



# DIAGNOSTIC X-RAY UNIT QC STANDARDS IN BC

## Background

As defined in Diagnostic X-ray Imaging Quality Assurance: An Overview by Periard and Chaloner (1996) of Health Canada, “quality control consists of a series of standardized tests developed to detect changes in x-ray equipment function from its original level of performance ... to allow for prompt corrective action to maintain x-ray image quality”. Both the federal and provincial regulatory authorities place the ultimate responsibility for periodic quality control tests with the owner of the equipment or the physician in-charge of the X-ray facility. Quality control standards in British Columbia are presented in the table below and are based on the following documents (acronyms used in the table are shown in parentheses):

- Radiation Emitting Devices Regulations (Diagnostic X-ray Equipment), as amended in 2001 (RED Regulations 2001)
- Radiation Emitting Devices Regulations (Dental X-ray Equipment) (RED Regulations 1993)
- Regulations Amending the Radiation Emitting Devices Regulations (Dental Equipment) (RED Regulations 2003)
- X-ray Equipment in Medical Diagnosis, Part A: Recommended Safety Procedures for Installation and Use, 1980, revised 1999 (HC Safety Code 20A)
- Radiation Protection in Dentistry - Recommended Safety Procedures for the Use of Dental X-ray Equipment, 1999 (HC Safety Code 30)
- Canadian Mammography Quality Guidelines (Health Canada), 2002 (HC CMQG)
- Quality Assurance in Diagnostic Radiology - Report to RPS, 2000 (QA in DR)
- Diagnostic X-ray Equipment Compliance and Facility Survey, Health Canada, 1994
- Occupational Health and Safety Regulation (Part 7), WorkSafeBC, 1999

## DIAGNOSTIC X-RAY UNIT QC STANDARDS IN BC

### Summary of Standards/Limits for QC of Diagnostic X-ray Equipment

#### A. Design and Construction Standards at Registration - All X-ray units

Parameter	Frequency of Test	Testing by	Method	Standards/Tolerance Limits	Reference
Warning signs and labels	New unit	Surveyor	Visual check	<ol style="list-style-type: none"> <li>1. On the main control panel: <ul style="list-style-type: none"> <li>• Statement prohibiting unauthorized use</li> <li>• X-ray warning symbol at least 2 cm by 2 cm, visible @ 1m and in 2 contrasting colors</li> <li>• name of manufacturer, model, serial number date and country of manufacture of the X-ray generator</li> </ul> </li> <li>2. On the external surface of the X-ray tube housing: <ul style="list-style-type: none"> <li>• name of manufacturer, model designation, serial number, date X-ray tube installed, country of manufacture, minimum permanent inherent filtration (0.5 mm Al @ &lt;50 kVp, 1.5 mm Al @ 50-70 kVp, 2.5 mm Al @ &gt;70 kVp) with respect to X-ray tube assembly</li> <li>• indicator of focal spot</li> <li>• indicators of anode and cathode terminals if X-ray tube and generator not co-located in a common enclosure</li> </ul> </li> <li>3. On the external surface of beam limiting device <ul style="list-style-type: none"> <li>• total permanent filtration due to beam limiting device</li> </ul> </li> </ol>	<ul style="list-style-type: none"> <li>• RED Regulations 2001</li> <li>• HC Safety Code 20A</li> <li>• HC CMQG</li> <li>• HC Safety Code 30</li> </ul>
Warning Indicators	New unit	Surveyor	Visual check	<p>On the control panel:</p> <ul style="list-style-type: none"> <li>• when X-ray tube ready to be energized</li> <li>• when X-rays are being emitted</li> <li>• when AEC is used</li> <li>• when AEC not available, loading factors selected</li> </ul>	<ul style="list-style-type: none"> <li>• RED Regulations of 2001</li> </ul>
Focal Spot	New tube	Surveyor	Star pattern	±50%	<ul style="list-style-type: none"> <li>• QA in DR</li> </ul>
Leakage radiation (Tube Shielding)	New Tube	Surveyor	Meter	<p>≤1 mGy/h (115 mR/h) averaged over 100 cm<sup>2</sup> and @ 1m from focal point, except for dental equipment; ≤0.25 mGy/h (28.5 mR/h) averaged over 100 cm<sup>2</sup> and @ 1m from focal spot for dental X-ray equipment</p>	<ul style="list-style-type: none"> <li>• RED Regulations 1993, 2001 and 2003</li> </ul>
Room shielding	New facility or change in operation	Surveyor	Survey Meter	<p>≤1 mSv/y in all adjacent areas (action level for workers and limit for public) or ≤20 mSv/y in the control booth and ≤1 mSv/y in uncontrolled areas</p>	<ul style="list-style-type: none"> <li>• WCB OH&amp;S Regulation</li> </ul>

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## B. Functioning standards at Registration and/or QC Tests

### 1. Diagnostic Radiography

Parameter	Frequency of Test	Testing by	Method	Standards/Tolerance Limits	Reference
X-ray/light beam alignment*	New unit then Quarterly	Owner	Film / Markers	When the X-ray beam axis is perpendicular to image receptor plane <ul style="list-style-type: none"> <li>Separation between perimeter of visual field and X-ray field <math>\leq 2\%</math> SID</li> <li>Dimensions of X-ray field accurate to <math>\pm 2\%</math> SID</li> </ul>	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> </ul>
X-ray/light beam centering*	New unit then Quarterly	Owner	Film / Markers	Center of X-ray field and centre of image reception aligned to within 2% SID	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> </ul>
Light beam size calibration*	New unit then Quarterly	Owner	Film / Markers	<ul style="list-style-type: none"> <li>brightness at least 100 lx @ 1m or max SID</li> <li>circumscribed by beam limiting device</li> </ul>	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> </ul>
Distances and scales	Quarterly	Owner		$\pm 15\%$	<ul style="list-style-type: none"> <li>QA in DR</li> </ul>
Tube potential*	New unit then Annually	Surveyor	Meter	$\pm 10\%$	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> <li>QA in DR</li> </ul>
HVL @ 80 kVp*	New unit then Annually	Surveyor	Meter	$\geq 2.3$ mm Al	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> <li>QA in DR</li> </ul>
Output linearity*	New unit then Annually	Surveyor	Meter	$x_1 - x_2 \leq 0.1(x_1 + x_2)$ where $x_1$ and $x_2$ are average mR/mAs at 2 consecutive tube current settings	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> <li>HC Safety Code 20A</li> </ul>
Exposure time	New unit then Annually	Surveyor	Meter	$\pm 10\% + 1$ ms	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> <li>QA in DR</li> </ul>
Output reproducibility	New unit then Annually	Surveyor	Meter	Coefficient of variation of any 10 consecutive air kerma or exposure measurements $\leq 0.05$ and each measurement within $\pm 15\%$ of mean value	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> <li>HC Safety Code 20A</li> <li>QA in DR</li> </ul>
mAs	New unit then Annually	Surveyor	Meter	$\pm 10\% + 0.2$ mAs of selected value	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> <li>QA in DR</li> </ul>
AEC variation	New unit then Semi-annually	Owner	Phantom	<ul style="list-style-type: none"> <li>varying kVp, constant object thickness, <math>\pm 0.15</math> variation in OD</li> <li>fixed kVp, varying thickness, <math>\pm 0.2</math> variation in OD</li> <li>fixed kVp and thickness, <math>\pm 0.1</math> variation in OD</li> </ul>	<ul style="list-style-type: none"> <li>RED Regulations 2001</li> </ul>

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Parameter	Frequency of Test	Testing by	Method	Standards/Tolerance Limits	Reference																												
Mechanical Safety*	Semi-annually	Owner	Physical check	<ul style="list-style-type: none"> <li>x-ray tube securely fixed and correctly aligned</li> <li>tube housing does not drift or vibrate during operation</li> <li>tube housing supported by mechanical means; not hand-held</li> </ul>	• HC Safety Code 20A																												
Film density	Semi-annually	Owner	Phantom / Film	Baseline $\pm 0.3$ OD	• QA in DR																												
Cassette dose	Annually	Surveyor	Meter	$\pm 30\%$ baseline	• QA in DR																												
Entrance Skin Exposure (ESE)	Semi-annually	Surveyor	Meter	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><u>Examination</u></th> <th style="text-align: right;"><u>ESE (mR)</u></th> </tr> </thead> <tbody> <tr> <td>Chest PA</td> <td style="text-align: right;"><math>\leq 20</math></td> </tr> <tr> <td>Skull Lateral</td> <td style="text-align: right;"><math>\leq 170</math></td> </tr> <tr> <td>Abdomen A/P</td> <td style="text-align: right;"><math>\leq 450</math></td> </tr> <tr> <td>Cervical Spine A/P</td> <td style="text-align: right;"><math>\leq 120</math></td> </tr> <tr> <td>Thoracic Spine A/P</td> <td style="text-align: right;"><math>\leq 400</math></td> </tr> <tr> <td>Full Spine A/P</td> <td style="text-align: right;"><math>\leq 250</math></td> </tr> <tr> <td>Lumbo-Sacral Spine A/P</td> <td style="text-align: right;"><math>\leq 500</math></td> </tr> <tr> <td>Retrograde Pyelogram A/P</td> <td style="text-align: right;"><math>\leq 500</math></td> </tr> </tbody> </table> <p>for reference patient with anthropometrical characteristics of</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><u>Body part</u></th> <th style="text-align: right;"><u>Thickness (cm)</u></th> </tr> </thead> <tbody> <tr> <td>Head (lateral)</td> <td style="text-align: right;">15</td> </tr> <tr> <td>Neck A/P</td> <td style="text-align: right;">13</td> </tr> <tr> <td>Chest P/A</td> <td style="text-align: right;">23</td> </tr> <tr> <td>Abdomen A/P</td> <td style="text-align: right;">23</td> </tr> </tbody> </table>	<u>Examination</u>	<u>ESE (mR)</u>	Chest PA	$\leq 20$	Skull Lateral	$\leq 170$	Abdomen A/P	$\leq 450$	Cervical Spine A/P	$\leq 120$	Thoracic Spine A/P	$\leq 400$	Full Spine A/P	$\leq 250$	Lumbo-Sacral Spine A/P	$\leq 500$	Retrograde Pyelogram A/P	$\leq 500$	<u>Body part</u>	<u>Thickness (cm)</u>	Head (lateral)	15	Neck A/P	13	Chest P/A	23	Abdomen A/P	23	• HC Safety Code 20A
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### 2. Radioscopy

Parameter	Frequency of Test	Testing by	Method	Standards/Tolerance Limits	Reference
Distances and scales	Quarterly	Owner		$\pm 15\%$	• QA in DR
X-ray/light beam alignment, PBL	New unit then Quarterly	Owner	Film / Markers	<ul style="list-style-type: none"> <li>Difference in perimeters of illuminated field with X-ray field <math>\leq 3\%</math> SID</li> <li>Sum of excess length and width <math>\leq 4\%</math> SID</li> </ul>	• RED Regulations 2001
X-ray/image size	Annually	Surveyor	Test tool	$\leq 1.15$	• QA in DR
Tube potential*	New unit then Annually	Surveyor	Meter	$\pm 10\%$	<ul style="list-style-type: none"> <li>• RED Regulations 2001</li> <li>• QA in DR</li> </ul>
HVL @ 80 kVp*	New unit then Annually	Surveyor	Meter	$\geq 2.3$ mm Al	<ul style="list-style-type: none"> <li>• RED Regulations 2001</li> <li>• QA in DR</li> </ul>
Mechanical Safety*	Semi-annually	Surveyor	Physical check	<ul style="list-style-type: none"> <li>X-ray tube securely fixed and correctly aligned</li> <li>Tube housing does not drift or vibrate during operation</li> <li>Tube housing supported by mechanical means; not hand-held</li> </ul>	• HC Safety Code 20A
Dose reproducibility ABC*	Quarterly	Owner	Phantom	Exposure factors of phantom $\pm 25\%$	• QA in DR

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Parameter	Frequency of Test	Testing by	Method	Standards/Tolerance Limits	Reference
Spatial resolution	RF - monthly Angio - weekly	Surveyor / Owner	Leeds Phantom or equivalent	Baseline reduced by 2 groups	• QA in DR
Low contrast	RF-monthly Angio - weekly	Surveyor / Owner	Leeds Phantom or equivalent	Baseline reduced by 2 groups	• QA in DR
Phantom surface dose* - not equipped with an automatic intensity control	New unit then Annually	Surveyor	Meter	$\leq 50$ mGy/min (5.75 R/min) • @ 1 cm above table if X-ray source below the table • @30 cm above the table if X-ray source above the table • @30 cm from the II input surface for C-arm • @15 cm from centre line of table for lateral type	• RED Regulations 2001
Phantom surface dose (maximum)* - equipped with an automatic intensity control	New unit then Annually	Surveyor	Meter	$\leq 100$ mGy/min (11.5 R/min) (20 cm water) • @ 1 cm above table if X-ray source below the table • @30 cm above the table if X-ray source above the table • @30 cm from the II input surface for C-arm • @15 cm from centre line of table for lateral type	• RED Regulations 2001 • QA in DR
Phantom surface dose* - equipped with an automatic intensity control and a high-level irradiation control	New unit then Annually	Surveyor	Meter	$\leq 150$ mGy/min (17.25 R/min) (20 cm water) • @ 1 cm above table if X-ray source below the table • @30 cm above the table if X-ray source above the table • @30 cm from the II input surface for C-arm • @15 cm from centre line of table for lateral type.	• RED Regulations 2001 • QA in DR

### 3. Computed Tomography

Parameter	Frequency of Test	Testing by	Method	Standards/Tolerance Limits	Reference
Image noise	Weekly	Owner		Baseline $\pm 20\%$	• QA in DR
CT values	Weekly	Owner		Water $\pm 10$ HU Other $\pm 20$ HU	• QA in DR
CT number uniformity	Annually	Owner		1.5%	• QA in DR
CTDI	Annually	Surveyor		Baseline $\pm 20\%$	• QA in DR
High contrast resolution	Annually	Surveyor		$\pm 20\%$	• QA in DR
Image slice thickness	Annually	Surveyor		1 mm or $\pm 20\%$ , whichever is less	• QA in DR
Table top accuracy	Annually	Surveyor		2 mm in 20 cm	• QA in DR

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### 4. Mammography

Parameter	Frequency of Test	Testing by	Method	Standards/Tolerance Limits	Reference
Filter	Daily	Owner/ Technologist	Physical check	Not absent or dislodged	<ul style="list-style-type: none"> <li>• QA in DR</li> </ul>
X-ray/light beam alignment*	New unit then Quarterly	Owner	Film / Markers	When the X-ray beam axis is perpendicular to image receptor plane <ul style="list-style-type: none"> <li>• Separation between perimeter of visual field and X-ray field <math>\leq 2\%</math> SID</li> <li>• Dimensions of X-ray field accurate to <math>\pm 2\%</math> SID</li> </ul>	<ul style="list-style-type: none"> <li>• RED Regulations 2001</li> </ul>
Image quality	Weekly	Owner/ Technologist	RMI 156 Phantom	OD at center of phantom image $\geq 1.4$ and $\pm 20\%$ of established operating levels	<ul style="list-style-type: none"> <li>• HC CMQG</li> <li>• QA in DR</li> </ul>
Mechanical safety	Weekly	Owner	Physical check	<ul style="list-style-type: none"> <li>• X-ray tube securely affixed to and aligned within housing</li> <li>• Filters securely affixed</li> <li>• X-ray source assembly does not drift or vibrate during operation</li> </ul>	<ul style="list-style-type: none"> <li>• HC CMQG</li> </ul>
Compression force	Semi- annually	Surveyor/ Technologist		11.4 kg (25 lbs.) to 20.5 kg (45 lbs.)	<ul style="list-style-type: none"> <li>• HC CMQG</li> </ul>
Congruency of x-ray/light field	Annually	Surveyor/ Physicist		$\leq 2\%$ SID	<ul style="list-style-type: none"> <li>• HC CMQG</li> </ul>
Tube potential	New unit then Semi- annually	Surveyor	kVp Meter	$\leq 5\%$	<ul style="list-style-type: none"> <li>• RED Regulations 2001</li> <li>• HC CMQG</li> <li>• QA in DR</li> </ul>
Exposure time	New unit then Annually	Surveyor	Meter	$\pm 10\% + 1$ ms	<ul style="list-style-type: none"> <li>• RED Regulations 2001</li> <li>• HC CMQG</li> </ul>
Mean glandular dose	Annually	Surveyor/ Physicist	RMI-156 or NA# 18-220	$< 3$ mGy	<ul style="list-style-type: none"> <li>• HC CMQG</li> <li>• QA in DR</li> </ul>
Output reproducibility	New unit then Annually	Surveyor/ Physicist	Meter	Coefficient of variation of any 10 consecutive air kerma or exposure measurements $\leq 0.05$ and each measurement within $\pm 15\%$ of mean value	<ul style="list-style-type: none"> <li>• RED Regulations 2001</li> <li>• HC Safety Code 20A</li> <li>• QA in DR</li> </ul>
Output linearity	New unit then Annually	Surveyor	Meter	$x_1 - x_2 \leq 0.1(x_1 + x_2)$ where $x_1$ and $x_2$ are average mR/mAs at: <ul style="list-style-type: none"> <li>• any 2 consecutive mA or mAs settings if mA or mAs selection respectively, is discrete</li> <li>• any 2 mA or mAs settings different by factor of 2 or less if mA or mAs selection respectively, is continuous</li> </ul>	<ul style="list-style-type: none"> <li>• RED Regulations 2001</li> <li>• HC CMQG</li> </ul>
High contrast resolution	Annually	Surveyor/ Physicist	Test tool (bar pattern)	<ul style="list-style-type: none"> <li>• <math>\geq 11</math> line-pairs/mm when bars perpendicular to anode-cathode axis</li> <li>• <math>\geq 13</math> line-pairs/mm when bars are parallel to a-c axis</li> </ul>	<ul style="list-style-type: none"> <li>• HC CMQG</li> </ul>
Beam limitation	Annually	Surveyor/ Physicist		X-ray field does not exceed: <ul style="list-style-type: none"> <li>• 5 mm at edge of patient support next to chest wall</li> <li>• 2% of SID at other edges</li> </ul>	<ul style="list-style-type: none"> <li>• HC CMQG</li> </ul>

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Parameter	Frequency of Test	Testing by	Method	Standards/Tolerance Limits	Reference
Screen/film speed uniformity	Annually	Surveyor/Physicist		O.D. $\pm 0.15$ units from the mean value for all cassettes used in facility at same loading factors	<ul style="list-style-type: none"> <li>• HC CMQG</li> </ul>
AEC variation with kVp, thickness	Annually	Surveyor/Physicist	Phantom	OD variation $\pm 0.15$ of mean OD over 2 to 6 cm thickness	<ul style="list-style-type: none"> <li>• HC CMQG</li> <li>• QA in DR</li> </ul>
Controlling timer or AEC	Annually	Surveyor		1/60 s or time required for 5 mAs, whichever is less	<ul style="list-style-type: none"> <li>• HC CMQG</li> </ul>
Radiation output	Annually	Surveyor/Physicist		$\geq 7$ mGy/s (802 mR/s) with: <ul style="list-style-type: none"> <li>• Mo/Mo</li> <li>• breast compression device in place between source and detector</li> <li>• 28 kV</li> <li>• measured at 4.5 cm above patient support</li> <li>• averaged over 3 s</li> </ul>	<ul style="list-style-type: none"> <li>• HC CMQG</li> <li>• QA in DR</li> </ul>
HVL	Annually	Surveyor/Physicist		<ul style="list-style-type: none"> <li>• with compression paddle in place, HVL <math>\geq (kV/100 + 0.03)</math> but <math>&lt; kV/100 + C</math> where C is:               <ul style="list-style-type: none"> <li>0.12 for Mo/Mo</li> <li>0.19 for Mo/Rh</li> <li>0.22 for Rh/Rh</li> <li>0.30 for W/Rh</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• HC CMQG</li> </ul>

### 5. Dentistry

Parameter	Frequency of Test	Testing by	Method	Standards/ Tolerance Limits	Reference																																	
Tube Voltage	New unit then 3 years	Surveyor	Meter	$\geq 50$ kVp not more than $\pm 10\%$ of selected value	<ul style="list-style-type: none"> <li>• RED Regulations 1993, 2003</li> <li>• HC Safety Code 30</li> <li>• QA in DR</li> </ul>																																	
Filtration	New unit then 3 years	Surveyor		<table border="0"> <tr> <td>Normal use</td> <td>kV</td> <td>HVL (mm Al)</td> </tr> <tr> <td>50 - 70</td> <td></td> <td>1.5</td> </tr> <tr> <td>50 -125</td> <td>50</td> <td>1.5</td> </tr> <tr> <td></td> <td>60</td> <td>1.8</td> </tr> <tr> <td></td> <td>70</td> <td>2.1</td> </tr> <tr> <td></td> <td>80</td> <td>2.3</td> </tr> <tr> <td></td> <td>90</td> <td>2.5</td> </tr> <tr> <td></td> <td>100</td> <td>2.7</td> </tr> <tr> <td></td> <td>110</td> <td>3.0</td> </tr> <tr> <td></td> <td>120</td> <td>3.2</td> </tr> <tr> <td></td> <td>125</td> <td>3.3</td> </tr> </table>	Normal use	kV	HVL (mm Al)	50 - 70		1.5	50 -125	50	1.5		60	1.8		70	2.1		80	2.3		90	2.5		100	2.7		110	3.0		120	3.2		125	3.3	<ul style="list-style-type: none"> <li>• RED Regulations 1993, 2003</li> <li>• QA in DR</li> </ul>
Normal use	kV	HVL (mm Al)																																				
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Exposure time	New unit then 3 years	Surveyor	Meter	$\pm 10\% + 1$ ms	<ul style="list-style-type: none"> <li>• RED Regulations 2003</li> </ul>																																	
Minimum irradiation time	New unit then 3 years	Surveyor		Minimum irradiation time at kVp indicated: <table border="0"> <tr> <td>kVp</td> <td>s</td> <td>cycles</td> <td>mAs</td> </tr> <tr> <td><math>\leq 70</math></td> <td>1/20</td> <td>3</td> <td>0.75</td> </tr> <tr> <td>71-80</td> <td>1/30</td> <td>2</td> <td>0.50</td> </tr> <tr> <td><math>\geq 81</math></td> <td>1/60</td> <td>1</td> <td>0.25</td> </tr> </table>	kVp	s	cycles	mAs	$\leq 70$	1/20	3	0.75	71-80	1/30	2	0.50	$\geq 81$	1/60	1	0.25	<ul style="list-style-type: none"> <li>• RED Regulations 1993, 2003</li> <li>• QA in DR</li> </ul>																	
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Output linearity	New unit then 3 years	Surveyor	Meter	$X1-X2 \leq 0.1 (X1 + X2)$ where X1 and X2 are average mR/s, mR/pulse or mR/mAs at: <ul style="list-style-type: none"> <li>• 2 settings of the controlling timer that differ by less than a factor of 2, if mA is fixed</li> <li>• 2 mA settings that differ by less than a factor of 2, if time is fixed</li> </ul>	• RED Regulations 2003																																																																	
Focal spot to skin distance	New unit then 3 years	Surveyor		$\geq 15$ cm for panoramic $\geq 18$ cm for all other dental equipment	• RED Regulations 2003																																																																	
Beam limitation	New unit then 3 years	Surveyor		<ul style="list-style-type: none"> <li>• for panoramic, excess <math>\leq \frac{1}{2}</math></li> <li>• dimension of scanning slit or 2% SID, whichever is less</li> <li>• for cephalometric, <math>\leq 30</math> cm diameter circle or 800 cm<sup>2</sup> rectangle, fully intercepted by cassette, at a distance of 1.5 m or max SID, whichever is lesser</li> <li>• for intra-oral, <math>\leq 7</math> cm diameter or 38.5 cm<sup>2</sup> rectangle</li> </ul>	<ul style="list-style-type: none"> <li>• RED Regulations 1993</li> <li>• QA in DR</li> </ul>																																																																	
Dose at cone tip for bitewing	3 years	Surveyor	Meter	For "D" speed film: <table style="margin-left: 20px;"> <thead> <tr> <th>kV</th> <th colspan="2">Lower Limit</th> <th colspan="2">Upper Limit</th> </tr> <tr> <th></th> <th>(mGy)</th> <th>(mR)</th> <th>(mGy)</th> <th>(mR)</th> </tr> </thead> <tbody> <tr><td>50</td><td>3.49</td><td>400</td><td>4.80</td><td>550</td></tr> <tr><td>55</td><td>3.23</td><td>370</td><td>4.54</td><td>520</td></tr> <tr><td>60</td><td>2.79</td><td>320</td><td>4.15</td><td>475</td></tr> <tr><td>65</td><td>2.36</td><td>270</td><td>3.62</td><td>415</td></tr> <tr><td>70</td><td>2.01</td><td>230</td><td>3.14</td><td>360</td></tr> <tr><td>75</td><td>1.57</td><td>180</td><td>2.66</td><td>305</td></tr> <tr><td>80</td><td>1.40</td><td>160</td><td>2.27</td><td>260</td></tr> <tr><td>85</td><td>1.22</td><td>140</td><td>2.01</td><td>230</td></tr> <tr><td>90</td><td>1.05</td><td>120</td><td>1.83</td><td>210</td></tr> <tr><td>95</td><td>0.87</td><td>100</td><td>1.70</td><td>195</td></tr> <tr><td>100</td><td>0.79</td><td>90</td><td>1.57</td><td>180</td></tr> </tbody> </table>	kV	Lower Limit		Upper Limit			(mGy)	(mR)	(mGy)	(mR)	50	3.49	400	4.80	550	55	3.23	370	4.54	520	60	2.79	320	4.15	475	65	2.36	270	3.62	415	70	2.01	230	3.14	360	75	1.57	180	2.66	305	80	1.40	160	2.27	260	85	1.22	140	2.01	230	90	1.05	120	1.83	210	95	0.87	100	1.70	195	100	0.79	90	1.57	180	• HC Safety Code 30
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\*Tests required by the Diagnostic Accreditation Program as of 1998

# DIAGNOSTIC X-RAY UNIT QC STANDARDS IN BC

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April 14, 2009