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COMMISSION RECOMMENDATION (Euratom) 2026/403

of 23 February 2026

on the establishment, review and use of diagnostic reference levels for radiodiagnostic examinations and interventional radiology procedures

THE EUROPEAN COMMISSION,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 33, second paragraph, and Article 106a thereof referring to Article 292 of the Treaty on the Functioning of the European Union,

Having consulted the group of experts referred to in Article 31, first paragraph of the Treaty establishing the European Atomic Energy Community,

Whereas:

(1) Article 2, point (b), of the Treaty establishing the European Atomic Energy Community ('Euratom Treaty') provides for the establishment of uniform safety standards to protect the health of workers and of the general public against the dangers arising from ionising radiation.

(2) To achieve that objective, Article 31 of the Euratom Treaty entrusts the Council with the task of establishing basic standards for the protection of the health of workers and the general public against the dangers arising from ionising radiations on a proposal from the Commission, while Article 32 allows those basic standards to be revised or supplemented.

(3) The Council has adopted several directives laying down those basic safety standards, including Council Directive 2013/59/Euratom ([1]).

(4) Directive 2013/59/Euratom establishes standards for the protection of the health of individuals subject to occupational, medical and public exposure against the dangers arising from ionising radiation. Those standards apply, among others, to the medical uses of ionising radiation for diagnostic, therapeutic, interventional, planning, guiding and verification purposes. Medical uses of ionising radiation are an essential component of modern medical diagnostics and treatment, which, if conducted appropriately, offer significant benefits to the patients and to society.

(5) Directive 2013/59/Euratom defines diagnostic reference levels (DRLs) as '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'.

(6) Article 56(2) of Directive 2013/59/Euratom requires Member States to ensure the establishment, regular review and use of DRLs for radiodiagnostic examinations and, where appropriate, for interventional radiology procedures, having regard to the recommended European DRLs where available. Article 58, point (f), further requires Member States to ensure that appropriate local reviews are undertaken whenever DRLs are consistently exceeded, and that appropriate corrective action is taken without undue delay.

(7) The concept of DRLs was first introduced by the International Commission on Radiological Protection (ICRP) in 1991 ([2]) and has since then been further developed and acknowledged as a fundamental component of optimisation in medical exposure. DRLs have been part of Euratom legislation since the entry into force of Council Directive 97/43/Euratom ([3]), and were further strengthened in Directive 2013/59/Euratom.

([1]) Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom (OJ L 13, 17.1.2014, p. 1, ELI: http://data.europa.eu/eli/dir/2013/59/oj).

([2]) ICRP 1991. 1990 Recommendations of the International Commission on Radiological Protection. ICRP Publication 60. Ann. ICRP 21 (1-3).

([3]) Council Directive 97/43/Euratom of 30 June 1997 on health protection of individuals against the dangers of ionizing radiation in relation to medical exposure, and repealing Directive 84/466/Euratom (OJ L 180, 9.7.1997, p. 22, ELI: http://data.europa.eu/eli/dir/1997/43/oj).

(8) Medical procedures remain by far the largest artificial source of exposure to ionising radiation for the public, with particular safety and quality challenges identified in diagnostic and interventional radiology, radiotherapy and nuclear medicine procedures. A recent report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) showed an increase in patient exposure ([4]). This rise in radiation dose may be linked to technological advances in the medical uses of ionising radiation combined with an increase in the number of indications for medical imaging and the longer life expectancy of the population.

(9) In the past decade, the Commission has funded several European projects on how to establish and facilitate the implementation and use of DRLs in Member States ([5]). In June 2024, the Commission organised a workshop on DRLs ([6]) to evaluate and discuss the level of national implementation of the requirements set out in Directive 2013/59/Euratom and the guidance provided in the Commission radiation protection series publications ([7]).

(10) Even though Member States strongly support the concept of DRLs, including local DRLs, many DRLs are outdated, and their utilisation and implementation in clinical practice varies greatly. Differences exist in methodology, review frequency and challenges in data collection. The role and advantages of dose monitoring systems (DMS) and big data in establishing DRLs are strongly advocated by the Member States, but low data quality and the lack of standardisation and harmonisation to allow for structured data remain a problem. Recent developments, such as the adoption of the Regulation on the European Health Data Space ([8]), may aid in these tasks. The possibilities and role of artificial intelligence (AI) in improving DRLs, and the implementation of AI solutions in clinical practice, were highlighted as important.

(11) It is therefore appropriate to make recommendations for harmonising the provisions applicable in the Member States regarding the implementation of the provisions of Directive 2013/59/Euratom on the establishment, review and use of DRLs for radiodiagnostic examinations and interventional radiology procedures, in order to promote a more harmonised approach at Community level.

(12) The aim of this Recommendation is to support Member States, national authorities and healthcare facilities in the implementation of the provisions of Directive 2013/59/Euratom on DRLs in medical applications of ionising radiation, with a special focus on improving their use in the day-to-day optimisation of radiation protection.

([4]) United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) 2020/2021 Report, Annex A: *Evaluation of Medical Exposure to Ionizing Radiation*. (New York: United Nations, 2022), https://www.unscear.org/unscear/uploads/documents/unscear-reports/UNSCEAR_2020_21_Report_Vol.I.pdf.

([5]) See, for example, European Commission: Directorate-General for Energy, *Medical radiation exposure of the European population (RP 180)*, Luxembourg: Publications Office of the European Union, 2015, https://data.europa.eu/doi/10.2833/708119; European Commission: Directorate-General for Energy, *European guidelines on diagnostic reference levels for paediatric imaging (RP 185)*, Luxembourg: Publications Office of the European Union, 2018, https://data.europa.eu/doi/10.2833/486256 and European Commission: Directorate-General for Energy, Damilakis, J., Frija, G., Jaschke, W., Paulo, G. et al., *European study on clinical diagnostic reference levels for X-ray medical imaging – EUCLID (RP 195)*, Luxembourg: Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2833/452154.

([6]) European Commission, Workshop on Diagnostic Reference Levels, 17-18 June 2024, Luxembourg.

([7]) https://energy.ec.europa.eu/topics/nuclear-energy/radiation-protection/scientific-seminars-and-publications/radiation-protection-series-publications_en.

([8]) Regulation (EU) 2025/327 of the European Parliament and of the Council of 11 February 2025 on the European Health Data Space and amending Directive 2011/24/EU and Regulation (EU) 2024/2847 (OJ L, 2025/327, 5.3.2025, ELI: http://data.europa.eu/eli/reg/2025/327/oj).

(13) This Recommendation takes into account the positions put forward by the Steering Group on Quality and Safety of medical applications of ionising radiation ('SGQS') ([9]), whose objective is to support the implementation in Member States of activities in the area of quality and safety of medical applications of ionising radiation. These positions emphasised the need for management of patient exposure and optimisation of radiation protection, since dose limits do not apply to medical exposures. The Steering Group acknowledged that DRLs are an essential tool in optimisation of radiation protection of patients helping to ensure a continuous improvement in the quality and safety of healthcare services. At the same time, they highlighted that the concept of DRLs is complementary to other methods of optimisation and recognised the importance of DMS, big data and AI to facilitate the establishment and use of DRLs,

HAS ADOPTED THIS RECOMMENDATION:

This Recommendation concerns good practices with respect to the establishment, review and use of diagnostic reference levels for radiodiagnostic examinations and interventional radiology procedures. It invites the Member States to follow these good practices.

1. **National framework for DRLs**

Member States should provide a national governance framework for the establishment, review and use of diagnostic reference levels (DRLs) and earmark appropriate resources to support and maintain such a framework.

Member States should promote a consistent national approach to the establishment, review and use of DRLs by clearly identifying the relevant stakeholders and their respective responsibilities in the process. Relevant stakeholders may vary but Member States should consider including competent authorities, health boards, professional societies, healthcare facilities, manufacturers and vendors of medical equipment. At a minimum, the establishment and review of DRLs, the collection, validation and analysis of data, and the production of guidance material for healthcare facilities on the use of DRLs should be included.

Member States should define the respective roles of the practitioner, the medical physics expert and those persons entitled to carry out practical aspects of medical radiological procedures in the collection, validation and analysis of data for establishment of DRLs as well as in the use of DRLs as a tool for optimisation in healthcare facilities.

Member States should put in place a flexible and dynamic process to establish and review DRLs. Flexibility is necessary for procedures where few data are available (e.g. interventional procedures in paediatric patients), or where data are available from a small number of healthcare facilities. A dynamic process is necessary to allow initial DRLs to be derived from these data while waiting for a more comprehensive data collection.

2. **Methodology for establishing and reviewing national DRLs**

Member States should identify examinations and procedures for which national DRLs should be established, aiming for a sufficient coverage of the most common examinations and procedures or those where the collective dose to the population is significant. Where possible, given the different needs in image quality, national DRLs should be established for clinical indications. However, it is acknowledged that DRLs based on clinical indications are not suitable for all modalities, examinations and procedures, and hence DRLs based on anatomical regions could be used in these cases.

Member States should consider the nomenclature used to describe clinical indications, examinations and procedures when establishing DRLs. They should promote the use of standardised terminology and support the development of such terminology where not available. Consistent and precise description is important, especially for clinical indication-based DRLs.

For this purpose, Annexes 1 and 2 provide an overview of (i) terms used in this document; (ii) relevant dose quantities; and (iii) clinical indications, examinations and procedures for which European DRLs have been established. While differences in equipment stocks, together with varying frequency of examinations and procedures, may complicate a harmonised approach, Member States should refer to these annexes to promote consistency when establishing national DRLs.

([9]) Register of Commission Expert Groups and Other Similar Entities, reference code E03845.

Member States should seek to ensure that national DRLs reflect current national practices and associated patient doses, and should adopt a review frequency that fits continuous advances in imaging technologies and low-dose techniques. The relevance of the DRLs should be checked regularly by national surveys, at least every three to five years, except for dental examinations, for which a lower frequency can be adopted.

3. **Data collection and setting of the DRL values**

National DRLs should be based on national dose surveys, collecting data from a representative range of healthcare facilities. To be considered representative, Member States should include both public and private facilities, and facilities of different sizes, from the entire country. To obtain national dose distributions suitable for setting DRL values, Member States should promote national DRLs based on a relevant number of typical values collected from an appropriate and representative range of healthcare facilities.

Typical values from healthcare facilities established from retrospective reviews of large numbers of patients, preferably obtained from dose management systems (DMS) or patient dose repositories, could be considered representative of the patient population even if the data include no information on the patient morphology. However, typical values could also be established for a smaller number of patients standardised by weight. In this case, data on the patient morphology are of great importance, and Member States should promote the quantification of the standard size (for example: weight, height, body mass index) for the patient population to guide this process. Care should be taken to ensure consistent data collection. Retakes and other irregularities should not be included in the definition of typical examinations used to derive typical values submitted to establish DRLs, because they are not considered part of a regular examination. Such data, however, are useful for national and local reviews. This is not the case for large amounts of data collected through DMS, as the impact of rejected images on typical dose will be negligible.

The DRL value set at the 75th percentile of the national distribution of typical values (i.e. median values) for a given DRL quantity should normally be adopted as the national DRL ([10]).

Member States may consider establishing an achievable dose level ([11]), to be set at the median of the national dose distribution. This achievable dose level provides a further opportunity for optimisation for healthcare facilities whose typical values lie under the national DRL.

Member States may consider establishing the 25th percentile as a level for identifying examinations where sufficient diagnostic image quality should be verified.

Member States may also consider analysing the national dose distribution to obtain valuable information about the level of optimisation at national level. For instance, a wide dose distribution may indicate that additional optimisation efforts would be needed.

4. **Data validation and data quality**

Member States should support healthcare facilities in ensuring appropriate quality control and validation of data before submission for inclusion in national dose distributions.

It should be recognised that the use of DMS aids the establishment of DRLs and their frequent updating. However, when large amounts of data obtained from different IT systems are used, the quality and inherent uncertainty of the data should be carefully considered.

Vendors should make efforts that the relevant Digital Imaging and Communications in Medicine (DICOM) data comply with the concept of Radiation Dose Structured Report (RDSR) ([12]). For the implementation of these standards, integration profiles such as those from the IHE (Integrating the Healthcare Enterprise) initiative could be used, as detailed in the IHE Radiation Exposure Monitoring (REM) profile ([13]). Vendors and equipment manufacturers also play an important role in the harmonisation of dose quantities and units displayed by radiological equipment to improve the consistent display of DRL quantities ([14]), which can assist staff and foster optimisation.

([10]) ICRP, 2017. Diagnostic reference levels in medical imaging. ICRP Publication 135. Ann. ICRP 46(1).
([11]) National Council on Radiation Protection and Measurements (NCRP) Report No 172: *Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States* (2012).
([12]) https://www.dicomstandard.org/using/radiation.
([13]) https://www.ihe.net/resources/profiles/.
([14]) HERCA Working Group on Medical Applications: *HERCA Report on Equipment* (January 2021).

Mechanisms to assess the quality of the data and the consistency of the values should be checked in relation to the examination under consideration. Member States should consider possible limitations of automated systems used for the establishment and review of DRLs. Member States should work together with manufacturers to address the need for harmonised examination nomenclature, access to structured data on clinical indications and the harmonisation of dose quantities and units displayed by radiological equipment. Access to good-quality digital data plays an important role in the generation and presentation of large amounts of data used for establishing DRLs.

The use of artificial intelligence for data verification and analysis may be considered by Member States, based on appropriate validation of the AI tools available. A coordinated effort could be supported by the Member States already advanced in this area.

5. **Image quality**

Member States should support the inclusion of image quality assessments when applying the concept of DRLs. Evaluation of patient radiation dose based on DRL quantities alone, without taking image quality criteria into account, should not be seen as appropriate. Otherwise, the DRL quantity could reach a level that compromises the image quality. Healthcare facilities should always place emphasis on image quality being adequate before collecting dose data to set national DRLs. It should be recognised that the 25th percentile value could be used as a tool to identify situations where image quality needs to be evaluated. However, the impact of image post-processing tools should be considered in image quality assessments, and the complexity of the relationship between dose and image quality is further increased by introduction of AI to enhance image quality.

6. **DRLs in specific clinical settings**

Member States should promote the establishment of national DRLs to sufficiently cover common examinations and procedures across all modalities, including dental cone beam computed tomography (CBCT), mammography, hybrid imaging and image-guided radiotherapy (IGRT), for both paediatric and adult patients.

Methodological differences and challenges in data collection, especially in paediatric radiology, nuclear medicine and IGRT, indicate the need for further development and guidance. In circumstances of limited availability of resources, establishment of DRLs should be prioritised for frequent and high-dose examinations/procedures and examinations/procedures of populations at higher risks (e.g. paediatric patients).

6.1. *Paediatric DRLs*

Establishment of paediatric DRLs should consider the individual size differences in this population, which can make it difficult to collect sufficient data to establish DRLs. For examinations/procedures of the body, it is recommended to differentiate size by weight groups instead of age groups, while differentiation by age groups is preferred for head examinations/procedures. Since weight may not yet routinely be registered and/or accessible from IT systems of healthcare facilities, Member States may still have their paediatric DRLs based on age. Actions to shift from age- to weight-based DRLs should be encouraged by the Member States. Further recommendations on weight and age groups can be found in Annex 3. In addition, surveys to establish DRLs may focus primarily on specialised paediatric facilities with high volumes of paediatric imaging.

To overcome the general paucity of dose data in paediatric examinations/procedures within each size group, the DRLs can be presented as a function of the parameter used for patient grouping ([15]). The DRL-curve approach should only be applied if data from the patient dose surveys indicate a clear relationship between the DRL quantity and the patient grouping parameter, for example patient weight (DRL quantity-weight curve). This approach enables healthcare facilities to verify compliance with DRLs based on data collected from a limited number of patients (e.g. ten consecutive patients) regardless of their size, by indicating these data points on the DRL curve. If the majority of the data points are beneath the DRL curve, or if a curve fitted to the data lies below the DRL curve, then the DRL value has not been exceeded ([16]).

([15]) See Kiljunen T., Järvinen H. Savolainen S., *Diagnostic reference levels for thorax X-ray examinations of paediatric patients*, The British Journal of Radiology, 80 (2007), 452-459, and Almén A et al. *Establishing paediatric diagnostic reference levels using reference curves – A feasibility study including conventional and CT examinations*, Physica Medica, Volume 87, July 2021, pages 65-72.

([16]) ICRP, 2017. Diagnostic reference levels in medical imaging. ICRP Publication 135. Ann. ICRP 46(1).

6.2. *Nuclear medicine DRLs*

Observed differences in methodology for DRLs in nuclear medicine indicate a need for harmonisation across the EU. Standard methodology should be followed, meaning that DRLs should be set at the 75th percentile of the national distribution of typical values. However, it is acknowledged that Member States may continue to use existing methodologies for calculating DRL values to maintain their ability to monitor national trends. A transition may be performed by setting DRLs based on both approaches for a transition period, over one or a few data collection cycles.

To promote the use of DRLs as a tool for optimisation in nuclear medicine, Member States should establish DRLs based on measured administered activity per body weight and not on fixed nominal activity. While it is acknowledged that weight-based activity is not always in clinical use, Member States should strive to implement this practice where reasonably applicable.

For hybrid imaging, the concept of DRLs should be extended to include the CT component of the examination. The various purposes of the CT scan (attenuation correction, localisation and diagnostics) should be considered when setting the DRL value.

6.3. *Image-guided radiotherapy DRLs*

Directive 2013/59/Euratom requires that all doses due to medical exposure for planning, guiding and verification purposes are optimised. However, the establishment of DRLs for image-guided radiotherapy (IGRT) has not been explicitly included in the concept of DRLs. With reference to the steady increase in the use of IGRT in treatment planning as well as for positioning and verification purposes, Member States may consider establishing DRLs ([17]) also for these exposure situations. Easy access to relevant dose quantities is still limited, and Member States should engage with vendors and manufacturers of equipment to facilitate efficient access to dose quantities for establishment of DRLs in IGRT.

7. **Use of DRLs as a tool for optimisation of radiation protection in healthcare facilities**

Member States should encourage healthcare facilities to implement the concept of DRLs as a tool for optimisation in their clinical practice to enhance the quality and safety of medical applications using ionising radiation. The role and use of DRLs in the optimisation process should be described in the facilities' management systems.

DRLs are used to identify and evaluate whether, in routine circumstances, the amount of ionising radiation used in medical imaging or interventional procedures at a local healthcare facility is systematically unusually high or low. This is done by comparing their typical values for given examinations/procedures against established national DRL values. Appropriate local review should be undertaken whenever typical doses exceed national DRLs, and appropriate corrective actions should be taken without undue delay. If typical values are significantly below the DRL values, an investigation should be performed to ensure that the image quality is sufficiently high for the clinical needs.

It is acknowledged that optimisation is a task that requires a multidisciplinary team and must consider all factors affecting radiation dose and image quality. In addition to the DRL methodology used, factors like equipment type, quality control, calibration, exposure parameters and procedure complexity, as well as training of the practitioner and personnel who conduct the practical aspects of the procedure should be investigated. Healthcare facilities should aim for representative typical values, which implies that these values should be updated after changes have been made to the standardised protocols and following equipment replacement or software upgrades that may affect the patient dose.

Member States should provide guidance and educational support to healthcare professionals enabling them to fully integrate the concept and use of DRLs in clinical practice.

([17]) In the case of image-guided radiotherapy, more appropriately referred to as 'dose reference levels'.

8. **Establishment of local DRLs**

Establishment of local DRLs is recommended to extend the concept of DRLs even further. Local DRLs should be established where national DRLs are missing or outdated, or where local circumstances make national DRLs not suitable for optimisation purposes. Local needs should be considered when setting local DRLs, for example when a new technology is put into clinical use. Establishment and review of local DRLs should follow the same methodology as for the establishment and review of national DRLs.

Done at Brussels, 23 February 2026.

For the Commission
Dan JØRGENSEN
Member of the Commission

ANNEX 1

The following terms (adapted from ICRP 135 ([1])) are used in the main document:

'DRL quantity' means a commonly and easily measured or determined radiation metric that assesses the amount of ionising radiation used to perform a medical imaging task.

'DRL value' means the 75th percentile of the medians of the distribution of the DRL quantity obtained from surveys or other means. This term applies to Local and National DRLs (ICRP 135).

'Typical value' means the median of the distribution of a DRL quantity for a defined clinical indication, examination or procedure. The distribution includes data from a particular healthcare facility that may have a single or several X-ray rooms.

'Local DRL' means a DRL value for an X-ray procedure set in a specific region of a country or for a group of facilities for a defined clinical indication, examination or procedure.

'National DRL' means a DRL value set in a country based on data from a representative sample of healthcare facilities in that country for a defined clinical indication, examination or procedure.

'European DRL' means DRLs set in Europe as the median of the distribution of national DRLs from a number of European countries.

DRL quantities used for setting DRLs are provided in the Table below.

Table

Dose-related quantities used for setting DRLs (adapted from ICRP 135, RP 172 ([2]), RP 185 ([3]), RP 195 ([4]), MEDIRAD ([5]), VERIDIC ([6]) and HERCA ([7]))

Modality	Abbreviation	Quantity	Unit
Radiography	P_{KA}	Air kerma-area product	mGy.cm^2
	$K_{a,e}$	Entrance-surface air kerma	mGy
Dental, intra-oral	$K_{a,i}$	Incident air kerma	mGy
Dental, panoramic	P_{KA}	Air kerma-area product	mGy.cm^2

([1]) ICRP, 2017. Diagnostic reference levels in medical imaging. ICRP Publication 135. Ann. ICRP 46(1).
([2]) European Commission: Directorate-General for Energy, Cone beam CT for dental and maxillofacial radiology – Evidence-based guidelines (RP 172), Publications Office, 2012, https://data.europa.eu/doi/10.2768/21874.
([3]) European Commission: Directorate-General for Energy, European guidelines on diagnostic reference levels for paediatric imaging (RP 185), Publications Office, 2018, https://data.europa.eu/doi/10.2833/486256.
([4]) European Commission: Directorate-General for Energy, Damilakis, J., Frija, G., Jaschke, W., Paulo, G. et al., European study on clinical diagnostic reference levels for X-ray medical imaging – EUCLID (RP 195), Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2833/452154.
([5]) Implications of Medical Low Dose Radiation Exposure (MEDIRAD) Project, Recommendations, 2022, https://www.eibir.org/projects/medirad/medirad-recommendations/.
([6]) Dabin, J 2020, 'VERIDIC – Validation and estimation of radiation skin dose in interventional cardiology: Commissioning and quality control protocols for skin dose calculation software', AIR2 Bulletin on infrastructures, Vol. May 2020, No 12, pp. 1 & 3. https://www.concert-h2020.eu/en/Concert_info/Access_Infrastructures/Bulletins.
([7]) HERCA proposal on harmonization of DAP units (2012), approved on the occasion of the 10th HERCA Meeting, 31 October 2012.

Modality	Abbreviation	Quantity	Unit
Cone-Beam CT	P_{KA}	Air kerma-area product	$mGy.cm^2$
Mammography, Breast tomosynthesis	D_G	Mean glandular dose	mGy
CT	$CTDI_{vol}$	Computed tomography dose index (volume)	mGy
	DLP	Dose-Length Product	mGy.cm
Fluoroscopy and fluoroscopically guided interventions	P_{KA}	Air kerma-area product	$Gy.cm^2$
	$K_{a,r}$	Air kerma at the patient entrance reference point	Gy
Nuclear Medicine		Administered activity per body weight	$MBq.kg^{-1}$
		Administered activity	MBq
Hybrid imaging – CT-part	$CTDI_{vol}$	Computed tomography dose index (volume)	mGy
	DLP	Dose-Length Product	mGy.cm

ANNEX 2

An overview of clinical indications, examinations and procedures for which European DRLs have been established, is given in the Table below. DRL values established by the referenced projects are available in their reports. They are not included below as they are an aggregate of DRLs in a number of European countries at a certain point in time and are not expected to represent the actual practice in a particular Member State or healthcare facility.

Table

Clinical indications, examinations and procedures for which European DRLs have been established (adapted from RP 185, RP 195, MEDIRAD and VERIDIC)

Modality	Patient Group	Procedure, anatomical area, clinical indication	Quantity	Unit
Radiography	Paediatrics	Head AP/PA	P_{KA}	$mGy.cm^2$
		Head LAT	P_{KA}	$mGy.cm^2$
		Thorax AP/PA	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Abdomen AP	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Pelvis AP	P_{KA}	$mGy.cm^2$
Radiography	Adults	Cervical spine AP	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Cervical spine LAT	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Thoracic spine AP	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Thoracic spine LAT	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Lumbar spine AP	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Lumbar spine LAT	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Skull AP/PA	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Skull LAT	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Chest PA	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Chest LAT	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Abdomen AP	P_{KA}	$mGy.cm^2$
			Ka,e	mGy

Modality	Patient Group	Procedure, anatomical area, clinical indication	Quantity	Unit
		Pelvis AP	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
		Hip AP	P_{KA}	$mGy.cm^2$
			Ka,e	mGy
CT	Paediatrics	Head	$CTDI_{vol}$	mGy
			DLP	mGy.cm
		Thorax	$CTDI_{vol}$	mGy
			DLP	mGy.cm
		Abdomen	$CTDI_{vol}$	mGy
			DLP	mGy.cm
	Adults	Stroke – Detection or exclusion of a haemorrhage	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm
		Chronic sinusitis – Detection or exclusion of polyps	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm
		Cervical spine trauma – Detection or exclusion of a lesion	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm
		Pulmonary embolism – Detection or exclusion	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm
		Coronary calcium scoring – Risk stratification	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm
		Coronary angiography – Vessels assessment	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm
		Lung cancer – Oncological staging, First and Follow-up	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm

Modality	Patient Group	Procedure, anatomical area, clinical indication	Quantity	Unit
		Hepatocellular carcinoma – Oncological staging	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm
		Colic / abdominal pain – Exclusion or detection of a stone	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm
		Appendicitis – Detection or exclusion	$CTDI_{vol}$	mGy
			DLP	mGy.cm
			Scan length	cm
Fluoroscopy	Paediatrics	Micturating cystourethrography (MCU)	P_{KA}	$mGy.cm^2$
Fluoroscopically guided intervention	Adults	Arterial occlusive disease of iliac arteries	P_{KA}	$Gy.cm^2$
			Ka,r	mGy
			Time	minutes
		Transarterial chemoembolisation (TACE)	P_{KA}	$mGy.cm^2$
			Ka,r	mGy
			Time	minutes
		Arterial occlusive disease of femoropopliteal arteries	P_{KA}	$mGy.cm^2$
			Ka,r	mGy
			Time	minutes
		Biliary drainage	P_{KA}	$mGy.cm^2$
			Ka,r	mGy
			Time	minutes
		Percutaneous Coronary Intervention (PCI)	P_{KA}	$Gy.cm^2$
			Ka,r	mGy
		Chronic Total Occlusion Percutaneous Coronary Intervention (CTO)	P_{KA}	$Gy.cm^2$
			Ka,r	mGy
		Trans catheter Aortic Valve Implantation (TAVI)	P_{KA}	$Gy.cm^2$
			Ka,r	mGy
Hybrid imaging	Adults	[^{18}F] FDG PET/CT half body attenuation correction only (AC)	$CTDI_{vol}$	mGy
			DLP	mGy.cm
		[^{18}F] FDG PET/CT half body attenuation correction and anatomical localisation (AL)	$CTDI_{vol}$	mGy
			DLP	mGy.cm

Modality	Patient Group	Procedure, anatomical area, clinical indication	Quantity	Unit
		[^{18}F] FDG PET/CT brain attenuation correction	$CTDI_{vol}$	mGy
			DLP	mGy.cm
		99mTc-bone SPECT/CT (trunc.) anatomical localisation	$CTDI_{vol}$	mGy
			DLP	mGy.cm
		Parathyroid SPECT/CT anatomical localisation	$CTDI_{vol}$	mGy
			DLP	mGy.cm
		99mTc-Cardiac SPECT/CT attenuation correction	$CTDI_{vol}$	mGy
			DLP	mGy.cm

In accordance with RP 195, Dose Length Product (DLP) values mentioned in Tables 1 and 2 refer both to individual sequences (DLP_p) or to a complete examination (DLP_t), as information about the number of phases considered for the determination of DRLs should always be provided and all phases should be considered in establishment, as they incorporate information about the exposure conditions of the whole CT examination.

ANNEX 3

When establishing paediatric DRLs, recommended age and weight categorisation is displayed in Table A below.

Table A

Recommended age and weight categorisation for paediatric DRLs (RP 185)

Recommended weight groups for body examinations	Recommended age groups for head examinations
< 5 kg	0 – < 3 months
5 – < 15 kg	3 months – < 1 y
15 – < 30 kg	1- < 6 y
30 – < 50 kg	≥ 6 y
50 – < 80 kg	

The categorisation of paediatric patients for body examinations is suggested to be done based on weight. However, when paediatric populations are differentiated by age for body examinations in a healthcare facility or a Member State, approximate equivalence of weight and age groups is also supplied for the relevant conversion of data, see Table B.

Table B

Weight and age groups for comparing weight-based DRLs with age-based DRLs (RP 185)

Description	Weight Group	Age Group
Neonate	< 5 kg	< 1 month
Infant, toddler and early childhood	5 – < 15 kg	1 month – < 4 years
Middle childhood	15 – < 30 kg	4 – < 10 years
Early adolescence	30 – < 50 kg	10 – < 14 years
Late adolescence	50 – < 80 kg	14 – < 18 years