

How to calculate KAP and DAP from dose measurements

This application note describes how to calculate Kerma Area Product (KAP) and Dose Area Product (DAP) from dose measurements.

KAP and DAP can be calculated from measurements with any instrument that measures dose, for example, the RaySafe X2 R/F, RaySafe X2 CT, RaySafe Xi R/F, RaySafe Xi CT, or RaySafe ThinX.

BACKGROUND

Kerma Area Product (KAP) and Dose Area Product (DAP) are measures of the total amount of radiation delivered to a person, with the area of the irradiated tissue taken into account. In diagnostic X-ray, the terms KAP and DAP are used interchangeably. For simplicity, only the term DAP is used throughout this application note.

DAP is normally measured as the absorbed dose to air [Gy], times the irradiated area [cm²]. Backscattered radiation should not be included in DAP measurements.

Most RaySafe instruments are shielded from backscatter. However, the RaySafe X2 CT sensor and the RaySafe Xi CT detector are pencil ion chambers and should be placed free in air (at a minimum distance of 30 cm from scattering material) to avoid including backscatter in the measurement.

DAP IS CONSTANT

The DAP value is independent of the distance (r) to the X-ray source, since dose decreases as $1/r^2$ while the irradiated area squares with the distance, Figure 1.

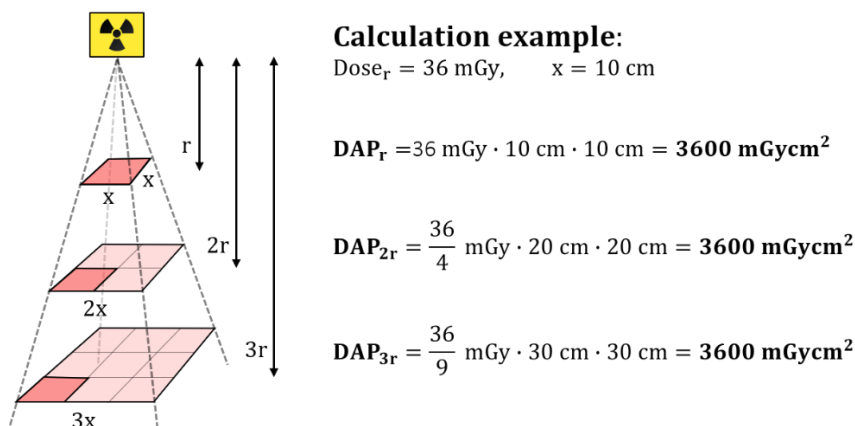


Figure 1: Illustration and calculation example showing that DAP is constant. Irradiated area is shown in red as a square of side x cm at a distance of r from the X-ray source. In the calculation example, the dose is 36 mGy over an area of 10 · 10 cm² at a distance of r.

INSTRUCTIONS

HOW TO CALCULATE DAP FROM DOSE MEASUREMENTS

1. Measure the dose [Gy] at a certain distance from the X-ray source (Figure 2).
2. Measure the size of the irradiated area [cm²] at the very same distance.
3. Calculate DAP [Gy·cm²] as the measured dose times the irradiated area.

Note: Make sure to irradiate the entire active sensor area of the instrument.

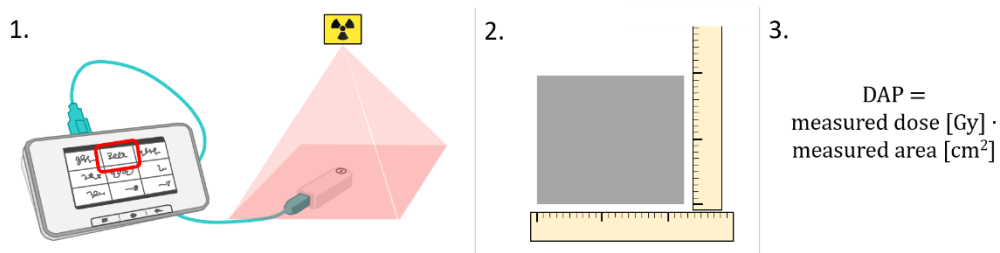


Figure 2: How to calculate DAP from dose measurements with RaySafe instruments.

CALCULATION EXAMPLE:

Measured dose @ 1 m from the X-ray source:

Dose = 2 mGy = 0.002 Gy

Size of irradiated area @ 1 m from the X-ray source:

Area = 20 cm · 20 cm = 400 cm²

DAP = 0.002 Gy · 400 cm² = 0.8 Gy·cm²

EXAMPLES OF HOW TO MEASURE THE SIZE OF THE IRRADIATED AREA

- Use radiochromic film¹ to detect the edges of the radiation field. The color of the film changes when exposed to ionizing radiation. Measure the width and the depth of the field.
- Use the RaySafe DXR+ to detect the edges of the radiation field. Measure the width and the depth of the field.
- Make an exposure on the image receptor and measure the size of the resulting image. Note that the image receptor must be larger than the x-ray field.

CONTACT

Please visit www.raysafe.com for more information.

¹ Provided by RaySafe: GAFCHROMIC FILM XR-QA2 - 10PCS