Computed Tomography: Annual Safety Training

Name: _____

Facility: _____

Once you have reviewed the material referenced, initial the left hand column for each item.   Further information on select items listed can be found at the web links below.

	Radiation dose optimization for adult and pediatric protocols, as addressed in Image Gently and Image Wisely campaigns
	Safe procedures for operation of CT equipment
	Expected or typical dose levels for common CT exams
	Dose notification and alert levels
	Adult CT scan protocols

I have read the documents and understand their content. I have visited the linked websites and am familiar with the information available to myself and my patients referenced in these sites. If I have any questions in the future regarding these matters, I realize that I may request additional information from my supervisor, the Radiation Safety Officer, or a physicist at Medical Physics Consultants, Inc. (734-662-3197).

Signature: _____   Date:_____

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Radiation dose optimization:
Patient radiation doses from CT scans can be much higher than those delivered in routine diagnostic radiology. Many organizations have taken on campaigns to optimize or minimize the radiation levels delivered from CT.

Image Gently was created to help healthcare providers use lower radiographic techniques for pediatric patients, in part because adult techniques had been inappropriately used and because young patients are more sensitive to radiation effects.
This website has many resources, including vendor-specific modules, to help you modify your protocols to keep pediatric dose optimize. We recommend that you visit this site and "Take the Pledge" at:
http://www.imagegently.org/Procedures/ComputedTomography.aspx

Image Wisely was created to help reduce radiation doses for adult patients. Their website has resources to guide protocol modification for dose optimization, vendor-specific information provided by CT manufacturers. Please visit to "Take the Pledge" at:
http://www.imagewisely.org/Imaging-Modalities/Computed-Tomography

Safe procedures for operation of CT equipment:
As part of the effort to improve CT dose optimization, several organizations have developed CT scanner performance requirements. NEMA-MITA, has developed "XR-29 Standard Attributes on CT Equipment Related to Dose Optimization and Management", also called "Smart Dose". There are 4 components to Smart Dose.

1. DICOM Radiation Dose Structured Report for post-exam electronic reporting of dose levels delivered from each exam. This can be included in the patient's record and compared to national benchmarks for comparison.
2. CT Dose Check incorporates the programmed dose notification and alert levels to caution the CT operator prior to scanning with an excessive technique that will exceed threshold levels.
3. Automatic Exposure Control allows the CT scanner to modulate the tube current (mA) to maintain optimum dose levels to the image detectors. It can be preset based on localization scans or on-the-fly variable modulation during scanning.
4. Pediatric and Adult Reference Protocols must be preloaded on the system. These protocols should be routinely reviewed to ensure they are still relevant and that dose levels are within guidelines.

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Expected or typical CT dose levels:

Medical Physics Consultants, Inc. (MPC) has developed the following table of expected CTDIvol ranges, based on years of testing hundreds of CT scanners. Any CTDIvol values that are outside these ranges should be evaluated to determine if the exposure to the patient was appropriate. CT image quality generally improves as the CTDIvol increases. A CTDIvol below the minimum range could be an indication that patient dose was low enough to result in poor image quality. However, a low value could be acceptable if the patient was very small. A CTDIvol above the maximum could be an indication that the dose was higher than necessary to give good image quality. However, a high value could be acceptable if the patient was very large. Use the attached "Abnormal CTDIvol Tracking Log" to meet The Joint Commission's requirement (PL.02.01.01.A6) to record any CTDIvol values outside the expected ranges. If there are instances that cannot be adequately explained by patient size, work with your CT protocol committee to improve that particular protocol.

Adult CT scan protocols:

Several common adult CT exam protocols are listed on the American Association of Physicists in Medicine website. Vendor-specific recommendations for exam protocols and teaching presentations can be found at this link:
http://aapm.org/pubs/CTProtocols/

CT Protocol Committee:

The Joint Commission requires (PC.01.03.01.A26) that CT imaging protocols be kept current with input from an interpreting physician, a medical physicist, and the lead CT technologist, who comprise the CT Protocol Committee. After an initial thorough review, any proposed changes to the saved protocols need to be approved by the CT Protocol Committee. Ideally, the existing protocols will be password protected with a password known only to the lead CT technologist and the CT/radiology manager. None of this prevents a technologist from using his/her expertise to optimize the CT technique factors for an individual exam as may be necessary.

Typical ranges for CTDIvol for common CT exams

*These guidelines are for educational purposes only and
should not be considered standards or limits.*

	Low CTDIvol (mGy)	Normal CTDIvol (mGy)	High CTDIvol (mGy)	*Phantom Size*
Brain	40	60	80	*16 cm*
Sinus, Facial Bones should be less than half of these values				
Base of Head	70	100	120	*16 cm*
includes: Posterior Fossa, IAC				
Brain Perfusion	250	500	600	*16 cm*
Spine	10	30	60	*32 cm*
includes: Cervical, Thoracic, Lumbar, Neck, Shoulder				
Chest	8	12	25	*32 cm*
includes: Chest, PE, AAA				
Low Dose Lung Screening	1	3	5	*32 cm*
includes: Ca Scoring, CTA				
Abdomen	8	18	50	*32 cm*
includes: Abdomen, Pelvis, Renal Stones, Urogram, Carotid				
Extremity	4	8	20	*32 cm*
Extremity	8	16	40	*16 cm*
includes: Hand, Elbow (above torso), Foot, Ankle, Knee				
Pediatric Head (< 10 years old)	20	30	50	*16 cm*
Sinus, Facial Bones should be less than half of these values				
Pediatric Abdomen (<10 yrs old)	3	8	15	*32 cm*
Pediatric Abdomen (<10 yrs old)	5	12	25	*16 cm*
Pediatric Chest (<10 years old)	2	5	10	*32 cm*
Pediatric Chest (<10 years old)	4	10	20	*16 cm*

Michigan Rule R325.5713(2) states "The CT operator shall check the display panel before and after performing each scan to make sure the amount of radiation delivered is appropriate for the technique and individual patient. This may be accomplished by reviewing dose indicator devices if available or dose indices such as the technique factors. Dose indicators or indices outside of expected values shall be documented and reviewed by an interpreting physician or medical physicist."

Dose Notification (CTDIvol for a single series) Suggestion:
  If more than 2% of your patients generate dose notifications, contact your physicist for advice regarding those specific protocols/notifications.

Dose Alert (highest CTDIvol from the entire exam) Suggestion:
  Do not require a password to exceed the Dose Alert.
  If Dose Alert is set for the system as a whole, use 1000 mGy.

Dose notification and alert levels:

NEMA-MITA has developed "XR-25 Dose Check Standard" with 2 action levels regarding radiation doses from CT scans. The Notification value is the projected level of radiation prior to each scan that might exceed the following thresholds established by the ACR/AAPM:

Exam	CTDIvol (mGy)
Adult Head	80
Adult Torso	50
Brain Perfusion	600
Cardiac-retrospective	150
Cardiac-prospective	50
Pediatric Head (<2 year old)	50
Pediatric Head (2-5 year old)	60
Pediatric Torso	25

Notification values need to be programmed in as part of each scan's protocol. The nationally established Notification values are high and are almost never reached. Your MPC physicist can assist you in establishing Dose Notification values appropriate for your particular scanner's characteristics.

The Alert value triggers an alert to the CT operator when the system projects that the combined planned scans in an exam will exceed the set threshold level. Generally, one Alert level is established for all the protocols on a scanner. MPC does not recommend requiring a password to be entered when Alert levels are exceeded, but does require the operator to document the reason that the Alert value was exceeded. The standard can be found here:

http://www.nema.org/Standards/Pages/Computed-Tomography-Dose-Check.aspx

Abnormal CTDI$_{vol}$ Tracking Log

Site: _____   **Scanner:** _____

Exam date	Patient ID	Exam type	Patient Size		Delivered Dose		Date reported	Date reviewed	Reviewer's Initials
			Height	Weight	CTDI$_{vol}$	DLP			
Analysis:									
Analysis:									
Analysis:									
Analysis:									
Analysis:									
Analysis:									
Analysis:									
Analysis:									
Analysis:									