

*Computed Tomography Dose Limit
Reporting Guidelines
for Section 3 – 115113*

California Dose Reporting Law

Three sections to the Health and Safety Code:

(115111, 115112, 115113)

Senate Bill SB 1237, enacted November, 2010

Section 3 in force January 1, 2011

Recommendations of the
California Clinical and Academic
Medical Physicists (C-CAMP)

(ver. 5.0/2010-Dec-06)

California Health and Safety Code Section 3 (115113)

- Requires a facility that uses Computed Tomography (CT) to report to DPH* any scan that is repeated, or a scan of the wrong body part, that results in:
 - An Effective Dose (E.D.) that exceeds 0.05 Sv (5 rem)
 - A dose in excess of 0.5 Sv (50 rem) to any organ or tissue
 - Shallow dose to the skin of 0.5 Sv (50 rem) to the skin
- **UNLESS:**
 - Repeat due to movement or interference of patient.
 - Ordered by a physician

*DPH= Department of Health

Section 3 (continued)

- Requires facilities that use CT to report to DPH:
 - Unanticipated permanent damage to organ, hair-loss, or erythema.
 - **Dose to fetus that is greater than 50 mSv (5 rem) for known pregnancies**
 - Therapeutic radiation delivered to the wrong person or that differs from prescribed dose by more than 20%.

Practical Implementation

- While actual enforcement of these provision may be problematic, failure to comply is a **CRIME**.
- Except for scans of *known pregnant* women (fetal dose threshold), it is unlikely that the notification dose limits would be exceeded in most clinical scenarios.

Practical Implementation

- The following slides are designed to ***assist*** the institution by ***alerting*** the user to scenarios that might exceed action levels by converting the state's threshold dose reporting levels into CT dose values that are actually reported by the CT scanner.
- The following “trigger” values are ***guidelines*** only and should be considered as ***investigatory thresholds*** to engage a *Qualified Medical Physicist* to determine if reporting is required.
- The trigger values are based on ***scanner displayed CTDI/DLP*** values that should be verified by a Qualified Medical Physicist.

Patient Effective Dose Threshold: 50 mSv

- For most standard CT scans, an approximate patient effective dose can be *estimated* from the product of Dose Length Product (DLP) and a conversion factor (k-factors) specific for a given body part and patient age. Based on those k-factors the following cumulative DLPs will yield effective doses **exceeding** 50 mSv.
- **Note:** two tables are included, one for scanners that use the 32 cm dose phantom for the adult body (only), and one for scanners that use the 32 cm dose phantom for the pediatric and adult body for CTDI calibration. You must discern what method your scanner uses, and select the appropriate table

Patient Effective Dose Threshold: 50 mSv

Table below is for scanners (e.g., GE, others) that use:

- CTDIvol and DLP from 16 cm diameter phantom for all head and all pediatric (pediatric head and pediatric body) scans
- CTDIvol and DLP from 32 cm diameter phantom ONLY for adult body scans (highlighted orange)

DLP Reporting Thresholds for Incorrect/Repeated Exams

DLP in mGy·cm

	0 year old	1 year old	5 year old	10 year old	adult
head & neck	3840	5880	8770	11900	16120
head	4540	7460	12500	15620	23800
neck	2940	4160	4540	6320	8470
chest	1280	1920	2770	3840	3570
abd/pelvis	1020	1660	2500	3330	3330
trunk (C/A/P)	1130	1780	2630	3570	3330

Patient Effective Dose Threshold: 50 mSv

Table below is for scanners (e.g., Siemens, Philips, others) that use:

- CTDIvol and DLP from 16 cm diameter phantom ONLY for head scans (Pediatric and Adult head)
- CTDIvol and DLP from 32 cm diameter phantom for BOTH pediatric AND adult body scans (highlighted orange)

DLP Reporting Thresholds for Incorrect/Repeated Exams

DLP in mGy·cm

	0 year old	1 year old	5 year old	10 year old	adult
head & neck	3840	5880	8770	11900	16120
head	4540	7460	12500	15620	23800
neck	2940	4160	4540	6320	8470
chest	550	830	1200	3840	3570
abd/pelvis	440	720	1080	3330	3330
trunk (C/A/P)	490	770	1140	3570	3330

Organ Dose Threshold: 500 mSv

- Computed Tomography Dose Index (CTDI) as reported by the CT scanner represent dose to a cylindrical plastic phantom of **a specific diameter**. Therefore CTDI tends to **overestimate** dose to large patients and **underestimate** dose to a small patient.
- Thus organ doses can only be **approximated** from CTDI values when combined with specific knowledge about patient size and morphology (as well as the amount of organ in question is included within the extents of the scan range).
- While all of the above are required to make accurate estimates of organ dose, the total $CTDI_{vol}$ as reported by the scanner for a given body region can be used to provide **an estimate** for organ dose for the body region containing the scanned organ.

Organ Dose Threshold: 500 mSv

- The following situations may result in an organ dose exceeding the reporting threshold of 500 mSv:
 - Scans with table movement (any axial or helical scan)
 - For Pediatric, if the cumulative CTDI_{vol} for any given body part **exceeds 200 mGy**
 - For Adult, if the cumulative CTDI_{vol} for any given body part **exceeds 250 mGy**
 - Scans with NO table movement (e.g., neuroperfusion scan)
 - For Pediatric if the cumulative CTDI_{vol} for any given body part **exceeds 650 mGy**
 - For Adult, if the cumulative CTDI_{vol} for any given body part **exceeds 650 mGy**

Organ Dose Threshold: 500 mSv

- Here “cumulative” CTDIvol means if the same anatomic region is scanned multiple times (e.g. ,pre- and post-contrast of the same region), then these CTDIvol should be added.
- NOTE: if different regions are scanned (e.g., pre-contrast abdomen, post-contrast thorax and pelvis), then the CTDIvol are *not* added.

Skin Dose Threshold: 500 mSv

- It is unlikely in CT that skin dose averaged over entire organ will exceed 500 mSv.
- ***Rather for skin the immediate concern is potential for deterministic injury such as erythema (reddening), or hair loss (epilation), or more serious skin burns.***
- In this case we want to identify what scans might result in a total **PEAK** skin dose that exceeds 500 mGy.
- In general, peak skin dose is greatest when the scan table is held stationary and multiple scan “slices” are performed in the same anatomical location.

Skin Dose Threshold: 500 mSv

- The principal scan where the table is held stationary and doses might result in a skin injury are neuro-perfusion scans.
- For these types of scans, Dose *Length* Product (DLP) tends to **underestimate** peak skin dose as a relatively small *length* of the body is actually being scanned.
- By definition $CTDI_{vol}$ reports dose assuming multiple contiguous scan slices and considers scatter radiation from adjacent slices and thus **overestimates** peak skin dose for repeated scans in a fixed location.
- Data for skin dose received from neuro-perfusion scans indicates that $CTDI_{vol}$ overestimates peak skin dose by 30 to 100%.

Skin Dose Threshold: 500 mSv

- The following situations may result in an skin dose exceeding the reporting threshold of 500 mSv:
 - Scans with NO table movement (e.g., neuroperfusion scan)
 - For Pediatric, if the cumulative CTDIvol for any given body part **exceeds 650 mGy**
 - For Adult, if the cumulative CTDIvol for any given body part **exceeds 650 mGy**
 - Scans with table movement (any axial or helical scan)
 - For Pediatric, if the cumulative CTDIvol for any given body part **exceeds 200 mGy**
 - For Adult, if the cumulative CTDIvol for any given body part **exceeds 250 mGy**

Skin Dose Threshold: 500 mSv

- Here “cumulative” CTDIvol means if the same anatomic region is scanned multiple times (e.g., pre- and post-contrast of the same region), then these CTDIvol may be added.
- NOTE: if different regions are scanned (e.g., pre-contrast abdomen, post-contrast thorax and pelvis), then the CTDIvol are not added.

Fetal Dose Threshold: 50 mSv

- Section 3 (115113) also requires that a CT or therapeutic dose to an embryo or fetus greater than 50 mSv (5 rem) dose equivalent be reported if dose delivered is to a ***known pregnant individual*** unless the fetal dose was specifically approved, in advance, by qualified physician.
- Exceeding the specified fetal dose threshold may occur in certain clinical scenarios.

Fetal Dose Threshold: 50 mSv

- For CT the following situations may result in an embryo or fetal dose exceeding the reporting threshold of 50 mSv:
 - Scans with table movement (any axial or helical scan)
 - If the cumulative CTDIvol for a scan of the abdomen/pelvis including the uterus **exceeds 25 mGy**
 - Scans with NO table movement (e.g., perfusion scan of abd/pelvis)
 - If the cumulative CTDIvol for a scan including the abdomen/pelvis including the uterus **exceeds 65 mGy**

Fetal Dose Threshold: 50 mSv

- Here “cumulative” CTDIvol means if the uterine/abdomen region is scanned multiple times (e.g., pre- and post-contrast of the same region), then these CTDIvol should be added.
- NOTE: if regions outside of the abdomen/pelvis are scanned then the CTDIvol are not added.

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** With the best of intentions in addressing this new regulation in a practical & expedient fashion!*