Mount Vernon Cancer Centre

NHS
East and North Hertfordshire Teaching NHS Trust

Paul Strickland Scanner Centre

CT patient dose audit 2026

Audit year:	2026 (data from Siemens Team Play)
Scanner:	Siemens Somatom Force
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1. Introduction

The Ionising Radiation (Medical Exposure) Regulations 2017 (IR(ME)R), Regulation 6(5)(c), requires that the Employer establish and review Local Diagnostic Reference Levels (LDRLs) for commonly performed radiological procedures. Regulation 12(3)(c) further requires that the Operator adhere to those established LDRLs.

A patient dose audit was carried out for CT examinations performed on the Siemens Force CT system at Paul Strickland Scanner Centre (PSSC), using data extracted from Siemens teamplay for the calendar year 2026. The audit covers all adult CT protocols with a sufficient sample size. Median CT Dose Index (CTDIvol) and Dose-Length Product (DLP) values have been compared with: (i) current National Diagnostic Reference Levels (NDRLs), as published by the UK Health Security Agency and effective from 11 December 2025; and (ii) existing Local Diagnostic Reference Levels (LDRLs) established at the previous audit.

This report has been produced in accordance with the guidance set out in IPEM Report 88 and recommendations from ICRP Report 135. NDRLs are referenced from:

https://www.gov.uk/government/publications/diagnostic-radiology-national-diagnostic-reference-levels-ndrls/ndrl#national-drls-for-computed-tomography

For this audit, protocols have been grouped into three clinical categories to aid review and presentation of results:

- **Group 1:** Head & Face protocols (Mandible, Maxilla) and CTPA
- **Group 2:** Thorax protocols (Thorax no IVC, Thorax CAP with Care kV & IVC)
- **Group 3:** Complex and Dual Energy protocols (combined TAP, DE Thorax/Neck/AbdoPelvis, and DE Bolus Track protocols)

2. Method

Dose data were reviewed in Siemens teamplay, alongside tube voltage (kV), patient weight, and scan length for each protocol. Data are automatically transmitted from the scanner to teamplay for all active protocols. All data were collected for patients within the weight range of 50–90 kg, in line with standard DRL methodology.

The median CTDIvol and DLP per scan protocol were extracted and compared first against the current NDRL, and subsequently against the existing LDRL, where one is in place. The following decision rules were applied:

- Where the median CTDIvol or DLP exceeds the NDRL, an immediate investigation has been recommended.
- Where the median is more than 20% above the existing LDRL, a formal investigation into potential overexposure has been recommended.
- Where the median has reduced by more than 20% below the existing LDRL, a review of scan parameters and image quality should be undertaken to ensure that optimisation has not been inadvertently achieved at the expense of diagnostic quality.
- Where no LDRL exists, a new value has been recommended based on the current dataset.
- Protocols with fewer than 20 patients within the weight range were considered to have insufficient data. For these, the existing LDRL has been retained and the protocol flagged for follow-up at the next audit cycle.

Doses were audited based on the study description rather than clinical indication. Where a single study description encompasses multiple series (e.g. an appended head series within a combined Thorax/Abdomen/Pelvis study), each component series was audited individually, as well as the accumulated whole-study DLP. For example, the protocol ThorAbdoPelvis_Routine_IVC (Adult) typically contains three series: a thorax acquisition, an abdomen/pelvis acquisition, and an appended head series.

This audit is intended to inform future protocol optimisation. Since optimisation aims to achieve the optimal balance between radiation dose and diagnostic image quality, any recommendation for dose reduction should be accompanied by a structured image quality review before implementation.

3. Results and Discussion

All patient data analysed fall within the 50–90 kg weight range. Four protocols — Thorax IVC, Abdomen/Pelvis with IVC, Head and Abdomen Fiducial Markers — did not accumulate sufficient patient numbers during 2026 to permit formal analysis; these are flagged in the results table (Appendix 1), and their previous LDRLs are retained.

A full summary of CTDIvol, DLP, LDRL, and NDRL values is provided in Appendix 1.

3.1 Group 1: Head and Face Protocols and CTPA

Current NDRLs: Paranasal sinuses — CTDIvol 12 mGy, DLP 160 (UKHSA, December 2025). *Note: no dedicated NDRL exists for mandible or maxilla CT; the paranasal sinuses NDRL is applied as the nearest appropriate comparator.*

Two head and face protocols were audited: Mandible, Maxilla.

The Mandible protocol returned a median CTDIvol of 9.1 mGy and a median DLP of 114 mGycm, and the Maxilla protocol returned 8.7 mGy and 94 mGycm, respectively. Both values are well below the paranasal sinuses NDRL of 12 mGy / 160 mGycm and are consistent with the existing LDRLs of 13 mGy / 130mGycm and 8.8mGy / 90 mGycm. No investigation is required.

CTPA

Current NDRLs: CTPA — CTDIvol 9.1 mGy, DLP 310 mGycm (UKHSA, December 2025)

The CTPA protocol returned a median CTDIvol of 2.7 mGy and a median DLP of 100 mGycm — substantially below the NDRL of 9.1 mGy / 310 mGycm. The existing LDRL of 3.1mGy /110 mGycm remains appropriate.

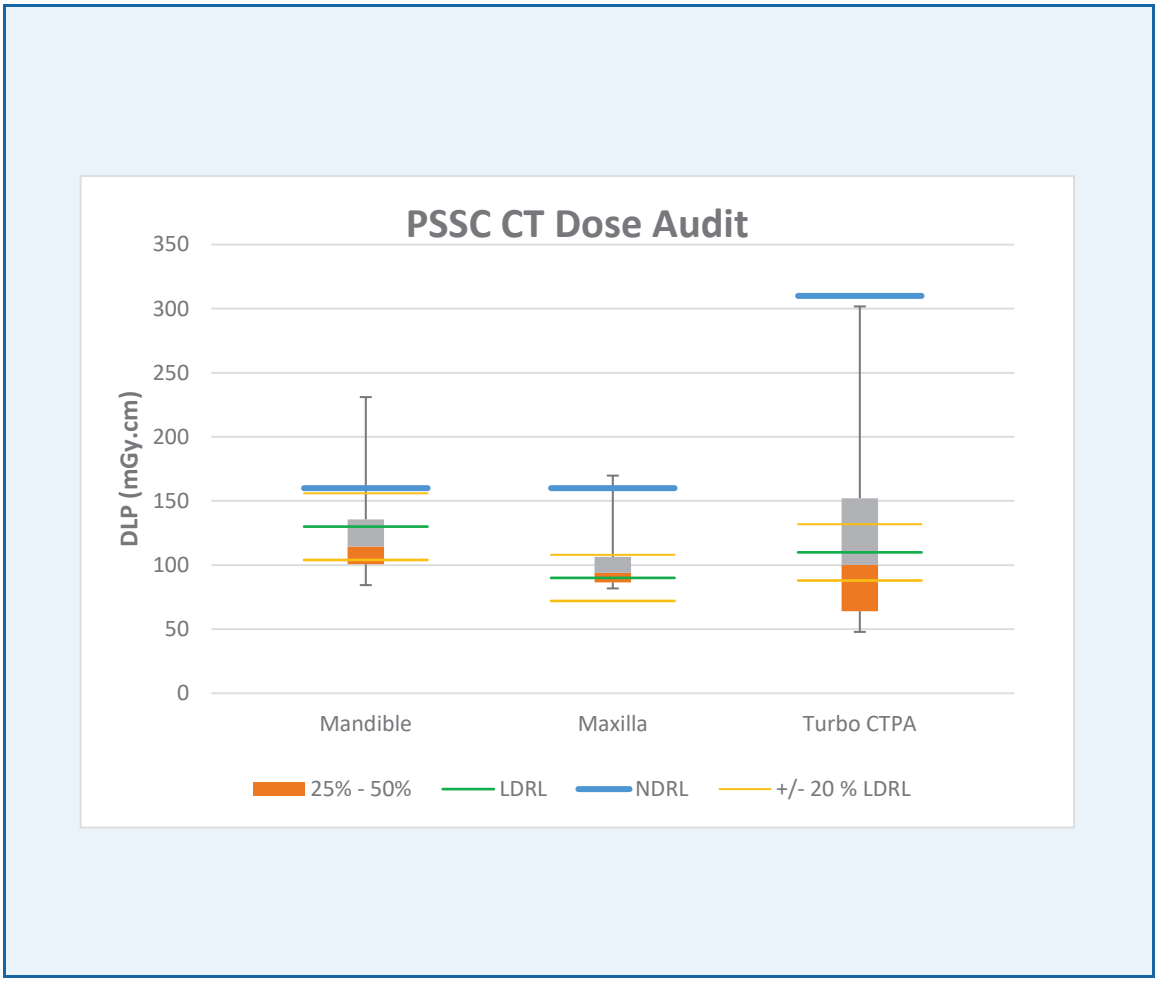

Figure 1. *Box plots of DLP for Head and Face protocols and CTPA.*

3.2 Group 2: Thorax Protocols

Current NDRLs: Chest — CTDIvol 8.5 mGy, DLP 290 mGycm; Chest, Abdomen, Pelvis (TAP, cancer staging) — DLP 660 mGycm (UKHSA, December 2025).

Two thorax protocols were reviewed in this group: Thorax no IVC, and Thorax CAP with Care kV and IVC. These share thorax-primary acquisitions and are presented together to allow direct comparison of dose efficiency between standard and automated dose-modulated techniques.

The Thorax no IVC protocol returned a median CTDIvol of 2.7 mGy and DLP of 100 mGycm, both significantly below the NDRL and consistent with the LDRL of 3.1mGy/120 mGycm. This reflects continued efficient dose delivery. No changes are recommended.

The Thorax CAP with Care kV and IVC protocol returned a whole-study CTDIvol of 3.3 mGy and DLP of 284 mGycm — well below both the chest NDRL of 290 mGycm and the TAP NDRL of 660

mGycm. At the series level: the thorax component (CTDIvol 3 mGy, DLP 118 mGycm) is consistent with the LDRL of 3.1 mGy / 130 mGycm; the abdomen/pelvis component (2.9 mGy / 143 mGycm) is consistent with the LDRL of 3.2 mGy / 160 mGycm. No changes are recommended.

The Thorax IVC protocol did not have sufficient patient data during 2026. The existing LDRL of CTDIvol 3.2 mGy and DLP 130 mGycm is retained; this protocol is flagged for re-examination at the next audit cycle.

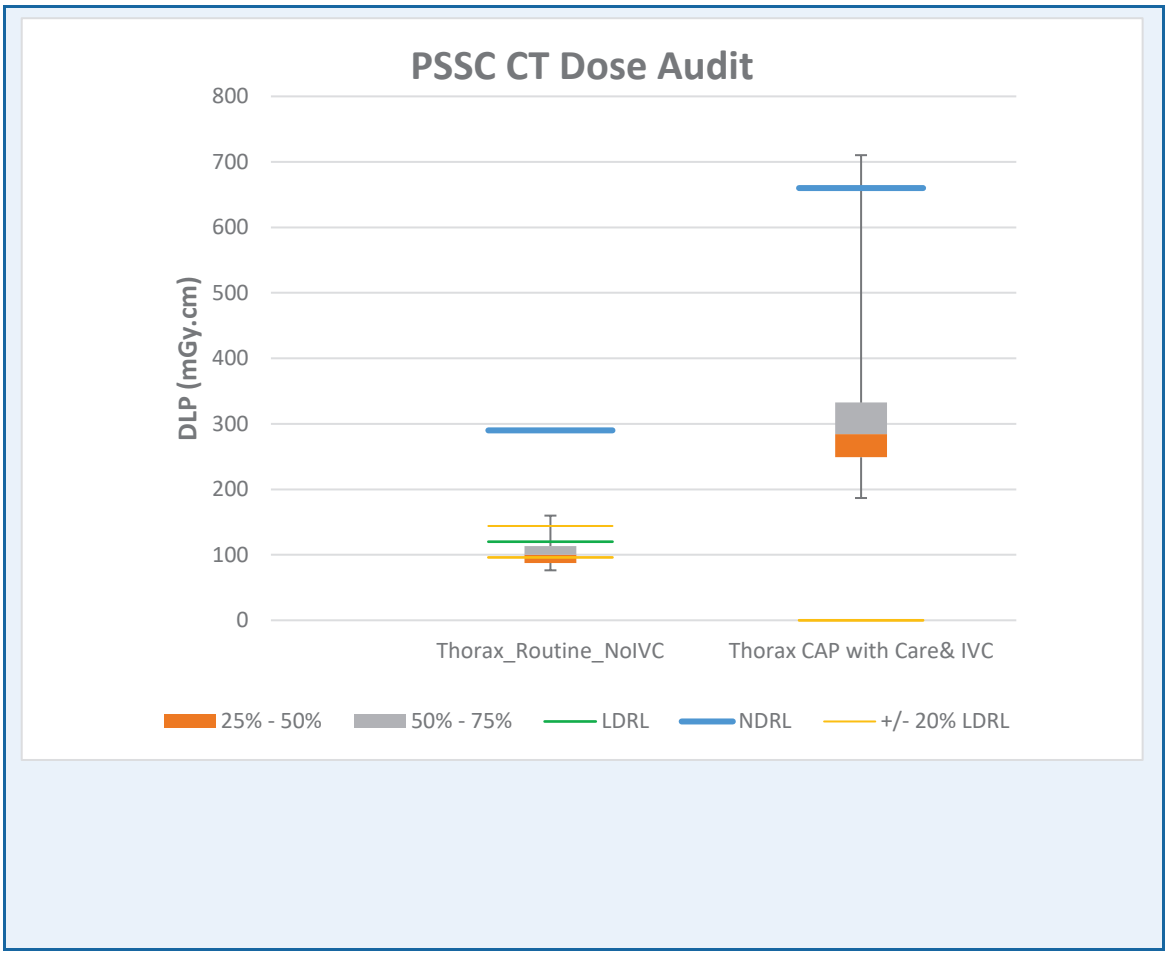

Figure 2. *Box plots of DLP for Group 2 — Thorax protocols (Thorax no IVC; Thorax CAP with Care kV & IVC*

3.3 Group 3 — Complex and Dual Energy Protocols

Current NDRLs: Chest, Abdomen, Pelvis (TAP, cancer staging) DLP 660 mGycm; Neck, Chest, Abdomen and Pelvis (cancer) DLP 850 mGycm; Abdomen and Pelvis CTDIvol 10 mGy / DLP 530 mGycm (UKHSA, December 2025). No dedicated NDRL exists for dual energy acquisitions; the nearest single energy equivalent is applied as per standard practice.

DE Thorax / Neck / AbdoPelvis

The Dual Energy Thorax/Neck/AbdoPelvis protocol returned a whole-study CTDIvol of 8.6 mGy and median accumulated DLP of 723 mGycm, below the NDRL of 850 mGycm. At the series level, the DE Neck component (5.6 mGy / 133 mGycm) is in close agreement with the LDRL of 5.2 mGy / 130 mGycm. The DE Thorax component (3.4 mGy / 121 mGycm) sits slightly above its LDRL of 2.8mGy / 110 mGycm but remains within the 20% investigation threshold (upper limit 3.36 mGy); this should be kept under review at the next audit. The DE Abdo/Pelvis component (7.6mGy / 369 mGycm) has no existing series-level LDRL; the accumulated whole-study DLP is therefore used as the primary comparator, and performance is satisfactory.

Combined TAP Protocols

The TAP scan with No IVC returned an overall CTDIvol of 8.7 mGy and accumulated DLP of 627 mGycm, below the TAP NDRL of 660 mGycm. The ThorAbdoPelvis series DLP of 504 mGycm is within the existing LDRL of 660 mGycm.

The Routine TAP with IVC returned a whole-study CTDIvol of 7.4 mGy and DLP of 468 mGycm, comfortably within the LDRL of 660 mGycm. Individual thorax (CTDIvol 3 mGy, DLP 116 mGycm) and abdomen/pelvis (7.2 mGy / 332 mGycm) series are consistent with their respective LDRLs and NDRLs. No investigation is required.

Dual Energy Bolus Track Protocols

The DE Bolus Track for Renal Melanoma/GIST returned a whole-study CTDIvol of 8.8 mGy and DLP of 656 mGycm, just within the TAP NDRL of 660 mGycm. The DE Thorax component (3.5 mGy / 185 mGycm) and DE Abdomen component (8.2 mGy / 391 mGycm) are consistent with their LDRLs of 3.6 mGy/180 mGycm and 8.6 mGy / 420 mGycm, respectively. No investigation is required, though the proximity of the whole-study DLP to the NDRL should be noted.

The DE Bolus Track for Breast/Lung/Colon/Ovary returned a whole-study CTDIvol of 8.1 mGy and DLP of 506 mGycm, below the TAP NDRL of 660 mGycm. The DE Thorax (3.2 mGy / 113 mGycm) and DE Abdo (8.1 mGy / 376 mGycm) components are consistent with their LDRLs of 3.3 mGy / 120 mGycm and 8.4 mGy / 390 mGycm. No investigation is required.

The DE AbdoPelvis with IVC & 65s delay protocol returned a whole-study CTDIvol of 7.1 mGy and DLP of 345 mGycm, well below the AbdoPelvis NDRL of 10 mGy / 530 mGycm. The existing LDRL of 8.5mGy / 420 mGycm remains appropriate. No investigation recommended.

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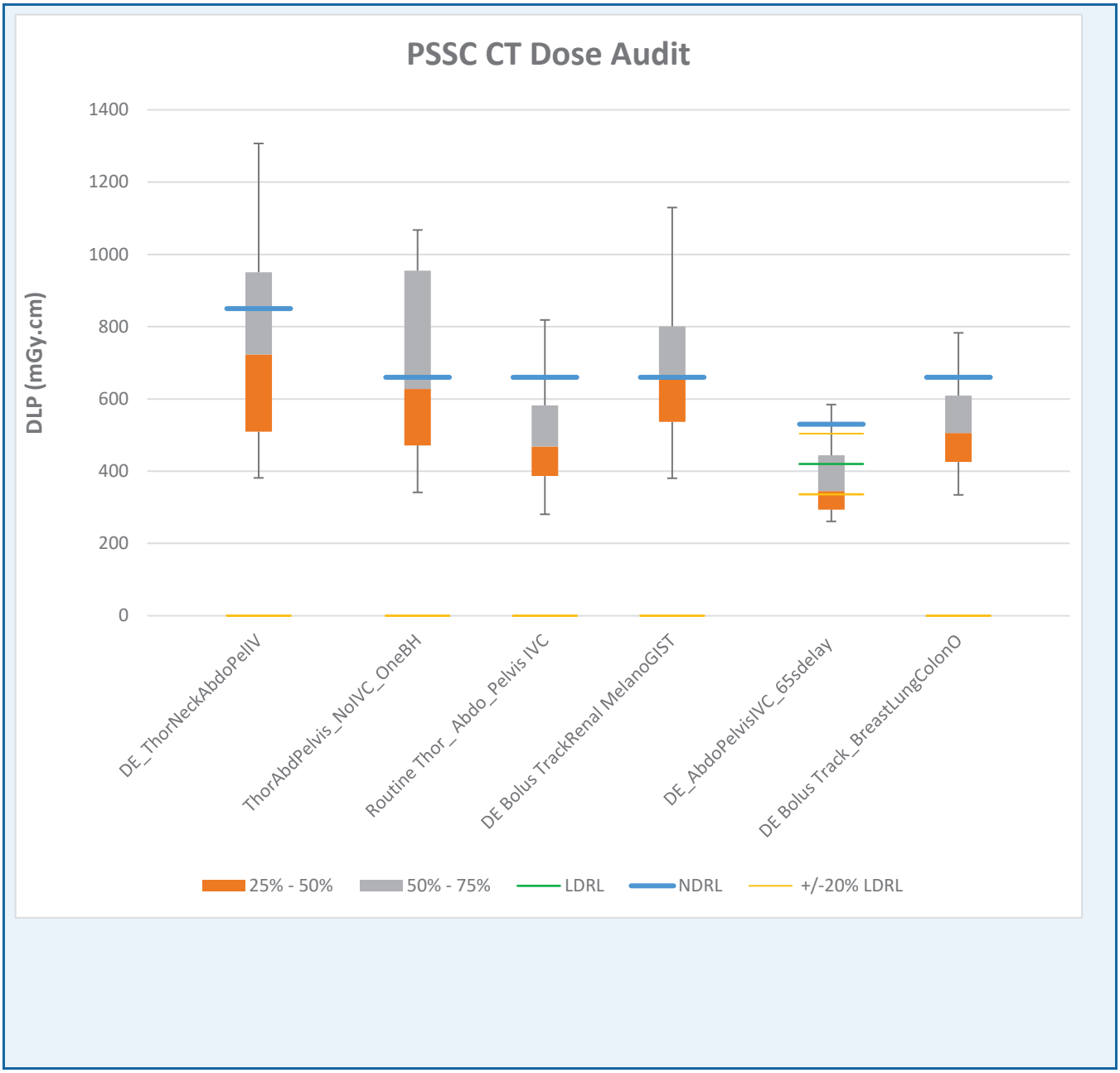

Figure 3. *Box plots of DLP for complex and dual energy protocols: DE Thorax/Neck/AbdoPelvis, combined TAP protocols, and DE Bolus Track protocols.*

4. Comparison with Previous Audits

Data were compared to the previous CT dose audit [2022]. There have been no significant changes to protocols between audit cycles. All median values remain within the 20% threshold relative to existing LDRLs, and no protocol exceeds the current NDRL.

It is noted that the NDRLs applicable to this audit reflect revised values published by UKHSA on 11 December 2025. All audited protocols remain compliant against the updated values.

5. Conclusions and Recommendations

1. All protocols with sufficient patient data return median CTDIvol and DLP values below the relevant National Diagnostic Reference Levels (UKHSA, effective 11 December 2025).
2. No protocol demonstrates a median CTDIvol or DLP more than 20% above the existing LDRL. No formal optimisation investigations are therefore required at this time.
3. Existing LDRLs are confirmed as appropriate and unchanged for all protocols with sufficient data.
4. The following protocols had insufficient patient numbers (n < 20 in the 50–90 kg range) and could not be fully audited in 2026. LDRLs are retained from the previous cycle:
   a. Thorax IVC LDRL: CTDIvol 3.2 mGy / DLP 130 mGycm
   b. Abdomen/Pelvis with IVC: LDRL CTDIvol 6.9 mGy / DLP 330 mGycm
   c. Abdomen Fiducial Markers: LDRL CTDIvol 13 mGy / DLP 180 mGycm
   d. Head_NoIVCNeuroXCARE: LDRL CTDIvol 45 mGy / DLP 750 mGycm
5. In accordance with IPEM Report 88, it is recommended that local DRLs be reviewed annually.

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Appendix 1 — Results Data Table

Table A1 provides the full summary of 2026 median CTDIvol and accumulated DLP values for all audited protocols and component series, alongside existing LDRLs and current National DRLs. All CTDI values are in mGy; all DLP values are in mGycm. Protocols are presented in the three clinical groups defined in Section 1.

Protocol name	2026 whole study		Series	2026 Series		LDRL		NDRL	
	CTDI (mGy)	DLP (mGycm)		CTDI (mGy)	DLP (mGycm)	CTDI (mGy)	DLP (mGycm)	CTDI (mGy)	DLP (mGycm)
Mandible	9.1	114	Mandible			13	130	12	160
Maxilla	8.7	94	Maxilla			8.8	90	12	160
CTPA	2.7	100	CTPA			3.1	110	9.1	310
Dual Energy Thorax/NeckAbdoPelvis	8.6	723	DE Neck	5.6	133	5.2	130		850
			DE Thorax	3.4	121	2.8	110		
			DE Abdo/Pel	7.6	369				
Thorax no IVC	2.7	100	Thorax			3.1	120	8.5	290
Thorax/Abdomen/Pelvis scan with No IVC	8.7	627	Head*	50.2	850				660
			ThorAbdoPelvis	7.4	504				
Routine Thorax/Abdomen/Pelvis with IVC	7.4	468	Thorax	3	116	3.1	130		660
			AbdoPelvis	7.2	332	7.6	360		
			Head IVC*	47.4	785				
Thorax CAP with Care & IVC	3.3	284	Thorax	3	118	3.1	130	8.5	660
			AbdoPelvis	2.9	143	3.2	160		
			Head IVC*	50.7	859				
Dual Energy Bolus Track for Renal Melanoma GIST	8.8	656	DE Thorax	3.5	185	3.6	180		660
			DE Abdomen	8.2	391	8.6	420		
			Head IVC*	48	803				
Dual Energy Bolus Track for Breast/Lung/Colon/Ovary	8.1	506	DE Thorax	3.2	113	3.3	120		660
			DE Abdo	8.1	376	8.4	390		
Dual Energy Abdomen/Pelvis with IVC &_65s delay	7.1	345	DE AbdoPelvisIVC			8.5	420	10	530
Abdomen/Pelvis with IVC (not enough data)						6.9	330		660
Abdomen Fiducial markers (not enough data)						13	180		
Thorax IVC (not enough data)						3.2	130	8.5	290
Head (not enough data)						45	750	47	790

*Head series values are calculated on a 16mm phantom.

Table A2. CT Dose Audit 2026 — New LDRLs

Protocol name	Series	New LDRL	
		CTDI (mGy)	DLP (mGycm)
Mandible	Mandible	13	130
Maxilla	Maxilla	8.8	90
CTPA	CTPA	3.1	110
Dual Energy Thorax/NeckAbdoPelvis	DE Neck	5.2	130
	DE Thorax	2.8	110
	DE Abdo/Pel	7.6	369
Thorax no IVC	Thorax	3.1	120
Thorax/Abdomen/Pelvis scan with No IVC	Head*	8.7	627
	ThorAbdoPelvis		
Routine Thorax/Abdomen/Pelvis with IVC	Thorax	3.1	130
	AbdoPelvis	7.6	360
	Head IVC*		
Thorax CAP with Care & IVC	Thorax	3.1	130
	AbdoPelvis	3.2	160
	Head IVC*		
Dual Energy Bolus Track for Renal Melanoma GIST	DE Thorax	3.6	180
	DE Abdomen	8.6	420
	Head IVC*		
Dual Energy Bolus Track for Breast/Lung/Colon/Ovary	DE Thorax	3.3	120
	DE Abdo	8.4	390
Dual Energy Abdomen/Pelvis with IVC &_65s delay	DE AbdoPelvisIVC	8.5	420
Abdomen/Pelvis with IVC		6.9	330
Abdomen Fiducial markers		13	180
Thorax IVC		3.2	130
Head		45	750

*Head series values are calculated on a 16mm phantom.