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; high doses of radiation can kill cells, leading to tissue damage (for example, 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 Sievert (Sv).
  - Older unit, which 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).
  - Pregnancy – the total occupational dose of a declared pregnant woman may not exceed 5 mSv or 0.05 mSv 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.
  - 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.
Dose Limits and Radiation Measurement Responsibilities (Cont.)

- 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 principle guiding radiation protection is 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 radiation absorbed dose to as low as is reasonably achievable.

Minimizing Radiation Exposure

- 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.
  - Use rare-earth screens to decrease 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.
- Lead impregnated vinyl or leather are 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 (by taking a radiograph of the equipment).
  - 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.
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 apron
  - A ring or wrist badge should be worn for fluoroscopy procedures