

# Radiation Dosimetry for CT Protocols

This document contains radiation dosimetry information from CT scans and can be used by investigators to estimate the dosimetry information required by the JRSC or RDRC for research protocols involving human subjects. For all research studies involving CT scans and requiring JRSC or RDRC approval, researchers are to provide  $CTDI_{vol}$ , DLP, and effective dose values for the clinical exam to be given. Researchers using CT in conjunction with radiopharmaceuticals are in addition required to provide critical organ dose estimates.

## CT Dosimetry for Procedures not Involving Radiopharmaceuticals

In general, investigators should provide the most accurate dose estimates possible. Dosimetry of clinical protocols is provided for typical, scanner-specific protocols for scanners in the medical center for the following routine adult CT examinations:

- head
- neck
- chest
- abdomen
- pelvis

If an investigator knows which CT scanner will be used, scanner specific information should be used to fill out the form. If this information is unknown or unavailable, the average CT scanner information provided below may be used instead.

***Users should take special care when providing dose estimates for special CT protocols. It is the principal investigator's responsibility to provide reasonable estimates of all radiation doses a patient may incur.***

# **Table 1**

## **Average CT Scanner**

<b>Scan type</b>	<b>CTDIvol (mGy)</b>	<b>DLP (mGy-cm)</b>	<b>Effective dose (mrem)</b>
Adult head	59.7	1044.3	219
Adult abdomen	14	310.6	525
Adult pelvis	14	310.6	525
Adult chest	8.4	294.0	412
Adult neck	14.9	223.8	132
Pediatric abdomen	8.5	126.9	270

## **Milstein 2nd Floor - Spect-CT**

<b>Scan type</b>	<b>CTDIvol (mGy)</b>	<b>DLP (mGy-cm)</b>	<b>Effective dose (mrem)</b>
Adult head	33.59	587.8	123
Adult abdomen	4.94	123.5	185
Adult pelvis	4.94	123.5	185
Adult chest	2.96	103.6	145
Adult neck	8.40	126.0	74

## **Irving 1st Floor - Siemens Sensation 16**

<b>Scan type</b>	<b>CTDIvol (mGy)</b>	<b>DLP (mGy-cm)</b>	<b>Effective dose (mrem)</b>
Adult head	58.30	1020.25	214
Adult abdomen	9.30	232.5	349
Adult pelvis	9.30	232.5	349
Adult chest	5.58	195.3	273
Adult neck	14.58	218.7	129

## **Irving 1st Floor - GE Lightspeed 64 VCT**

<b>Scan type</b>	<b>CTDIvol (mGy)</b>	<b>DLP (mGy-cm)</b>	<b>Effective dose (mrem)</b>
Adult head	85.50	1496.25	314
Adult abdomen	16.50	412.5	619
Adult pelvis	16.50	412.5	619
Adult chest	9.90	346.5	485
Adult neck	21.38	320.7	189

## **Milstein 8th Floor - GE Lightspeed Pro**

<b>Scan type</b>	<b>CTDIvol (mGy)</b>	<b>DLP (mGy-cm)</b>	<b>Effective dose (mrem)</b>
Adult head	63.40	1109.5	233
Adult abdomen	20.70	517.5	776
Adult pelvis	20.70	517.5	776

Adult chest	12.42	434.7	609
Adult neck	15.85	237.75	140

#### VC-ER - Siemens Sensation 10

Scan type	CTDIvol (mGy)	DLP (mGy-cm)	Effective dose (mrem)
Adult head	50.16	877.8	184
Adult abdomen	13.52	338.0	507
Adult pelvis	13.52	338.0	507
Adult chest	8.11	283.85	397
Adult neck	12.54	188.1	111
Pediatric Abdomen	7.37	110.55	233

#### Allen Pavilion - Siemens Sensation 4

Scan type	CTDIvol (mGy)	DLP (mGy-cm)	Effective dose (mrem)
Adult head	61.86	1082.55	227
Adult abdomen	15.78	394.5	592
Adult pelvis	15.78	394.5	592
Adult chest	9.47	331.45	464
Adult neck	15.47	232.05	137
Pediatric Abdomen	11.40	171.0	360

#### CHONY 3rd Floor - GE Lightspeed VCT

Scan type	CTDIvol (mGy)	DLP (mGy-cm)	Effective dose (mrem)
Adult head	58.60	1025.5	215
Adult abdomen	17.97	449.25	674
Adult pelvis	17.97	449.25	674
Adult chest	10.78	377.3	528
Adult neck	14.65	219.75	130
Pediatric Abdomen	6.63	99.24	209

#### Milstein 3rd Floor - Siemens Volume Zoom 4

Scan type	CTDIvol (mGy)	DLP (mGy-cm)	Effective dose (mrem)
Adult head	66.00	1155.0	243
Adult abdomen	13.30	332.5	499
Adult pelvis	13.30	332.5	499
Adult chest	7.98	279.3	391
Adult neck	16.50	247.5	146

## Organ Doses for Procedures Involving Radiopharmaceuticals

Investigators using radiopharmaceuticals for research studies requiring JRSC or RDRC approval are required to provide critical organ dose information. The table below provides dose estimates using an average CT scanner at the medical center from routine adult CT examinations to all organs defined in ICRP 103. These organ dose estimates are provided by the ImPACT CT Patient Dosimetry Calculator.

For researchers using PET/CT, the CT dose estimates below should not be used

### Table 2

Organ	CT Examination Type				
	Abdomen <i>Organ Dose (mrad)</i>	Pelvis <i>Organ Dose (mrad)</i>	Chest <i>Organ Dose (mrad)</i>	Neck <i>Organ Dose (mrad)</i>	Head <i>Organ Dose (mrad)</i>
Gonads	99	1000	1	0	0
Bone Marrow	360	510	360	120	400
Colon	800	1100	8	0	0
Lung	300	3	1300	44	23
Stomach	1900	67	120	1	1
Bladder	50	2100	0	0	0
Breast	74	3	1200	8	6
Liver	1800	44	180	3	2
Oesophagus (Thymus)	54	0.96	1500	38	20
Thyroid	6	0.26	220	2300	550
Skin	310	320	240	160	420
Bone Surface	570	530	690	400	1600
Brain	0	0	11	280	4900
Salivary Glands (Brain)	0	0	11	280	4900
Adrenals	1700	20	230	2	1
Small Intestine	930	1100	8	0	0
Kidney	2100	76	50	2	0
Pancreas	1700	39	180	2	2
Spleen	1800	35	140	38	2
Thymus	54	1	1500	0	20
Uterus / Prostate (Bladder)	110	2000	1	130	0.025
Muscle	390	490	260	1	190
Gall Bladder	1900	130	65	11	1
Heart	370	5	1300	0	6
ET region (Thyroid)	6	0	220	2300	550
Lymph nodes (Muscle)	390	490	260	130	190
Oral mucosa (Brain)	0	0	11	280	4900

Eye lenses	0	0	15	600	5500
Testes	4	400	0	0	0
Ovaries	190	1700	2	0	0
Uterus	170	1800	2	0	0
Prostate	50	2100	0	0	0

### Dose Estimates for Pediatric Patients

The effective dose estimates given above are for adults. These dose estimates can be used to estimate the effective dose to pediatric patients by using the scaling factors given below. These scaling factors, provided by Kersheed, may be used to provide an estimate of the dose to pediatric patients based on the dose received by an adult.

**Table 3**

	Head and Neck	Chest	Abdomen & Pelvis
Adult	1.0	1.0	1.0
15 y	1.1	1.0 - 1.1	1.0 - 1.1
10 y	1.2 - 1.3	1.1 - 1.4	1.2 - 1.5
5 y	1.6 - 1.7	1.2 - 1.6	1.2 - 1.6
1 y	2.2	1.3 - 1.9	1.3 - 2.0
Newborn (0 y)	2.3 - 2.6	1.4 - 2.2	1.4 - 2.4

Typical normalized effective doses to pediatric patients relative to adults

### Example for Dose Estimation Not Involving Radiopharmaceuticals

Consider a research protocol requiring two abdominal CT scans to be performed on the GE Lightspeed 64 VCT (Irving 1<sup>st</sup> Floor).

JRSC form 5c is to be used, since this protocol does not include radiopharmaceuticals. CTDI<sub>vol</sub>, DLP, and effective dose for the GE Lightspeed 64 VCT are read off of [table 1](#) above. Form 5c, page 3 would be as follows:

Exam	CTDI <sub>vol</sub> (mGy)	DLP (mGy-cm)	Effective Dose per exam (mrem)	Total No. of Exams per Study	Total Effective Dose per Study (mrem)
Abdominal CT	16.5	412.5	619	2	1238



**LIST OF SCANNERS AND CT EXAMINATIONS INCLUDED IN THIS REPORT**

<b>CT Scanner</b>	<b>Location</b>	<b>Abdomen</b>	<b>Head</b>	<b>Pediatric</b>
Philips Spect-CT	Milstein 2 <sup>nd</sup> Floor	120kVp, 50 mAs, Helical, 16x1.5 Pitch .938	120kVp, 150mAs, Axial, SL5 Pitch 1	n/a
Siemens Sensation 16	Irving 1 <sup>st</sup> Floor	120kVp, 160mA, 1s, Helical, 16x1.5, Pitch 1.25	120kVp, 300mA, 1s, Axial, 12x1.5	n/a
GE LightSpeed 64 VCT	Irving 1 <sup>st</sup> Floor	120kVp, 250 mA, 1s, Helical, 32x5, Pitch 1.375	120kVp, 400mA, 1s, Axial, 32x0.625	n/a
GE LightSpeed Pro	Milstein 8 <sup>th</sup> Floor	120kVp, 350 mA, 0.5s, Helical, SL5.0, Pitch .938	120kVp, 300mAs, Axial, SL5.0/5.0	n/a

Siemens Sensation 10	VC ER	120kVp, 200 eff mAs*, Helical, SL5.0/6*3/12, Pitch 0.65	120kVp, 300mAs, Axial, SL5.0/5.0	120kVp, 55mAs, Helical, SL5.0/3.0/18.0 Pitch 1, 25-34kg
Siemens Sensation 4	Allen Pavilion	120kVp, 200 eff mAs*, Helical, SL5.0/2.5/8.8, Pitch 0.88	120kVp, 300mAs, Axial, SL5.0/2.5	120kVp, 75mAs, Helical, SL3.0/2.5/10.0 Pitch 1.0 25-34kg
GE Lightspeed VCT	CHONY 3 <sup>rd</sup> Floor	120kVp, 210mAs, Helical, SL5.0/39.37, Pitch .984	120kVp, 210mAs, Axial, SL5.0/4i	120 kVp, 135mA, .4s, Pitch 1.375 31.5-40 lbs
Siemens Volume Zoom 4	Milstein 3 <sup>rd</sup> Floor	120 kVp, 200 mA, 1s, Helical, 4x2.5, Pitch 2	120kVp, 300mA, 1s, Axial, 4x2.5	n/a

\* Effective mAs = mAs/pitch