

DAI Policy 500.40.16 Dental Radiation Procedure and Safety
Attachment A – DOC Guide for X- Ray Safety Procedures for Dental Facilities
Effective Date: 04/20/2018

DOC Guide Index

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Introduction

Dental facilities are required by Wisconsin Administrative Code DHS 157.74 to have operating and safety procedures for radiography. These policies and procedures apply to any employee who operates the x-ray equipment. The sample procedures in this guide are generic. Dental facilities must prepare procedures that are specific for their facilities. By using this guide, a facility may create its own unique set of operating and safety procedures. Not all sections of this guide will apply to all facilities. For example, if the facility uses digital imaging and does not have conventional film processing, then the processing and darkroom sections will not apply. This guide is to remain on file at the facility and be available for inspection by DHS inspectors.

Any changes in the facility registration such as change of address or ownership, must be sent to the department within 30 days of the change. Change of ownership requires re-registration with full fees paid by the new owner. Addition of new equipment or the replacement of old equipment needs to be reported also. Changes to the registration information may be faxed to (608) 267- 4799 or mailed to Division of Public Health, Radiation Protection Section, PO Box 2659, Madison WI 53701-2659.

The pertinent sections of DHS 157 that apply to dentists are: Subchapter I, III, VIII, X, XI, XII. Within Subchapter VIII, DHS 157.74, .75, .77 (for ceph and pan units), .78 and .86. The Code may be retrieved from the DHS web site:

[https://docs.legis.wisconsin.gov/document/administrativecode/DHS%20157.74\(2\)](https://docs.legis.wisconsin.gov/document/administrativecode/DHS%20157.74(2))

(DHS REV 08/11)

Radiation Operating and Safety Procedures

The DOC Dental Unit shall use this guide as is and fill in the appropriate information that is requested in each section. OPERATING AND SAFETY PROCEDURES FOR:

DSU: _____

The Unit Radiation Safety Officer (URSO) is HSM/Dr. _____.

The following procedures have been established to minimize radiation exposure to patients and employees. They are provided to comply with rules enforced by the Wisconsin Department of Health Services, Section of Radiation Protection. These rules require that each dental x-ray facility be registered with the Department of Health Services.

I. Operation Training and Safety Requirements

A. Training Requirements for X-Ray Machine Operators

1. All newly hired x-ray machine operators must be trained in the safe operation of the x-ray equipment, selection of proper technique from a technique chart, patient radiation protection and proper film processing. X-ray machine operators need to be trained on each piece of x-ray equipment they will be operating. Though they may have operated similar equipment in the past, each unit has some unique operating characteristics.
2. Upon completion of x-ray training staff should sign date the log Appendix A of this Guide.

B. Individual Radiation Monitoring Requirements

1. Employees who operate dental x-ray machines are required to be assigned an individual radiation monitoring device (personal dosimeter) *if* they are likely to be exposed to 5 mSv (500 mRem) per year. If previous radiation monitoring records show that it is unlikely that a person will be exposed to 5 mSv, then monitoring is not required. Re-testing every five years should be conducted to ensure all employees are following the radiation safety policies. State radiation protection staff inspects all dental offices about every three to four years. During the inspection radiation measurements are made at the operator positions to determine whether dosimeters will be required.
2. Changes made to the office configuration such as relocation of x-ray equipment or replacement of one type of equipment with another (pan for intra-oral) requires re-testing with monitors to ensure that adequate operating procedures are in place.
3. New offices require monitoring of personnel for one year to ensure adequate protection for the operators. Monitoring may be discontinued if the results indicate that no employee is likely to receive 5 mSv in a year.
4. If monitoring devices are worn, they shall be worn at the neck level or on the upper torso. If a protective apron is worn because the operator needs to be less than six feet from the tube or patient, the monitoring device must be worn at the collar outside the apron. If any badge wearer exceeds the 5 mSv (500 mR) in a year, all wearers will have to change badges every month until the cause of the high reading is determined.
5. DHS 157.88 in Subchapter X discusses the requirements for notifying the employee of their monitoring results. Each employee who wears a monitor should be shown the monitor report and acknowledge seeing the results by initialing the report by their name. Names may be used for identifying each employee or an employee number may be used for identification.
6. Records of employee exposure must be retained, even after the employee has left employment at the facility. Upon departure, each employee must receive a copy of their final monitoring report that shows their exposure for the entire employment period. The information on the periodic monitor report may be recorded on facility letterhead and include the phrase "This report is furnished to you under the provisions of Wisconsin Administrative Code, Chapter DHS 157, Radiation Protection. You should retain this report for future reference".
7. Staff who do not routinely operate the x-ray equipment do not need to be monitored.

Situations may exist where office staff is routinely within 6 feet of the x-ray tube when it is operated. The situation should be evaluated to determine whether staff in those areas need to be monitored.

8. Digital intraoral imaging systems (DR) substantially reduce the radiation exposure to the patient and the operators. Generally, DR systems reduce the patient and operator exposure by 80-90%. CR systems reduce patient and operator exposure by 60-70%. Offices that are 100% digital generally do not need to provide personal dosimetry except for declared pregnant workers or workers who must assist patients during radiography.
9. Dosimetry devices may be obtained from whichever of the following is in contract with DOC:
 - a. GlobalDosimetry Service 800-251-3331 or DOC approved vendor.

C. Holding of patients and/or film

1. Holding film in the patient's mouth by the operator shall be avoided. Film holding devices must be used unless there are patient management issues that may require parents, guardians or staff to hold the film in position.
2. If someone must hold a film in position, the following precautions must be taken:
 - a. Always try to use a remote holding device to stabilize the film position.
 - b. The person holding the film should always wear an apron.
 - c. If the film must be held in position using a finger, always try to have a non-employee (ex: patient) hold the film.
 - d. If an employee must hold the film with a finger, the person is limited to 350 such exposures a year and must wear a ring badge dosimeter. Any more will exceed the permitted occupational exposure to the extremities.
 - e. No employee may be assigned the task of holding a film on a regular basis.
3. The tube housing shall not be held during an exposure by any person, either staff or parents. If the tube support assembly is unstable and the tube drifts during an exposure, the unit should be taken out of service and repaired.

D. Posting Notices and Instructions to Workers

1. The "Notice to Employees" form needs to be posted on an employee bulletin board or in a employee accessible area. The notice to employees form applies to all staff, not just the x-ray machine operators.
2. Employees must read the "Notice to Employees" sign posted on the dental office bulletin board.
3. The "Notice to Employees" form can be printed from the DHS web site: http://www.DHS.state.wi.us/dph_beh/BEH/notcemp.pdf
4. The certificate of registration, issued by the department annually at the time of x-ray installation registration renewal, the operating and safety procedures and any notices of violations involving radiological working conditions are located in the DSU's: **RADIATION SAFETY MANUAL.**
5. The employee rights and obligations as a radiation worker are found in DHS 157.88. (This may also be printed from the DHS web site listed above and is located in Subchapter X.)

E. Occupational Radiation Dose to X-ray Machine Operators

1. Occupational dose limits for x-ray machine operators are found in s. DHS 157.22 in Subchapter III. If any x-ray machine operator is pregnant or becomes pregnant, she may voluntarily inform the Radiation Safety Officer (RSO) or employer in writing of the pregnancy. If the RSO or employer is informed of the pregnancy, the employer must ensure that the dose to the embryo or fetus does not exceed 5 mSv (500 mrem) during the entire pregnancy and no more than 0.5 mSv (50 mrem) in any month. The dose to the monitoring device worn at the waist level is considered to be the fetal dose. Pregnant x-ray machine operators shall be monitored for radiation exposure. If the x-ray machine operator chooses to wear a leaded apron and have dosimetry, two monitors are recommended; one device will be worn at the neck and the second under the apron at the waist level. If an apron is not worn, only one monitor may be assigned and that shall be worn at the waist level.
2. If an x-ray machine operator does not declare their pregnancy in writing, for radiation safety

purposes they are not considered to be pregnant and the 50 mSv (5 Rem) occupational exposure limit applies.

3. If you suspect there has been an excessive exposure or a radiation incident such as unintentional exposure of yourself or another employee, immediately notify the URSO.
4. **Top Ten Dosimeter Do's and Don'ts**
 - a. **DO WEAR IT** when working. It has no value in your locker or purse.
 - b. **DON'T WEAR IT** when you are receiving x-rays for your own health care.
 - c. **DON'T WEAR IT** away from the workplace. Leave your dosimeter in the same place every day when you leave the office so you know where it is.
 - d. **DON'T WEAR IT** under your apron unless you are wearing two dosimeters, one at the neck level outside the apron and one under the apron. This applies to pregnant workers.
 - e. **DO TURN IT IN** on time. Time gaps make analysis more difficult, less accurate and reduces legal and historical value of the reports.
 - f. **DO PLACE** the control dosimeter in a radiation-safe area; the dose to the control is subtracted from each dosimeter and needs to be accurate.
 - g. **DO REPORT LOST OR DAMAGED** dosimeters immediately. Prevent damage by not leaving your dosimeter in areas of high temperature such as your dashboard or in the clothes dryer.
 - h. **DON'T PLACE** a dosimeter in an area for testing of stray radiation. Additional dosimeters can be assigned for testing.
 - i. **DON'T SHARE** dosimeters; this is illegal. An average total for a shared dosimeter is meaningless to each individual.
 - j. **DON'T TAMPER** with your dosimeter or anyone else's. The reports are legal documents and are regarded as real exposures received. Tampering with dosimeters is grounds for dismissal.

F. Multiple Employers or Work sites

1. If an x-ray machine operator works in more than one facility and wears a dosimeter in each facility, each such employee is responsible for reporting their exposure from each job to each employer. The cumulative exposure from each job is the occupational exposure limit.
2. No x-ray machine operator is allowed to receive more than 50 mSv (5 rem) from all employment during a calendar year.

G. Patient Safety

Patient radiation safety practices include:

1. Using the lowest possible radiation exposure for each exam by using the fastest film speed and the shortest exposure time.
2. Avoiding repeat x-rays by using the correct setting and technique.
3. Positioning the tube head and film carefully.
4. Providing the patient with a leaded apron.

II. X-ray Machine Operation

A. X-ray Machine Operator Position during Exposure

1. The x-ray machine operator must be able to continuously communicate with the patient. The x-ray machine operator position must allow the operator to convey any verbal instructions to the patient.
2. During the exposure, the employee must stand at least six feet from the useful beam or behind a protective barrier and not in the direction that the tube was pointed. (Most employees step into the hallway because drywall provides adequate protection).

B. Use of a Settings/Technique Chart (Guide Appendix D)

1. Technique charts are required for systems with adjustable settings, such as kV, time or pulses and mA (x-ray tube current).
2. The use of a technique chart aids in reducing the exposure to the employee and patient by providing a standard technique for a given machine regardless of the employee operating the equipment.

3. The chart must be posted near the control panel of each x-ray machine, near the control where the technique is adjusted.
4. If the exposure values can be adjusted from outside the room, then the chart should be posted near the control where the employee adjusts the technique. If you are switching from film to digital imaging, be sure to post new technique charts.

C. X-ray Beam Restriction and Alignment

1. Use the beam limiting devices (cone) provided on the x-ray machine. Never take a patient x-ray without a cone on the tube head. Beam limiting devices must meet the requirements of DHS 157.78. The short, black plastic cones are no longer permitted as they allowed too much scatter radiation exposure to the patient. They must be replaced with the shielded, lead lined, cylinder, open-ended cones. (Measurements have shown a scatter reduction to the patient of up to 75 percent by changing to the shielded cone).
2. Multipurpose units used for intra-oral and cephalometric exams must use the appropriate alignment devices and secure the tube head at the specified distance for proper beam size and alignment.

D. Use of Mobile or Portable Machines

During the exposure using a mobile or portable x-ray device the x-ray machine operator:

1. Must be positioned so that his/her exposure to scatter radiation is as low as reasonably achievable (ALARA) (e.g. 6 feet or more away).
2. Should never be in line with the direct beam.
3. If the x-ray machine operator must be closer than 6 feet from the patient, the operator must wear a lead apron.
4. No person may hold the x-ray tube housing during the exposure. A stand or other means of support shall be used during the exposure. There is the possibility of electric shock from improper grounding if the machine is hand-held.

III. Film Processing

NOTE: Facilities with digital imaging and no "wet chemistry" processing capability are not required to comply with this section.

A. Film Handling and Storage

1. Unexposed film is stored in a location in each operatory where the useful beam does not strike it.
2. Unexposed film is safe in the operatory as long as it is not stored in line with the direct beam of the x-ray tube.
3. Large quantities of unexposed film (more than used in one month) should be stored according to the manufacturer requirements.
4. Film may be frozen for long term storage of up to two years. Frozen film should be allowed to thaw at room temperature for at least 24 hours before use.
5. For automatic processors, run blank films through the processor at the beginning of the workday to clean the transport system if recommended by the manufacturer.

B. Film Processor: Systems Testing for Quality Control

1. Quality control of the processing "system" is an often over-looked area of radiography yet it is the most critical to consistent, quality images.
 - a. Check expiration dates on film and chemicals periodically.
 - b. Rotate new film or chemicals so the oldest are used first.
 - c. Dispose of films or chemicals that reach the expiration date.
 - d. Replace chemicals according to the manufacturer's or chemical supplier's recommended interval, which is or no longer than one month. Document date replaced.
 - e. Clean the processor according to manufacturer's recommendations, document.
 - f. Use the logs provided in the appendices to this Guide.

C. Film Processor Testing Procedures

1. Test processor chemistry activity at least once a week (less for part time DSUs) using a density comparison technique, such as the Dental Radiographic Quality Control Device (Crabtree)[®] or a density step wedge such as the 76-025-4000 Dental Aluminum Step Wedge from Cardinal Health/Nuclear Associates^{**}.
2. Purchasing Processor Testing Devices
 - a. Step wedges may also be hand-made by using dental lead foil from film packets. Stagger a group of four lead foils to create steps of different thicknesses to create a wedge shape.
 - b. *A Dental Radiographic Quality Control Device[©] (Crabtree) device is a tool used to compare the density of dental films exposed using the device to a standard film strip which comes with the device. A copper plate in the device creates a density when the film is exposed to x-ray. The films taken at various times of the month can be compared to see if the chemistry is becoming exhausted and needs to be replaced.
 - c. The DRQCD[©] CRABTREE device is available by:
 - i. calling DRQCD at (970) 470-0859, or **Fax** (970) 476-5126 or
 - ii. Write DRQCD, P.O. Box 5126, Vail, CO 1658
 - iii. From the Internet <http://www.xrayqc.com>.
 - d. Other density comparison devices, such as an **aluminum step wedge**, may be used as well. The wedge is placed on the film and exposed to the same technique from the same tube head each time. The films are processed and compared with the master film created when the processor chemistry is first replaced. The master film is stored and used for the weekly comparison. A master film needs to be made each time the chemistry is changed. Contact your supplier for more information.
 - e. Other 3"x6" 11 step wedge suppliers include:
 - i. Cone Instruments – 800-321-6964
 - ii. Dental Step Wedge – 866-722-3368
 - iii. NOTE: Mention of a device, product or service does not constitute an endorsement by the department and serves only as a representation of the types of devices, products or services which are available.

D. Film Processor: Testing Logs (Appendix B & C)

1. Appendix B – Crabtree/Step Wedge Tests Log
 - a. Processor Maintenance Log
 - b. Chemical Change Log
2. State inspectors will check to see if the processor Quality Control (QC) is being performed but will not expect to see historical records or old films. They will check for current and most recent films.
3. The processor chemistry change log and processor maintenance log sheets should be **posted in the film processing area.**

E. Leaded Shielding garments and devices shall be fluoroscopically or radiographically inspected at least every 2 years for defects and replaced if defective. If visual inspection reveals possible defects, radiographic or fluoroscopic inspections shall be performed. Leaded shielding garments and devices include aprons, gloves, vests, skirts, thyroid shields and gonadal shield.

GUIDE – APPENDIX A

Complete on-line training annually on Cornerstone: Radiology Safety

GUIDE – APPENDIX B

CRABTREE &/OR STEP WEDGE TEST & PROCESSOR LOGS

Calendar YEAR: _____

Identify X-ray Machine: Intraoral #1 Intraoral #2 Intraoral #3 Panoramic
(non-digital)

Film Speed: D E F

Exposure Factors: KVP _____ mA _____ Timer Settings _____

Acceptable Density Step Recorded: 3 4 5

Date Test Film Exposed	Density match on Device: Step Number	Density Step Number Acceptable? Yes/No	Comments	Date Processor Solutions Changed	Date Processor Cleaned

GUIDE – APPENDIX C

Instructions for Registering X-ray Devices:

To register x-ray devices at a new location, or register a change in ownership: Fill out form [DPH 7097-- Application for Registration of Ionizing Radiation Devices](#) (PDF, 25 KB), and return, **with the appropriate fee** made payable to the Department of Health Services, to:

Wisconsin Department of Health Services
Division of Public Health
X-ray Device Registration
P.O. Box 2659
Madison, WI 53701-2659

To register changes in the number of tubes (new x-ray devices or a change in the tube count), for those locations currently registered with the Department of Health Services, send the above address the following information:

- x-ray device registration ID number
- Device detail
 - Manufacturer
 - Model number
 - Serial number
 - Max kVp & Max mA
 - Year installed
 - **No fee is required** when adding or changing device information to a current registration. The change in device information will appear on your next annual renewal notice.

Please Note:

1. Multiple x-ray units at a single radiation installation and under the control of one person may be registered on a single registration application and for one fee.
2. If the units/sources are located at separate addresses, each installation will require a separate registration and fee.
3. Registration of sources of ionizing radiation must be made by the person in control.
4. Renewal registration applications are sent out by DHS in November of each year.

If you have questions, please [contact staff](#) at the Division of Public Health for assistance.

Surveys/Inspections:

DHS Radiation Protection personnel conduct survey inspections of x-ray units to determine compliance with DHS 157. After an inspection, a copy of the report will be sent to the registrant.

GUIDE – APPENDIX D

RADIATION WORKERS NOTICE

EMPLOYEE RIGHTS & OBLIGATIONS

ARE LOCATED IN THIS DSU'S:

DENTAL X-RAY SAFETY MANUAL

(SEE DHS 157.88)

RADIATION WORKERS:

EMPLOYEE RIGHTS & OBLIGATIONS

ARE LOCATED IN THIS DSU'S:

DENTAL X-RAY SAFETY MANUAL

(SEE DHS 157.88)