Radiation Therapy***

- Documents radiation exposure parameters.
- Maintains imaging and treatment records according to institutional policy.
- Reports any treatment discrepancies to appropriate personnel in accordance with departmental, institutional and regulatory requirements.

### ***Radiography***

- Documents fluoroscopic time.
- Documents radiation exposure.
- Documents the use of shielding devices and proper radiation safety practices.

### ***Radiologist Assistant***

- Communicates and documents radiologist's order to other health care providers.
- Documents a history and physical examination in the patient record.
- Documents administration of medications.
- Documents and assists radiologist in quality reporting measures for the purpose of improved patient care.
- Documents dose and route of administered radiopharmaceutical in the patient medical record.
- Documents the implementation, evaluation and modification of the radiation safety plan under the authority of the RSO.
- Documents use of minimal and moderate sedation.
- Reports clinical and imaging observations and procedure details to the supervising radiologist.

### ***Sonography***

- Documents initial impressions and technical data.
- Records interval changes in sonographic findings compared to previous imaging.

## **Standard Nine – Quality**

The medical imaging and radiation therapy professional strives to provide optimal care.

### *Rationale*

Patients expect and deserve optimal care during diagnosis and treatment.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Adheres to standards, policies, statutes, regulations and established guidelines.
- Anticipates, considers and responds to the needs of a diverse patient population.
- Applies professional judgment and discretion while performing the procedure.
- Collaborates with others to elevate the quality of care.
- Participates in ongoing quality assurance programs.

### *Specific Criteria*

#### ***Bone Densitometry***

- Advocates that facilities determine precision error and calculate the least significant change.

#### ***Cardiac-Interventional and Vascular-Interventional***

Refer to general criteria.

#### ***Computed Tomography***

- Advocates that facilities performing remote CT require a registered technologist be physically present with the patient.

#### ***Limited X-ray Machine Operator***

Refer to general criteria.

#### ***Magnetic Resonance***

- Advocates the need for a minimum of one registered magnetic resonance technologist and one additional MR Level 2 Personnel as the standard for safe and efficient delivery of magnetic resonance procedures.

#### ***Mammography***

Refer to general criteria.

#### ***Medical Dosimetry***

Refer to general criteria.



***Nuclear Medicine***

- Performs procedures in accordance with the NRC or in agreement with state regulations.

***Quality Management***

- Verifies the achievement of goals and identifies exceptions.

***Radiation Therapy***

- Performs procedures in accordance with the NRC or in agreement with state regulations.
- Promotes patient safety by performing external beam treatments with a minimum of two registered radiation therapists.

***Radiography***

Refer to general criteria.

***Radiologist Assistant***

- Performs procedures in accordance with the NRC or in agreement with state regulations.

***Sonography***

Refer to general criteria.

## **Standard Ten – Self-Assessment**

The medical imaging and radiation therapy professional evaluates personal performance.

### *Rationale*

Self-assessment is necessary for personal growth and professional development.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Assesses personal work ethics, behaviors and attitudes.
- Evaluates performance, applies personal strengths and recognizes opportunities for educational growth and improvement.
- Recognizes hazards associated with their work environment and takes measures to mitigate them.

### *Specific Criteria*

#### ***Bone Densitometry***

Refer to general criteria.

#### ***Cardiac-Interventional and Vascular-Interventional***

Refer to general criteria.

#### ***Computed Tomography***

Refer to general criteria.

#### ***Limited X-ray Machine Operator***

- Investigates avenues to continue progress to become a registered radiographer.

#### ***Magnetic Resonance***

Refer to general criteria.

#### ***Mammography***

Refer to general criteria.

#### ***Medical Dosimetry***

Refer to general criteria.

#### ***Nuclear Medicine***

Refer to general criteria.

#### ***Quality Management***

Refer to general criteria.

***Radiation Therapy***

Refer to general criteria.

***Radiography***

Refer to general criteria.

***Radiologist Assistant***

Refer to general criteria.

***Sonography***

Refer to general criteria.

## **Standard Eleven – Collaboration and Collegiality**

The medical imaging and radiation therapy professional promotes a positive and collaborative practice atmosphere with other members of the health care team.

### *Rationale*

To provide quality patient care, all members of the health care team must communicate effectively and work together efficiently.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Develops and maintains collaborative partnerships to enhance quality and efficiency.
- Informs and instructs others about radiation safety.
- Promotes understanding of the profession.
- Shares knowledge and expertise with others.

### *Specific Criteria*

#### ***Bone Densitometry***

Refer to general criteria.

#### ***Cardiac-Interventional and Vascular-Interventional***

Refer to general criteria.

#### ***Computed Tomography***

Refer to general criteria.

#### ***Limited X-ray Machine Operator***

Refer to general criteria.

#### ***Magnetic Resonance***

Refer to general criteria.

#### ***Mammography***

Refer to general criteria.

#### ***Medical Dosimetry***

Refer to general criteria.

#### ***Nuclear Medicine***

Refer to general criteria.

***Quality Management***

Refer to general criteria.

***Radiation Therapy***

Refer to general criteria.

***Radiography***

Refer to general criteria.

***Radiologist Assistant***

Refer to general criteria.

***Sonography***

Refer to general criteria.

## **Standard Twelve – Ethics**

The medical imaging and radiation therapy professional adheres to the profession's accepted ethical standards.

### *Rationale*

Decisions made and actions taken on behalf of the patient are based on a sound ethical foundation.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Accepts accountability for decisions made and actions taken.
- Acts as a patient advocate.
- Adheres to the established ethical standards of recognized certifying agencies.
- Adheres to the established practice standards of the profession.
- Delivers equitable and inclusive patient care and service free from bias or discrimination.
- Promotes radiation safety standards.
- Provides health care services with consideration for a diverse patient population.
- Reports unsafe practices to the RSO, regulatory agency or other appropriate authority.
- Respects the patient's right to privacy and confidentiality.

### *Specific Criteria*

#### ***Bone Densitometry***

Refer to general criteria.

#### ***Cardiac-Interventional and Vascular-Interventional***

Refer to general criteria.

#### ***Computed Tomography***

Refer to general criteria.

#### ***Limited X-ray Machine Operator***

Refer to general criteria.

#### ***Magnetic Resonance***

Refer to general criteria.

#### ***Mammography***

Refer to general criteria.

***Medical Dosimetry***

Refer to general criteria.

***Nuclear Medicine***

Refer to general criteria.

***Quality Management***

Refer to general criteria.

***Radiation Therapy***

Refer to general criteria.

***Radiography***

Refer to general criteria.

***Radiologist Assistant***

Refer to general criteria.

***Sonography***

- Opposes participation in sonographic procedures for the purpose of nonmedical entrepreneurial application or entertainment contrary to the tenets of ethical medical practice.

## **Standard Thirteen – Research, Innovation and Professional Advocacy**

The medical imaging and radiation therapy professional participates in the acquisition and dissemination of knowledge and the advancement of the profession.

### *Rationale*

Participation in professional organizations and scholarly activities advances the profession.

The medical imaging and radiation therapy professional:

### *General Criteria*

- Adopts new best practices.
- Advocates for an ergonomically safe work environment based on evidence-based practices.
- Investigates innovative methods for application in practice.
- Monitors changes to federal and state law, regulations and accreditation standards affecting area(s) of practice.
- Participates in data collection.
- Participates in professional advocacy efforts.
- Participates in professional societies and organizations.
- Pursues lifelong learning.
- Reads and evaluates research relevant to the profession.
- Shares information through publication, presentation and collaboration.

### *Specific Criteria*

#### ***Bone Densitometry***

Refer to general criteria.

#### ***Cardiac-Interventional and Vascular-Interventional***

- Advocates for a safe working environment to mitigate the occupational risk related to fluoroscopically-guided interventional procedures.

#### ***Computed Tomography***

Refer to general criteria.

#### ***Limited X-ray Machine Operator***

Refer to general criteria.

#### ***Magnetic Resonance***

Refer to general criteria.



***Mammography***

Refer to general criteria.

***Medical Dosimetry***

Refer to general criteria.

***Nuclear Medicine***

Refer to general criteria.

***Quality Management***

Refer to general criteria.

***Radiation Therapy***

Refer to general criteria.

***Radiography***

Refer to general criteria.

***Radiologist Assistant***

Refer to general criteria.

***Sonography***

- Advocates for an ergonomically safe working environment, based on evidence-based practices, to mitigate the risk of work-related musculoskeletal disorders.

## **Advisory Opinion Statements**

Advisory opinion statements provide explanations of the practice standards.

ASRT issues advisory opinions to clarify what constitutes appropriate practice and offer guidance for specific practice issues.

The profession holds medical imaging and radiation therapy professionals responsible and accountable for rendering safe, effective clinical services to patients and for judgments exercised and actions taken in the course of providing those services. The advisory opinion statements assist medical imaging and radiation therapy professionals in safe practice.

The medical imaging and radiation therapy professional's performance should be evidence-based and consistent with federal and state laws, regulations, established standards of practice and facility policies and procedures.

The ASRT recognizes the use of GRADE for measuring the quality of evidence and strength in recommendations for the development of advisory opinion statements.

Each medical imaging and radiation therapy professional must exercise prudent judgment when determining whether the performance of a given act is within the scope of practice for which the individual is licensed, if applicable within the jurisdiction in which the person is employed, educationally prepared and clinically competent to perform.

## **Guidance for the Communication of Clinical and Imaging Observations and Procedure Details by Radiologist Assistants to Supervising Radiologists**

After research of evidentiary documentation, the ASRT issued opinions contained herein.

### **Advisory Opinion**

It is the opinion of the ASRT based on evidentiary documentation and where federal or state law and/or institutional policy permits that:

1. Communication of clinical and imaging observations and procedure details by the radiologist assistant to the supervising radiologist is an integral part of radiologist assistant practice. Without clear, consistent and appropriate communication between members of the radiology team, there is a possibility of inadequate patient care, incomplete reports and diminished departmental productivity. To create a safe and productive radiology environment, communication between the radiologist assistant and supervising radiologist must be free-flowing, consistent and relevant to the patient examination or procedure. This communication can take many forms, including verbal, written and electronic correspondence. These communications may be included and taken into consideration by the radiologist in creating a final report. However, initial clinical and imaging observations and procedure details communicated from the radiologist assistant to the radiologist are only intended for the radiologist's use and do not substitute for the final report created by the radiologist. These communications should be considered and documented as "initial clinical and imaging observations or procedure details."
2. While assisting radiologists in the performance of imaging procedures or during the performance of procedures under radiologist supervision, the radiologist assistant must be able to communicate and document procedure notes, observations, patient responses and other types of information relevant to the radiologist's interpretation and creation of the final report. Radiologist assistants do not independently "report findings" or "interpret" by dictation or by any other means; and to avoid any confusion, these terms should not be used to refer to the activities of the radiologist assistant. However, radiologist assistants may add to the patient record (following the policies and procedures of the facility) in a manner similar to any other dependent nonphysician practitioner. Radiologist assistants who are authorized to communicate initial observations to the supervising radiologist using a voice recognition dictation system or other electronic means must adhere to institutional protocols ensuring that initial observations can be viewed or accessed only by the supervising radiologist. Initial clinical or imaging observations or procedure details created by the radiologist assistant resulting from the radiologist assistant's involvement in the performance of the procedure that are included in the final report should be carefully reviewed by the supervising radiologist and should be incorporated at the supervising radiologist's discretion.

GRADE: Strong

### **Definitions**

See glossary.

## **Evidentiary Documentation**

### *Current Literature*

Not applicable

### *Curricula*

- Radiologist Assistant Curriculum (ASRT, 2020)

QUALITY OF EVIDENCE: High

### *Certification Agency Entry-Level Clinical Activities*

- Registered Radiologist Assistant Entry-Level Clinical Activities (ARRT, 2023)

The document states that radiologist assistants may “Review imaging procedures, make initial observations, and communicate observations **ONLY** [*emphasis added*] to the radiologist; record initial observations of imaging procedures following radiologist approval; communicate radiologist’s report to appropriate health care provider consistent with the ACR Practice Parameter for Communication of Diagnostic Imaging Findings.”

### *Certification Agency Content Specifications*

Not applicable

QUALITY OF EVIDENCE: High

### *Scopes of Practice and Practice Standards Reference*

- Scope of Practice (radiologist assistant only)
  - Communicating the supervising radiologist’s report to the appropriate health care provider consistent with the ACR Practice Guidelines for Communication of Diagnostic Imaging Findings.
  - Evaluating images for completeness and diagnostic quality and recommending additional images.
  - Obtaining images necessary for diagnosis and communicating initial observations to the supervising radiologist. The radiologist assistant does not provide image interpretation as defined by the ACR.
  - Providing follow-up patient evaluation.
- The ASRT Practice Standards for Medical Imaging and Radiation Therapy
  - Performs history and physical examination, analyzes data, and reports findings as part of a radiologist-led team. (Standard One, radiologist assistant only)
  - Performs follow-up patient evaluation and communicates findings to the supervising radiologist. (Standard Seven, radiologist assistant only)
  - Documents diagnostic, treatment and patient data in the medical record in a timely, accurate and comprehensive manner. (Standard Eight, General Criteria)
  - Maintains documentation of quality assurance activities, procedures and results. (Standard Eight, General Criteria)
  - Communicates and documents a radiologist’s order to other health care providers. (Standard Eight, radiologist assistant only)

- Documents and assists radiologist in quality reporting measures for the purpose of improved patient care. (Standard Eight, radiologist assistant only)
- Reports clinical and imaging observations and procedure details to the supervising radiologist. (Standard Eight, radiologist assistant only)

QUALITY OF EVIDENCE: High

*Federal and State Statute References*

Not applicable

*Other*

Not applicable

## **Medication Administration in Peripherally Inserted Central Catheter Lines or Ports With a Power Injector\*\*†**

After research of evidentiary documentation, the ASRT issued the opinions contained herein.

### **Advisory Opinion**

It is the opinion of the ASRT based on evidentiary documentation and where federal or state law and/or institutional policy permits that:

Medical imaging and radiation therapy professionals can access and/or use an FDA approved:

1. Peripherally inserted central catheter (PICC) line by inserting an approved connective device. The PICC line must be designated for use with power injectors. Manufacturer guidelines regarding infusion rate and pressure must be followed.
2. Port by inserting an approved non coring needle. The port must be designated for use with power injectors. Manufacturer guidelines regarding infusion rate and pressure must be followed.

GRADE: Strong

### **Definitions**

See glossary.

### **Evidentiary Documentation**

#### *Current Literature*

Not applicable

#### *Curricula*

- Computed Tomography Curriculum (ASRT, 2018)
- Magnetic Resonance Curriculum (ASRT, 2020)
- Nuclear Medicine Technology Competency-Based Curriculum Guide (SNMMI, 2015 Amended April 2020)
- Radiography Curriculum (ASRT, 2022)
- Radiologist Assistant Curriculum (ASRT, 2020)

QUALITY OF EVIDENCE: High

#### *Certification Agency Content Specifications*

- Components of Preparedness (NMTCB, 2020)
- Computed Tomography (ARRT, 2022)
- Positron Emission Tomography (PET) Specialty Examination Content Outline (NMTCB, 2022)
- Vascular Interventional Radiography (ARRT, 2017)

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry

QUALITY OF EVIDENCE: High

*Scopes of Practice and Practice Standards Reference*

- Scope of Practice
  - Administering medications enterally, parenterally, through new or existing vascular access or through other routes as prescribed by a licensed practitioner.\*†
  - Administering medications with an infusion pump or power injector as prescribed by a licensed practitioner.\*†
  - Identifying, calculating, compounding, preparing and/or administering medications as prescribed by a licensed practitioner.\*†

QUALITY OF EVIDENCE: High

*Federal and State Statute References*

Not applicable

*Other*

Not applicable

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry

## **Medication Administration Through New or Existing Vascular Access\*†**

After research of evidentiary documentation, the ASRT issued opinions contained herein.

### **Advisory Opinion**

It is the opinion of the ASRT based on evidentiary documentation and where federal or state law and/or institutional policy permits that:

1. It is within the scope of practice for medical imaging and radiation therapy professionals to access and administer medications through new or existing vascular access by an approved method of administration (e.g., hand injection, power injection, slow push, bolus, infusion) as prescribed by a licensed practitioner.

GRADE: Strong

### **Definitions**

- access – The process of inserting an approved connective device through the access point of an existing vascular access device to deliver intravenous (IV) fluids or medication.
- existing vascular access – Peripheral or central vascular implanted devices or external access lines that include, but are not limited to, peripherally inserted central catheter lines, intravenous lines, central lines and ports.

### **Evidentiary Documentation**

#### *Current Literature*

- ACR Committee on Drugs and Contrast Media. *ACR Manual on Contrast Media*. American College of Radiology; 2022.
- American College of Radiology. ACR-SPR practice parameter for performing and interpreting diagnostic computed tomography (CT). Revised 2022.
- American College of Radiology. ACR practice parameter for performing and interpreting magnetic resonance imaging (MRI). Revised 2022.
- American College of Radiology. ACR-SPR practice parameter for the use of intravascular contrast media. Revised 2022.
- Rockwell D. A competency for central line use in radiology. *J Radiol Nurs*. 2008;27(2):84. doi:10.1016/j.jradnu.2008.04.016

QUALITY OF EVIDENCE: High

#### *Curricula*

- Cardiac-Interventional and Vascular-Interventional Curriculum (ASRT, 2019)
- Computed Tomography Curriculum (ASRT, 2018)
- Magnetic Resonance Curriculum (ASRT, 2020)
- Mammography Curriculum (ASRT, 2018)
- National Education Curriculum for Sonography (JRC-DMS, 2016)

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry



- Nuclear Medicine Technology Competency-Based Curriculum Guide (SNMMI, 2022)
- Radiation Therapy Curriculum (ASRT, 2019)
- Radiography Curriculum (ASRT, 2022)
- Radiologist Assistant Curriculum (ASRT, 2020)

QUALITY OF EVIDENCE: High

*Certification Agency Content Specifications*

- Components of Preparedness (NMTCB, 2020)
- Computed Tomography (ARRT, 2022)
- Examination Overview: Registered Cardiovascular Invasive Specialist (CCI, 2022)
- Magnetic Resonance Imaging (ARRT, 2020)
- Nuclear Medicine Technology (ARRT, 2022)
- Positron Emission Tomography ( PET) Specialty Examination Content Outline NMTCB, 2021
- Radiography (ARRT, 2022)
- Registered Radiologist Assistant (ARRT, 2023)
- Vascular-Interventional Radiography (ARRT, 2017)

QUALITY OF EVIDENCE: High

*Scopes of Practice and Practice Standards Reference*

- Scope of Practice
  - Administering medications enterally, parenterally, through new or existing vascular access or through other routes as prescribed by a licensed practitioner.\*†
  - Identifying, calculating, compounding, preparing and/or administering medications as prescribed by a licensed practitioner.\*†
  - Performing venipuncture as prescribed by a licensed practitioner.\*†
  - Starting, maintaining and/or removing intravenous access as prescribed by a licensed practitioner.\*†

QUALITY OF EVIDENCE: High

*Federal and State Statute References*

Not applicable

*Other*

Not applicable

\* Excludes limited x-ray machine operator

† Excludes medical dosimetry

## **Placement of Personnel Radiation Monitoring Devices**

After research of evidentiary documentation, the ASRT issued opinions contained herein.

### **Advisory Opinion**

It is the opinion of the ASRT based on evidentiary documentation and where federal or state law and/or institutional policy permits that:

1. Radiation workers wear a personnel radiation monitoring device outside of protective apparel with the label facing the radiation source at the level of the collar.
2. In specific cases, a whole-body monitor may be indicated. This monitor should be worn at the waist inside of protective apparel, with the label facing the radiation source.
3. In some cases, a ring monitor may be indicated. This monitor should be worn on the hand likely to receive the highest exposure, with the label facing the radiation source.

GRADE: Strong

### **Definitions**

See glossary.

### **Evidentiary Documentation**

#### *Current Literature*

- Bushong S. Occupational radiation dose management. In: *Radiologic Science for Technologists: Physics, Biology, and Protection*. 12th ed. Elsevier; 2020: 547 - 549.
- By standards number: 1910.1096(d)(3)(i) – ionizing radiation. Occupational Safety and Health Administration website.
- Gilmore D, Watersham-Rich K. Radiation safety in nuclear medicine. In: *Nuclear Medicine and PET/CT: Technology and Technique*. 8th edition. Elsevier; 2016:116.
- Statkiewicz-Sherer MA, Visconti PJ, Ritenour ER, Welch-Haynes K. Radiation monitoring. In: *Radiation Protection in Medical Radiography*. 9th ed. Elsevier; 2022:72-87.

QUALITY OF EVIDENCE: High

#### *Curricula*

- Bone Densitometry Curriculum (ASRT, 2019)
- Limited X-ray Machine Operator Curriculum (ASRT, 2020)
- Nuclear Medicine Technology Competency-Based Curriculum Guide (SNMMI, 2022)
- Radiation Therapy Curriculum (ASRT, 2019)
- Radiography Curriculum (ASRT, 2022)
- Radiologist Assistant Curriculum (ASRT, 2020)

QUALITY OF EVIDENCE: High

*Certification Agency Content Specifications*

- Cardiac-Interventional Radiography (ARRT, 2017)
- Components of Preparedness (NMTCB, 2020)
- Limited Scope of Practice in Radiography (ARRT, 2023)
- Nuclear Medicine Technology (ARRT, 2022)
- Radiation Therapy (ARRT, 2022)
- Radiography (ARRT, 2022)
- Registered Radiologist Assistant (ARRT, 2023)
- Vascular-Interventional Radiography (ARRT, 2017)

QUALITY OF EVIDENCE: High

*Scopes of Practice and Practice Standards Reference*

- When appropriate, uses personnel radiation monitoring devices(s) as indicated by the RSO or designee, (Standard Four, General Criteria)

*Federal and State Statute References*

- § 19.12 Instruction to Workers (NRC, 2021)
- § 20.1208 Dose Equivalent to an Embryo/Fetus (NRC, 2021)
- § 20.1502 Conditions Requiring Individual Monitoring of External and Internal Occupational Dose (NRC, 2021)
- Regulatory Guide 8.34: Monitoring Criteria and Methods to Calculate Occupational Radiation Doses (NRC, 2022)
- Regulatory Guide 8.36: Radiation Dose to the Embryo/Fetus (NRC, 2017)
- Regulatory Guide 8.7: Instructions for Recording and Reporting Occupational Radiation Exposure Data (NRC, 2018)

QUALITY OF EVIDENCE: High

*Other*

- AAPM Report No. 58: Managing the Use of Fluoroscopy in Medical Institutions. Appendix A: Radiation Safety/Quality Assurance Program

QUALITY OF EVIDENCE: High

## **Use of Postexposure Shuttering, Cropping and Electronic Masking in Radiography**

After research of evidentiary documentation, the ASRT issued opinions contained herein.

### **Advisory Opinion**

It is the opinion of the ASRT based on evidentiary documentation and where federal or state law and/or institutional policy permits that:

1. It is within the scope of practice of a radiologic technologist to determine and apply appropriate pre-exposure collimation to individual projections of examinations to comply with the principle of ALARA. Postexposure shuttering, cropping, electronic collimation or electronic masking to eliminate the visibility of large regions of brightness are acceptable, where automatic processing fails to do so.
2. It is outside of the scope of practice of a radiologic technologist to use postexposure shuttering, cropping, electronic collimation or electronic masking to eliminate any anatomical information. This information is a part of the patient's permanent medical record and should therefore be presented to the licensed practitioner to determine whether the exposed anatomy obtained on any image is significant or of diagnostic value.
3. It is outside the scope of practice of a radiologic technologist to use postexposure shuttering, cropping, electronic collimation or electronic masking to duplicate and use any acquired image for more than one prescribed view or projection on any exam. Facilities acquiring digital images are legally required to retain information in the DICOM information of each image that identifies the selected view or projection at the time of image acquisition. Using the same acquired image to represent two different prescribed views or projections is a falsification of the information in the patient medical record and imaging study made available to the licensed practitioner.

GRADE: Strong

### **Definitions**

See glossary.

### **Evidentiary Documentation**

#### *Current Literature*

- American College of Radiology. ACR-AAPM-SIIM-SPR practice parameter for digital radiography. Revised 2022.
- Bomer J, Wiersma-Deijl L, Holscher HC. Electronic collimation and radiation protection in paediatric digital radiography: revival of the silver lining. *Insights Imaging*. 2013;4(5):723-727. doi:10.1007/s13244-013-0281-5
- Carroll QB. *Radiography in the Digital Age*. 3rd ed. Charles C Thomas; 2018.
- Carter C, Vealé B. *Digital Radiography and PACS*. 3rd ed. Elsevier; 2019.
- Chalazonitis AN, Koumarios D, Tzovara J, Chronopoulos P. How to optimize radiological images captured from digital cameras, using the Adobe Photoshop 6.0 program. *J Digit Imaging*. 2003;16(2):216-229.
- DeMaio DN, Herrmann T, Noble LB, et al; American Society of Radiologic Technologists. Best practices in digital radiography. Published 2019.

- Don S, Macdougall R, Strauss K, et al. Image Gently campaign back to basics initiative: ten steps to help manage radiation dose in pediatric digital radiography. *AJR Am J Roentgenol.* 2013;200(5):W431-W436. doi:10.2214/AJR.12.9895
- Fauber TL, Dempsey MC. X-ray field size and patient dosimetry. *Radiol Technol.* 2013;85(2):155-161.
- Fauber TL. *Radiographic Imaging and Exposure.* 6th ed. Elsevier; 2020:120 and 176.
- Goske MJ, Charkot E, Herrmann T, et al. Image Gently: challenges for radiologic technologists when performing digital radiography in children. *Pediatr Radiol.* 2011;41(5):611-619. doi:10.1007/s00247-010-1957-3
- Lo WY, Puchalski SM. Digital image processing. *Vet Radiol Ultrasound.* 2008;49(1 suppl 1):S42-S47. doi:10.1111/j.1740-8261.2007.00333.x
- Russell J, Burbridge BE, Duncan MD, Tynan J. Adult fingers visualized on neonatal intensive care unit chest radiographs: what you don't see. *Can Assoc Radiol J.* 2013;64(3):236-239. doi:10.1016/j.carj.2012.04.004
- Seeram E. *Digital Radiography: An Introduction.* Cengage Learning; 2011.
- Uffmann M, Schaefer-Prokop C. Digital radiography: the balance between image quality and required radiation dose. *Eur J Radiol.* 2009;72(2):202-208. doi:10.1016/j.ejrad.2009.05.060
- Willis CE. Optimizing digital radiography of children. *Eur J Radiol.* 2009;72(2):266-273. doi:10.1016/j.ejrad.2009.03.003
- Zetterberg LG, Espeland A. Lumbar spine radiography—poor collimation practices after implementation of digital technology. *Br J Radiol.* 2011;84(1002):566-9. doi:10.1259/bjr/74571469

QUALITY OF EVIDENCE: High

#### *Curricula*

- Limited X-ray Machine Operator Curriculum (ASRT, 2020)
- Radiography Curriculum (ASRT, 2022)

#### *Certification Agency Content Specifications*

- Limited Scope of Practice in Radiography (ARRT, 2023)
- Radiography (ARRT, 2022)

#### *Scopes of Practice and Practice Standards Reference*

- Scope of Practice
  - Applying principles of ALARA to minimize exposure to patient, self and others.
  - Selecting the appropriate protocol and optimizing technical factors while maximizing patient safety.
- The ASRT Practice Standards for Medical Imaging and Radiation Therapy
  - Employs professional judgment to adapt procedures to improve diagnostic quality or therapeutic outcomes. (Standard Two, General Criteria)
  - Adheres to radiation safety rules and standards. (Standard Four, General Criteria)

- Participates in ALARA, patient and personnel safety and risk management activities (Standard Four, General Criteria)
- Positions patient for anatomic area of interest, respecting patient ability and comfort. (Standard Four, General Criteria)
- Uses pre-exposure collimation and proper field-of-view selection. (Standard Four, limited x-ray machine operator and radiography only)
- Evaluates images for optimal demonstration of anatomy of interest. (Standard Five, General Criteria)
- Evaluates images to determine the use of appropriate imaging parameters. (Standard Five, limited x-ray machine operator and radiography only)
- Verifies that exposure indicator data for digital radiographic systems has not been altered or modified and is included in the DICOM header and on images exported to media. (Standard Five, limited x-ray machine operator and radiography only)
- Adheres to the established practice standards of the profession. (Standard Twelve, General Criteria)

QUALITY OF EVIDENCE: High

*Federal and State Statute References*

Not applicable

*Other*

Not applicable

## Glossary

The glossary is an alphabetical list of defined terms or words specifically found in the ASRT Practice Standards for Medical Imaging and Radiation Therapy. The terms or words have meaning that might not be general knowledge. The definitions are formulated using evidentiary documentation and put into place following extensive review and subsequent approval. The glossary is not all-inclusive. New terms and new usage of existing terms will emerge with time and advances in technology.

**AAPM** – American Association of Physicists in Medicine

**ACR** – American College of Radiology

**adverse event** – Any undesirable experience associated with the use of a medical product in a patient.

**ALARA** – Acronym for “as low as (is) reasonably achievable,” which means making every reasonable effort to maintain exposures to radiation as far below the dose limits as practical, consistent with the purpose for which the licensed activity is undertaken, while taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety and other societal and socioeconomic considerations, and in relation to the use of nuclear energy and licensed materials in the public interest. The ASRT recognizes the concept of ALARA to include energies used for magnetic resonance and sonographic imaging.

**anatomic (anatomical) landmarks** – Bones or other identifiable points that are visible or palpable and indicate the position of internal anatomy.

**archive (archival)** –The storage of data in either hard (film) or soft (digital) form.

**ARDMS** – American Registry for Diagnostic Medical Sonography

**ARRT** – American Registry of Radiologic Technologists

**artifact** – Extraneous information on the image that interferes with or distracts from image quality.

**ASRT** – American Society of Radiologic Technologists

**authorized user** – A physician, dentist or podiatrist who meets the requirements as defined by the United States Nuclear Regulatory Commission.

**beam-modification devices** – Devices that change the shape of the treatment field or distribution of the radiation at (tissue) depth.

**brachytherapy** – A method of treatment that involves the temporary or permanent placement of radiation source(s) (isotopic or electronic) inside or immediately adjacent to a tumor-bearing region.

**CCI** – Cardiovascular Credentialing International

**change management** – Systematic approach to preparing for, implementing and sustaining a change in process.

**clinical** – Pertaining to or founded on actual observations and treatments of patients.

**clinically competent** – The ability to perform a clinical procedure in a manner that satisfies the demands of a situation, as assessed and documented by a qualified individual.

**compounding medication** – The combining, mixing, pooling or otherwise altering of a conventionally manufactured drug in response to or anticipation of a medication order.

**compounding radiopharmaceutical** – The combining, mixing, pooling or otherwise altering of a conventionally manufactured radiopharmaceutical or synthesizing/formulating a radiopharmaceutical from bulk drug substances and radionuclides.

**contrast media** – A substance administered during a medical imaging procedure for the purpose of enhancing the contrast between an internal structure or fluid and the surrounding tissue.

**cropping** – The process of selecting and removing a portion of the image.

**custom blocks** – Devices designed to shape the radiation field.

**DICOM** – Acronym for “Digital Imaging and Communications in Medicine.” The DICOM standards are a complex set of instructions to exchange and present medical image information.

**dose distribution** – Spatial representation of the magnitude of the dose produced by a source of radiation. It describes the variation of dose with position within an irradiated volume.

**dose pooling** – Combining unit doses of a radiopharmaceutical to meet the dosage requirements of a single patient.

**dosimetric calculations** – Computation of treatment unit settings, monitor units, treatment times and radiation doses to anatomical areas of interest.

**ECG** – electrocardiogram

**educationally prepared** – The successful completion of didactic and clinical education necessary to properly perform a procedure in accordance with accepted practice standards.

**electronic masking** – Electronic collimation or cropping of the digital radiographic image that occurs during postprocessing of the acquired image and does not alter the size of the irradiated field.

**FDA** – U.S. Food and Drug Administration

**fiducial markers** – Fixed reference points against which other objects can be measured. They may be placed internally, at skin surface or fixed externally to the patient.

**GRADE** – Grading of Recommendations Assessment, Development and Evaluation

**HQCC** – Healthcare Quality Certification Commission

**hybrid imaging** – The combination of imaging technologies that allows information from different modalities to be presented as a single set of images.

**image-guided radiation therapy** – A process of using various imaging technologies to localize the target and critical tissues and, if needed, reposition the patient just before or during the delivery of radiotherapy.

**imaging technologies** – Technologies using ionizing and nonionizing radiation to visualize physiological processes, internal structures and fiducial markers, both anatomical and nonanatomical.



**immediate use** – Dose preparation, including one made using appropriate and necessary deviation, and/or the dispensing of a sterile radiopharmaceutical specific for a single patient.

**immobilization device** – Device that assists in maintaining or reproducing the position while limiting patient movement.

**initial observation** – Assessment of technical image quality with pathophysiology correlation communicated to a radiologist.

**interpretation** – The process of examining and analyzing all images within a given procedure and integration of the imaging data with appropriate clinical data in order to render an impression or conclusion set forth in a formal written report composed and signed by a licensed practitioner.

**interventional procedures** – Invasive medical imaging guidance methods used to diagnose and/or treat certain conditions.

**ISCD** – International Society for Clinical Densitometry

**JRC-DMS** – Joint Review Committee on Education in Diagnostic Medical Sonography

**least significant change** – The least amount of bone mineral densitometry change that can be considered statistically significant.

**licensed practitioner** – A medical or osteopathic physician, chiropractor, podiatrist or dentist who has education and specialist training in the medical or dental use of radiation and is deemed competent to perform independently or supervise medical imaging or radiation therapy procedures by the respective state licensure board.

**MDCB** – Medical Dosimetrist Certification Board

**medical physicist** – An individual who is competent to practice independently in the safe use of x-rays, gamma rays, electron and other charged particle beams, neutrons, radionuclides, sealed radionuclide sources, ultrasonic radiation, radiofrequency radiation and magnetic fields for diagnostic and therapeutic purposes. An individual is considered competent to practice in the field of medical physics if the individual is certified by the appropriate recognized certification organization.

**medication** – Any chemical substance intended for use in the medical diagnosis, cure, treatment or prevention of disease.

**minimal sedation (anxiolysis)** – A drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected.

**moderate sedation** – A drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.

**molecular imaging** – A noninvasive, diagnostic imaging technology that enables visualization, characterization and measurement of biologic processes at the molecular and cellular levels. Molecular imaging techniques may be applied to computed tomography, magnetic resonance, nuclear medicine, optical imaging, PET-CT, sonography and spectroscopy.

**monitor units** – Unit of output measure used for linear accelerators, sometimes indicated with the abbreviation MU. Accelerators are calibrated so that 1 MU delivers 1 cGy for a standard reference field size at a standard reference depth at a standard source to calibration point.

**MQSA** – Mammography Quality Standards Act

**MR Level 2 Personnel** – Individuals who have completed more extensive education in broad MR safety issues related to all MR energy fields.

**NECS** – National Education Curriculum for Sonography

**NMTCB** – Nuclear Medicine Technology Certification Board

**noninterpretive fluoroscopic procedures** – Use of fluoroscopic imaging under the direction of a licensed practitioner for purposes other than interpretation.

**normal tissue tolerance** – Radiation tolerance levels of healthy organs near or within the radiation treatment fields.

**NRC** – U.S. Nuclear Regulatory Commission

**panning** – Movement of the procedure table during image production to maintain visualization of an anatomic region of interest.

**personnel radiation monitoring devices** – Devices designed to be worn or carried by an individual for the purpose of measuring the dose of radiation received.

**physics survey** – Performing equipment testing, evaluating the testing results and completing a formal written report of results. The written survey report, validated by a medical physicist, contains sufficient information to document that each test was conducted according to local, federal or state requirements and includes an assessment of corrective actions and recommendations for improvements.

**point of care testing** – Medical diagnostic testing performed outside the clinical laboratory in close proximity to where the patient is receiving care (e.g., blood sugars, creatinine).

**postprocessing** – Computerized processing of data sets after acquisition to create a diagnostic or therapeutic image.

**procedure** – Specific course of action intended to result in an imaging study, treatment or other outcome.

**processing** – Manipulation of the raw data just after acquisition.

**protocol** – The plan for carrying out a procedure, scientific study or a patient's treatment regimen.

**quality assurance** – Activities and programs designed to achieve a desired degree or grade of care in a defined medical, nursing or health care setting or program. Sometimes indicated with the abbreviation QA.

**quality control** – The routine performance of techniques used in monitoring or testing and maintenance of components of medical imaging and radiation therapy equipment. This includes the interpretation of data regarding equipment function and confirmation that corrective actions are/were taken. Sometimes indicated with the abbreviation QC.

**radiation oncologist** – A physician who specializes in using radiation to treat cancer.

**radiation protection** – Prophylaxis against injury from ionizing radiation. The only effective preventive measures are shielding the operator, handlers and patients from the radiation source; maintaining appropriate distance from the source; and limiting the time and amount of exposure.

**radioactive material** – A substance composed of unstable atoms that decay with the spontaneous emission of radioactivity. Includes radiopharmaceuticals, unsealed sources (open, frequently in liquid or gaseous form) and sealed sources (permanently encapsulated, frequently in solid form).

**radiobiology** – The study of the effects of radiation on living organisms.

**radiography** – The process of obtaining an image for diagnostic examination using x-rays.

**radiotheranostics** – The use of radionuclides for the paired imaging and therapy agents.

**remote scanning** - Operator control of image acquisition from a physical location that is different from the patient.

**RSO** – Radiation Safety Officer

**scholarly activity** – Activities that systematically advance the teaching, research and practice of the medical imaging and radiation therapy profession through scientific investigation, presentation, and publication.

**setup** – Arrangement of treatment parameters used in preparation for delivering radiation therapy; includes patient positioning data, field alignment information and equipment configurations.

**shuttering** – A postprocessing technique that may be used to eliminate ambient light around an image for the sole purpose of improving the quality of the displayed image. It should not be used as a substitute for insufficient collimation of the irradiated field.

**simulation** – A process using imaging technologies to plan radiation therapy so that the target area is precisely located and marked; the mockup procedure of a patient treatment with medical imaging documentation of the treatment portals.

**SNMMI** – Society of Nuclear Medicine and Molecular Imaging

**static** – Any medical image that is fixed or frozen in time.

**supervising radiologist** – A board-certified or board-eligible radiologist who oversees duties of the radiologist assistant and has appropriate clinical privileges for the procedure performed by the radiologist assistant.

**theranostics** – The systematic integration of targeted diagnostics and therapeutics.

**timeout** – Preprocedural pause to conduct a final assessment that the correct patient, site and procedure are identified.

**tolerance levels (doses)** – The maximum radiation dose that may be delivered to a given biological tissue at a specified dose rate and throughout a specified volume without producing an unacceptable change in the tissue.

**treatment calculations** – *See dosimetric calculations.*

**treatment field (portal)** – Volume of tissue exposed to radiation from a single radiation beam.

**treatment planning** – The process by which dose delivery is optimized for a given patient and clinical situation. It encompasses procedures involved in planning a course of radiation treatment, including simulation through completion of the treatment summary.

**treatment record** – Documents the delivery of treatments, recording of fractional and cumulative doses, machine settings, verification imaging and the ordering and implementation of prescribed changes.

**T-score** – Number of standard deviations the individual's bone mineral density is from the average bone mineral density for gender-matched young normal peak bone mass.

**USP** – United States Pharmacopeia

**vascular access device** – Apparatus inserted into the peripheral or central vasculature for diagnostic or therapeutic purposes.

**vascular closure device** – Active or passive medical devices used to achieve hemostasis after a cardiovascular or endovascular procedure that requires catheterization.

**venipuncture** – The transcutaneous puncture of a vein by a sharp rigid stylet or cannula carrying a flexible plastic catheter or by a steel needle attached to a syringe or catheter.

**verification images** – Images produced to confirm accurate treatment positioning and accurate treatment portals.

**Z-score** – Number of standard deviations the individual's bone mineral density is from the average bone mineral density for age- and gender-matched reference group.