Most veterinary technicians will work with radiation, at least occasionally. You should be aware of the principles of radiation safety and the laws and requirements regarding radiation exposure. Some of the specific regulations regarding radiation safety may vary by state but the most common rules and principles are described in this PowerPage.

Relevant Pathophysiology

- Radiation causes damage to cells; possible results of this damage include:
  - Damage may be repaired without incident; the vast majority of damage to cells is repaired successfully
    - Damage may be lethal; especially high doses of radiation can kill cells; this type of damage can lead to tissue damage such as cataracts to the lens of the eye
  - Damage may be repaired with errors; this type of damage can lead to:
    - Increased risk of cancer (including skin cancer, leukemia)
    - Risk of birth defects

Dose Limits and Radiation Measurement Responsibilities

- The unit absorbed dose equivalent used for radiation safety is the Seivert (Sv)
  - The older unit that is still used in some instances is the radiation equivalent in man (rem)
- Maximum permissible dose limits for annual exposure are as follows:
  - Whole body – 50 mSv (5 rem)
  - Skin and extremities – 500 mSv (50 rem)
  - Eye or lens dose- 150 mSv (15 rem)
- Most states require individual monitoring devices to be worn by workers who are likely to receive a radiation dose of > 10% of the legal limit in one year
  - It is unlikely that most veterinary technicians will approach 10% of the limit
  - Most veterinary practices elect to provide individual monitors anyway
- Registered veterinary technicians may operate radiographic equipment under indirect supervision of a licensed veterinarian
- The overriding principle guiding radiation protection is known as ALARA (as low as reasonably achievable)
  - This principle reflects that even if individuals do not approach annual dose limits, steps should always be taken to minimize their radiation absorbed dose to as low as is reasonably achievable. The three main ways to minimize radiation dose are to:
    - Decrease the time of exposure to a radiation source
      - Use chemical or mechanical restraints when possible so that individuals do not need to be in the x-ray room during the exposure
      - Using rare-earth screens can decrease the amount of exposure needed to create a well exposed image
      - Plan carefully and avoid retakes
    - Increase distance from a radiation source
      - If an operator triples the distance from a radiation source, their exposure is decreased to one-ninth (decreased by the square of the distance- 9 is 3-squared)
    - Increase shielding between individuals and a radiation source
      - Protective barriers are an important way to decrease dose with shielding.
      - Individuals in an x-ray room during exposure should be behind a protective barrier or wear a protective apron of at least 0.25mm (ideally 0.5mm) lead equivalent
Radiation Safety

- Lead impregnated vinyl or leather or used to make aprons and gloves
- 0.25 mm lead equivalent material reduces a 100kVp x-ray beam by 60% while 0.5 mm lead equivalent reduces it by 85%.
  - Aprons and gloves must be periodically evaluated for tears and cracks; this can be accomplished by taking a radiograph of the equipment
  - All shielding devices are intended to protect the wearer from SCATTER RADIATION ONLY. These devices do not sufficiently reduce the primary x-ray beam which is made up of higher energy x-rays with better penetrating ability.

- Veterinary assistants who are unregistered in the area of radiation safety and technique may operate radiographic equipment under direct supervision of a licensed technician or veterinarian

- Restrictions on pregnant women: the total occupational dose of a declared pregnant woman may not exceed 5mSv or 0.05mSv in any month
  - The first 3 months of pregnancy are the most important as the embryo is most sensitive to adverse radiation effects at this time
- Restrictions on young people: Individuals under 18 years of age should be excluded from performing or assisting in radiographic examinations. The occupational dose limit for individuals under 18 are 10% of the limit for adults

Monitoring Devices
- The most commonly used personnel monitoring devices are:
  - Film badges
  - Thermoluminescent dosimeters (TLDs)
  - Pocket dosimeters
  - Ring or wrist badges

- The monitoring device should be worn at thyroid level on the collar outside of the apron
  - A ring or wrist badge should be worn for fluoroscopy procedures