

# Veterinary Radiation Safety



# Radiation Safety

South Carolina Law requires that persons who perform diagnostic radiology procedures on animal patients be adequately trained in equipment operation and radiation safety principles.



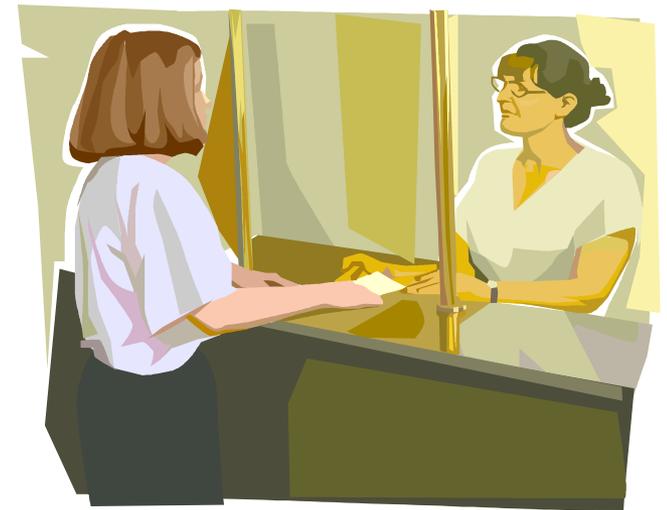
# Authorization to take a radiograph

Radiology Examinations must be ordered by a Clemson Veterinarian or by the Animal Care Supervisor – Research Services. Veterinary equipment must not be used for human exams.



# First Things First

Make sure you have correctly identified the patient.



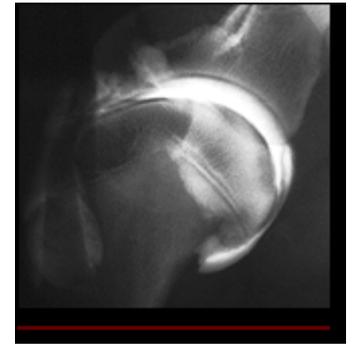
# Repeat Radiographs



The National repeat rate for radiographs is ~8 %.  
Each repeat radiograph is additional radiation dose to the patient and staff.

Watch the patient closely through the x-ray shield view window. If the patient has moved or is no longer in the correct position, do not take the exposure. Reposition or restrain again to ensure the radiography does not have to be repeated.

# Prior Radiograph Viewing



Viewing prior radiographs, especially for orthopedic studies, can dramatically reduce the repeat rate for radiographs. Whenever possible, view original orthopedic radiographs before performing another examination.

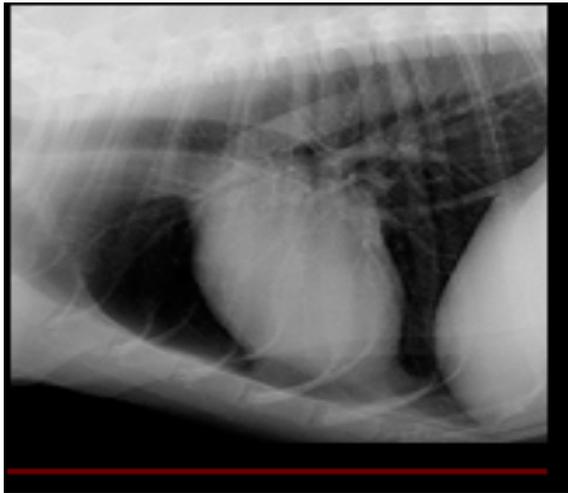
# What Else Can You Do?

Close collimation reduces patient's and staff's exposure dose.



# Technical Factors

Use of higher Kvp WITH AN APPROPRIATE REDUCTION IN mAs results in less radiation dose. However, Kvp must be appropriate for the study.



Ex. For an Lateral Chest Radiograph

70 Kvp @ 15 mAs  
results in less dose  
than 60 Kvp @  
30 mAs.

# Imaging



**Use of faster film/screen combination [consistent with the requirements of the examination] also reduces dose.**

**Proper photo-timing can also reduce radiation exposure. Be sure the sensors are properly centered for the organ/part of interest.**

**Careful alignment of the x-ray beam with the patient and image receptor is vital.**



# Filtration



Do not remove filtration from x-ray tubes.

Tubes must have aluminum filtration to remove the “soft” x-rays that do not produce the radiographic image.

Regulation requires at least 2.5 mm Al filtration for most x-ray units.

# Holding Patients

Use approved mechanical restraining devices to hold patients whenever possible.

Trained adults may hold patients if necessary.

Ensure assistant patient holders, wear a lead apron and gloves. Keep out of the primary beam. **NEVER** point the tube at the control booth.

**Whenever possible, use sandbags and other restraints instead of having persons hold patients**



# Wear Lead apron, and gloves.



Do not hold patients for bucky exposures – only for table top exams on small animals.

**Use equipment or sedation to restrain large animals for exams that use the bucky tray**



## Shielding – stand completely behind the control booth lead wall during x-ray exposures



# Restricting Access to X-ray Rooms

Allow no unauthorized visitors during x-ray exams.

South Carolina Law requires that only individuals required for the radiographic procedure shall be in the radiographic room during exposures; and except for the patient, no unprotected body parts of their bodies shall be in the useful beam.

# Fluoroscopy equipment

Fluoroscopy delivers a dose of approximately 5 Rads per minute.

Fluoroscopy should not be used by veterinary technologists as a substitute for radiography.

[Ex. Do not fluoro when a conventional radiograph was ordered just to avoid complex positioning.]

# Fluoro equipment continued

**Do not remove lead drapes which provide shielding and reduce scatter radiation reaching the operator.**

**Ensure fluoro is energized only when a veterinarian is actively looking at the fluoro image.**

**Use of intermittent fluoro reduces patient and operator exposure.**

# Wear a lead apron during fluoro

0.5 mm lead  
equivalent for fluoro  
aprons –“wrap around”  
style aprons are best.



# Portable Radiography



Wear lead apron and gloves.

Ensure animal is calm and as still as possible.

Use long handled cassette holders.

No worker shall be in the direct beam.

Do not direct the x-ray beam at a corridor or into an area where others may be exposed inadvertently.

Stand as far from the x-ray tube and patient as feasible.

# Portable X-ray Unit

Use the fastest imaging system possible.

Close collimation reduces scatter radiation and helps keep your radiation exposure low.

Do not hold the x-ray machine during exposures.

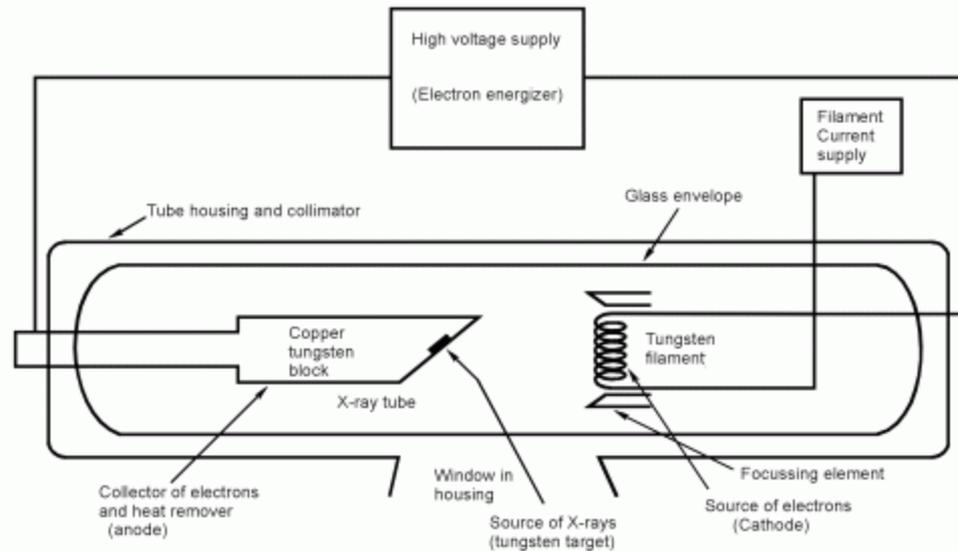
Use the exposure control cord to step 6' away from the x-ray machine during the exposure.

# Reporting problems

Report any changes in technical factors and keep a technique chart up to date.

Remove from service any x-ray equipment that appears to be malfunctioning. Contact your supervisor and repair personnel.

# X-ray Production



Components of an x-ray machine

# Radiation Biology

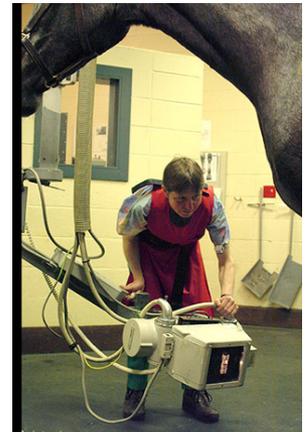
Even small doses of radiation can damage DNA.

Very large doses of radiation [ $>100$  Rem] can cause health effects.



# Typical Large Patient Doses for Common Exams – skin entrance doses

DV Chest	10 mRem
DV Abdomen	325 mRem
Head CT	2000 mRem
Paw	6 mRem
Knee	20 mRem
Shoulder	25 mRem
Lat skull	70 mRem



# Occupational Dose limits

Annual worker dose limits help ensure worker safety.

Whole body limit - 5000 mRem/yr

Dose to typical Techs - < 100 mRem/yr

# Radiation Badges

**All badges are NVLAP certified to ensure maximum accuracy of the dose report.**

**Wear the badge flat against your body. Do not wear badges on a chain, which would allow the badge to turn at various angles as you work.**

# Remember to:

**Wear only your own badge**

**Wear it whenever working with an X-ray producing device.  
Leave it in a cool, dry place and away from radiation when not in use.**

**Do not take your badge home.**

**Do not launder the badge or get it wet.**

**Do not expose to heat, such as in a car in summer.**

**Do not open badge.**

**Do not expose the badge to other sources of radiation.**

**Do not wear the badge for personal x-ray or nuclear medicine exams.**

**Turn in your badge for processing in a timely manner.**

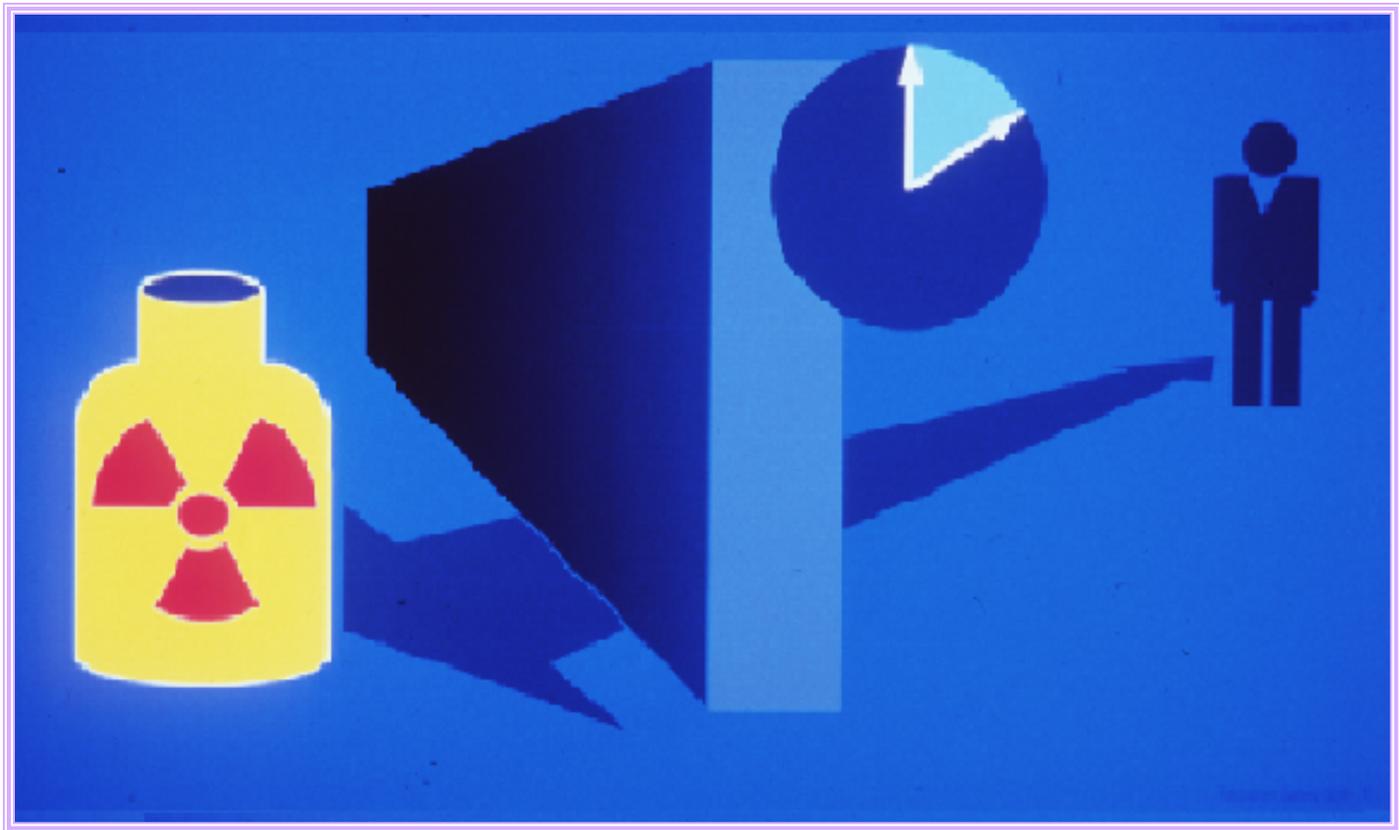
# Pregnant Radiation Workers

Pregnant Rad. Workers must be limited to 500 mRem/9 months. The goal is to have the exposures  $\leq$  50 mRem/ 9 mos.

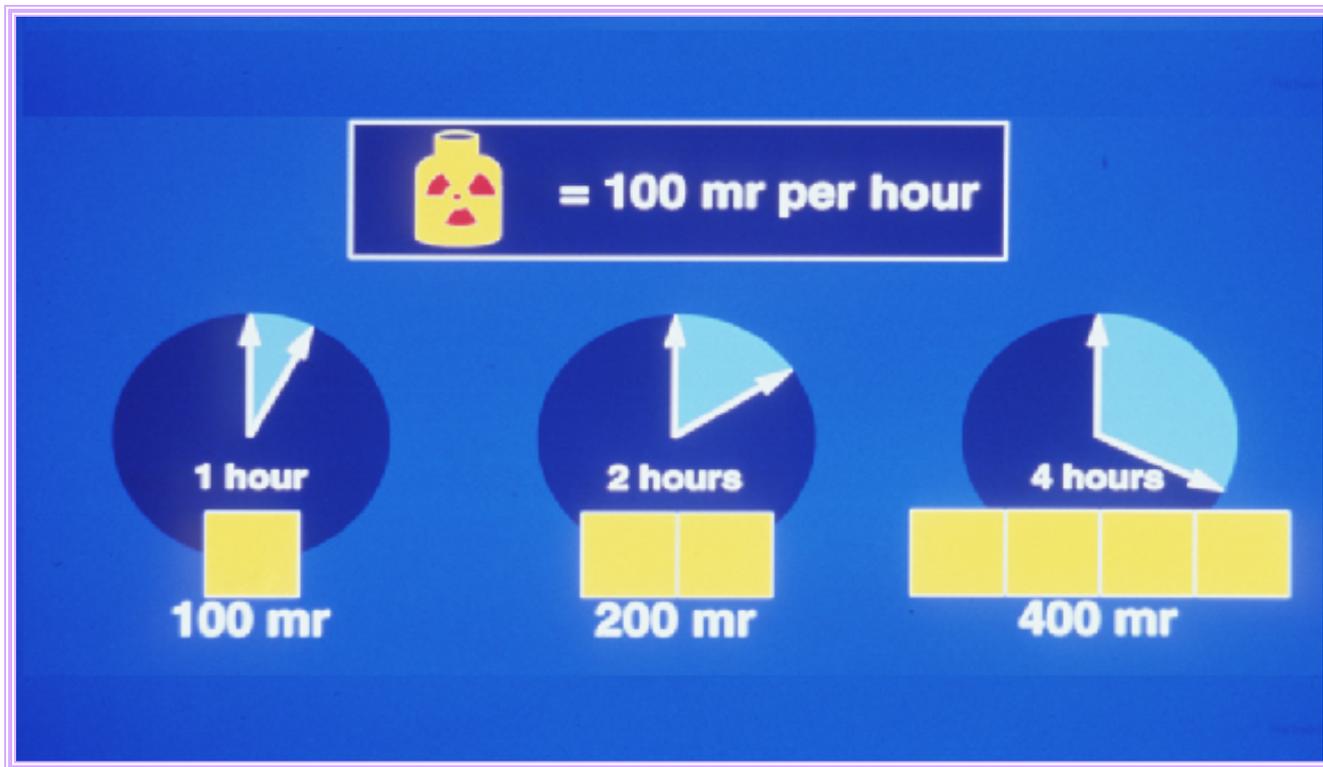
Extra badges to wear at the waist are available to pregnant radiation workers who declare the pregnancy.

# Controlling External Exposure

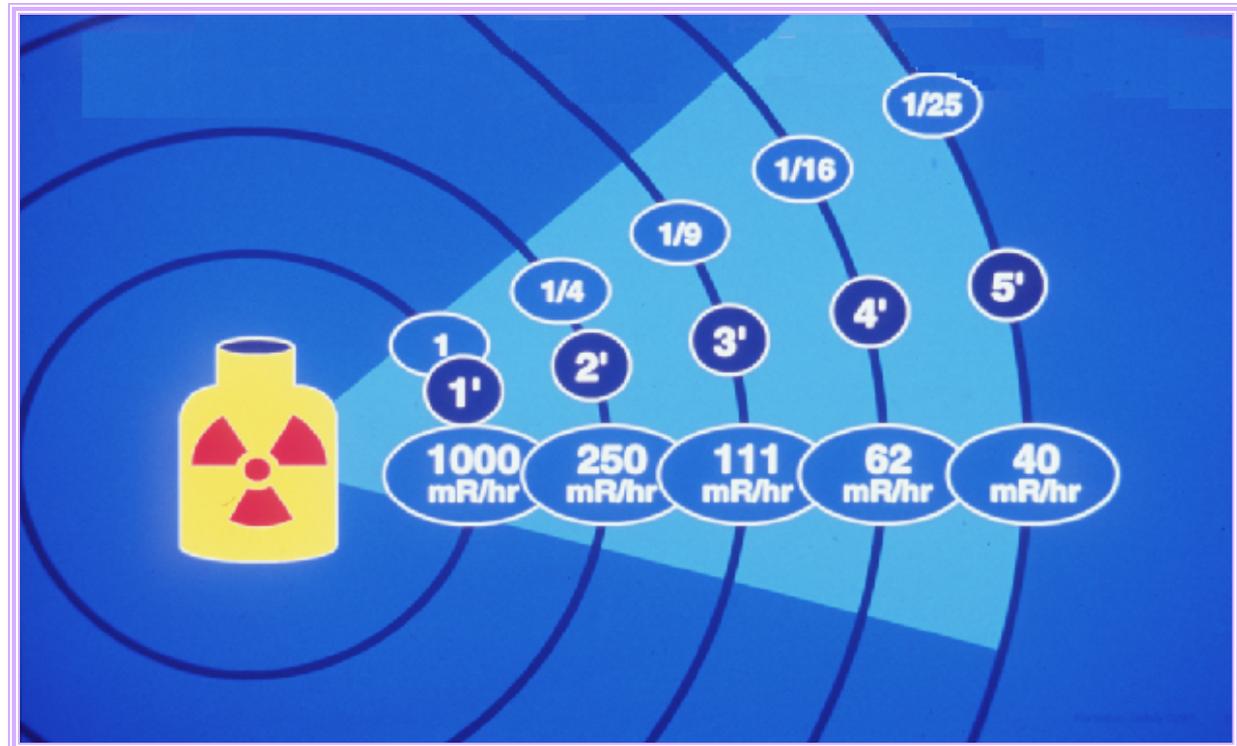
## Time, Distance & Shielding



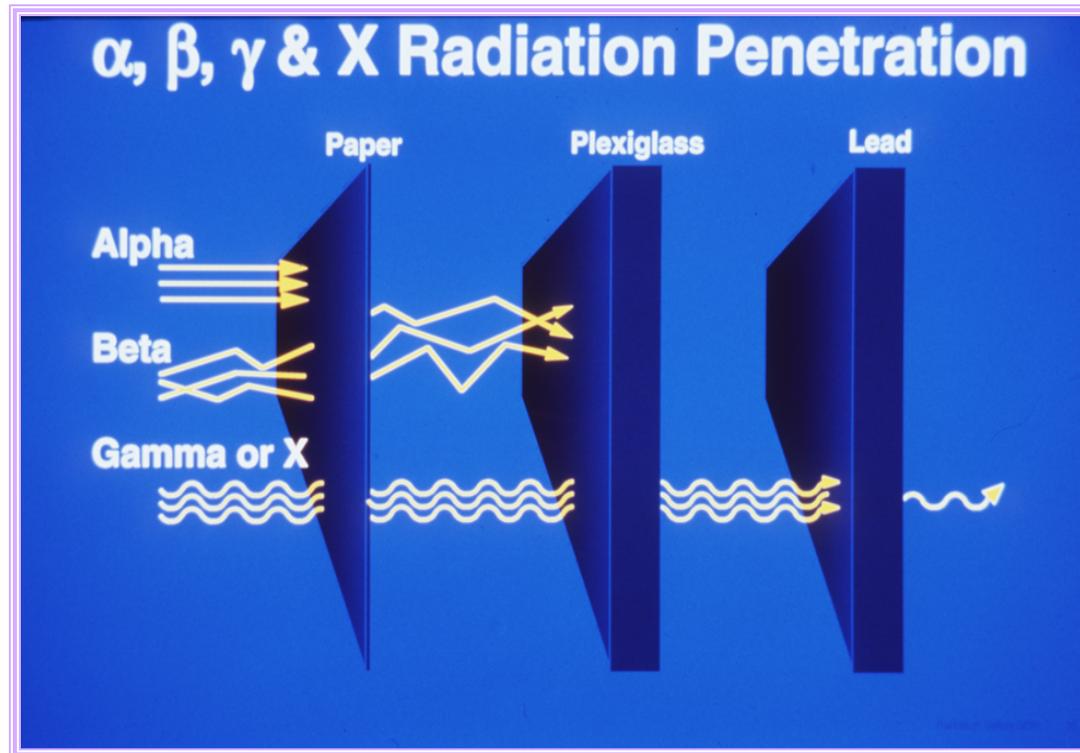
**Time – make sure the fluoroscopist knows the total fluoro time- Only required people should be present**



**Distance - stand as far away from the patient during fluoro as feasible. When not assisting, stand in the control booth.**



# Shielding Properties – most radiography rooms require 1/16 inch of lead



# Lead aprons to protect staff

All workers in the x-ray room during studies must have a lead apron. Keep the lead between you and the x-ray tube. That is, do not turn your unshielded back to the x-ray machine. Use of wrap around style aprons is best.



# Thyroid Shield

Use of a thyroid shield, if available, will help keep the worker's radiation dose ALARA [as low as reasonably achievable.]



# Lead Shield Care

Hang aprons and shields on racks.

Do not bend or fold lead aprons or shields. Folding can cause cracks and tears in the protective material.

Periodically inspect shields for evidence of damage. Remove damaged ones from use.

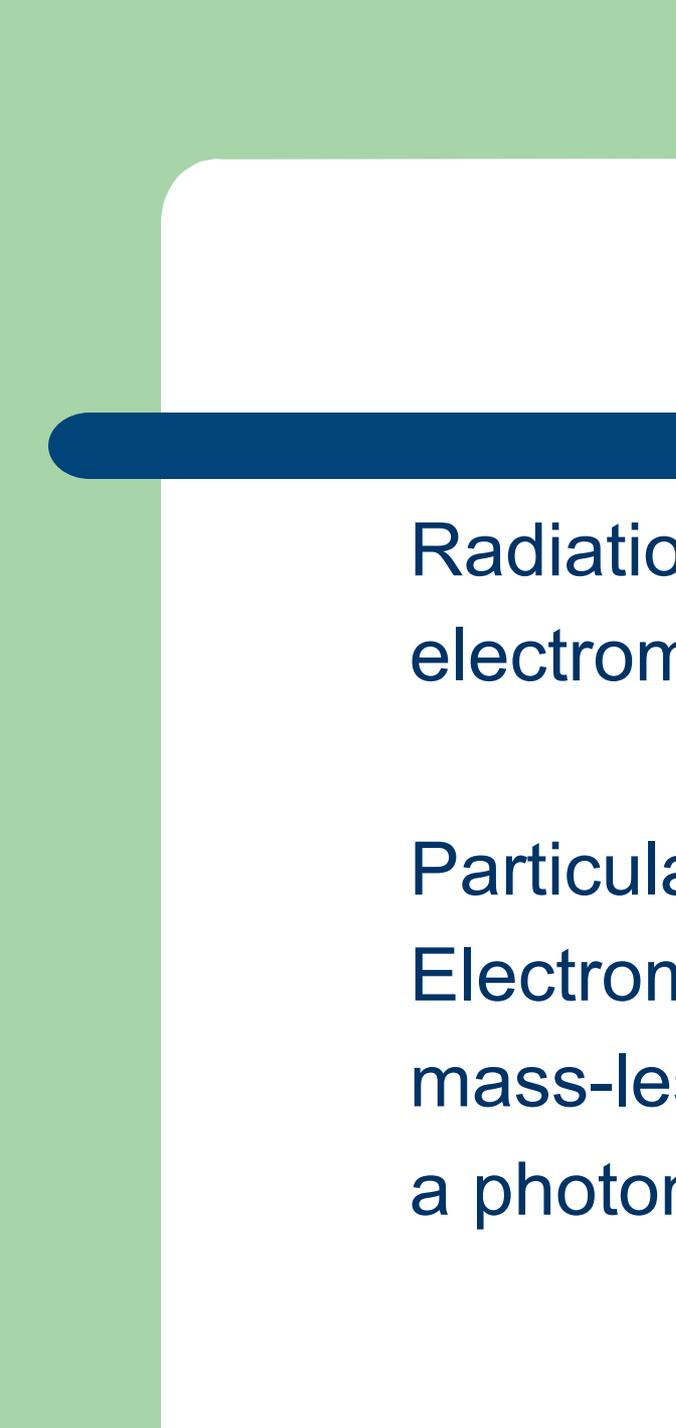
A decorative graphic on the left side of the slide, consisting of a light green vertical bar and a dark blue horizontal bar with rounded ends.

# Additional Radiation Related information

# Types of Radiation

Radiation can be non ionizing such as lasers or microwaves, or

Radiation can be ionizing such as x-rays



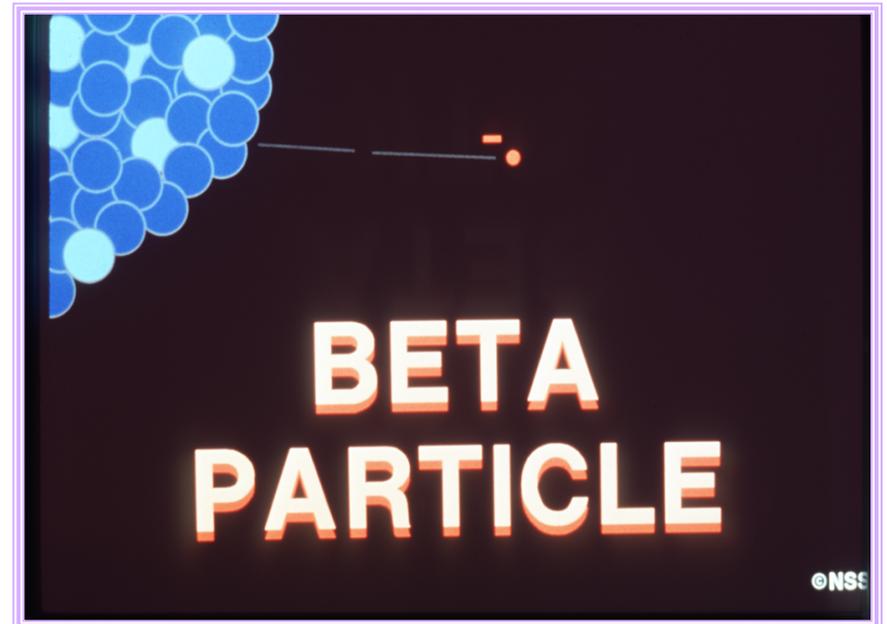
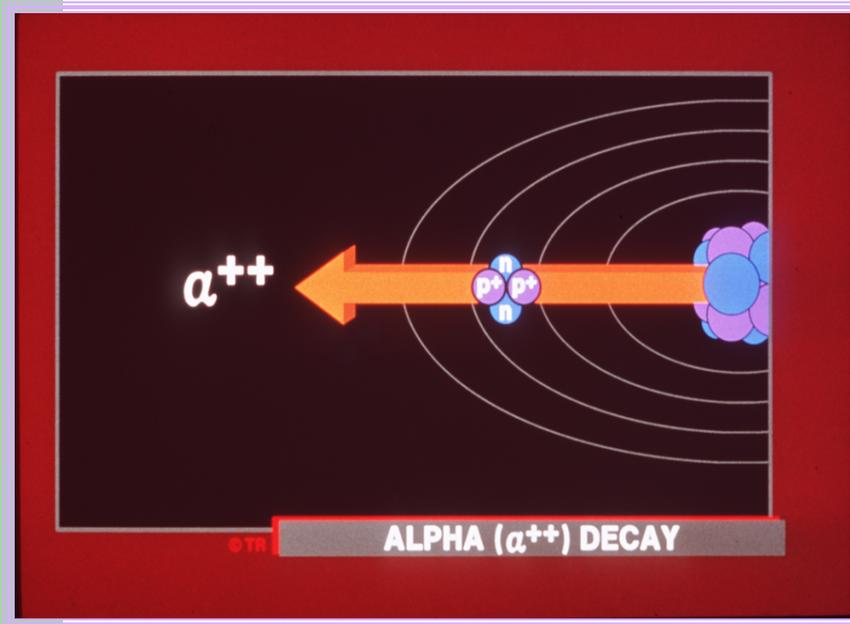
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Radiation can be particulate or electromagnetic.

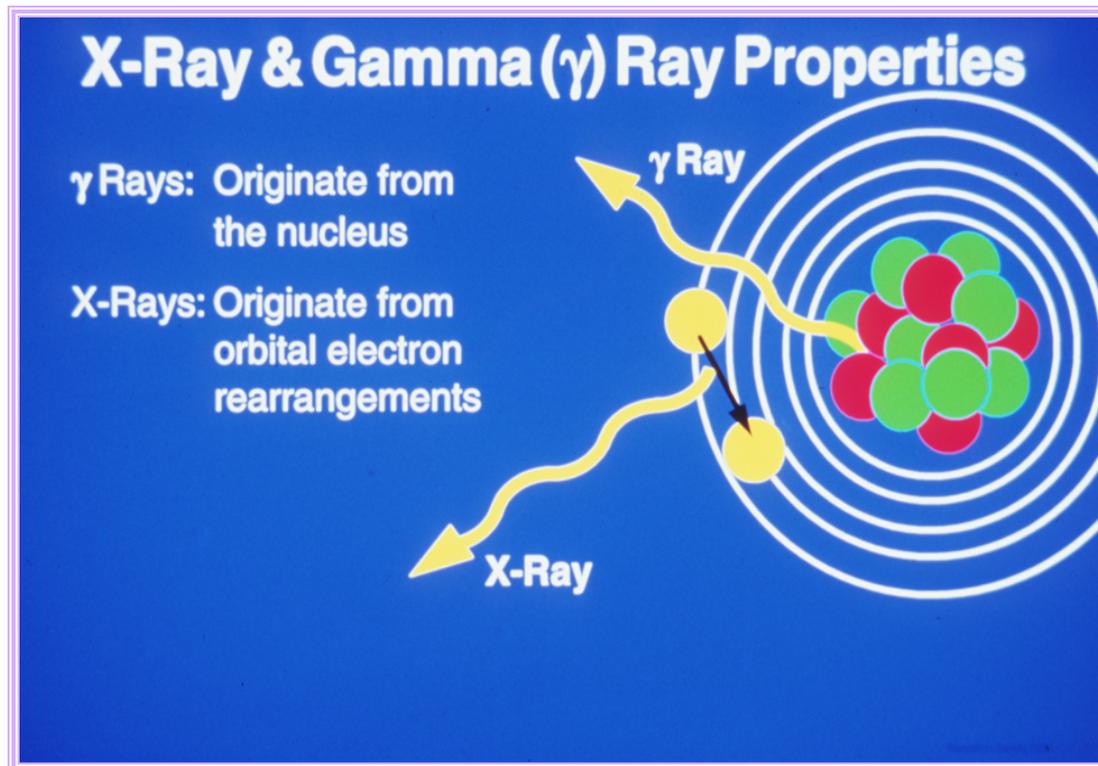
Particulate radiation has mass.

Electromagnetic radiation is a mass-less packet of energy called a photon.

# Particulate Radiation



# Electromagnetic Radiation

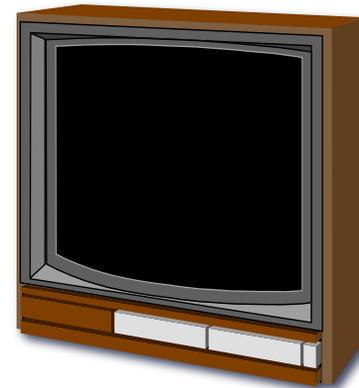
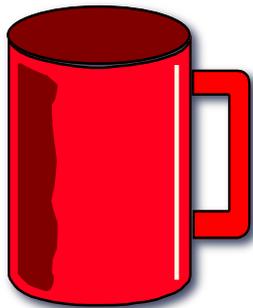


# Sources of Radiation

Radiation can be naturally occurring such as radon and cosmic rays.

Radiation can be man made, such as x-rays.

# Consumer Products as radiation sources



EXIT

# ALARA

As Low As Reasonably Achievable

Using good safety practices each day, every study, to keep your and your patient's radiation dose as low as feasible.

# For Further Information

Contact :

The Radiation Safety Office  
Office of Research Safety  
at 864 656-3516