



charles lowe

## Chapter 6

# How Is Radiation Detected and Measured?

## Chapter 6: How is Radiation Detected and Measured?



### **Preface**

- Humans can't sense ionizing radiation.
- Survey meter, alarm rate meter, pocket dosimeter, film badge.
- Use them! They will save you!

## Chapter 6: How is Radiation Detected and Measured?



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## Chapter 6: How is Radiation Detected and Measured?



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### Survey Meter

- Primary device.
- Measures in Dose Rate.
- Must be able to read from 2 mR/h to 1000 mR/h.
- Typically, 2 meters per mobile unit (or sufficient number).

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### Reading a Survey Meter

- “Batt”
- X1 – sensitive.
- X10 - less sensitive.
- X100 - less sensitive.
- X1 - checking perimeter.
- X10 – contact surveys.

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### Reading a Survey Meter

- On x1 and meter reads 8
- On x10 and meter reads 6
- On x10 and meter reads 6.5

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### Reading a Survey Meter

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### Reading a Survey Meter

- Watch short video:  
Survey meter reacts to radiation away from camera, the approach to camera, and on contact of camera (next slide).
- Source is shielded fully.



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### **Starting Work with an Operable Survey Meter**

- Check calibration sticker.
- Check batteries.
- Check survey meter response to radiation.

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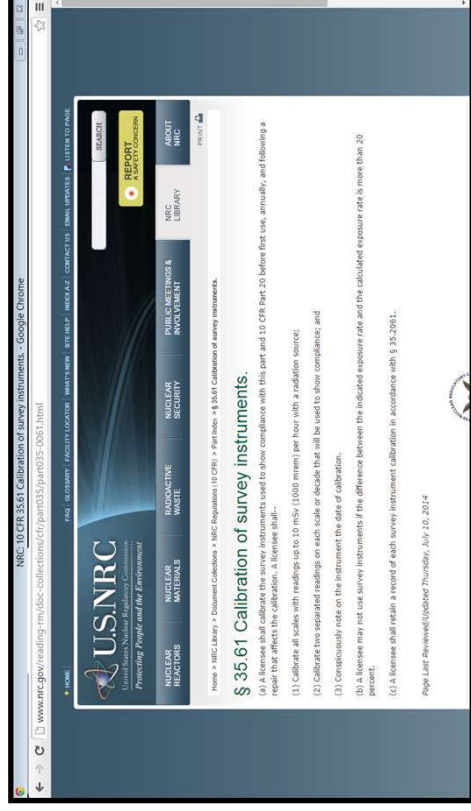
### **Making a Radiation Survey**

- Most important survey:  
After making exposure.
- Survey the camera.
- Abnormal readings?

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# Calibration

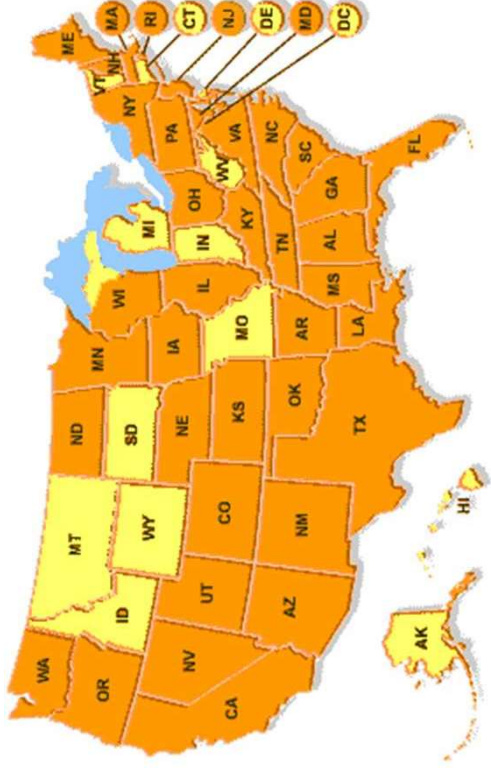
- US NRC requires calibration every 6 months or when meter is repaired, whichever occurs first.
- Accuracy: +/- 20%.



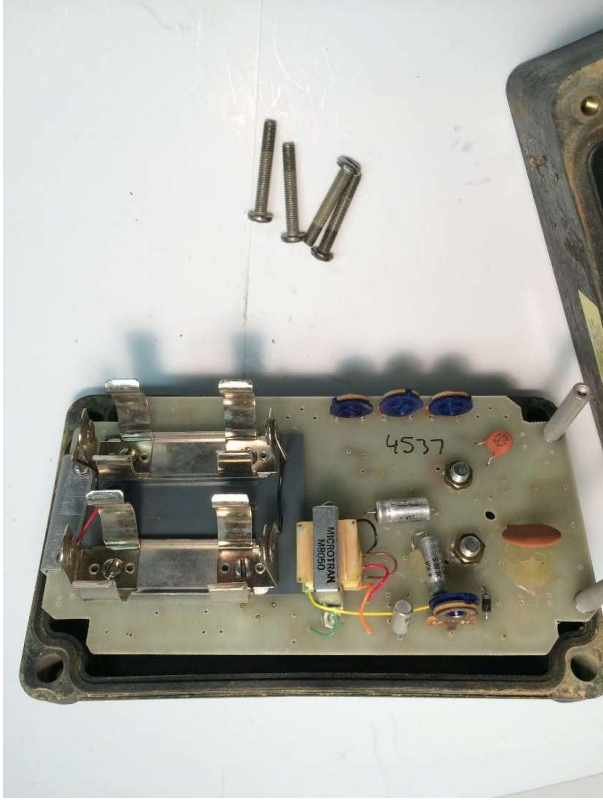
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### Calibration

- Some Agreement States require survey meter calibration to be performed every 3 months.



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### Care of Survey Meters

- Be gentle with meters.
- Keep meters dry.
- Radiation saturation?

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## Dosimeters Measure Dose

- Measure dose received.
- Pocket dosimeters.
- Film badges.

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### **Pocket Dosimeters**

- Measure dose received since last charged (or reset).
- Needle on scale moves as radiation is received.



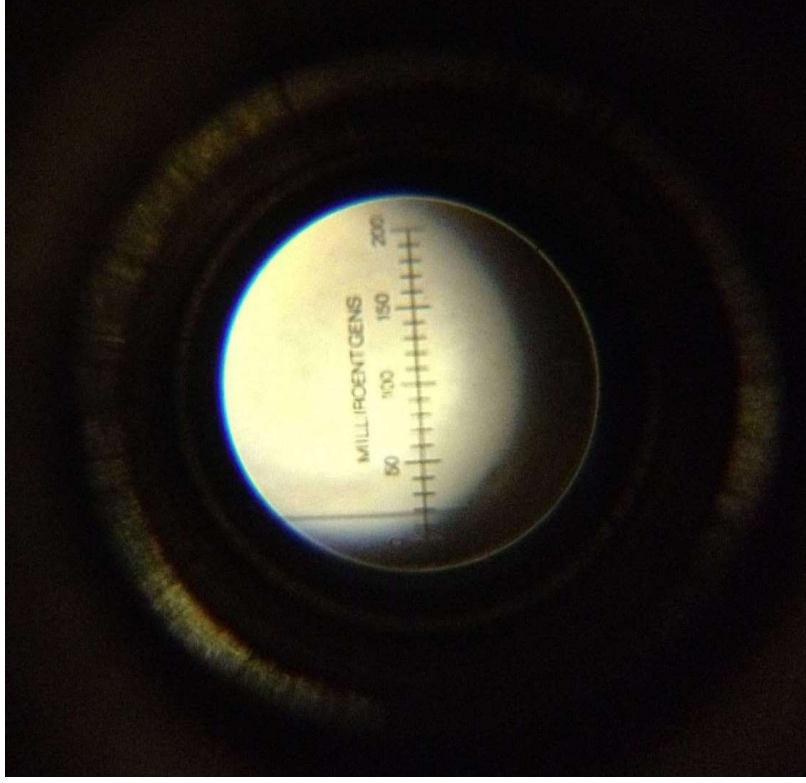
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### Pocket Dosimeters

- Reset at the beginning of shift.
- Record reading onto your daily radiation report.



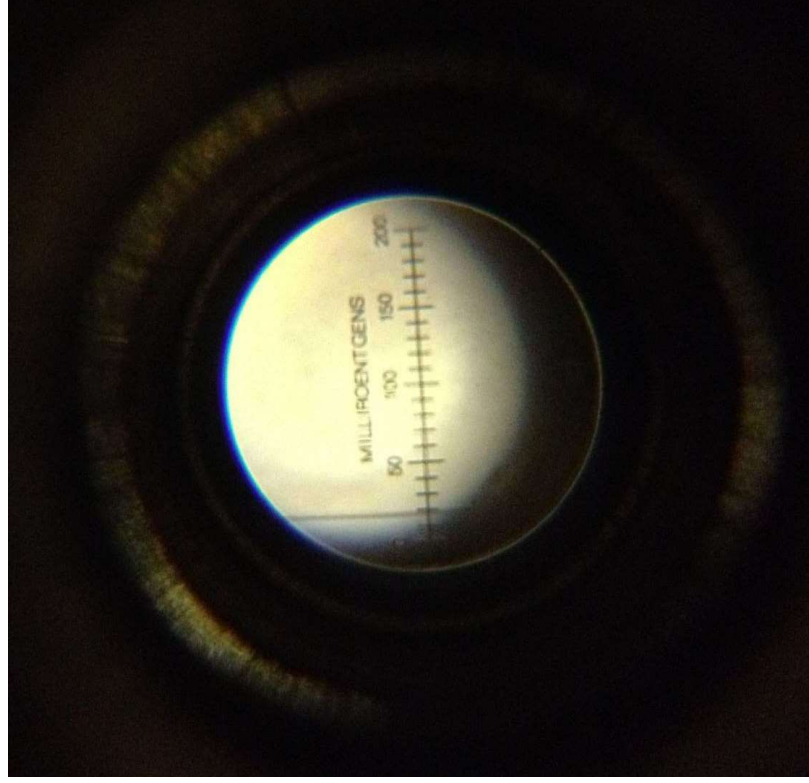
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### **Pocket Dosimeters**

- Scale must read from 0 to 200 mR.
- Record readings as required.
- Dose over 200 mR?

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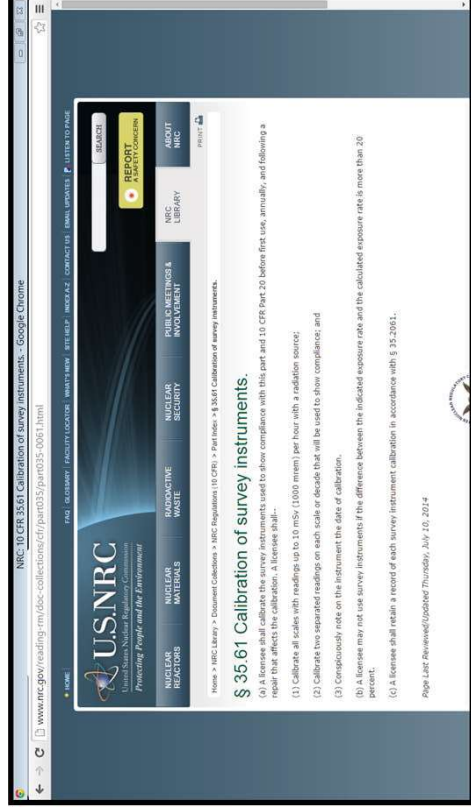


### **Dose over 200 mR?**

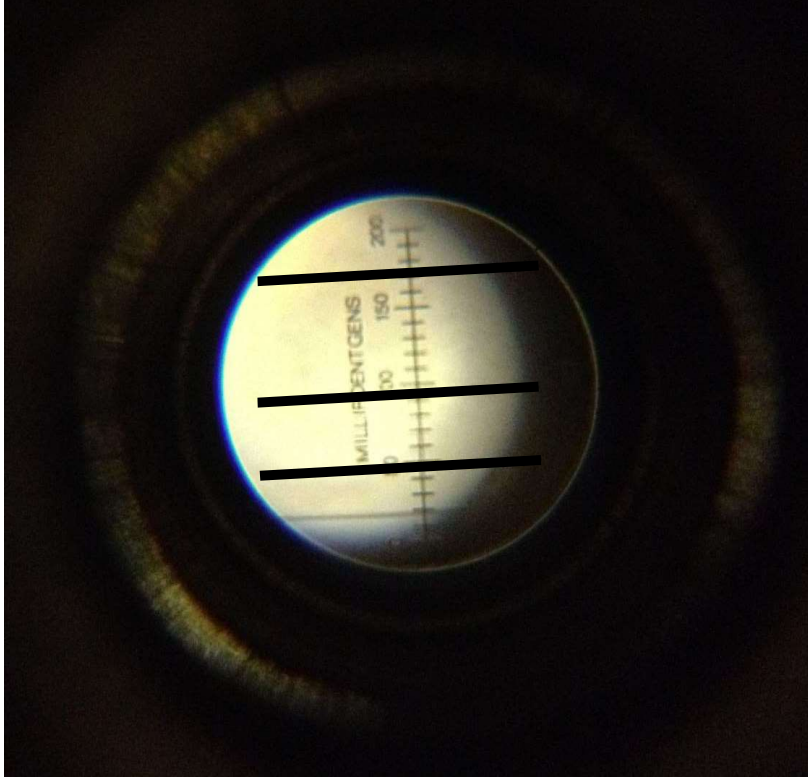
- Stop work.
- Call RSO.
- Await further instructions.

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- **US NRC requires dosimeters be calibrated annually.**



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### Care of Pocket Dosimeters

- Be gentle with pocket dosimeters.
- Keep dosimeters dry.
- Leaking charge?



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### Film Badges

- Measure dose received.
- Piece of radiographic film contained in hard plastic case.
- Exchanged monthly.





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### Care of Film Badges

- Be gentle with film badges.
- Keep film badge dry.
- Don't leave badge near a source of radiation.

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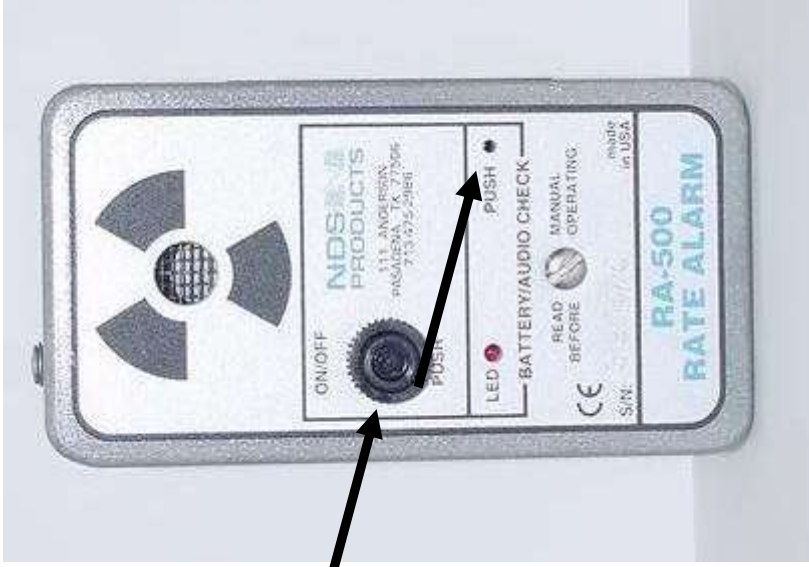


## Thermoluminescent Dosimeters

- “TLD”
- Get familiar by reading section on pages 63-64.
- Not commonly used in Industrial Radiography.



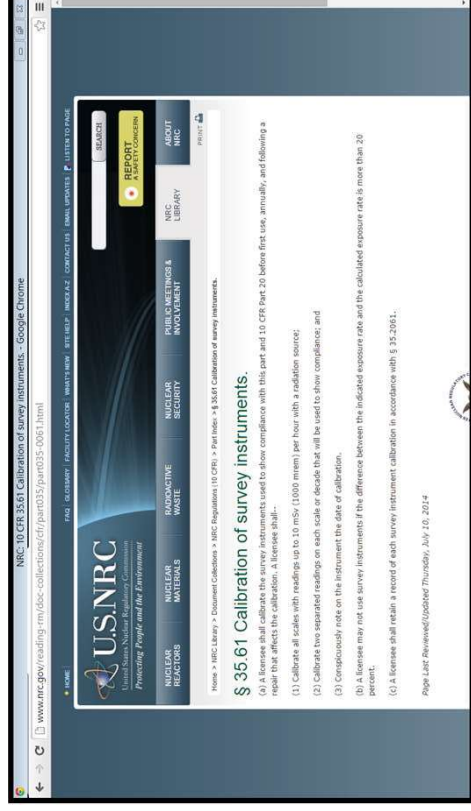
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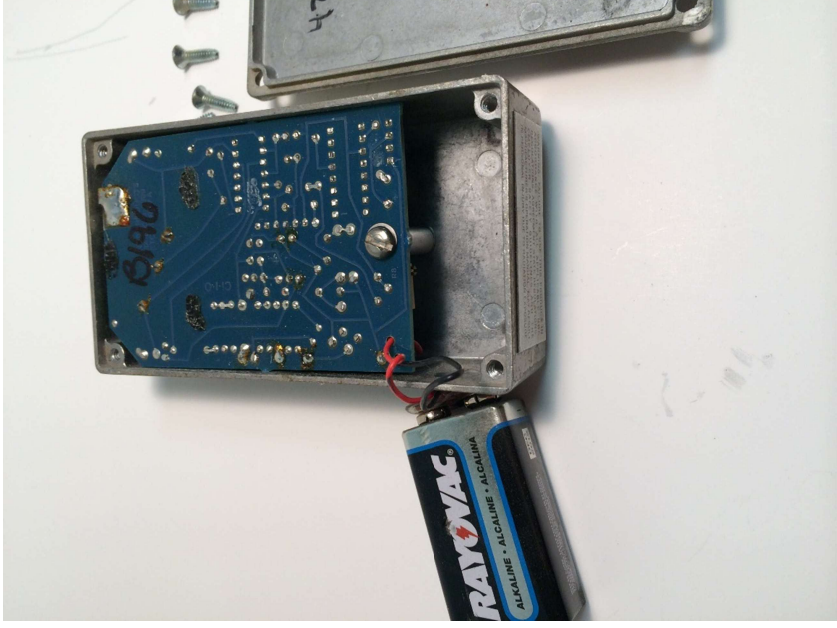
- ### How to Operate
- Turn on.
  - Push test button.
  - Listen for audible alarm.

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- **Alarm Rate Meter**
- **Alarm WILL sound upon cranking source out of shielded position.**
- **Careful of louder noises in area.**
- **Calibration of device required annually.**



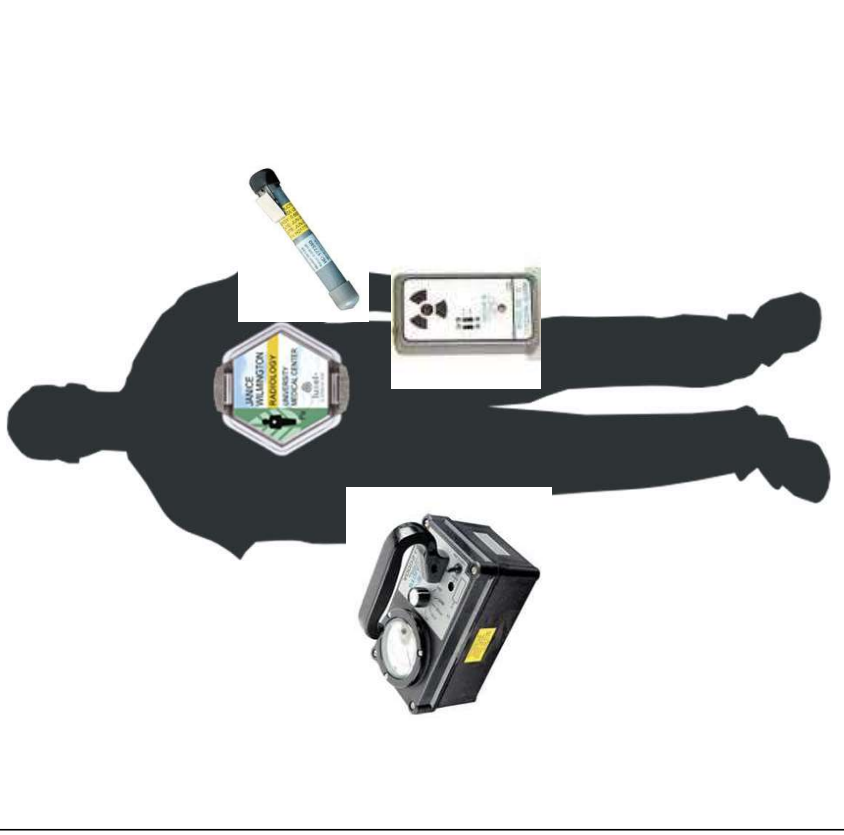
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### Care of Alarm Rate Meter

- Be gentle with rate alarm meters.
- Keep rate alarm meters dry.

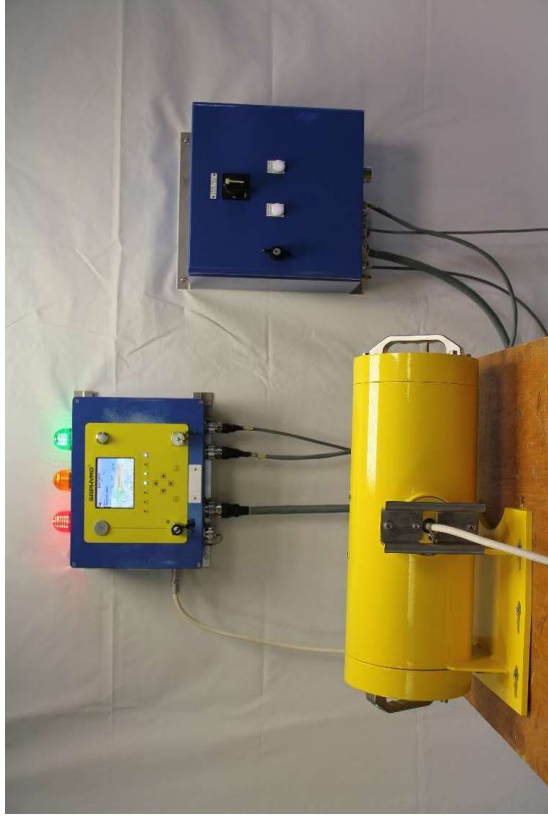
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### **Required to Work**

- All equipment must be operable, calibrated, and used!
- Violations: You and the Licensee.

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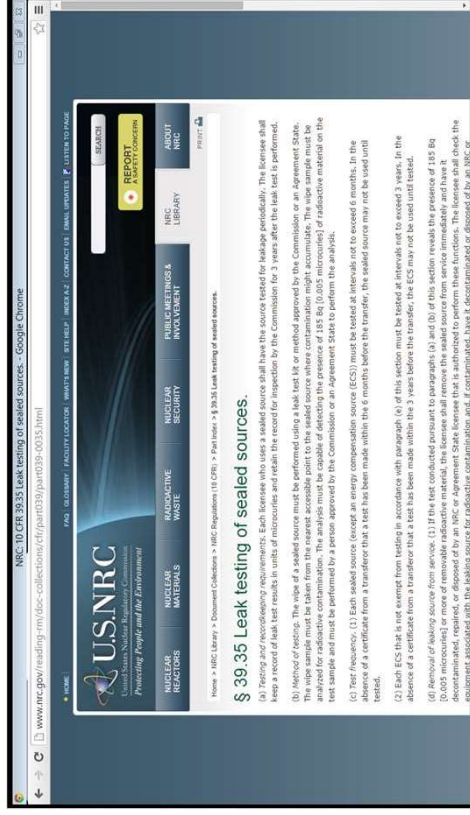
### **Alarm Systems at Permanent Installations**

- Required at permanent radiographic installations.
- Used for alarming personnel that radiation is exposed.

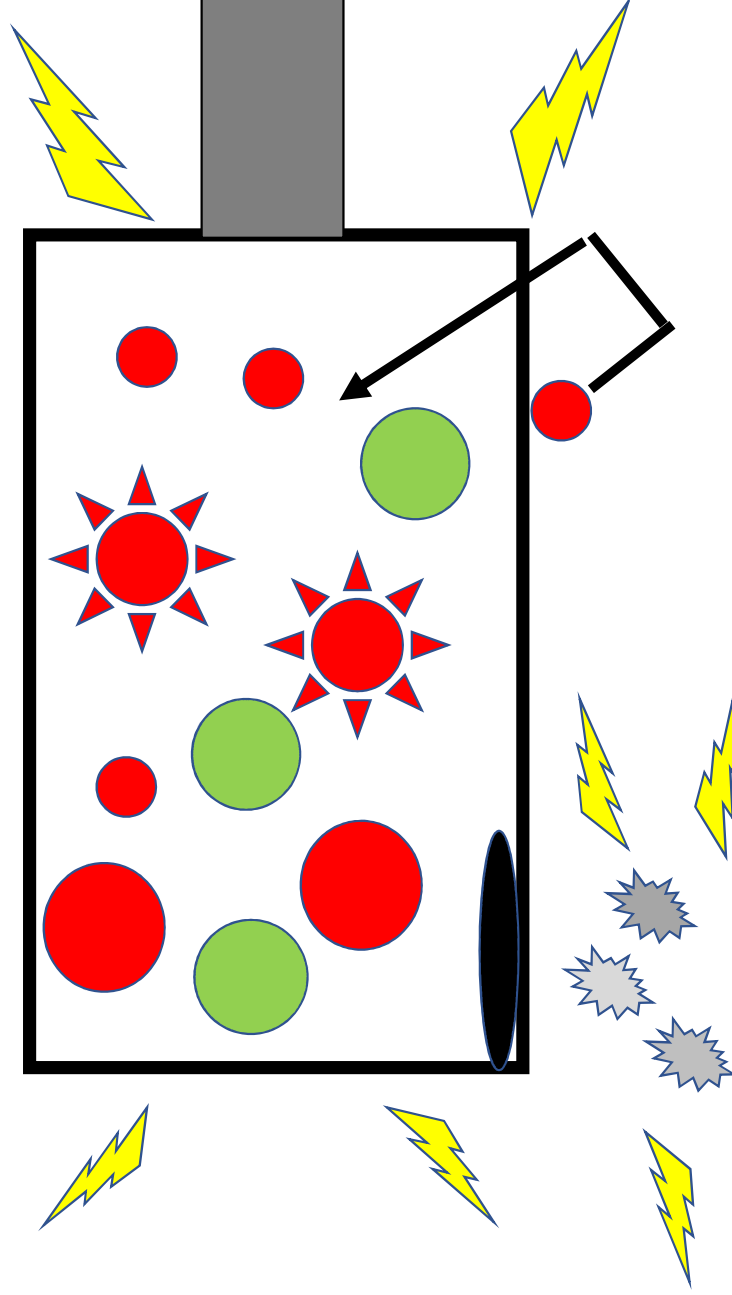
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# Testing Sources for Leaks

- Leak test also means wipe test.
- See your source certificate (decay chart). Can you spot the leak test date?



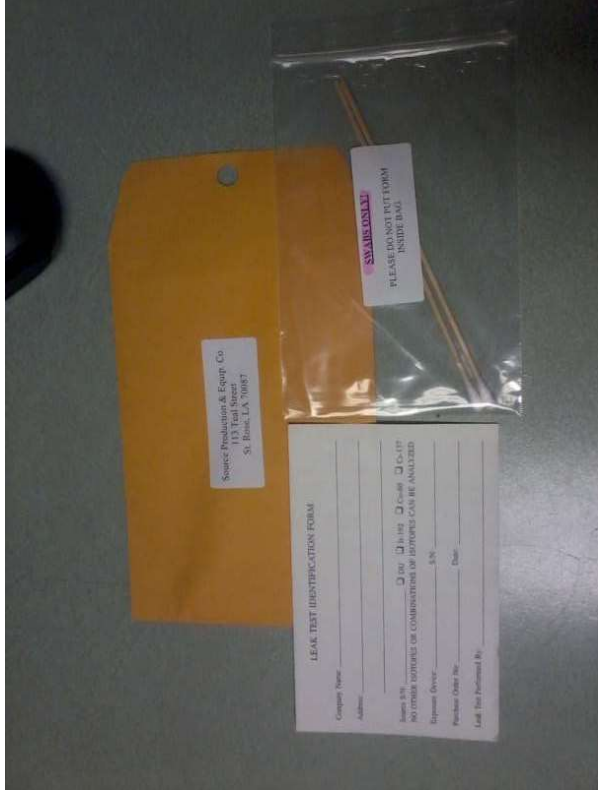
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### Testing Sources for Leaks

- Radioactive sources leaked tested every 6 months. (DU leak tested annually).
- No leak test? Source can't be used or shipped.



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### Testing Sources for Leaks

- A simple procedure performed by the RSO to check for radioactive contamination.

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### Leak Test Results



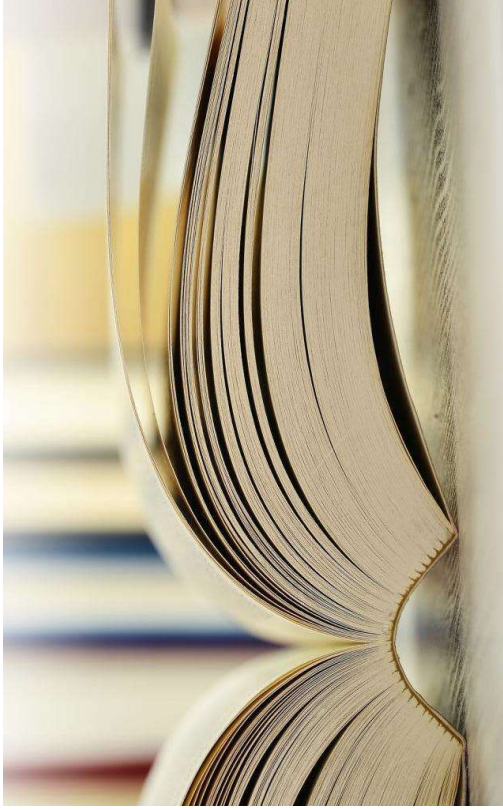
Source Serial No: 877878  
Isotope: Ir-192  
Device Serial No: D1676  
Device Type: ACE-680  
Wipe Date: 2/19/2013  
Contamination, less than: 0.002 Microcuries  
Analysis Performed By: Greg Edwards  
Analysis Date: 3/19/2013  
Invoice No: 61329  
Invoice Date: 3/20/2013

Source Production and Equipment Company, Inc  
115 Tull Street  
St. Rose, LA 70087  
(504) 454-9471

## Testing Sources for Leaks

- Leak test kit used for leak testing procedure.
- Kit sent for processing.
- Excess of 0.005  $\mu\text{Ci}$  = radiation contamination.

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### **Making Sense of It All**

- Importance of radiation detection equipment.
- Dose rate devices: Primary and secondary.
- Dose devices: Records personal dose.
- Leak Testing.

## Quiz 1 of 8:

If your survey meter suddenly lacks battery power or malfunctions during a 360 degree, post-exposure survey, what other detection device is a back-up?

**Alarm rate meter.**

## Quiz 2 of 8:

The US NRC requires a sealed source leak tested  
how often?

**Every 6 months.**

## Quiz 3 of 8:

Survey meters respond to radiation when the source is cranked out of its shielded position. Is there a response from the survey meter if the source is in a safely shielded in the camera?

**Yes. The depleted uranium does not totally shield all radiation emission.**

## Quiz 4 of 8:

What may occur if you leave a survey meter in the immediate area of high radiation exposure?

**Radiation will saturate the survey meter ionization chamber resulting in malfunction.**

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Quiz 5 of 8:

Film badges are exchanged how often?

**Monthly.**

## Quiz 6 of 8:

Your pocket dosimeter “needle” goes off-scale (beyond 200 mR). What does this signify?

**A malfunctioning dosimeter, or a radiation overexposure occurred.**

Chapter 6: How is Radiation Detected and Measured?: Quiz 6 of 8

Quiz 6 of 8:

If you're pocket dosimeter goes off-scale, what are you to do?

**Follow O&E Manual. Stop work, call the RSO, and await further instructions.**

## Quiz 7 of 8:

After making 1 exposure, you read your pocket dosimeter. It's reading 150 mR. What is wrong?

**It's possible you were exposed to a high dose of radiation or your pocket dosimeter is losing charge or "floating" .**

## Quiz 8 of 8:

As you crank the radioactive source out of the camera, is it possible for your rate alarm to sound?

**Yes. The source guide tube provides minimal shielding as the source travels from the camera to the end of the source guide tube.**



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**End of Chapter 6**

**How Is Radiation Detected and Measured?**