Commission for the Protection
From Ionising and Non-Ionising Radiation

F22, Mosta Technopark, Triq Valletta,
Mosta MST 3000, Malta
Tel: 2799 8676
info.rpc@gov.mt

Diagnostic Reference Levels
&
Guidance on the establishment and use of Diagnostic Reference Levels for Medical Exposures

The Commission for the Protection from Ionising and Non-ionising Radiation (Commission) has coordinated the development of these guidelines with the support of stakeholders.

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Contents

1. Introduction 3
2. National and Facility DRLs 3
3. DRL dose metrics 5
4. Reviewing of DRLs 6
   4.1. NDRL 6
   4.2. FDRL 6
5. Establishing and use of FDRLs 6
   5.1. Establishing FDRLs 6
   5.2. Use of FDRLs 7
6. Establishing specific FDRLs for different practices 8
   6.1. Aspects to be considered when setting up FDRLs 8
   6.2. Planar Radiography 9
   6.3. Mammography 10
   6.4. Fluoroscopic Examinations, Interventional and Cardiac 10
   6.5. Computed Tomography and CT in multi-modality system SPECT /CT, PET/CT 11
   6.6. Diagnostic nuclear medicine 12
   6.7. Dental examinations 13
   6.8. Paediatric 13
      6.8.1. Paediatric radiograpy and fluoroscopy 13
      6.8.2. Paediatric interventional procedures 13
7. National DRL values 14
   7.1. Planar Radiography 14
   7.2. Mammography 15
   7.3. Diagnostic Fluoroscopy 15
   7.4. General Interventional 16
To be made available when sufficient data is supplied to the Commission. 16
   7.5. Interventional cardiology 16
To be made available when sufficient data is supplied to the Commission. 16
   7.6. Computed Tomography 16
   7.7. Multi-modality system: SPECT/CT, PET/CT 17
   7.8. Radiotherapy Planning CT scans 17
   7.9. Nuclear medicine 18
   7.10. Dental 19
   7.11. Paediatric Radiology and fluoroscopy 19
   7.12. Paediatric Computed Tomography 20
   7.13. Paediatric dentistry 20
8. Annexes 21
   8.1. Annex 1 - References to DRLs in the Regulations 21
      8.1.1. Definition of DRL 21
      8.1.2. The Role of the Commission 21
      8.1.3. The obligations of an undertaking: 21
      8.1.4. Role of Medical Physics Experts 21
   8.2. Annex 2 – Reference material 22
   8.3. Annex 3 - Abbreviations 23
   8.4. Annex 4 – Definitions 24
Revision History 24

1. Introduction

The Basic Safety Standards for Ionising Radiation Regulations[1] (BSS regulations) requires that all undertakings that perform diagnostic medical exposures, are to make use of Diagnostic Reference Levels (DRL).

DRLs should be used to ensure that radiation dose received by patients for a specific type of medical radiological procedure is optimised.

Optimisation of the radiation dose to the patient is a continual process to avoid any unnecessary radiation that does not contribute to the clinical purpose of medical imaging. Referrers, practitioners, medical radiographers, Medical Physics Experts (MPE)s and persons performing the practical aspects all have responsibilities in the process of optimisation.

A key element in the optimisation process is monitoring of patient doses.

The establishment and periodic review of DRLs are an essential component of this optimisation process. The analysis of DRL values over time can be useful in identifying dose trends which in turn can be used in the process of optimisation.

DRLs are levels used in medical imaging to indicate whether, in routine conditions, the dose to the patient or the activity of radiopharmaceuticals administered in a specified radiological procedure is unusually high or unusually low for that procedure.

A DRL is a level set for a standard procedure for groups of "standard-sized patients" and not for individual exposures.

DRLs are not individual dose limits for patients or procedures, but an aid that should be used as a supplement to professional judgement to aid in the optimisation of medical exposures to ionising radiation.

A focus on DRL quantities alone, without considering image quality could drive the value of the DRL ever downwards to the detriment of image quality. Patient doses must not be reduced such that the images become non-diagnostic.

Undertakings must ensure that this guidance document is made available to practitioners, radiographers and MPEs.

Undertakings must also establish local Facility DRLs, ensure that these are regularly reviewed and used by persons conducting medical radiological procedures.

2. National and Facility DRLs

The BSS regulations require the establishment and use of DRLs.

The National DRLs (NDRLs) are set for common procedures and clinical tasks, allowing undertakings to compare their own Facility DRLs (FDRLs).

NDRLs value is a dose level which is set at the 75th percentile of the distribution of the medians obtained from national surveys or on published values that are appropriate for the local circumstances and given in Section 7.

[1] S.L.585.01. https://legislation.mt/eli/sl/585.1/eng

NDRLs will be updated by the Commission as required.

In order to complete NDRL reviews, the Commission may require information from undertakings that includes:

- Median dose quantity values, where available, for diagnostic and interventional medical radiological procedures given in Section 6 of this Guidance.
- Median dose quantity values for medical radiological procedures which deliver high radiation doses (not included in Section 6 of this Guidance).
- Equipment details (manufacturer, model, detector types and software available).

Undertakings should note that this list is not exhaustive and may be subject to change.

NDRLs are dose levels set to aid optimisation of diagnostic and interventional medical exposures. They provide a standard for comparison to help ensure the radiation protection of patients undergoing these types of medical radiological procedures.

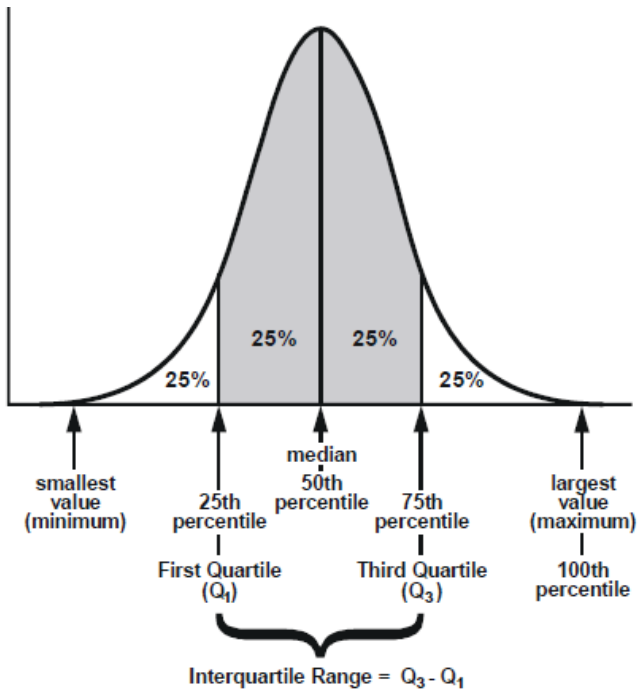
Each undertaking should develop their own FDRLs and compare the latter with NDRLs. The methodology of establishing and using FDRLs are given in Section 5 of this guidance document.

Dose data for each contributing facility is only collected for procedures where the image quality was confirmed as adequate for the clinical purpose.

Undertakings must ensure that FDRLs are established, regularly reviewed, and used, taking corrective action where necessary.

FDRLs is a median value for an individual x-ray room or a single facility. If there are insufficient number of patients from a single x-ray room, or a single facility the median value should be used as “typical value” to identify x-ray units requiring further optimisation.

Optimisation of protection and safety should be reviewed if the comparison shows that the FDRLs exceed or are substantially below the NDRLs, (the shaded area in the image below)



If FDRLs exceed or are substantially lower than NDRLs, an investigation must be conducted by the undertaking to ensure optimal practices and intended outcomes are delivered.

Undertakings are reminded of the fact that they are required to undertake clinical audits of diagnostic medical exposures which will include dosimetry of patients and use of DRLs.

3. DRL dose metrics

The patient dose metrics, shown in the below table, are used as a DRL quantity, easily measured or available and whenever possible, and based on clinical tasks.

Application	Dose quantity		Dose unit
Dental radiography	Kerma-area product (panoramic) Incident air kerma	P_{ka} IAK	$Gy.cm^2$ mGy
Radiography	Kerma-area product	P_{ka}	$Gy.cm^2$
Mammography	Mean glandular dose Compressed breast thickness	MGD CBT	mGy mm
	Entrance -surface air kerma	Ka,e. (ESAK, ESD)	mGy
Diagnostic fluoroscopy	Kerma area product	P_{ka} (KAP, DAP)	$Gy.cm^2$
	Fluoroscopy time	FT	s
interventional procedures	Cumulative kerma Area product Fluoroscopy time	cP_{ka} FT	$mGy.cm^2$ s/m
	Number of images (in cine or digital subtraction angiography runs)	n	
Computed tomography	Computed tomography dose index (volume) Kerma length product, Size Specific Dose Index	$CTDI_{vol}$ P_{kl} SSDE	mGy mGy.cm mGy
Nuclear medicine	Administered activity	Activity	MBq

4. Reviewing of DRLs

4.1. NDRL

It is recognised that NDRL values will need to be kept up to date to take into account new technologies, procedures and radiological equipment.

The Commission shall coordinate with the various stakeholders and seek to update the NDRLs values from data from both the public and private sector as required.

NDRLs should be review not later than 5 years from the approval date.

4.2. FDRL

FDRL values are not static. The FDRL process does not stop after one review but should be subject to regular review and incorporated into an undertaking's quality assurance programme.

FDRLs should be annually reviewed or after the introduction of new equipment, software or techniques. FDRLs for dental procedure should be reviewed every two years.

Undertakings shall keep records of FDRL reviews, and any corrective actions carried out for a period of five years and make these records available to Commission.

5. Establishing and use of FDRLs

5.1. Establishing FDRLs

All undertakings have a requirement under the BSS regulations to establish their own FDRLs.

FDRLs should be established by the undertaking for those procedures listed in NDRLs that are carried out in the facility. However, some procedures or clinical tasks may not be included in the NDRLs as they may be unique to a facility, hospital or medical speciality and expertise. Where this is the case, particularly when these procedures involve high patient doses, FDRLs for such procedures or clinical tasks should be established by the undertaking.

In establishing FDRLs it is important that the practitioners and persons performing the practical aspects (radiographer, MPE, cardiologists and radiologists) are consulted.

To establish FDRLs, an undertaking should:

1. Decide on which imaging procedures FDRLs are to be established, and which metrics will be collected. FDRLs should be collected for relevant procedures or clinical tasks for which NDRLs values already exist and/or for those that are associated with high patient doses. In the event that a NDRL does not exist, the undertaking should still produce a FDRL for the particular procedure/clinical task.
2. Decide on the methodology, i.e. which patients (groups, sample size, etc.), or use of phantoms. DRLs established using real examinations should be preferred over phantom studies.
3. Prepare standardised data collection forms (electronic or paper based).
4. Collect and record the patient's exposure data, according to the information given in Section 6.
5. Collect data from different X-ray rooms, performing the same procedure.
6. Perform statistical analysis and set FDRLs as median values for individual x-ray rooms or a single facility accordingly. If a facility has several similar medical radiological

imaging installations (room), the statistical analysis should determine the median of room medians.

7. Compare FDRLs to NDRLs and investigate variances to identify the cause and take corrective actions as necessary.
8. Make FDRLs data available for appropriate staff.
9. Review FDRLs regularly.

More detailed information on how to collect specific FRDLs for different procedures is given in Section 6 of this document.

It is recommended that undertakings make use of dose monitoring platforms for recording data whenever possible.

FDRLs should be set for representative examinations or procedures performed.

Where no NDRL values exist, FDRLs might be introduced to assist the optimisation process further.

5.2. Use of FDRLs

The BSS regulations require that undertakings use DRLs. References to DRLs in the BSS regulations are given in Section 8.1 of this document.

As part of the undertaking's radiation protection programme, an undertaking must ensure that practitioners and individuals that conduct medical exposures are informed of the role of DRLs as may be advised upon by the MPE.

An undertaking must ensure that practitioners, including medical physicists, radiographers, radiologists, dentists, MPEs and other individuals that conduct medical exposures are well informed on NDRLs and FDRLs must be established to facilitate patient dose optimisation.

DRLs do not replace professional judgement in connection with individual medical exposures but rather aid in the optimisation of medical exposures.

An undertaking shall ensure that FDRLs are established, regularly reviewed, and used, having regard to the NDRLs where available.

Undertakings are required to retain records of reviews of their DRLs, and any corrective actions carried out for a period of five years and to make these records available to Commission on request.

If a NDRL does not exist for a particular procedure or clinical task, similar internationally established DRL values or peer reviewed literature can be consulted.

Any FDRL that is higher than the NDRL is to be justified and reported to the Commission. In this event the MPE is to be consulted in producing the report.

Once the FDRLs have been established, their practical use should be included in the undertaking's Radiation Protection Programme and should include at least the following:

a) Investigation of high doses with a review of the justification of that exposure thus enabling prospective process improvement.

b) Procedure for regularly reviewing of FDRLs, keeping records of FDRLs reviews and any corrective actions carried out, revision and adjustment of the protocol, additional training of staff (proper use of DRLs should be included in the education and training programmes of radiographers (including dentists), medical physics experts, and others as appropriate, who are involved in medical exposure.

c) Priority is given to in-depth analysis of every high dose examination compared to FDRLs, enabling appropriate investigations and, if needed, corrective action when FDRL values are consistently exceeded.

A FDRL value is considered to be 'consistently exceeded' when the median dose quantity is greater than the established FDRL value.

When a FDRL value is identified as being consistently exceeded, an investigation of equipment and practices must be conducted.

When the investigation determines the reason that the FDRL is consistently exceeded, corrective actions must be taken without undue delay.

This investigation into the cause should, at a minimum, examine:

- the measurement methodology used to assess the DRL quantities
- the characteristics and performance of medical radiological equipment
- the case-mix included in the sample size
- the technical parameters used in the medical radiological procedure
- the technique(s) used in the medical radiological procedure
- medical radiological procedure protocols and adherence to their use.

When the investigation determines the reason that the FDRLs are consistently exceeded, without justified/valid reasons, corrective action must be taken without undue delay.

Any corrective actions deemed necessary must be recorded.

Undertaking shall ensure that protection and safety should be optimized for each medical exposure.

6. Establishing specific FDRLs for different practices

6.1. Aspects to be considered when setting up FDRLs

Only data gathered from procedures where the image quality was confirmed as adequate for the clinical purpose should be recorded.

Phantom-based DRLs may be acceptable but shall be labelled as such as they may not be readily comparable with patient-based DRLs. Patient-based DRLs are to be given priority over phantom based DRLs. Only in special circumstance that phantom based DRLs are acceptable, for instance brain CT.

For each data set the median value, sample size *n* is to be recorded:

Only data gathered from procedures where the image quality was confirmed as adequate for the clinical purpose should be recorded.

If available, Dose Management Platforms (DMPs) can be used to establish FDRLs.

Where larger numbers of patients (>50) are included in the survey, it is recommended that that any dose outliers should be removed from the data. However, it should be noted that dose outliers should only have a minimal effect on the median of the distribution. No patient weight standardisation is necessary in the case of a large number of patients.

In the event that there are only a small number (i.e. less than indicated in the below sections) of a particular procedure performed data should still be recorded. In the event of a small number of procedures FDRLs should be created for 20 representative patients (preferably 30 for diagnostic imaging, fluoroscopy or CT and 50 patients for mammography). Ensure patients are weight-standardised (72.5kg +/- 10 kg.).

6.2. Planar Radiography

Priority field of examination

Priority should be given to the following body regions and views. For examinations involving more than one view, a separate entry for the total for that examination could also be included.

- Cervical spine: AP, LAT
- Thoracic spine: AP, LAT
- Lumbar spine: AP, LAT
- Skull: AP or PA and LAT
- Chest: PA, LAT
- Chest: AP (useful especially in portable settings)
- Abdomen: AP or PA
- Pelvis: AP
- Hip: AP

Patient selection

A sample size *n* of at least 20 patients with weight restriction of 72.5kg +/- 10 kg.

For very large studies there is no need to record patient weights as the outlying patient weights will cancel each other out.

Data to be recorded:

Minimum:

- Procedure type (including clinical indication)
- Equipment
- Date
- Age
- Gender
- Number and type (e.g. PA/AP/Lat) of radiographic projection
- DAP per projection
- Weight (Not required for very large surveys)

It is advisable to distinguish between procedures performed within fixed and mobile units.

DRL Metric

kerma-area product: Pka (DAP) ($Gy.cm^2$)

6.3. Mammography

Applicable to plain digital mammography and digital tomosynthesis mammography (DBT).

DRL should be evaluated for Cranio-Caudal (CC), Medio-Lateral Oblique (MLO):
- views for both left and right breast – for plain digital mammography (2D)
-multiply projection – for DBT

Patient selection
At least -50 patients

Data to be recorded:
Minimum:
- Procedure type: plain mammography and/or breast tomosynthesis
- Equipment
- Date
- Mammographic projection, Cranio-Caudal (CC), Medio-Lateral Oblique (MLO), number of views
- Mammographic projection: multiple projections (for DBT)
- Compressed Breast Thickness (CBT) values (mm)
- Mean Glandular dose (MGD), mGy.
- Compressed breast thickness (mm)
- target/filter combinations

DRL Metric
Mean glandular dose (MGD), mGy.

6.4. Fluoroscopic Examinations, Interventional and Cardiac

Priority field of examination
To be given to the more frequent and high dose procedures.
DRLs should be defined according to clinical indication, rather than anatomical location.

DRL Metric
Cumulative kerma-area product: cPka (cDAP) (Gy.cm^2) and total fluoroscopy (screening) time.

For fluoroscopy and acquisition should be recorded separately.

Patient selection
At least 30 patients

Data to be recorded:

Minimum:

- Procedure type (including clinical indication)
- Equipment
- Date
- Age
- Gender
- Total fluoroscopy and acquisition time separately
- Air kerma-area product: P_{KA} (Gy.cm^2), screening (for bi-plane systems, this is usually the sum of PKA for frontal and lateral tubes.)
- Weight/height (for limited number of patients)

6.5. Computed Tomography and CT in multi-modality system SPECT /CT, PET/CT

Priority field of examination

More frequent and high dose procedures, however, should ensure to include if performed:

- Head
- Cervical
- Chest
- Abdomen
- Abdomen and pelvis
- Chest, abdomen and pelvis

DRLs should be defined according to clinical indication, rather than anatomical location.

Data for contrast-enhanced and non-contrast enhanced studies should be recorded separately

DRL Metric

cDLP, CTDI vol per sequence (mGy), SSDE (mGy)

Patient selection

At least 30 patients

For CT in multi-modality system (MD/CT) -SPECT/CT, PET/CT - at least 30 patients (adult patients with a weight between 50 and 90 kg) per examination of the most frequently performed hybrid imaging studies in the nuclear medicine departments.

If patients with weight outside the predefined range were included in the forms, these data points cannot be taken into account for further calculations.

Data to be recorded:

Minimum:

- Procedure type (including clinical indication)
- Equipment
- Date
- Age
- Gender
- DLP, CTDI vol per sequence, SSDE
- Weight of patient (for limited number of patients)

6.6. Diagnostic nuclear medicine

As opposed to using the term DRL the term optimal activity can be used.

Priority field of examination

More frequent and high dose procedures

DRL Metric

MBq or MBq Kg-1

Patient selection

At least 30 patients in the case of adults.

For paediatric patients the EANM Paediatric Dose Card (PDC) may be used. https://eanm.org/wp-content/uploads/2024/05/EANM_Dosage_Card_040214.pdf

Data to be recorded:

Minimum:

- Procedure type (including clinical indication)
- Equipment
- Date
- Age
- Gender
- Radionuclide/Radiopharmaceutical
- Administered activity.
- Patient weight (if procedure uses metric MBq Kg^{-1})

6.7. Dental examinations

Examination parameters:

- Procedure (intra oral, panoramic, cephalometric, CBCT)
- Clinical indication targeted for the examination
- Patient type (adult/ child)
- For CBCT the field of view.

When establishing intra-oral dental DRLs, dosimetry measurements are favoured over patient studies.

To establish intra-oral dental DRLs, measurements of incident air kerma (Ka, i) can be made at standard settings with a suitable calibrated detector placed at the end of the spacer cone of the X-ray set.

6.8. Paediatric

For paediatric DRLs, patients should be grouped by weight for body examination and age groups for head examinations and each group should include a minimum of 10 patients.

For nuclear medicine procedures, refer to recommended weight-based administered activities provided by the EANM paediatric dosage card.

The DRL values in Radiation Protection No. 185 European Guidelines on Diagnostic Reference Levels for Paediatric Imaging[2] will be referred to in this guidance.

DRLs value should be stratified (when relevant for that modality) preferably by weight and if not possible by age.

Typically head imaging would be stratified by age, whilst body imaging by weight.

6.8.1. Paediatric radiograpy and fluoroscopy

Radiograpy:

Head	AP/PA, Lat
Thorax	AP/PA
Abdomen	AP
Pelvis	AP

Flouroscopy:

Micturating cystourethrography

Paediatric computed tomography

Head

Thorax

Chest

Abdomen

6.8.2. Paediatric interventional procedures

No data available, undertakings to record their values.

[2] https://op.europa.eu/en/publication-detail/-/publication/6e473ff5-bd4b-11e8-99ee-01aa75ed71a1/language-en

7. National DRL values

7.1. Planar Radiography

National DRLs for Planar Radiography		
Procedure	Pka (DAP) (Gy.cm^2)	Year NDRLs adopted
Abdomen AP	1.8	2022
Abdomen PA	3.0	2022
C Spine AP	0.18	2022
C Spine LAT	0.13	2022
Chest LAT	0.80	2022
Chest PA	0.15	2022
Hip AP	2.5	2022
L Spine AP	3.8	2022
L Spine LAT	2.9	2022
Pelvis AP	2.4	2022
Skull AP	0.62	2022
Skull LAT	0.47	2022
Skull PA	0.67	2022
T Spine AP	0.99	2022
T Spine LAT	1.6	2022

Planar radiography projections. C- L- T- spine = Cervical- Lumbar- Thoracic-spine.

7.2. Mammography

National DRLs for Planar Mammography		
View	MGD (mGy)	Year NDRLs adopted
Cranio-caudal (CC)	1.46	2022
Medio-lateral oblique (MLO)	1.80	2022

National DRLs* for Tomosynthesis Mammography		
View	MGD (mGy)	Year NDRLs adopted
Cranio-caudal (CC)	2.8*	2025
Medio-lateral oblique (MLO)	2.8*	2025

*

*Based on the Ireland national DRLs, 2023.

7.3. Diagnostic Fluoroscopy

National DRLs for Diagnostic Fluoroscopy			
Procedure	cPka (cDAP) (Gy.cm2)	Fluoroscopy time (min)	Year NDRLs adopted
Barium swallow	6.24	1.5	2022
Video fluoroscopy	1.22	2.2	2022

7.4. General Interventional

To be made available when sufficient data is supplied to the Commission.

7.5. Interventional cardiology

To be made available when sufficient data is supplied to the Commission.

7.6. Computed Tomography

National DRL for Computed Tomography		
Procedure	cDLP (mGy.cm) (75%)	Year NDRLs adopted
Abdomen	734.93	2025
Abdomen and Pelvis	718.70	2025
Abdominal Aorta CTA	1977.73	2025
Brain	692.05	2025
Brain and Facial Bones	901.18	2025
Coronary Calcium Score CTA	302.65	2025
HRCT thorax	178.17	2025
IVU	1056.68	2025
Kidneys	2052.74	2025
KUB	331.54	2025
Liver	2481.23	2025
Neck and Trunk	1425.37	2025
Pancreas	1488.30	2025
Pneumonia	161	2025
Pulmonary CTA	270.64	2025
Sinuses	136.20	2025
Stroke Investigation	1739.70	2025
Thorax	543.70	2025
Thorax Abdo and pelvis	877.92	2025
Virtual Colonoscopy	1301.72	2025

CT procedures. CTA = CT Angiography, IVU = Intravenous Urogram, KUB = Kidneys Ureters Bladders, HRCT = High Resolution CT,

7.7. Multi-modality system: SPECT/CT, PET/CT

*

National DRLs for CT in multi-modality system: PET/CT				
Procedures (CTACL) & isotope	Sample Size	DLP (mGy.cm), 75%	CTDIvol, median 50% (mGy)	Year NDRLs adopted
Brain, F-18	80	71.5	2.9	2025
Head &Neck, F-18	62	937.9	22.8	2025
Half Body, F-18/Ga-68	861	1364.4	11,8	2025
Full Body, F-18/Ga-68	245	1510.2	11.7	2025
Dynamic, Ga-68	83	357.21	12.6	2025

National DRLs for CT in multi-modality system: SPECT/CT				
Procedures (CTACL) & isotope	Sample size	DLP (mGy.cm), 75%	CTDIvol (mGy), 50%	Year NDRLs adopted
Lung, Tc-99m	30	169.6	4.41	2025
Parathyroid, Tc-99m	40	177.9	4.3	2025
Whole body bone	43	150.1	3.6	2025

7.8. Radiotherapy Planning CT scans

*National DRLs for radiotherapy planning CT scans				
Examination	CTDI (mGy)	DLP (mGy cm)	Scan length (mm)	Year NDRLs adopted
breast	10	390	360	2025
gynaecological,	16	610	400	2025
lung 3D	14	550	390	2025
lung 4D	63	1750	340	2025
prostate,	16	570	340	2025
brain,	50	1500	290	2025
head and neck	49	2150	420	2025

*These NDRLs values taking from UK Guidance, 2022. Measurements may be made with standard CT dosimetry phantom (head and neck – 16cm phantom, all other – 32 cm phantom (without patients).

7.9. Nuclear medicine

National DRLs for Nuclear Medicine				
Examination	Radio-nuclide	Radio-pharmaceutical	Administered activity or activity per body weight (MBq or MBq.kg^{-1})	Year NDRLs adopted
Bone Scan (whole body)	TC-99m	MDP/HMDP	700	2022
Bone Scan (Three Phase)	TC-99m	MDP/HMDP	200	2022
Myocardial Perfusion (2-day protocol)	TC-99m	MIBI	400 (stress) 500 (rest)	2022
Myocardial Perfusion (1 day protocol)	TC-99m	MIBI	200 (stress) 600 (rest)	2022
Cardiac Amyloid	TC-99m	PYP	700	2022
Renogram (Dynamic)	TC-99m	DTPA	200 (Use PAC for paeds)	2022
	TC-99m	MAG3	70 (Use PAC for paeds)	2022
Renal Cortex Imaging	TC-99m	DMSA	150 (Use PAC for paeds)	2022
Lung Ventilation	TC-99m	Ventilation	700	2022
Lung Perfusion	TC-99m	MAA	100	2022
Lung Clearance	TC-99m	Ventilation	1500	2022
Thyroid Imaging	TC-99m	Pertechnetate	200	2022
Lymphoscintigraphy	TC-99m	Nanocolloid	37/injection site ,37 sentinel node imaging, 37/injection site (sentinel node melanoma)	2022
Gastric Emptying	TC-99m	Sulphur Colloid	80	2022
Gastrointestinal Bleed	TC-99m	Sulphur Colloid	600	2022
Hepatobiliary*	TC-99m	HIDA	150	2022
Hepatic Haemangioma	TC-99m	Stanous	600	2022
Parathyroid	TC-99m	Pertechnetate	50	2022
Parathyroid	TC-99m	Sestamibi	350	2022
Thyroid	TC-99m	Pertechnetate	200	2022
	I-131	Capsule	185 (post thyroid ablation)	2022
Meckel's Diverticulum	TC-99m	Na Pertechnetate	370 (Use PAC for paeds)	2022
MUGA	TC-99m	Stannous	570	2022
Parathyroid	TC-99m	MIBI	400	2022
	TC-99m	Na Pertechnetate	50	2022
Salivary Gland	TC-99m	Na Pertechnetate	150	2022
MUGA	TC-99m	Stannous	600	2022
Whole body	F-18	FDG	230	2022
Brain	F-18	FDG	100	2022
Prostate cancer	Ga-68	PSMA	2/Kg up to Max 200	2022
Neuroendocrine Tumours	I-123	MIBG	150 (Use PAC for paeds)	2022
	Ga-68	Dotatate	2/Kg up to Max 200	

DRLs are determined after an audit on adult patients weighing 70 ± 15 kg

DRL values are the optimised activity to a "standard-sized patient" with tolerance of +/- 10%.

For paediatric patients, or adults under 70 kg, use the Paediatric Dose Card (PDC)

7.10. Dental

*National DRLs for dentistry			
Modality	IAK (mGy)	Pka (DAP) mGycm^2	Year NDRLs adopted
Adult Intra oral mandibula	1.2		2022
Panoramic adult full jaw		81	2022
Cephalometric adult lateral		35	2022
CBCT adult prior to placement of a maxillary molar implant		265	2022

*Taken from Current DRL values from UK and Ireland.

7.11. Paediatric Radiology and fluoroscopy

* National DRL Paediatric Radiography and fluoroscopy			
Examination	Age or weight group	Kerma-area product Pka (DAP) mGycm^2	Year NDRLs adopted
Head AP/PA	3 months to 1 year	215	2022
	1 to 6 years	295	2022
	More than 6 years	350	2022
Head LAT	3 months to 1 year	200	2022
	1 to 6 years	250	2022
Thorax AP/PA **	Less than 5kg	15	2022
	5kg to 15kg	22	2022
	15kg to 30kg	50	2022
	30kg to50kg	70	2022
	50kg to 80kg	87	2022
Abdomen AP	Less than 5kg	45	2022
	5kg to 15kg	150	2022
	15kg to 30kg	250	2022
	30kg 50kg	475	2022
	50kg to 80kg	700	2022
Pelvis AP	15kg to 30kg	180	2022
	30kg to 50kg	310	2022
MCU	Less than 5kg	300	2022
	5kg to 15kg	700	2022
	15kg to 30kg	800	2022
	30kg to 50kg	750 *	2022

* Based on the European Guidelines on Diagnostic reference levels for Paediatric Imaging, Radiation Protection 185

** AP/PA DRL applies to both AP and PA projections

7.12. Paediatric Computed Tomography

* National Paediatric DRLs for Computed Tomography				
Examination	Age or Weight Group	$CTDI_{vol}$ mGy	DLP mGy.cm	Year NDRLs adopted
Head	Up to 3 months	24	300	2025
	3months to 1year	28	385	2025
	1 to 6 years	40	505	2025
	More than 6years	50	650	2025
Thorax	Less than 5kg	1.4	35	2025
	5kg to 15kg	1.8	50	2025
	15kg to 30kg	2.7	70	2025
	30kg to50kg	3.7	115	2025
	50kg to 80kg	5.4	200	2025
Abdomen	Less than 5kg	-	45	2025
	5kg to 15kg	3.5	120	2025
	15kg to 30kg	5.4	150	2025
	30kg to50kg	7.3	210	2025
	50kg to 80kg	13	480	2025

* Based on the UK national DRLs value, 2022

7.13. Paediatric dentistry

National DRL for children dentistry			
Modality	IAK (mGy)	Pka (DAP) (mGy/cm^2)	Year NDRLs adopted
Child Intra oral mandibula	0,7		2025
Panoramic child full jaw		60	2025
Cephalometric child lateral		24	2025
CBCT child (imaging of an impacted maxillary canine of a 12-year-old child) adult prior to placement of a maxillary molar implant		170	2025

IAK - Incident air kerma (mGy)

8. Annexes

8.1. Annex 1 - References to DRLs in the Regulations

8.1.1. Definition of DRL

The definition of an DRL is given in Regulation 4 of SL585.01 as:

> *“"diagnostic reference levels" means dose levels in medical radiodiagnostic or interventional radiology practices, or, in the case of radiopharmaceuticals, levels of activity, for typical examinations for groups of standard-sized patients or standard phantoms for broadly defined types of equipment;”*

8.1.2. The Role of the Commission

Regulation 66(3)(a) states:

> *(a) The Commission shall establish and regular review national diagnostic reference levels for radio-diagnostic examinations, having regard to the current European diagnostic reference levels where available, and where appropriate, for interventional radiology procedures, and the availability of guidance for this purpose.*

8.1.3. The obligations of an undertaking:

Regulation 66(3)(b) states:

> *(b) An undertaking shall ensure that their diagnostic reference levels for radiodiagnostic examinations, and where appropriate for interventional radiology procedures, are established, regularly reviewed and used, having regard to the national diagnostic reference levels where available.*

Regulation 70 (e) states:

> *“Undertaking’s radiation protection programmes shall include that:*
> *…*
> *(e) appropriate reviews are undertaken whenever diagnostic reference levels are consistently exceeded and that appropriate corrective action is taken without undue delay;”*

8.1.4. Role of Medical Physics Experts

Regulation 107(2)(c) states:

> *“(2) Depending on the medical radiological practice, the medical physics expert shall take responsibility for dosimetry, including physical measurements for evaluation of the dose delivered to the patient and other individuals subject to medical exposure, give advice on medical radiological equipment, and contribute in particular to the following:*
> *…*
> *(c) optimisation of the radiation protection of patients and other individuals subject to medical exposure, including the application and use of diagnostic reference levels.*

8.2. Annex 2 – Reference material

Maltese Legislation

Basic safety standards for ionising radiation regulations, SL 585.01
https://legislation.mt/eli/sl/585.1/eng

European Guidelines

Radiation Protection No.154 European Guidance on Estimating Population Doses from Medical X-Ray Procedures
https://op.europa.eu/en/publication-detail/-/publication/72d806a2-2fb4-4e4d-a845-3b276feed8eb

Radiation Protection No. 185 European Guidelines on Diagnostic Reference Levels for Paediatric Imaging.
https://op.europa.eu/en/publication-detail/-/publication/6e473ff5-bd4b-11e8-99ee-01aa75ed71a1/language-en

Radiation Protection No. 195 European Study on Clinical Diagnostic Reference Levels for X-ray Medical Imaging
https://op.europa.eu/en/publication-detail/-/publication/a78331f7-7199-11eb-9ac9-01aa75ed71a1

Published paper on DRLs in Malta

Establishing Local and National Diagnostic and Interventional Cardiology and Radiology Reference Levels in A Small European State: The Case of Malta
Eric Pace, Kelvin Cortis, Joseph Debono, Marvin Grech and Carmel J Caruana

Radiation Protection Dosimetry (2020), Vol. 191, No. 3, pp. 261–271

EU member states dental DRLs referenced

Irish DRLs

Diagnostic Reference Levels Guidance on the establishment, use and review of diagnostic reference levels for medical exposure to ionising radiation December 2023

https://www.hiqa.ie/sites/default/files/2023-11/Diagnostic-Reference-Levels-Undertaking-guidance-2023.pdf

UK DRLS

Guidance National Diagnostic Reference Levels (NDRLs) from 13 October 2022
https://www.gov.uk/government/publications/diagnostic-radiology-national-diagnostic-reference-levels-ndrls/ndrl

8.3. Annex 3 - Abbreviations

AP	Anterier-Posterior
CA	Coronary angiography
CC	Craniocaudal
cPka (cDAP)	Cumulative kerma area product
CBCT	Cone beam computed tomography
CT	Computed tomography
$CTDI_{vol}$	Volume computed tomography dose index
cDLP	Cumulative kerma length product in mGy.cm
DAP	Dose area product
DBT	Digital tomosynthesis mammography
DLP	Dose length product
DRL	Diagnostic Reference Level
FDRL	Facility Diagnostic Reference Level
IAK	Incident air kerma (mGy)
IQR	Interquartile Range
IVU	Intravenous Urogram
Pka (DAP)	Kerma-area product in $mGy.cm^2$
LAT	Lateral
LSJ	Lumbo-sacral-joint
MLO	Mediolateral oblique
MPE	Medical Physics Expert
MGD	Mean glandular dose
NDRL	National Diagnostic Reference Level
PA	Posterior-Anterior
PICC	Peripherally inserted central catheter
PAC	Paediatric activity calculator
PCI	percutaneous coronary intervention
PTA	percutaneous transluminal angioplasty
PTC	Percutaneous transhepatic cholangiography
PTCA	Percutaneous transluminal coronary angioplasty
SSDI	Size specific dose index

8.4. Annex 4 – Definitions

Facility – One or more rooms at a single Commission licenced location were medical exposures take place. For organisations that have several Commission licenced sites each site will need its own facility DRL.

Typical dose value – means a median of the sample.

Facility DRLs – means a median values for individual x-ray room or a single facility. If there are insufficient data in a single x-ray room, or a single facility the median value should be used as "typical value" to identify x-ray units requiring further optimisation.

Mean values - is an observed for a selected sample of departments.

Median value – means the 50th percentile of the distribution of a DRL quantity observed in a survey of department.

Patient exposure data – means a collection of metrics characterising patient exposure to ionising radiation including both modality centric and patient centric quantities.

Exposure monitoring - means a process including the mechanism and the operational elements related to collecting, interpreting, and acting upon quantities associated with clinical imaging operation.

Recording (collecting) patient exposure data – means a process of documenting patient exposure data into a common system manually or electronically.

Managing patient exposure data – means a process of oversight through exposure data recording, tracking, and analysis towards improvement of radiation protection and patient care.

Cumulative r kerma, cPka (cDAP) - is the accumulated or total Pka (DAP) value over the procedure, reflecting the sum of all Pka (DAP) measurements from the beginning to the end of the session (total).

Mean glandular dose (MGD) – means an absorbed dose in glandular breast tissue.

Might be calculated to the standard breast which is defined as 4.2 cm thick ACR phantom:

MGD = Kgcs

K – entrant surface air kerma (the air kerma from the incident beam on the central x-ray beam axis at the skin entrance plane, backscatter excluded),

- *g- conversion factor for 50% glandular breast based on thickness and half -value layer.*
- *c- correction factor based on non-standard granularity/thickness.*
- *s - correction factors based on non-molybdenum anode/ filter combination.*

Percentile - a percentile is the value below which a percentage of data falls. For example, a value is the 75th percentile where 75% of the data is below that value.

Revision History

Prepared by	Approved by	Approval Date	Summary of change
Secretariat	P Brejza	January 2022	Initial version
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