


RADIATION SAFETY TRAINING

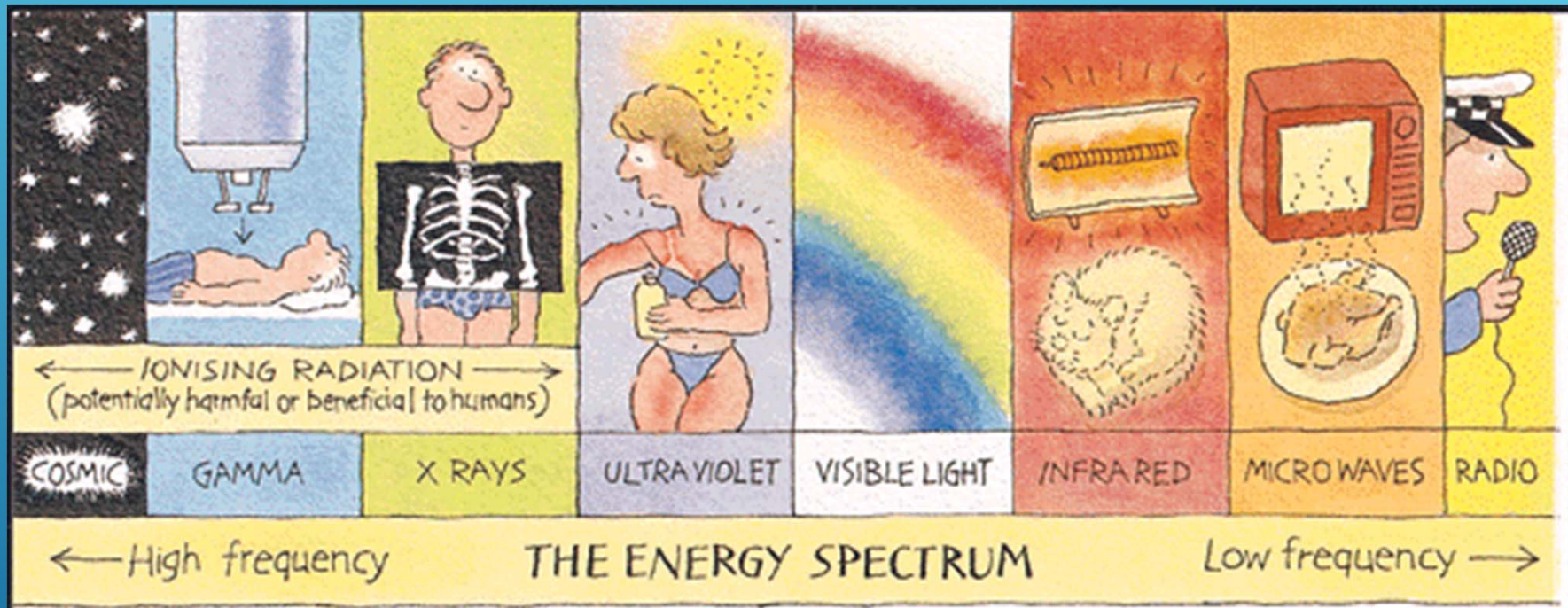
NEW JERSEY INSTITUTE OF
TECHNOLOGY

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TRAINING SPECIFICS

- The use of radioactive material and radiation producing equipment is regulated in NJ by the Department of Environmental Protection, Radiation Protection Programs.
 - This training deals with ionizing radiation only
 - Annual Refresher training is mandatory
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TRAINING SPECIFICS



TRAINING SPECIFICS

- Completion of this training is a regulatory requirement for any individual that will handle radioactive material or radiation producing equipment.
- All procedures are designed to protect the health and safety of researchers and maintain compliance with the applicable regulations, and **MUST** be followed.

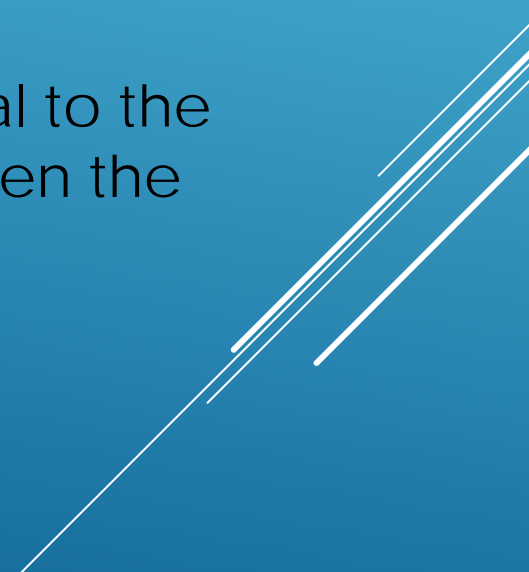
SOURCES OF IONIZING RADIATION AT NJIT

- X-ray producing equipment
 - Sealed sources
 - Radiolabeled compounds
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X-RAY PRODUCING EQUIPMENT

- Can range from hand held to large stationary devices
 - They are always locked when not in use by an Authorized User
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X-RAY PRODUCING EQUIPMENT

- X-rays are produced when an electron is accelerated through a vacuum tube and strikes a metal target.
 - The energy of the X-ray is proportional to the potential difference (voltage) between the anode and cathode of the tube.
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X-RAY PRODUCING EQUIPMENT

- The range of x-ray energies from various equipment is many orders of magnitude, from TV screens (120 volts) to linear accelerators (10 Giga volts)
- Analytical x-rays range from 15,000 volts for electron microscopes to 50,000 volts for X-ray diffraction machines


X-RAY PRODUCING EQUIPMENT

- Some produce x-rays via electricity while others use internal sealed sources
- An “X-Ray On” warning light is present on each machine.

X-RAY PRODUCING EQUIPMENT

- All modern analytical x-ray machines have safety interlocks. When the door to the cabinet is opened (to change samples) the beam is automatically shut off
 - Interlocks are tested for all new installations and every six months thereafter
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X-RAY PRODUCING EQUIPMENT

- Machine operators are provided with whole body and ring dosimeters.
 - An area dosimeter will be placed in the vicinity of the machine.
 - Only wear your badge, always wear your badge, don't take it home.
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HAND HELD X-RAY DEVICE




SCANNING ELECTRON MICROSCOPE




X-RAY FLUORESCENCE MACHINE



SEALED SOURCES

- Small amounts of material are electroplated onto metal discs, typically the size of a quarter
 - Are usually installed in other devices
 - Tested for leakage every six months
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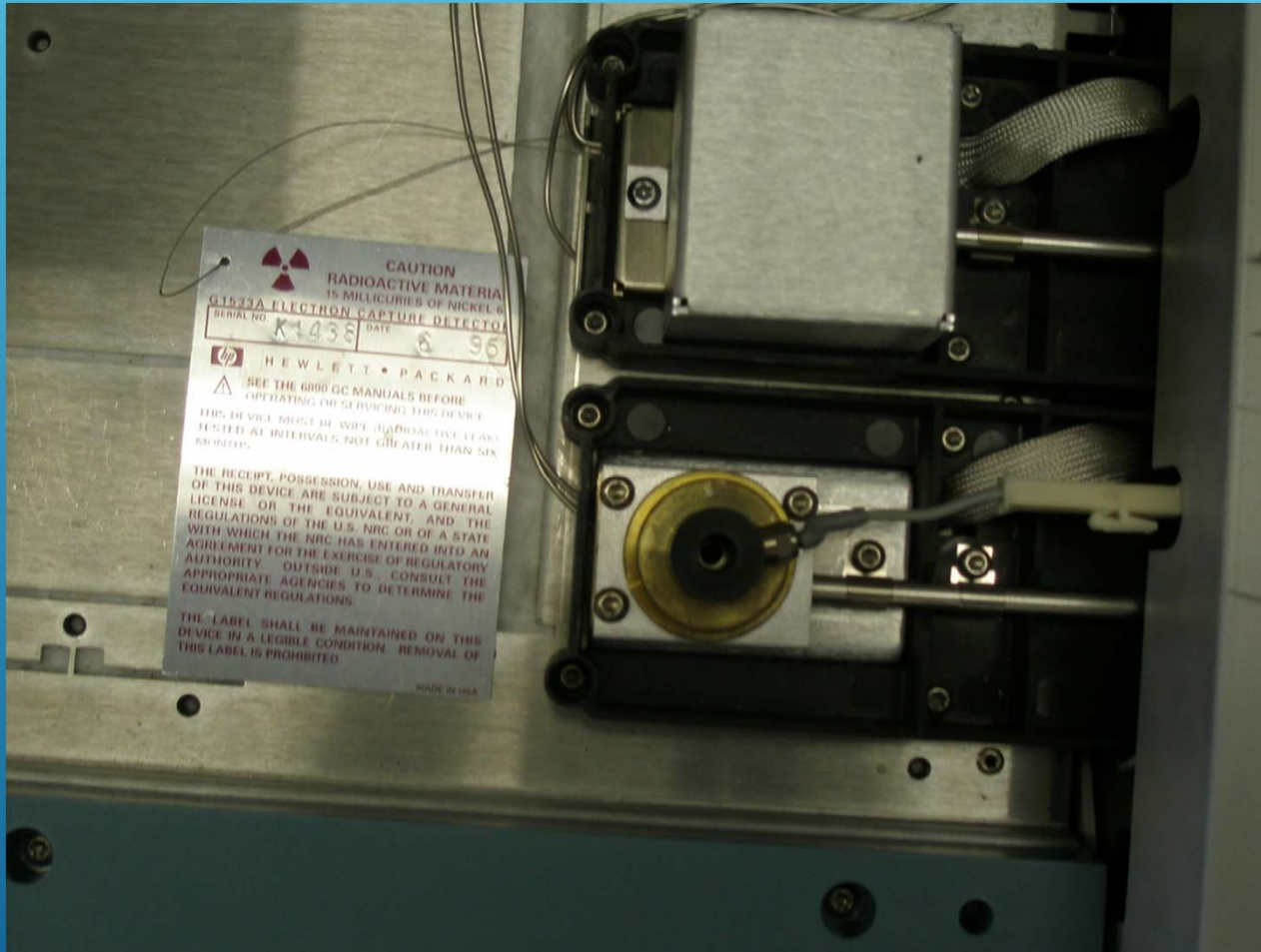
SEALED SOURCES

- Do not touch the surface of the source without gloves
 - Do not remove the source from any device without first notifying EH&S
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A GAS CHROMATOGRAPH CONTAINING A SEALED SOURCE




A NI-63 SEALED SOURCE



RADIOLABELED COMPOUNDS

- Typically 50-100 ml sized vials.
 - Possession and use specified in NJIT's Radioactive Materials License
 - Radiation Safety Officer and "Authorized Users" are specifically named on the license.
 - All others work under their supervision.
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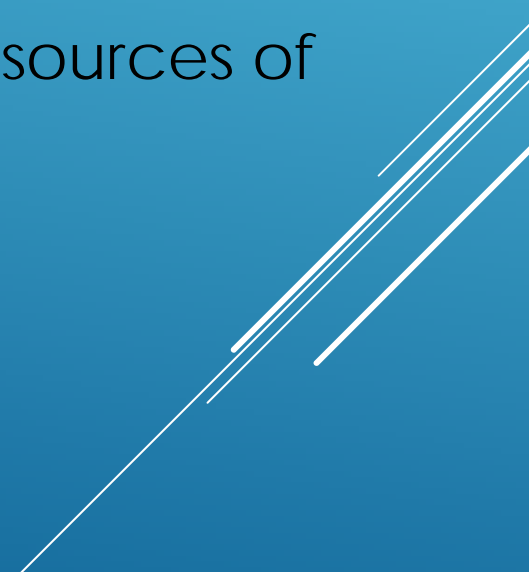
NJDEP LICENSE CONDITIONS

- A survey for contamination is conducted every time radioisotopes are used.
 - Monthly surveys by the RSO
 - Annual training, audits, inventory requirements.
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REQUIRED POSTING




SAFE HANDLING

- Understand the nature of the material you are handling
 - Minimize time spent handling radioactivity
 - Distance yourself appropriately from sources of radiation
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SAFE HANDLING

- Use appropriate shielding for the radiation you are working with
 - Contain radioactive materials within defined work areas and label them appropriately
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SAFE HANDLING

- Plan work schedules appropriately so you won't be too rushed to work thoughtfully.
 - Have a protocol in place – know what you are going to be doing.
 - Have all equipment in place before you start.
- 


SAFE HANDLING

- Set up the work area so it works for you.
 - Foresee potential problems and plan accordingly.
 - If dose rate is high or procedure is new, carry out a 'dummy run' without radioactivity to check your procedures.
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SAFE HANDLING

- Wear appropriate protective clothing and dosimeters
 - Monitor yourself and the work area frequently
 - Act responsively – make your work area safe for yourself and others
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SAFE HANDLING

- Dispose of waste by appropriate routes
 - Check your hands and feet
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SAFE HANDLING

- Plan work schedules appropriately so you won't be too rushed to work thoughtfully.
 - Have a protocol in place – know what you are going to be doing.
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- 


SAFE HANDLING

- Keep radioactive and inactive work separated. If possible, segregate isotopes and keep cold and hot labware separated.
 - No radioactivity on unprotected surfaces.
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SAFE HANDLING

- ▶ Work over a spill tray protected by absorbent paper or “diapers.”
- ▶ Liquids and liquid waste require double containment (e.g. tub under HPLC waste bottles).


SAFE HANDLING TECHNIQUES

- Don't tolerate removable contamination.
 - Don't let it get out of the lab.
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SURVEY TECHNIQUES

- Have survey meter in close proximity to work area
 - Do pre-operational check before use to ensure the meter is working properly and battery is not dead.
 - Turn off battery-operated meters when done
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SURVEY TECHNIQUES

- Position detector so it is directed toward your work area. (Enables you to conveniently monitor your hands as you work. Can indicate when materials are removed from shielded containers)
 - Always work with the audio turned on. [Awareness]
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SURVEY TECHNIQUES

If something that could cause contamination happens – stop and monitor very carefully.

- A radioactive package has a higher than expected dose reading or a hot wipe during package survey.
- Cap or pipette tip falls on the floor
- Your test-tube tips over
- Vial septum sputters while drawing a dose
- Plastic line leaks during transfer of radioactive material
- You notice a “little” drop of something on your glove

REMEMBER – A LITTLE RADIOACTIVITY GOES A LONG WAY


A small spill or removable contamination in
the wrong place can make a really big
mess (especially if undetected)

$$1 \text{ uCi} = 2,220,000 \text{ dpm}$$


Our clean up level is 200 dpm/100 cm²

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ALSO MONITOR YOURSELF AND WORK AREA CAREFULLY IF:

- Your hands, wrists, sleeves or other body parts are hot during an experiment or while exiting the lab (especially if unexplained).
 - Your shoes are hot.
 - Your lab-mate is hot or has a spill.
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ALSO MONITOR YOURSELF AND WORK AREA CAREFULLY IF:

- Background in the area or at the exit monitor is unexpectedly high.
 - Wipes during clean-up are elevated above what is expected.
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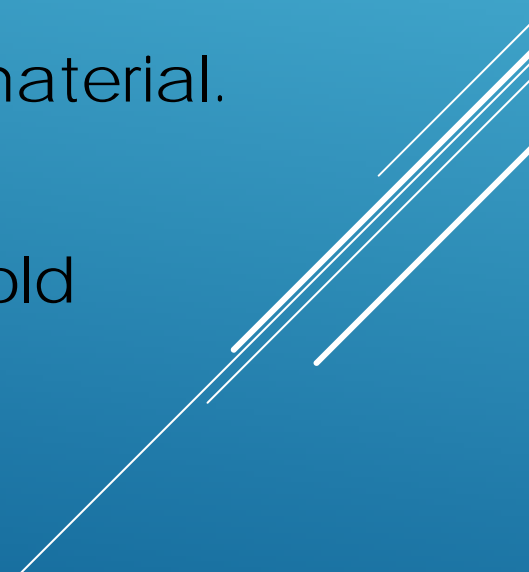
ACT RESPONSIVELY – MAKE YOUR WORK AREA SAFE FOR YOURSELF AND OTHERS

- Never pipette radioactive solutions by mouth.
 - Smoking, eating, chewing gum, drinking, and putting on makeup could result in ingesting radioactive material and are not allowed.
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ACT RESPONSIVELY – MAKE YOUR WORK AREA SAFE FOR YOURSELF AND OTHERS

- Always store compounds under the conditions recommended. Use CAS numbers (NJ Right to Know)
 - Label all containers clearly, indicating nuclide, compound, specific activity, total activity, date and name of user.
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EVEN EMPTY PACKAGES MUST BE HANDLED PROPERLY

- Do **NOT** discard intact radioactive labels/markings in normal trash!
 - Remove and/or completely deface labels before discarding uncontaminated boxes for rad material.
 - Check to make sure the box is cold before discarding
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SURVEY TECHNIQUES


**CHECK YOUR HANDS AND FEET
EVERY TIME THAT YOU LEAVE THE LAB**

(even if you didn't "Do" anything)


**This also holds for outside contractors, lab
supervisors and Directors.....)**

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RADIOACTIVE MATERIAL PACKAGES

- Ensure that all activity received gets entered into the inventory.
 - If you use stock solutions, enter what you used on “Usage logs” so inventories can be properly adjusted each month.
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INFORMATION, CONTACTS AND EMERGENCIES

- The Radiation Safety Manual, and other reference documents are available through EH&S
 - If you are unsure about any procedure ASK first.
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INFORMATION, CONTACTS AND EMERGENCIES

- Contact NJIT Security first in any emergency

- The Site Radiation Safety Officer can be contacted at;

Scott Dennerlein 609 290-4643

sdennerlein@comcast.net

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Questions?

The image features a blue gradient background. In the bottom right corner, there are several white diagonal lines of varying lengths and thicknesses, creating a sense of motion or a modern design element.