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Translation. Original text in Finnish.

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## **Reference levels for the patient's radiation exposure for conventional X-ray examinations of adults**

The responsible party's (party running a radiation practice) duty to introduce reference levels for X-ray examinations is laid down in the Decree of the Ministry of Social Affairs and Health on the medical use of radiation (423/2000). The Decree also prescribes that the reference levels for the most common examinations shall be issued by the Radiation and Nuclear Safety Authority. The provisions concerning reference levels and putting them into practice are laid down in Sections 2, 16 and 17 of the Decree.

This decision issues the reference levels for conventional X-ray examinations of adults: Table 1 provides reference levels as entrance surface doses (ESD) and as dose-area products (DAP). Table 2 provides the reference level for mammography examinations as mean glandular dose (MGD). In addition, table 3 provides achievable dose levels for X-ray equipment with flat panel detectors. The achievable dose levels describe dose levels enabled by the performance of the flat panel technology.

Responsible parties may introduce into practice the reference levels given in the appendices or they may use stricter values of their own. When desired, responsible parties may determine reference levels for their own use for examinations, which have not been given reference levels.

This decision is valid as of 1 June 2017 until further notice. This decision shall repeal the previous decision by the Radiation and Nuclear Safety Authority concerning reference levels (9/3020/2014), issued on 26 June 2011.

Director General

Petteri Tiippana

Director

Eero Kettunen

Appendix

Instructions: Reference levels for the patient's radiation exposure for conventional X-ray examinations of adults

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**Table 1.** Reference levels for conventional X-ray examinations as entrance surface doses and dose-area products for adults.

<b>Imaging projection</b>	<b>Entrance surface dose/projection (ESD)<sup>*)</sup> [mGy]</b>	<b>Dose-area product (DAP)<sup>**)</sup> [Gy · cm<sup>2</sup>]</b>
Thorax PA	0.12	0.1
Thorax LAT	0.5	0.2
Lumbar spine AP or PA	3.5	1
Lumbar spine LAT	10	2.1
Abdomen AP or PA	3.5	1.6
Dental imaging, upper molar	2.5	
Panoramic tomography of the teeth and jaws		0.12
Paranasal sinuses in one projection		0,09
*) The Entrance Surface Dose, ESD, refers to the absorbed dose on the skin.		
**) Product of the cross-section dose and area of the radiation beam (DAP).		

**Table 2.** Reference level for mammography examinations

<b>Imaging projection</b>	<b>Mean glandular dose (MGD)<sup>*)</sup>/projection [mGy]</b>
Breast CC, MLO LAT	1.5
*) The Mean Glandular Dose, MGD, refers to the average dose to the glandular tissue of the breast.	

**Table 3.** Achievable dose levels for conventional X-ray examinations of adults with X-ray equipment with flat panel detectors.

<b>Imaging projection</b>	<b>Entrance surface dose/projection (ESD)<sup>*)</sup> [mGy]</b>	<b>Dose-area product (DAP)<sup>**)</sup> [Gy · cm<sup>2</sup>]</b>
Thorax PA	0.05	0.07
Thorax LAT		0.14
Lumbar spine AP or PA	1.8	0.7
Lumbar spine LAT		1.5
Dental imaging, upper molar	1.7	
Abdomen AP or PA		0,8
*) The Entrance Surface Dose, ESD, refers to the absorbed dose on the skin.		
**) Product of the cross-section dose and area of the radiation beam (DAP).		

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## Reference levels for the patient's radiation exposure for conventional X-ray examinations of adults

### Definition of reference level

*Reference level* refers to a predetermined X-ray examination radiation dose level that is not presumed to be exceeded in a procedure performed according to the standards of good practice upon a patient of normal size.

### Use of reference levels

Reference levels can be used for detecting X-ray devices and practices that cause exceptionally high radiation exposures. Reference levels are not intended for limiting the radiation exposure of any individual patients but for comparing the average radiation exposure of a group of patients, selected as explained below, to the exposure caused by standard good practice.

If reference levels are exceeded, this does not necessarily mean that the examination has been improperly conducted. Exposures exceeding the reference levels may be expedient in order, for example, to achieve image quality which is better than usual. On the other hand, even if no reference levels are exceeded, this does not necessarily mean that the examination has been optimised for radiation safety. It is still necessary to ensure that image quality is sufficient for a reliable diagnosis and that the radiation exposure is not excessive.

### Determination of radiation exposure

STUK requires that patient's radiation exposure is measured or calculatory assessed according to separately issued instructions at intervals of no more than three years. Exposures are determined for the most common examinations with each examination stand and at least for one imaging projection for which a reference level has been issued. Radiation exposure is either measured or calculated on the basis of imaging values for a group of at least ten patients. The individuals in this group for mammography examinations should be selected so that the compressed tissue thickness of the breast is 4–6cm. The average compressed breast tissue thickness of the examined individuals should be approximately 5 cm. For other examinations, the patients should be selected so that their weights are between 55–85kg, averaging at approximately 70 kg. The average radiation exposure for the group is calculated and compared to the reference level. The radiation exposure must be redetermined and the comparison to the reference level must be repeated if the examination procedure or any equipment undergoes changes or repairs that affect radiation exposure.

The Radiation and Nuclear Safety Authority report STUK-TR11/marraskuu 2011 "Potilaan säteilyaltistuksen määrittäminen mammografiassa" (STUK-TR11/November 2011, Determination of the radiation exposure of a patient in mammography) describes the measurement and calculation methods required for the determination of the patient's exposure to radiation due to mammography.

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Between regular assessments of patient's exposure, it is sufficient to ensure that radiation exposure does not change and image quality does not deteriorate. This is checked for each examination stand using at least one type of examination conducted at the stand and for one imaging projection for which a reference level has been issued.

#### Assessment of results and corrective measures

Radiation exposure data must be recorded and systematically compared to reference levels. If reference levels are exceeded, the reason for this must be investigated and all necessary measures must be taken in order to reduce patient exposure.