POLICY FOR THE USE AND CONTROL OF IONIZING RADIATION FOR DIAGNOSTIC IMAGING AT THE SCHOOL OF DENTISTRY, UNIVERSITY OF MINNESOTA

The radiation use policy has been in effect since November 1981. This revised version incorporates the requirements of the Minnesota Department of Health Ionizing Radiation Rules of 1991, 1993, 1999, 2000, 2005 and 2012.

Due to continuing concern about the use and potential harmful effects associated with exposure to ionizing radiation, the following policy has been developed with an overall objective to implement those procedures which will assure the safe and effective use of ionizing radiation producing equipment and to minimize as much as possible any potential risks to patients, students, faculty and staff. Control and use of radioactive materials for research purposes, i.e. radioactive isotopes and radiopharmaceuticals, is specifically excluded from the scope of this policy. Responsibility for monitoring the use of such materials continues to lie with the Radiation Protection Division of the Department of Environmental Health and Safety, University of Minnesota.

I. ADMINISTRATIVE

1. This radiation policy must comply with all provisions of the Minnesota Department of Health Ionizing Radiation Rules Chapter 4730, Minnesota Dental Practice Act and the Radiation Protection Division of the Department of Environmental Health and Safety of the University of Minnesota.

2. Dr. Mansur Ahmad, the Director of the Oral and Maxillofacial Radiology Program shall serve as the Radiation Protection Representative/Officer (RPR) of the School of Dentistry.

3. The RPR has the full and complete responsibility and authority for establishing school-wide guidelines and policies on radiographic practices and, in cooperation with the University Radiation Protection Program, has responsibility for developing procedures to coordinate, monitor, and control the use of ionizing radiation producing and image processing equipment.

4. Radiographs/copies/digital radiographic files will be made available to private practitioners, patients or other appropriate professionals when so requested by patients in writing.

5. All intra-oral radiographs obtained in all clinics shall be exposed with digital sensors or double-film packets. Double-film packets will assist in making radiographic records available in case of misplaced charts, misplaced radiographs, or films separated from charts. The duplicate films must be sent to and filed in the Oral and Maxillofacial Radiology clinic. All digital images should be stored in the PACS system.

6. Individuals who may make exposures:
   a. Licensed practitioners of healing arts (dentists, physicians, etc.)

b. Licensed dental hygienists, dental therapists, and radiologic technologists (ARRT) under general supervision
c. Registered dental assistants and students of dentistry, dental hygiene, and dental therapy under indirect supervision

7. If the RPR determines that an individual operator lacks required skills, he/she will be asked to submit to and successfully complete a review of his/her proficiency in radiographic technique and knowledge of principles of radiation hygiene and protection. If the individual fails the review, he/she shall not be allowed to expose patients.

8. New employees, who will operate X-ray and processing equipment, will review radiation safety protocols of the School of Dentistry. This program will include material concerning information on the effects of radiation exposure to the human body and the embryo/fetus, radiation hazards, safety practices, quality assurance and radiation rules and regulations. All individuals must sign attendance records.

9. All departments shall inform the RPR before the acquisition of any X-ray machine. The RPR will make arrangements to ensure registration of the machine with the University Radiation Protection Division of the Department of Environmental Health as required by the University Regulations. A radiation-protection survey must be made by the Radiation Protection Division before this machine can be used.

10. The RPR shall implement and monitor a school-wide radiographic quality assurance program.

II. PHYSICAL FACILITIES AND EQUIPMENT

1. All radiographic facilities and equipment shall be designed or upgraded to maintain radiation exposures well within permissible limits to individuals in adjoining areas. All rooms containing X-ray machines shall be provided with appropriate primary and secondary barriers to ensure radiation protection.

2. Portable X-ray machines present difficult radiation protection problems. Such equipment shall be used only if the patient cannot be transferred to a permanent radiographic facility. Only the patient shall be exposed to the primary beam of radiation. All other personnel shall stand behind an appropriate barrier to ensure radiation safety during exposure. In addition, if the primary beam is directed at the wall(s) of adjoining room(s) or hallway and these wall(s) do not provide adequate shielding for radiation protection, <u>one</u> of the following provisions shall be complied with:

   a. All individuals (faculty, staff, students, patients) shall be cleared from these areas during exposure.

   b. A portable lead shield or a portable partition draped with 1/2 millimeter lead equivalent vinyl sheet lead shall be placed in the path of the primary beam.

   It is recommended that all facilities using portable X-ray equipment should give a serious consideration to purchasing a protective barrier described in b. above.

This policy shall also apply to portable X-ray machines used for animal studies and preclinical laboratory exercises.

3. The darkroom shall be light-tight. The safelight filters must be compatible with the films being processed.

4. A Quality Assurance (Q.A.) program must be implemented and followed to ensure that high quality films are produced consistently at minimum cost and minimum exposure to patient and operator. The following Equipment Performance tests and procedures shall be performed according to the frequency specified. Any corrective actions must be documented.

   a. DAILY
      (1) Sensitometry and densitometry - manual and automatic processing. Test films must be kept on file.
      (2) Temperature check

   b. WEEKLY - Processor cleaning and total chemistry change for high volume areas. This may be done every two weeks for low volume processors.

   Calibration of the cone beam CT unit will be done every week according to the manufacturer's recommendation.

   c. SEMIANNUALLY - Darkroom fog

   d. ANNUAL

      (1) Screen-film contact
      (2) Screen-film-cassette speed match

   e. BIANNUAL

      (1) SID accuracy
      (2) X-ray and light field alignment
      (3) X-ray and bucky alignment
      (4) Collimator dial accuracy
      (5) Reproducibility
      (6) mR/mAs
      (7) Linearity
      (8) Timer accuracy and reproducibility
      (9) Half-value layer
      (10) kVp accuracy
      (11) Phototimer reproducibility
      (12) Filtration-intraoral units
      (13) Radiation exposure at end of cone (intraoral units)

5. The Radiation Protection Division (RPD) at the University of Minnesota has the following provisions related to X-ray machines and facilities that must be complied with:

   a. All purchase requests and orders for X-ray machines require the approval of the RPD.

b. If a radiation-producing machine is to be sold, traded, transferred, or disposed off, RPD must be notified and approval received.

c. Any change in the use, design, or location of an X-ray machine must be approved by the RPD. Such changes may require amendment of registration form, along with a new radiation protection survey of the machine.

d. All plans for new and remodeled facilities must be reviewed by the RPD during the preliminary planning stages, and requirements specified by the RPD must be followed. A radiation survey of all new and remodeled facilities must be made before use.

6. A radiation safety checklist should be posted by each X-ray unit and include the following:

   a. The correct kVp, mA and exposure time
   b. Direction to evaluate stability of the PID (position indicating device; cone) and tubehead before making exposures
   c. Direction to use required leaded apron and thyroid shield
   d. A description of the required operator position during exposure

7. A description of the film processing techniques should be posted in each processing area and include the following:

   a. The correct time and temperature
   b. Appropriate lighting conditions
   c. Film feed instructions
   d. Washing, rinsing and drying conditions
   e. Replenishing regimen
   f. Film loading

8. In case of film based imaging, student's access to radiographic film should be controlled. Correct number of film packets should be provided and only when a prescription for specific radiographs has been signed by a licensed dentist.

9. Digital sensors will be secured by the clinic staffs, and will be issued to students only when a prescription for specific radiographs has been signed by a licensed dentist.

10. Radiographic viewing should be accomplished under ideal conditions with equipment such as dim background lighting, masked viewboxes of adequate and uniform intensity, opaque film mounts and magnifying glasses. All viewboxes must be kept clean, be of the same intensity and the same color. For viewing digital radiographs, the monitors should preferably housed in a dimly lit area. For diagnosis purpose, the images preferably should be viewed on a computer screen instead of a print.

III. CRITERIA FOR EXPOSURE

1. All radiographs shall be prescribed in writing on the Radiographic Request form or in axiUm and signed/digitally signed by a licensed dentist. The request must include clearly

stated reason for the examination, prior to the procedure being done and entered in the Progress Notes sheet or in axiUm.

2. Radiographs for all patients shall be ordered only after clinical examination to determine the need and desirability of specific radiographs. Radiographs ordered merely on the basis of routine or for screening purposes shall not be permitted.

3. Radiographs shall be limited to the minimum number needed for a complete diagnostic work-up of the patient's dental need. The limits on exposure in each case will be determined by the professional judgment of a faculty dentist.

4. There can be no set frequency for radiographic examinations. The procedure to be employed and the frequency of the examination shall be determined by the professional judgment of the dentist ordering the radiographs.

5. If prior radiographs are available from a private dentist or another institution, they must be evaluated before new radiographs are prescribed. Only those additional views needed to complete diagnosis and treatment planning shall be exposed. This requirement does not preclude making a new complete intraoral survey if it is appropriate to the diagnosis.

6. Radiographs should not be used merely to document clinically apparent lesions.

7. Radiographs obtained for administrative purposes only, including those for insurance claims or legal proceedings, should not be made. However, diagnostic radiographs already made may be used for administrative purposes.

8. Demonstrations or training on X-ray equipment must be performed with proper protection of the observers and operator(s). Phantoms (mannequins), not humans, must be used for demonstration.

9. Deliberate exposure of an individual to radiographic procedure for training or demonstration purposes shall not be permitted, unless there is a diagnostic need for the exposure.

10. Individuals exposed for other than diagnostic reasons shall have the approval of the Human Use Subcommittee and All-University Radiation Protection Committee of the University of Minnesota.

11. Students should be assisted with all patients requiring three or more retake radiographs on a complete intraoral radiograph survey.

12. Patients should not be subjected to retakes to satisfy technical perfection. A minimally acceptable complete mouth radiographic survey should demonstrate, at least one time, each tooth in entirety and each interproximal space without overlapping and with clarity and accuracy.

13. Discretionary radiographic examination of patients who are known to be pregnant should be delayed until after delivery. Specific emergency radiographs may be obtained as needed.

14. No individual under 18 years of age shall be allowed to receive any occupational radiation dose except for training purposes.

IV. EXPOSURE PROCEDURE

1. For film based radiography, only American National Standards Institute Speed Group E film or faster (i.e. Kodak Insight), shall be used for all intra-oral radiographic procedures.

2. For introral radiography, rectangular collimation should be achieved, either by using a rectangular tube or a rectangular collimation.

3. No operator shall be permitted to hold patients or films/sensors during exposure. If assistance is required for children or handicapped patients, an adult member of the patient's family may assist. The hands and body of the assisting person should be positioned in a manner to prevent primary beam exposure, and a protective lead apron and gloves of 0.5 mm lead equivalence should be provided for the assistant.

4. Only the patient shall be in the operatory during radiation exposure. All other individuals shall be required to leave the area.

5. During each exposure, the operator shall stand behind the barrier provided for each operatory.

6. Leaded rubber aprons and thyroid shields shall be used for all intra-oral procedures as an additional precaution to minimize scatter radiation exposure to the body of the patient.

7. Leaded rubber aprons should be used for all extra-oral procedures, when feasible.

8. The patient should be observed through a lead-glass window, if possible, during each exposure.

9. The patient record must accompany each patient before exposures can be made. The operator must review the history of previous patient exposure and status in regard to any infectious disease.

10. If a malfunction is detected in an X-ray machine, it should be corrected immediately or the machine shall be "closed down" until the necessary corrections have been made and the equipment recalibrated. All repairs/adjustments must be documented.

11. Mechanical support of the tube head and cone shall maintain the exposure position without drift or vibration. These shall not be hand held during exposure.

12. Intraoral film/sensor holding devices must be used except when endodontic procedures do not permit doing so. In those cases where the patient must hold the extraoral film cassette, the patient must wear 0.5 mm lead equivalent gloves on the hand that holds the cassette. In addition, any portion of the body, other than the area of interest must be covered by 0.5 mm lead equivalent material.

13. All intraoral film/sensor holding devices must be sterilized according to SOD Infection Control Policy.

14. Extra-oral exposures should employ screen-film combinations of the highest speed consistent with their diagnostic objectives. Direct exposure X-ray film (without intensifying screens in a cassette) shall not be permitted for extraoral radiography.

15. Intra-oral fluoroscopy shall not be used for intra-oral radiographic examinations.

16. The target to skin distance for intra-oral radiographs shall not be less than 7.1 inches, and preferably should be a minimum of 12 inches or longer. The target to skin distance for extra-oral radiography shall not be less than 11.8 inches.

17. The exposure control switch shall be of "dead-man" type, i.e., it requires continuous pressure by the operator to complete the circuit. This switch must be positioned behind a protective barrier.

18. All intra-oral X-ray machines shall be equipped with open-ended, shielded cones limiting the beam diameter to 2.76 inches at the patient's face. When using rectangular collimation, the longer side of the rectangular beam at the patient's face should not exceed 2 inches.

19. Extra-oral X-ray machines shall be collimated so that the beam size does not exceed the area of interest and/or the film cassette size.

20. The half-value layer (HVL, beam quality) for a given kVp should not be less than the values prescribed by the Minnesota Department of Health.

21. X-ray machines designed to use kilovotage of less than 50 shall not be used for diagnostic purposes.

V. INSTRUCTIONAL/TEACHING SUPPORT

1. Students must be closely supervised by teaching staff during all radiographic procedures conducted on patients.

VI. RADIATION MONITORING

1. Film badges shall be worn during working hours by all (faculty and staff) occupationally exposed personnel who regularly use X-ray equipment and all other individuals who are likely to be exposed to ionizing radiation regularly.

2. The film badge device shall not be stored in the radiation area to avoid exposure.

3. The film badge shall not be worn by the individual when he/she is exposed as a patient for any medical/dental reasons.

4. The personnel film badge must be obtained through the RPR. To obtain a badge, get a request card from the RPR. After the request card is returned, the RPR will make arrangements with the University Radiation Protection Division to obtain an appropriate film badge.

5. The RPR will keep on file the records of quarterly, yearly, and total cumulative exposure received by all individuals and makes these available for inspection by each employee quarterly. The RPR will review the reports on each individual for each change period. If the radiation dose is in excess of five percent of the maximum permissible dose limit for that period, or if an unusual dose is reported, the RPR will make a complete investigation of the circumstances involved in the dose received by the individual. The findings and conclusions will be made a part of the personnel monitoring record of the individual and a copy will be forwarded to the University Radiation Protection Division to be filed with the permanent radiation exposure history of the individual.

6. Records of individual exposure and the personnel monitoring records shall be preserved for the lifetime or 30 years after the termination of employment with the facility, whichever is less.

7. The records of individual exposure shall be furnished to an employee who is terminating employment. The report must be furnished within 30 days from the time of receipt of final dosimetry record.

8. If a film badge is lost or damaged, contact the RPR immediately so that arrangements can be made to replace it.

9. Pregnant workers may “declare” pregnancy in writing to the RPR who shall contact the Radiation Protection Division to arrange for the completion of specific training.

10. Operators who are pregnant shall not be exposed to more than 0.5 mSv (50 mrem) per month during pregnancy. Film badge dosimeters on these individuals shall be processed on a monthly basis.

VII. RECORDS

1. A record of radiation exposure history of every patient of the dental school will be maintained. All radiographic procedures shall be recorded on the inside cover of the patient's chart or in axiUm. The record must include the date of radiographic image exposure, number and type of radiographs, including number of retakes, name of operator, name of the person requesting radiographs and name of clinic where radiographs/images are stored.

2. All film based intraoral radiographs exposed at the Dental School shall be mounted in University of Minnesota film mounts and labeled with the patient's name, date exposed, and chart number. No loose, unmounted radiographs shall be permitted in the radiograph pocket of the patient's chart. Digital radiographs will be stored in MiPACS.

3. All duplicate radiographs will be kept on file in the Oral and Maxillofacial Radiology clinic.

4. All film based radiographs shall be kept in the patient's chart. If an academic unit wishes to retain film-based radiograph for its records, a copy may be obtained by written order to the Oral and Maxillofacial Radiology Clinic

5. Interpretation of radiographs should be documented in the patient's record.

VIII. SATELLITE RADIOGRAPHIC AREAS

1. The RPR in cooperation with the University Radiation Protection Division has the complete overall responsibility and authority for controlling use of ionizing radiation for diagnostic purposes and ensuring use of good radiologic practices in other clinical disciplines.

2. The following supplies will be available at appropriate places in or near each satellite area.

   a. "Radiographic Request" forms
   b. Film dispensing forms
   c. Lead aprons
   d. Thyroid shields
   e. Film mounts
   f. XCP or other film-holders

3. The operator shall comply with all radiation protection practices outlined in the school-wide policy.

4. All radiographs to be exposed in satellite radiographic facilities shall be prescribed in writing by a licensed dentist on the faculty and appropriately entered in the Progress Notes sheet.

5. In order to facilitate an accurate account of patient exposures, all radiographic films shall be dispensed to the students at designated areas to prevent unauthorized use. No automatic film dispensers shall be permitted in areas available for student activity.

6. Films/sensors shall be dispensed to the students only when a prescription for specific radiographs has been signed by a licensed dentist.

7. All film badge distribution and collection shall be handled by the RPR. The badges must be returned and the new ones picked up in the Oral and Maxillofacial Radiology Clinic within 4 days of each change period. The change periods are: the first working day in January, April, July, and October.

8. The Radiation Protection Division of the University has stipulated that a charge of $50.00 be assessed for a lost or unreturned film badge.

IX. DARKROOM MAINTENANCE POLICY

1. The following processor maintenance protocol shall be followed:

   a. Every cleaning cycle. To be done late afternoon on Friday or before a holiday.

      (1) Unplug processor.

      (2) Drain chemicals and water completely. Save used fixer in supplied plastic bottle for silver recovery and lawful disposal.

      (3) Remove transport system. Wash them well with soapy water and rinse thoroughly. Let them air dry over the weekend. Chemical cleaning solutions may be used as needed.

      (4) Wash out tanks with water and remove any chemical buildups. Wipe out tanks with a clean, lint-free cloth.

      (5) Fill tanks with new chemicals in the morning on Monday or after a holiday.

      (6) Fill water.

      (7) Replace transport system.

      (8) Plug in processor.

      (9) Run cleaner films through. Run at least two new <u>unexposed</u> periapical films through each chute.

      (10) If films come out clean and clear, the processor is ready for use. Proceed with Quality Control tests.

      (11) If there are marks or residue on the films or if periapical films are dark or fogged, call the Oral Radiology Clinic supervisor at 625-1126. Do not use processor until its use has been cleared by the Oral Radiology supervisor.

      (12) Check water temperature to be sure it is set to manufacturer's recommended temperature.

      (13) Make entry in the Processor Maintenance log posted in the darkroom.

   (b) Daily

      (1) Turn processor on. Change water daily

      (2) Check chemical level. If too low, add more.

      (3) Run cleaner films through as outlined in "a" above.

(4) Check temperature setting. If adequate, proceed with Q.C. film. Record temperature on log sheet.

(5) Expose and process a step wedge film and compare with standard. The step wedge film must be within one step of standard. If not, do trouble shooting. Repeat Q.C. tests until satisfactory results obtained.

(6) Turn processor and water off at the end of the day.

(7) Lift lid off slightly to allow air to circulate.

2. Film processing shall be monitored in each darkroom on a regular basis to assure film quality. Test records will be maintained by the RPR. Test films must be labeled and saved for 30 days.

3. Instructions for processing shall be posted in each darkroom.

4. All old films, lead foil film backings and used fixer must be saved for proper disposal by the Dental Engineering Department.

5. The darkrooms shall be evaluated for white light leakage and adequacy of safelights by the RPR every six months. All deficiencies must be corrected immediately.

IX. REGIONAL DENTAL BOARDS PATIENTS

1. A request for radiographs on all board examination patients shall be signed by a licensed dentist. Reason for radiographic examination must be recorded. Patients must fill out and sign Health History/Consent form.

2. All the regulations regarding radiation safety contained within this policy would apply when appropriate.