A stylized atom with a central nucleus of purple spheres and four red elliptical orbits, each with a purple electron. The background is a teal-to-blue gradient with faint circular patterns and numbers.

# RADIATION SAFETY FROM A DIAGNOSTIC PERSPECTIVE

Carly Hansen, MS  
April 18, 2021



## DISCLOSURES

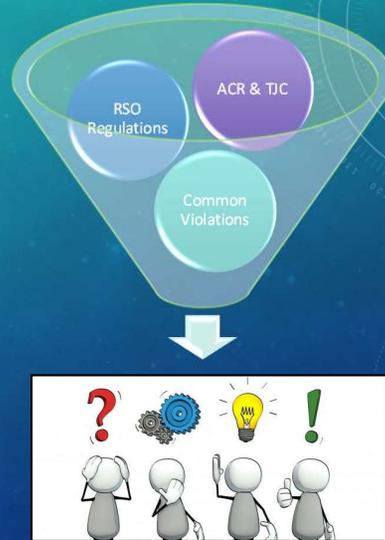
- None



# OBJECTIVES

Understand the Diagnostic Physicist's responsibilities as RSO

Obtain a better understanding of common regulatory issues encountered in the medical use of radioactive material and x-ray equipment



# ABOUT ME



Medical Physicist – Texas Children's Hospital, Houston, TX

Consulting Medical Physicist – Radcom Associates, Garland, TX



Health Physicist – Texas Radiation Control Program, Austin, TX

## WHAT IS A RADIATION SAFETY OFFICER?

According to the Conference of Radiation Control Program Directors' (CRCPD) Suggested State Regulations (SSR), an RSO is:

- *“an individual who has the knowledge and responsibility to apply appropriate radiation protection regulations and has been assigned such responsibility by the licensee or registrant”*



## RSO RESPONSIBILITIES

RAM

10 CFR 35.24(b)

A licensee's management shall appoint a:

- Radiation Safety Officer who agrees, in writing, to be responsible for implementing the radiation protection program.
- Shall ensure that radiation safety activities are being performed in accordance with licensee-approved procedures and regulatory requirements.

10 CFR 35.24(g)

A licensee shall provide the RSO sufficient authority, organizational freedom, time, resources, and management prerogative to:

- Identify radiation safety problems;
- Initiate, recommend, or provide corrective actions;
- Stop unsafe operations; and,
- Verify implementation of corrective actions.



## HOW DO YOU QUALIFY TO BE AN RSO? (RAM)

Board  
Certification

Training &  
Experience

RSO on a  
previous  
RAM  
License

Authorized  
Medical  
Physicist or  
Authorized  
User



## HOW DO YOU QUALIFY TO BE AN RSO? (RAM)

Board Certification

10 CFR Part 35.50(a)

- Is **certified by a specialty board** whose certification process has been recognized by the Commission or an Agreement State **and who meets the requirements in paragraph (d)** of this section. The names of board certifications that have been recognized by the Commission or an Agreement State are posted on the NRC's Medical Uses Licensee Toolkit web page.

10 CFR Part 35.50(d)

- Has **training in** the radiation safety, regulatory issues, and emergency procedures for the **types of use for which a licensee seeks approval**. This training requirement may be satisfied by completing training that is supervised by a Radiation Safety Officer, an Associate Radiation Safety Officer, authorized medical physicist, authorized nuclear pharmacist, or authorized user, as appropriate, who is authorized for the type(s) of use for which the licensee is seeking approval.



## HOW DO YOU QUALIFY TO BE AN RSO? (RAM)

### Board Certification

- American Board of Health Physics
- American Board of Science in Nuclear Medicine
  - Nuclear Medicine Physics & Instrumentation
  - Radiation Protection
- American Board of Radiology
  - Diagnostic Radiological Physics
  - Diagnostic Medical Physics
  - Medical Nuclear Physics
  - Nuclear Medical Physics
- American Board of Medical Physics
  - Medical Health Physics

Specialty Board Certification Process	Specialty Area	Sample Certificate Ex Date Range	Notes
American Board of Health Physics		January 1, 2005 to present	
American Board of Science in Nuclear Medicine	Nuclear Medicine Physics and Instrumentation Radiation Protection	June 2006 to present (a) June 2006 to present (a)	
American Board of Radiology	Diagnostic Radiologic Physics Diagnostic Medical Physics	June 2007 to June 2010 (a) May 2011 to May 2012 (a) May 2012 to May 2013 (a) May 2013 to May 2019 (a) May 2019 to present (a)	The words "RSO Eligible" must appear above the ABR seal. The words "RSO Eligible" must appear above the ABR seal. Certificates issued from May 2012 forward will initially be recognized for 4 years from the date of issuance and after the 4-year period, the ABR web site (www.abr.org) should be checked to ensure that the individual is still certified. The ABR members the certification status of its diplomates and posts this information on its web site (www.abr.org) for all individuals including those certified after 2012.
	Medical Nuclear Physics	June 2007 to June 2010 (a)	The words "RSO Eligible" must appear above the ABR seal.
	Nuclear Medical Physics	May 2011 to May 2012 (a) May 2012 to May 2013 (a) May 2013 to May 2019 (a) May 2019 to present (a)	The words "RSO Eligible" must appear above the ABR seal. Certificates issued from May 2012 forward will initially be recognized for 4 years from the date of issuance and after the 4-year period, the ABR web site (www.abr.org) should be checked to ensure that the individual is still certified. The ABR members the certification status of its diplomates and posts this information on its web site (www.abr.org) for all individuals including those certified after 2012.
American Board of Medical Physics	Medical Health Physics	2010 to present (a)	The words "RSO Eligible" must be on the certificate.

<https://www.nrc.gov/materials/miau/med-use-toolkit/spec-board-cert.html>

## HOW DO YOU QUALIFY TO BE AN RSO? (RAM)

### Training and Education

10 CFR Part 35.50(b)

#### 200 hours of classroom and laboratory training

- Radiation physics and instrumentation
- Radiation protection
- Mathematics pertaining to the use and measurement of radioactivity
- Radiation biology
- Radiation dosimetry

#### One year of full-time radiation safety experience under the supervision of an RSO. Experience must involve:

- Shipping, receiving, and performing related radiation surveys;
- Using and performing checks for proper operation of instruments used to determine the activity of dosages, survey meters, and instruments used to measure radionuclides;
- Securing and controlling byproduct material;
- Using administrative controls to avoid mistakes in the administration of byproduct material;
- Using procedures to prevent or minimize radioactive contamination and using proper decontamination procedures;
- Using emergency procedures to control byproduct material; and
- Disposing of byproduct material;
- **Written attestation, signed by a preceptor Radiation Safety Officer**
- Must state that the individual has satisfactorily completed the requirements in paragraphs (b)(1) and (d) of this section, and is able to **independently fulfill the radiation safety-related duties as a Radiation Safety Officer**

# HOW DO YOU QUALIFY TO BE AN RSO? RAM

## Training and Education

To whom it may concern:

I am writing to request the following changes to our Radioactive Material License:

- Please change the radiation safety officer (RSO) to Carly Hansen, MS.
  - Ms. Hansen has completed 200 hours of classroom and laboratory training in the following areas:

Radiation physics and instrumentation	PHYS 6992	48 hours
Radiation protection	PHYS 6700	48 hours
Mathematics pertaining to the use and measurement of radioactivity	PHYS 6730	48 hours
Radiation biology	RONC 7370	64 hours
Radiation dosimetry	PHYS 6993	48 hours

Please see the attached transcript showing these hours accompanied with course descriptions from the 2011-2012 East Carolina University Graduate Course Catalog.

- In addition to the 200 hours of training, Ms. Hansen has had training in the radiation safety, regulatory issues, and emergency procedures for the types of uses authorized by our license.
- She has had one year of full-time radiation safety experience under the supervision of an RSO identified on TX RAM License No. XXXX. The experience included the following:
  - Shipping, receiving, and performing related radiation surveys;
  - Using and performing checks for proper operation of dose calibrators, survey meters, and instruments used to measure radionuclides;
  - Securing and controlling radioactive material;
  - Using administrative controls to avoid mistakes in the administration of radioactive material;
  - Using procedures to control radioactive material; and
  - Disposing of radioactive material.
- Please see the attached attestation letter, signed by a preceptor RSO, documenting the above-mentioned training and experience.

**6710. Nuclear Medicine Physics (3)** P: PHYS 4417 or consent of director of medical physics. Comprehensive overview of physical aspects of diagnostic and therapeutic applications of radionuclides, radiation beams and measurement, imaging systems, and related equipment with lab activities in facility design, instrumentation essentials, quality assurance, and survey techniques.

**6715. Biomedical Physics (3) Formerly PHYS 5715** P: Consent of instructor. Applies physics principles in biology and medicine.

**6718. Therapeutic Radiological Physics (3) Same as RONC 6718** P: Consent of director of medical physics. Production, application, and measurement of electromagnetic radiation and high energy particle beams in therapeutic practice. Emphasis on conceptual, instrumental, and methodological aspects of therapeutic radiology.

**6720. Physics of Medical Imaging (3)** P: PHYS 6710 or consent of director of medical physics program. Physical principles of diagnostic radiology. Analog and digital x-ray radiography (including mammography), fluoroscopy, and computed tomography. Principles and applications of ultrasound and magnetic resonance imaging. Diagnostic calibration, radionuclide sources, counters, scanners, cameras, dosimetry, recording media, film densitometry, non-film media, and image evaluation.

**6750. Risk Assessment, Risk Communication and Regulations (3)** P: Consent of instructor. Risk assessment and communication including radiative voluntary and coerced risks with focus in the nuclear industry.

**6810. Topics in Atomic Collisions (3)** P: Consent of instructor. Review of processes in atomic collisions and their quantitative understanding. Introduces theories required to describe experimentally-observed behavior in electron-atom, ion-atom, and/or molecule collisions, and methods of observations. Emphasis on general topics of interest as found in current literature and particular areas of research at ECU Accelerator Laboratory.

**6816, 6817. Seminar (1,1)** Equivalent of 1 lecture hour per week. Areas of research in progress in physics department.

**6900. Introduction to Research (1)** Literature and lab research on individual problems in major field.

**6992. Radiation Therapy Physics (1) Same as RONC 6992** P: PHYS 6718 or RONC 6718. Radiation dose calculation and measurement of high energy photon and electron beams; high and low dose rate brachytherapy sources in clinical radiation therapy; cavity theory in ion chamber calibrations of photon and electron beams. Quality assurance, acceptance testing, and commissioning of equipment for clinical radiation therapy (linear accelerators, HDR, TLD, simulator, CT scanner).

**6993. Clinical and Medical Dosimetry (1) Same as RONC 6993** P: PHYS 6992 or RONC 6992. Practical patient dosimetry problems in radiation oncology: irregular field calculations, two- and three-dimensional treatment planning, isodose distribution, high and low dose rate brachytherapy planning for intracavitary, and interstitial radioactive sources.

**7000. Thesis (1-6)** May be repeated. May count maximum of 6 sh.

I am writing to attest that you have obtained training and experience in radiation safety aspects of the medical use of radioactive material per §289.256(b)(2). This experience includes all aspects regarding the use of RAM under specific authorizations in licenses 106601 and 106609 (including In-152 for HDR, Y-90 microspheres for the interstitial treatment of cancer, sealed source brachytherapy, and radiopharmaceutical therapy) from October 1, 2014 to November 6, 2015. This included RAM use as specified in §289.256(g), (h), including PET radiopharmaceuticals (88, and 68). This has included the following aspects:

- shipping, receiving, and performing related radiation surveys;
- using and performing checks for proper operation of dose calibrators, survey meters, and instruments used to measure radionuclides;
- securing and controlling radioactive material;
- using administrative controls to avoid mistakes in the administration of radioactive material;
- using procedures to prevent or minimize radioactive contamination and using proper decontamination procedures;
- using emergency procedures to control radioactive material; and
- disposing of radioactive material.

Additionally, you independently completed our coursework and test in D.O.T. Hazardous Materials training for which you were issued a certificate.

According to these requirements, I attest that you have achieved a level of radiation safety knowledge sufficient to function independently as an RSO for a medical use licensee in nuclear cardiology.

## Transcript

# HOW DO YOU QUALIFY TO BE AN RSO? (RAM)

## RSO on a previous RAM license

- If you have been an RSO on a RAM license in the past, you can typically submit a copy of that license that shows you as RSO in lieu of other documentation

To whom it may concern:

I am writing to request the following changes to our Radioactive Materials License:

- Please change the radiation safety officer to Carly Hansen, MS.
  - Please see the attached copy of RAM License No. XXXXXX for evidence of qualification.

Sincerely,  
*Signed by someone in upper management*

## HOW DO YOU QUALIFY TO BE AN RSO? (RAM)

Authorized User, Authorized Medical Physicist, or Board Certified Medical Physicist

10 CFR Part 35.50(c)

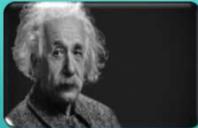
- (1) Is a medical physicist who has been certified by a specialty board whose certification process has been recognized by the Commission or an Agreement State under § 35.51(a)...
- (2) Is an authorized user, authorized medical physicist, or authorized nuclear pharmacist identified on a Commission or an Agreement State license...

10 CFR Part 35.50(d)

- Has training in the radiation safety, regulatory issues, and emergency procedures for the types of use for which a licensee seeks approval. This training requirement may be satisfied by completing training that is supervised by a Radiation Safety Officer, an Associate Radiation Safety Officer, authorized medical physicist, authorized nuclear pharmacist, or authorized user, as appropriate, who is authorized for the type(s) of use for which the licensee is seeking approval.



## PATHWAYS FOR QUALIFYING AS RSO (RAM)



Physicist

- Four pathways outlined above



Technologist (x-ray or nuclear medicine)

- Can qualify under the *Training and Education*
- May have to take a specific RSO course to complete required training hours
- May be able to show training hours through transcripts and continuing education
- Need "1 year RSO experience"



Physician

- Qualify under *Training and Education*
- Required hours and topics are completed in radiology residency program
- Need "1 year RSO experience"
- Qualify under *Authorized User* status
- Still need some "RSO training" signed off by RSO



## TEMPORARY RSO

### RAM

#### 10 CFR 35.24(c)

- For up to 60 days each year, a licensee may permit *an individual qualified to be a Radiation Safety Officer, under §§ 35.50 and 35.59*, to function as a temporary Radiation Safety Officer and to perform the functions of a Radiation Safety Officer, as provided in paragraph (g) of this section, if the licensee takes the actions required in paragraphs (b), (e), (g), and (h) of this section and notifies the Commission in accordance with § 35.14(b).



## RADIATION SAFETY COMMITTEE

### When is it required?

#### 10 CFR 35.24(f)

#### Authorities and Responsibilities for the Radiation Protection Program

- Licensees that are authorized for *two or more different types of uses of byproduct material under Subparts E, F, and H* of this part, *or two or more types of units under Subpart H* of this part, shall establish a Radiation Safety Committee to oversee all uses of byproduct material permitted by the license. The Committee must include an authorized user of each type of use permitted by the license, the Radiation Safety Officer, a representative of the nursing service, and a representative of management who is neither an authorized user nor a Radiation Safety Officer. The Committee may include other members the licensee considers appropriate.



## RADIATION SAFETY COMMITTEE - WHEN IS IT REQUIRED?

2 or more of these:

Subpart E	Unsealed Byproduct Material – Written Directive Required
Subpart F	Manual Brachytherapy
Subpart H	Photon Emitting Remote afterloader Units, Teletherapy Units, and Gamma Stereotactic Radiosurgery Units

--- Or ---

2 or more of these:

Subpart H	Photon Emitting Remote afterloader Units, Teletherapy Units, and Gamma Stereotactic Radiosurgery Units
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## RSO RESPONSIBILITIES X-RAY

State Specific

Example: Texas

- Establishing and overseeing operating and safety procedures that maintain radiation exposures as low as reasonably achievable (ALARA)
  - Review operating procedures them at intervals not to exceed 12 months;
- Ensuring that individual monitoring devices are properly used by occupationally-exposed personnel, that records are kept of the monitoring results, and that timely notifications are made as required by §289.203 of this title;
- Investigating and reporting to the agency each known or suspected case of radiation exposure to an individual or radiation level detected in excess of limits established by this chapter
- Assuming control and having the authority to institute corrective actions including shut-down of operations when necessary in emergency situations or unsafe conditions; and
- Maintaining records as required by this chapter



## HOW DO YOU QUALIFY TO BE AN RSO? X-RAY

### State Specific Requirements

### Typically More Pathways

### Less Strict T&E requirements

### State specific

- knowledge of potential radiation hazards and emergency precautions; and
- completed educational courses related to ionizing radiation safety or a radiation safety officer course; or
- experience in the use and familiarity of the type of equipment used.



## EXAMPLE X-RAY RSO PATHWAYS

### Example: Texas

#### Physician

- Practitioner with documentation of licensing board number

#### Physicist

- Texas medical physics license

#### Technologist

- ARRT & 2 years experience
- MRT & 2 years experience
- LMRT & 4 years experience

#### Other

- Associate degree in radiologic technology, health physics, or nuclear technology, and at least 2 years experience
- Nurse & 2 years experience with radiation machines
- PA & 2 years experience
- Bachelor's or higher in radiologic technology, health physics, or nuclear technology and at least 2 years of supervised experience



## HOW DO YOU QUALIFY TO BE AN RSO? X-RAY

Example: Minnesota

The individual designated as a radiation safety officer must be either a licensed practitioner of the healing arts;

or an individual who has completed training in the following items:

- fundamentals of radiation safety;
- familiarization with facility's radiation-producing equipment;
- film processing, if applicable;
- quality assurance program;
- audits of the quality assurance program;
- emergency procedures for radiation-producing equipment failures;
- proper use of personal dosimetry, if applicable;
- requirements of pertinent state rules; and
- the registrant's written operating and emergency procedures



## ACR & TJC



## TJC - RSO

LD.04.01.05 EP25

The hospital designates an individual to serve as the radiation safety officer who is responsible for making certain that radiologic services are provided in accordance with law, regulation, and organizational policy.

This individual has the necessary authority and leadership support to do the following:

- Monitor and verify compliance with established radiation safety practices (including oversight of dosimetry monitoring)
- Provide recommendations for improved radiation safety
- Intervene as needed to stop unsafe practices
- Implement corrective actions



## TJC – OCCUPATIONAL DOSIMETRY

EC.02.02.01 EP 17.

For CT, PET, NM, or Fluoro

- The *results of staff dosimetry monitoring are reviewed at least quarterly*
- To assess whether staff radiation exposure levels are ALARA
- Reviewed by:
  - RSO
  - Diagnostic medical physicist
  - Health physicist

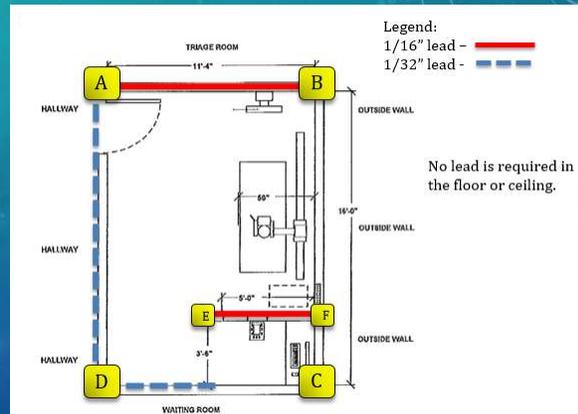


## TJC - SHIELDING DESIGNS

### EC.02.06.05 EP 4

#### For CT, PET, or NM services:

- A structural radiation shielding design assessment is conducted
- Prior to:
  - Installation of new imaging equipment
  - Replacement of existing imaging equipment
  - Modification to rooms
- For:
  - Rooms where ionizing radiation will be emitted
  - Rooms where radioactive materials will be stored (scan rooms or hot labs)
- Conducted by:
  - Medical physicist
  - Health physicist



## TJC - SHIELDING INTEGRITY TESTING

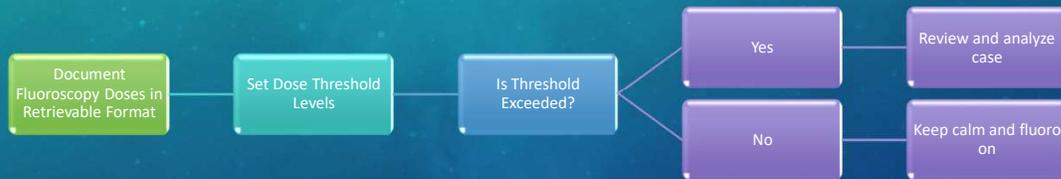
### EC.02.06.05 EP 6

#### For CT, PET, or NM services:

- Radiation protection survey to verify the adequacy of installed shielding
- Prior to:
  - Clinical Use of Room
- For:
  - Installation of imaging equipment
  - Construction in rooms where ionizing radiation will be emitted
  - Construction in rooms where radioactive materials will be stored (scan rooms or hot labs)
- Conducted by:
  - Medical physicist
  - Health physicist



## TJC – FLUOROSCOPY DOSE TRACKING AND REFERENCE LEVELS



## TJC – FLUOROSCOPY DOSE DOCUMENTATION

PC.01.02.15 EP 13

For hospitals that provide fluoroscopic services:

- The ***cumulative-air kerma or kerma-area product is documented in a retrievable format.***
- For fluoroscopy equipment that cannot display or provide cumulative-air kerma or kerma-area product, fluoroscopy time and number of images acquired are documented in a retrievable format, such as a picture archiving and communication system.
- Note: This element of performance does not apply to fluoroscopy equipment used for therapeutic radiation treatment planning or delivery or fluoroscopy equipment classified as a mini C-arm.

## TJC – FLUOROSCOPY DOSE THRESHOLD LEVELS

PC.02.01.01 EP 30

For hospitals that provide fluoroscopic services:

- The hospital *identifies radiation exposure and skin dose threshold* levels that, if exceeded, trigger further review and/or patient evaluation to assess for adverse radiation effects
- Note 1: Information on radiation exposure thresholds can be found in the National Council on Radiation Protection's (NCRP) report number 168 and on the US FDA's CDRH website.
- Note 2: Radiation exposure thresholds may be established based on metrics such as reference-air kerma, cumulative-air kerma, kerma-area product, or fluoroscopy time.



## TJC – FLUOROSCOPY DOSE REVIEW

PC.02.01.01 EP 20

For hospitals that provide fluoroscopic services:

- The hospital *reviews and analyzes instances where the radiation exposure and skin dose threshold levels identified by the organization are exceeded.*



# AMERICAN COLLEGE OF RADIOLOGY (ACR)

## ACR Toolkit

- Updated from time-to-time
- Make sure you are using the most up-to-date Toolkit
- Will make ACR surveys go smoother!



<https://www.acraccreditation.org/resources/validation-site-survey>



# ACR - ULTRASOUND

2/11/2021

## Ultrasound/Breast Ultrasound Equipment Annual Survey Summary

- All facilities applying for accreditation or renewal must demonstrate compliance with the ACR ultrasound QC requirements by completing and submitting the ACR's [Ultrasound/Breast Ultrasound Equipment Annual Survey Summary](#) for each unit.
- strongly recommend submitting the ACR [Ultrasound/Breast Ultrasound Equipment Annual Survey Summary](#) page,
- may provide own summary as long as it itemizes the pass/fail results for each required test.
- The original comprehensive annual survey report must be retained by the facility and will be requested during validation site surveys.

Ultrasound/Breast Ultrasound Equipment Annual Survey Summary		
Facility Name:		
LIAP/BLIAP #:	Unit #:	Report Date:
Serial Number:	Survey Date:	
System Manufacturer:	Model:	
Medical Physicist or designee (Print name):		
Medical Physicist or designee (Signature):		
Equipment Evaluation Tests		
Required	Pass/Fail *	Comments
1. Physical and Mechanical Inspection		
2. Image Uniformity and Artifact Survey		
3. System Sensitivity		
4. Scanner Electronic Image Display Performance		
Were all clinically used transducers tested? <input type="checkbox"/> YES <input type="checkbox"/> NO		
Optional		
1. Primary Interpretation Display Performance		
2. Contrast Resolution		
3. Spatial Resolution		
4. Geometric Accuracy		
Overall comments:		
<small>*If any Fail result is indicated above, documentation of corrective action is required.</small>		
<small>Revised 09/2020</small>		



## ACR - NUCLEAR MEDICINE

Quality Control: Nuclear Medicine

↓

“Continuous Quality Control”

↓

Phantom Scan

**Required Semiannually**

Recommended Quarterly

Nuclear Medicine Technologist's Quality Control Tests		
Test	Description	Frequency
Intrinsic or System Uniformity	Performed to verify that components are properly functioning and provide a uniform image in response to a uniform flux of radiation	Each day of use
Intrinsic or System Spatial Resolution	Performed to quantitatively verify that detector spatial resolution is satisfactory for clinical imaging – The weekly resolution phantom is not necessary on cameras with pixilated detectors but a resolution image using either the ACR SPECT phantom (preferred) or a 4-quadrant bar phantom must be done at least semi-annually, and also submitted with the accreditation application	Weekly
Center of Rotation	Performed to maintain ability to resolve details in clinical SPECT studies	Monthly
High-Count Floods for Uniformity Correction	Performed to correct for residual detector and collimator non-uniformity and to minimize the production of artifacts in clinical studies	As recommended by a qualified medical physicist
Overall System Performance for SPECT Systems	Performed to qualitatively verify that the system has maintained its capabilities with respect to tomographic uniformity, contrast, and spatial resolution that maximize the benefit in clinical studies. Technetium must be done at least semiannually; other radionuclides may be tested on alternate quarters.	Semiannually (quarterly recommended)
Dose Calibrators	<ul style="list-style-type: none"> <li>*Daily: Tests are performed to verify that the calibrator is accurate and reliable for the assay of doses administered to patients</li> <li>*Quarterly: A linearity test must be performed to document that accurate readings are provided through the entire range of activities used clinically. Other qualified personnel may do these tests</li> <li>*Semiannually: All non-exempt radionuclide sources must be tested to verify that radioactivity is not leaking from the sources. Other qualified personnel may also do these tests</li> </ul>	Daily, quarterly, and semiannually, as indicated
Thyroid Uptake and Counting Systems	Standards are measured to verify energy calibration and sensitivity for the measurement of organ function and the assay of patient samples	Each day of use

<https://accreditation.support.acr.org/support/solutions/articles/11000061046-quality-control-nuclear-medicine-revised-3-10-2021>

## ACR - NUCLEAR PET

Quality Control: PET

↓

Phantom Scan

**Required Semiannually**

Recommended Quarterly

ACR **Accreditation Support**

Home Solutions

**How can we help you today?**

SEARCH

[Solution home](#) / [Nuclear Medicine and PET Accreditation](#) / [Equipment, QC and QA: Nuclear Medicine/PET](#)

📄 **Quality Control: PET (Revised 3-10-2021)** 🖨️ Print

🕒 Modified on: Wed, 10 Mar, 2021 at 9:38 AM

📜 [Revision History](#)

It is recommended that the quality control (QC) testing be performed in accordance with the ACR Technical Standard for Medical Nuclear Physics Performance Monitoring of PET Imaging Equipment, as applicable. Data will continue to be collected regarding the QC tests performed by the facility. Based on these data, the ACR Committee on Nuclear Medicine Accreditation may establish QC requirements in the future. At this time, the ACR strongly recommends quarterly testing of each PET system with an appropriate ACR-approved phantom such as described below in addition to other tests recommended by the vendor. At a minimum, testing with the appropriate phantom must be performed semi-annually, but quarterly testing is strongly recommended.

<https://accreditation.support.acr.org/support/solutions/articles/11000062295-quality-control-pet#RevisionHistory>

## COMMON RECOMMENDATIONS / VIOLATIONS



## HAZMAT TRAINING FREQUENCY

### DOT

- All employees involved with the packaging, marking, labeling, measuring, loading, transporting, and storage of packages containing radioactive material are classified as “Hazmat Employees” and must have DOT training within 90 days of employment and **every 3 years** thereafter. (49 CFR 172.704)

### IATA (International Air Transport Association)

- 2 years
- Ex: rubidium generators are shipped by air





# LABELS FOR RAM SOURCES AND SOURCE HOLDERS

## 10 CFR 20.1904 Subpart J – Precautionary Procedures

### Labeling Containers

- The licensee shall ensure that each container of licensed material bears a durable, clearly visible label bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL." The label must also provide sufficient information (such as the radionuclide(s) present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation in the vicinity of the containers, to take precautions to avoid or minimize exposures. levels, kinds of materials, and mass enrichment) to permit individuals handling or using the containers, or working

## 10 CFR 20.1905

### Exemptions to labeling requirements

- A licensee is not required to label:
  - Containers holding licensed material in quantities less than the quantities listed in appendix C to part 20...
  - Co-57: 100 uCi
  - Cs-137: 10 uCi



# LABELS FOR RAM SOURCES AND SOURCE HOLDERS

## Common RAM Labeling Issues

### New flood sources

- Update the label on the existing case
- FYI, an extra label is included in the source envelope kit for this purpose!

### Watch vial sources (especially older ones)

- Labels can peel off
- Sometimes the label stays in place, but printing comes off





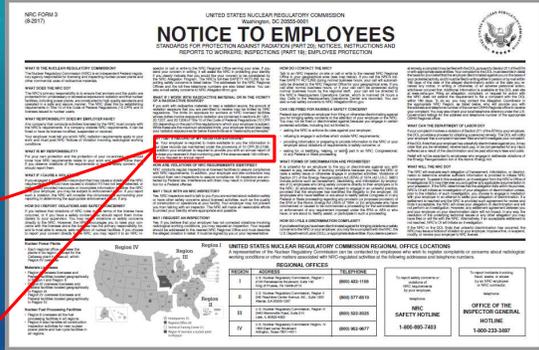
# PERSONNEL MONITORING – ANNUAL EXPOSURE

Provide Exposure in Writing

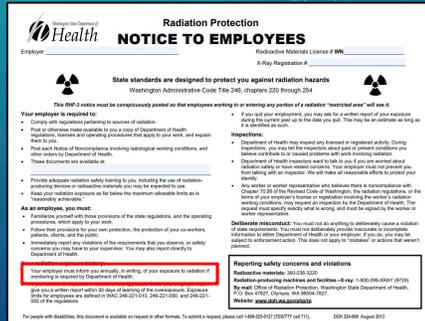
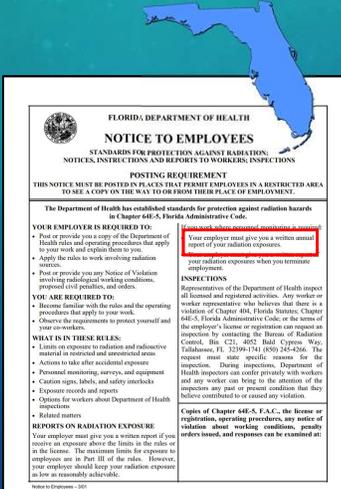
NRC Form 3 (or state equivalent)

“Notice to Employees”

- ...your employer is required to provide you with an annual report of the dose you received in that monitoring year if the dose exceeds 100 millirem, or if you request an annual report.



# PERSONNEL MONITORING – ANNUAL EXPOSURE





# PERSONNEL MONITORING – EDE CORRECTIONS

## EDE 1

- Two dosimeters
  - Waist level under lead apron
  - Collar level outside lead apron
- $1.5 (\text{waist DDE}) + 0.04 (\text{Collar DDE}) = \text{Assigned deep dose equivalent}$

Determine if your state accepts this correction method

## EDE 2

- One dosimeter
  - Collar level outside lead apron
- $0.3 (\text{Collar DDE}) = \text{Assigned deep dose equivalent}$

Determine which corrections are applicable to what employees



# TECHNIQUE CHARTS

Example: Texas

## Technique Chart Use

- A technique chart relevant to the particular radiation machine shall be provided or electronically displayed in the vicinity of the control panel and used by all operators.

## Technique chart definition

- A chart that provides technical factors, anatomical examination, patient thickness for examination being performed, and source-to-image distance needed to make clinical radiographs when the radiographic system is in manual mode.

RADIOGRAPHIC TECHNIQUE CHARTS									
<small>Note: If unit cannot exactly match the indicated mAs, select the mAs closest to, but does not exceed the indicated mAs.</small>									
Facility	Orientation	SID	Grid	Small		Medium		Large	
				kVp	mAs	kVp	mAs	kVp	mAs
<b>(ADULT)</b> Abdomen				18-20 cm		21-30 cm		31-40 cm	
	AP/PA Upright	40°	YES	80	18	80	35	80	71
	AP/PA Supine	40°	YES	80	18	80	35	80	71
Azimuthal/axial Joints				8-12 cm		12-20 cm		21-26 cm	
	With/Without	40°	YES	65	14	68	14	75	18
Ankle	AP/OBL/LAT	40°	NO	60	4	65	4	70	4
Calcaneus	LAT	40°	NO	60	4	65	4	70	4
	TANG	40°	NO	60	4	65	4	70	4
Chest				20-22 cm		23-31 cm		32-40 cm	
	PA/AP Grid	72°	YES	110	2	110	3	110	6
	PA/AP (no grid)	72°	NO	65	3	65	6	90	12
	LAT	72°	YES	110	7	120	13	130	22
	SECUB/GRID	72°	YES	180	4	195	4	110	4
Clavicle	AP/LAT	40°	YES	65	6	70	7	75	18
Elbow	AP/ANGLE 30	40°	YES	65	6	70	7	75	18
	AP/OBL/LAT	40°	NO	60	2	65	3	70	4
Facial Bones				18-17 cm		18-21 cm		22-26 cm	
	AP/CALDWELL	40°	YES	70	14	75	18	80	22
	LAT	40°	YES	70	11	75	14	75	18
Femur				15-16 cm		17-23 cm		24-30 cm	
	AP-Proximal	40°	YES	75	9	80	11	85	14
	AP-Distal	40°	YES	70	6	75	6	78	6
	Lac-Proximal	40°	YES	80	11	80	14	85	14
	Lac-Distal	40°	YES	70	6	75	6	78	6
	X-T Proximal	40°	YES	75	35	80	44	90	55
Fingers				3-2 cm		3-4 cm		5-6 cm	
	PA HAND	40°	NO	60	1	63	2	65	2
	OBL/LAT	40°	NO	60	1	60	1	65	1
Foot				5-6 cm		7-10 cm		11-14 cm	
	AP/OBL/L	40°	NO	60	2	60	3	60	4
	LAT	40°	NO	60	4	60	4	60	4
Forearms				6-7 cm		8-9 cm		10-12 cm	
	AP/LAT	40°	NO	60	4	60	6	65	6
Hand				3-4 cm		4-6 cm		7-8 cm	
	PA/OBL/LAT	40°	NO	60	1	63	2	65	2
Hip				18-20 cm		21-30 cm		31-40 cm	
	AP/LAT	40°	YES	75	14	80	14	80	18
	X-TABLE	40°	YES	75	35	80	44	90	55
Humerus				8-9 cm		10-12 cm		13-21 cm	
	AP/LAT	40°	YES	70	4	75	4	78	6
	TRANSRHOR	40°	YES	75	55	80	55	90	55
Knee				18-22 cm		18-25 cm		20-26 cm	
	AP/OBL/LAT	40°	NO	65	4	70	4	75	4
Mandible				12-14 cm		15-21 cm		22-26 cm	
	PA CALDWELL	40°	YES	75	14	80	14	85	14
	TOWNS	40°	YES	70	11	75	14	80	14
	OBLIQUE	40°	YES	70	4	75	4	80	6
Nasal Bones				13-14 cm		15-21 cm		22-26 cm	
	WATERS	40°	YES	75	11	80	15	85	18
	WATERS	40°	YES	75	4	80	4	85	4



## TECHNIQUE CHARTS

### Example: Minnesota

#### Radiographic Technique Chart

- A radiographic technique chart must be provided in the vicinity of the x-ray system's control panel.
- The technique chart must specify the following information for all examinations:
  - the technique factors to be used for anatomical parts and patient size;
  - the type of screen, type of film, and speed combination to be used;
  - the source-to-image distance to be used;
  - for automatic exposure control (AEC) or phototimed units, the percent differences between the AEC increments.
- For computed tomography systems, a current technique chart for each routine examination and the computed tomography conditions of operation must be provided.
- For filmless radiography, including computed radiography, digital radiography, computed tomography systems, and photostimulable storage phosphor imaging, the technique chart must reflect the adult and pediatric technique parameters for the individual system. This includes the manufacturer's requirements for technique parameters.

#### Exceptions.

- Diagnostic radiation-producing equipment manufactured with anatomical programming and industrial facilities with radiation-producing equipment are exempt from subpart 2.



## TECHNIQUE CHARTS

Be familiar with your state's regulations regarding technique charts

Develop a strategy for discussing with technologists

- Ask how/if techs use the technique chart
- Explain what an inspector may be looking for during an inspection
- Explain some physics measurements and how they impact the technique chart

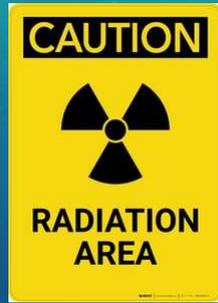
Demonstration

Have 3 or 4 technologists write down what technique they would use on an abdominal x-ray of yourself.

Compare answers – may be surprised at differences!



# CAUTION SIGNS FOR DIAGNOSTIC X-RAY & CT ROOMS



So many options.....



# CAUTION SIGNS FOR DIAGNOSTIC X-RAY & CT ROOMS

10 CFR 20.1902(a) - Subpart J

*Posting of radiation areas.*

- The licensee shall post each radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "**CAUTION, RADIATION AREA.**"

**Definitions**

- **Radiation area** means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates. 10 CFR §20.1003 Definitions

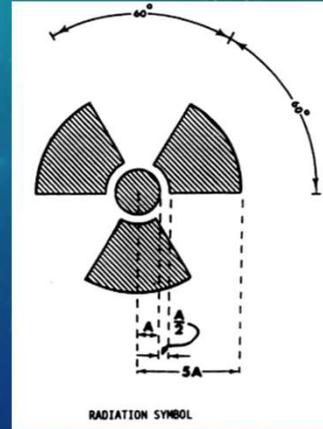


# CAUTION SIGNS FOR DIAGNOSTIC X-RAY & CT ROOMS

10 C.F.R. § 20.1901

## Caution Signs

- Sign must include standard radiation symbol
- Radiation symbol shall be **magenta, purple, or black** on **yellow** background



# RSO RESOURCES



NUREG-1556  
Volume 9, Rev. 3

## Consolidated Guidance About Materials Licenses

Program-Specific Guidance About Medical Use Licenses

AAPM REPORT NO. 160



## Radiation Safety Officer Qualifications for Medical Facilities

Report of AAPM Task Group 160

November 2010



## ACR-AAPM Radiation Safety Officer Resources

Essential information for radiation safety officers at medical imaging facilities.

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THANK YOU FOR LISTENING

