



**RPA GENERIC RISK ASSESSMENT NO 27:  
HAZARD IDENTIFICATION & RISK ASSESSMENT FOR A PLANMECA INTRA DENTAL X-RAY UNIT**

**INTRODUCTION**

- 1) The Planmeca Intra is an intra-oral dental x-ray radiography unit emitting x-rays up to 70kV and 8mA.
- 2) The unit is housed in a cubicle in the store room off the Clinical Skills classroom (room 6.50b) and the operating position is outside the cubicle behind a shielded screen.
- 3) The unit is used for teaching students to take radiographs on dental samples and is not used on patients.
- 4) The x-ray tube is connected to and directed down into a lead lined sample chamber.

<u>Version</u>	<u>Author</u>	<u>Checked</u>	<u>Approved</u>	<u>Date of issue</u>
1.0	ARC			5 January 2016

**DOSE ASSESSMENT**

- 5) Stray radiation measurements taken by the manufacturer show a maximum dose rate (Air Kerma) at 1m from tube of 275nGy/mAs (70kv/8mA/0.5s using a PMMA phantom) (ref 1). This is when used in a clinical situation, however when used as setup, i.e. directed down into the lead-lined sample chamber, then stray radiation dose rates are very much less than this.
- 6) The measured dose at the cone tip for mandibular molar examination is 1.808mGy (ref 2) – compared to current Diagnostic Reference Level (DRL) of 1.7mGy.
- 7) The projected maximum usage of the unit is 10 radiographs per student per year and settings used are as follows:

Type of exposure	kV	mA	secs
Lower anterior	60	8	0.125
Lower molar	63	8	0.160
Lower occlusal	70	8	0.160
Lower premolar	63	8	0.125
Molar endodontic	60	8	0.160
Upper anterior	60	8	0.160
Upper molar	63	8	0.200
Upper occlusal	70	8	0.160
Upper premolar	63	8	0.160

- 8) Maximum radiation dose to an operator if at a position 1m from the tube is therefore  $275 \times 8 \times 0.2 \text{ nGy} = 0.44 \mu\text{Gy}$  per operation. This is when used in a clinical orientation and would be much less than this in normal operation with the tube connected to the sample chamber and the operator behind the screen.

## HAZARD &amp; RISK ASSESSMENT

Condition	Persons exposed	Radiation exposure	Level of risk	Risk reduction measures
<b>Exposure to x-rays</b>				
Exposure to scatter radiation within 6.50b during normal operation: <b>outside controlled area.</b>	Operators	x-rays; scatter dose rate - negligible. Estimated dose (see 9 above) $\ll 0.01\text{mSv/y}$ .	<b>Negligible</b> The estimated dose is less than 0.01 of the annual UK natural background level. Dose rate is below the university's dose constraint of 1mSv for radiation workers.	Operator training. Access restrictions for x-ray cubicle.  Local rules include instructions for operator to keep out of controlled area whilst radiograph in progress.  Critical Examination before the x-ray tube is first used; if repaired, altered or moved; and biennial survey by NHS Medical Physics.
Exposure to scatter radiation within x-ray cubicle: <b>inside controlled area.</b>	Operators	x-rays; scatter dose rate - negligible. Estimated dose (see 8 and 9 above) $\ll 0.01\text{mSv/y}$ .	<b>Negligible</b> The estimated dose is less than 0.01 of the annual UK natural background level. Dose rate is below the university's dose constraint of 1mSv for radiation workers.	
Exposure to scatter radiation within x-ray area, abnormal operation (i.e. tube not connected to sample chamber): <b>inside controlled area.</b>	Operators	x-rays; scatter dose rate $< 0.5\mu\text{Gy/operation}$ Estimated dose (see 8 and 9 above) $< 0.01\text{mSv/y}$ .	<b>Low</b> The estimated dose is less than 0.01 of the annual UK natural background level. Dose rate is below the university's dose constraint of 1mSv for radiation workers.	
<b>Damage to equipment</b>				
Damage to the equipment by impact or fire.	Operators.	Penetrating x-rays; potential dose rate – several $\text{Sv h}^{-1}$ .	<b>Low</b> If the equipment were subject to damage it is possible that the x-ray shielding might be compromised although this is unlikely.	If the equipment has been damaged in any way the user should: - switch the power off and - inform the RPS and seek

Condition	Persons exposed	Radiation exposure	Level of risk	Risk reduction measures
			<p>If the equipment was damaged but still operable radiation exposure could exceed the University annual dose constraint of 1mSv.</p> <p>Dose rate could exceed dose constraint and legal dose limits; potential for legislative infraction.</p>	advice before using the equipment.
<b>Maintenance / servicing</b>				
Removal of panels / shielding giving access to unguarded x-ray beam	All persons entering the scanner room.	Penetrating x-rays; potential dose rate – several Sv h <sup>-1</sup> .	<p><b>Low</b></p> <p>Removal of panels or shielding could give access to areas where there is a high dose rate. Radiation exposure could exceed the University annual dose constraint of 1mSv in seconds.</p> <p>Dose rate could exceed dose constraint and legal dose limits; potential for legislative infraction.</p>	<p>All repairs and modifications to the equipment must only be carried out by a qualified service engineer.</p> <p>The service engineer must have sole use of the room if servicing requires the removal of shielding or over-riding of safety features.</p>

**REFERENCES:**

Ref 1: Planmeca Intra Technical Manual, Publication number 10006491 Version 16, Planmeca 2009-06.

Ref 2: Leeds Teaching Hospitals NHS Trust, Dental x-ray tube QA and Radiation Protection Report, 14/10/2014