

Meter Operations

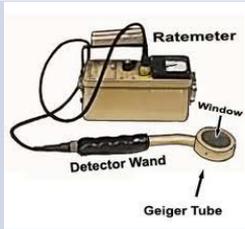


Objectives

- Understand strengths and weaknesses of GM, Ionization Chamber, and scintillation
- Measurement “tricks and tips”
- Proper use of a meter in a response



Which Meter to Use?

Type of Meter	Alpha	Beta	Gamma	Use	
Geiger Mueller Thin Window	Yes – limited	Yes	Yes – limited	Contamination	
Ionization Chamber	No	Yes – limited	Yes	Exposure rate	
Scintillation – Sodium Iodide	No	No	Yes	Detection or exposure rate	
Scintillation – Zinc Sulfide	Yes	No	No	Contamination	

Survey Meter “Components”

- Detector
 - GM
 - NaI
 - ZnSO
- Detector Location
 - Internal
 - External
- Meter body
 - Meter Scale
 - Controls
 - Speaker
- Other Items found on Meter Body
 - Calibration Sticker
 - Check Source
 - Strap Hooks
 - Head-set connector

Geiger Mueller Survey Meter

Model 3



Traditional

- 4-Decade Analog Meter
- Supports GM & Scintillator Detectors

Model 14C



Traditional

- 5-Decade Analog Meter
- Incorporates a built-in GM detector plus an external GM detector

Model 44-9

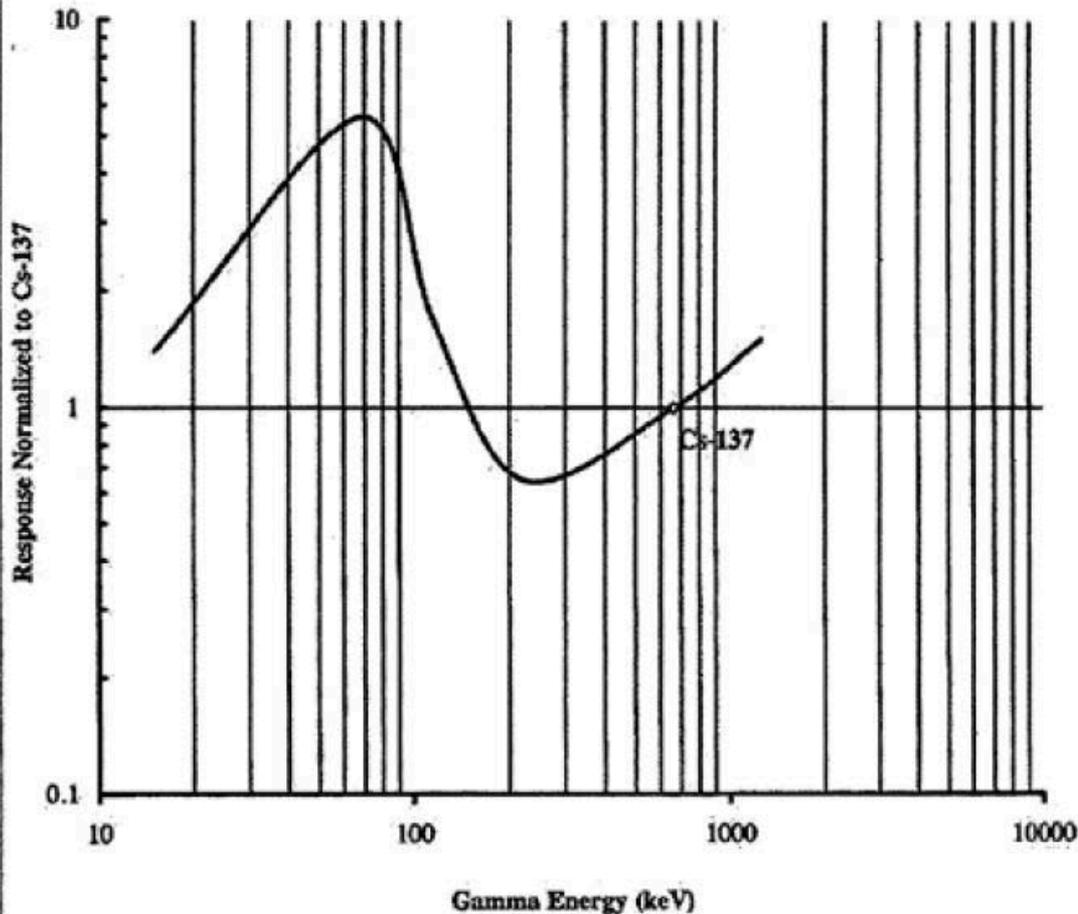


Part Number: 47-1539



Typical GM Detector Energy Response

Energy Response for Ludlum Model 44-9



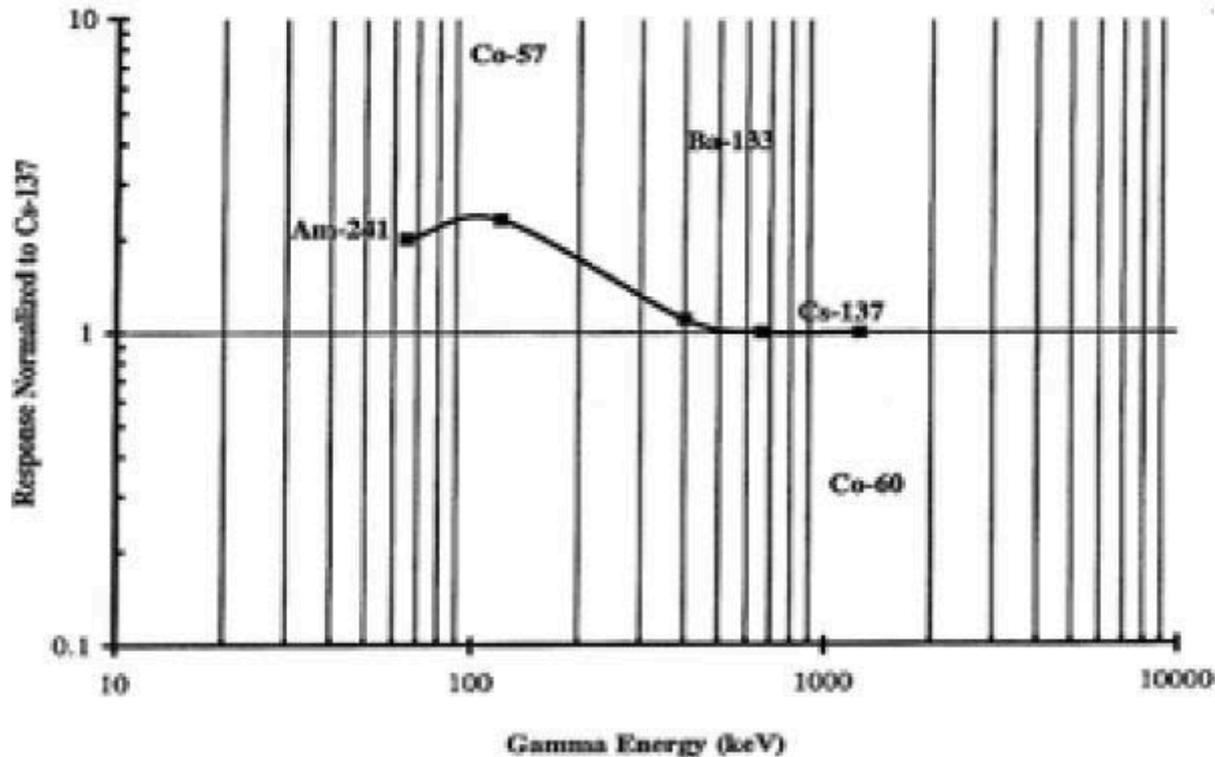
Model 44-9



Part Number: 47-1539

Typical GM Detector Energy Response

Energy Response for Model 44-6
(Shield Closed)



Part Number: 47-1535

Other GM Detector “types”



Lead Shield



Al Housing over Lead Shield



Detector is same GM element used in 44-9 “wand” probe

Sodium Iodide Survey Meter

Model 3



Traditional

- 4-Decade Analog Meter
- Supports GM & Scintillator Detectors

Model 14C



Traditional

- 5-Decade Analog Meter
- Incorporates a built-in GM detector plus an external GM detector



2" x 1 mm



2" x 2"



3" x 3"

ZnSO Survey Meter



ZnSO Scintillator Detector



Plastic Scintillator Detector

Meters and probes "LOOK THE SAME!!"

Meter Features

Speaker



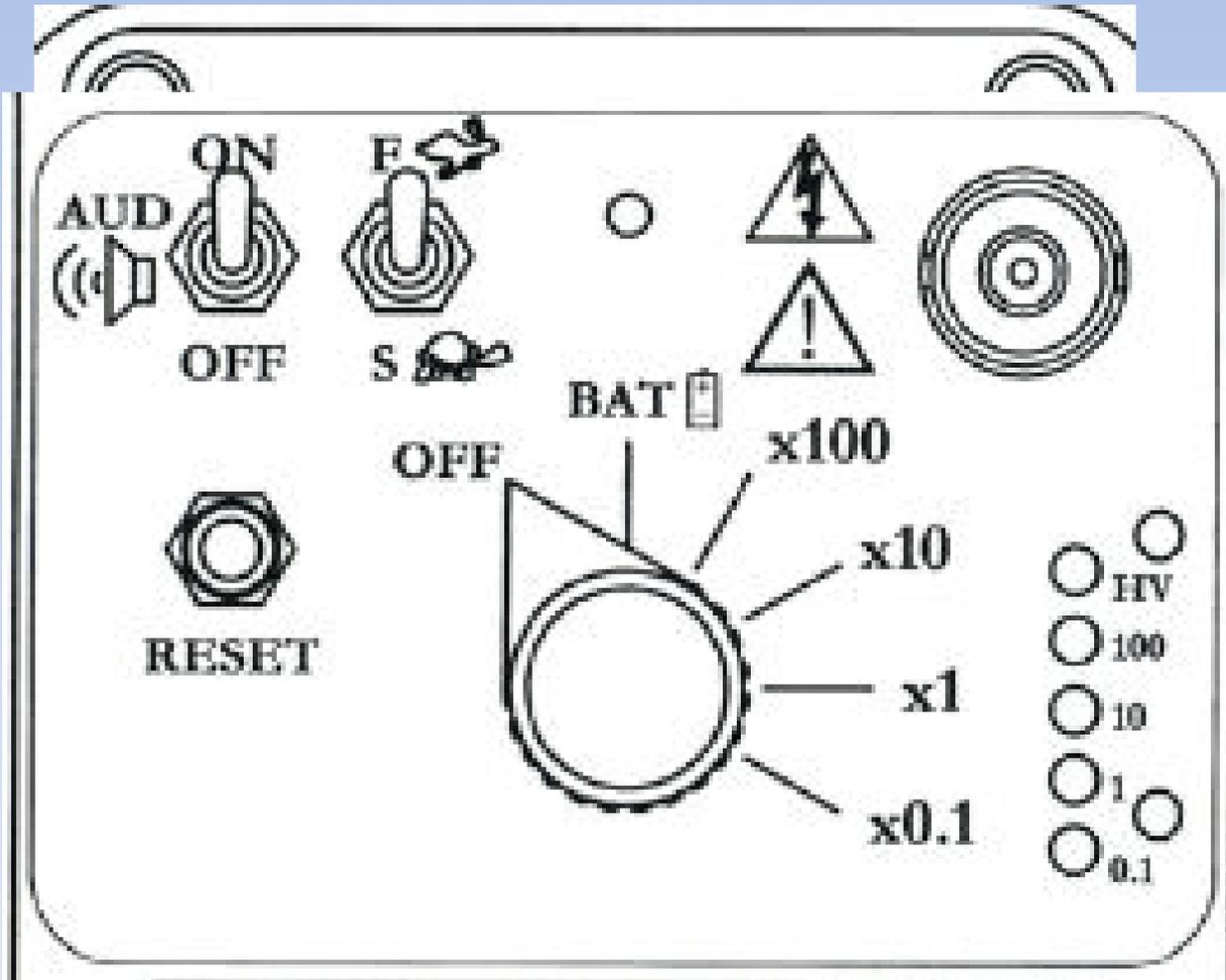
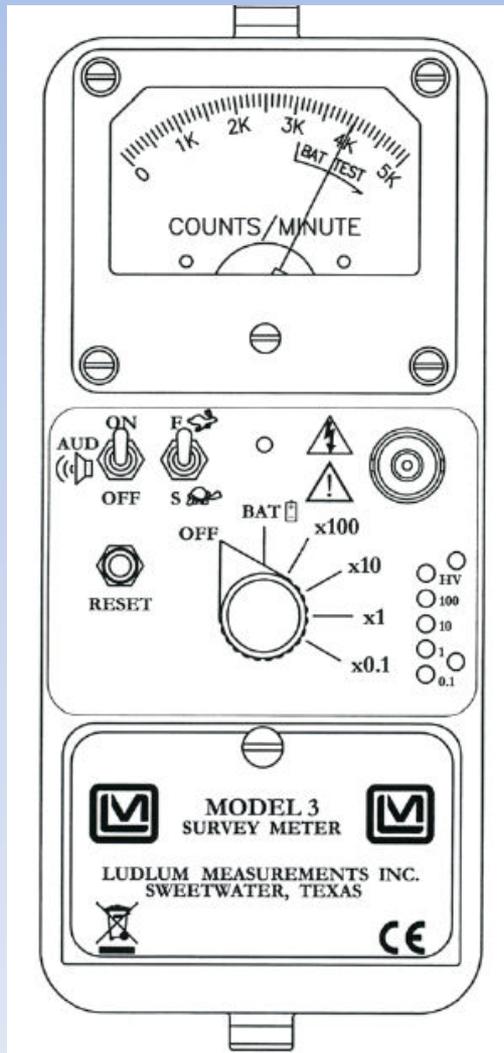
Scale



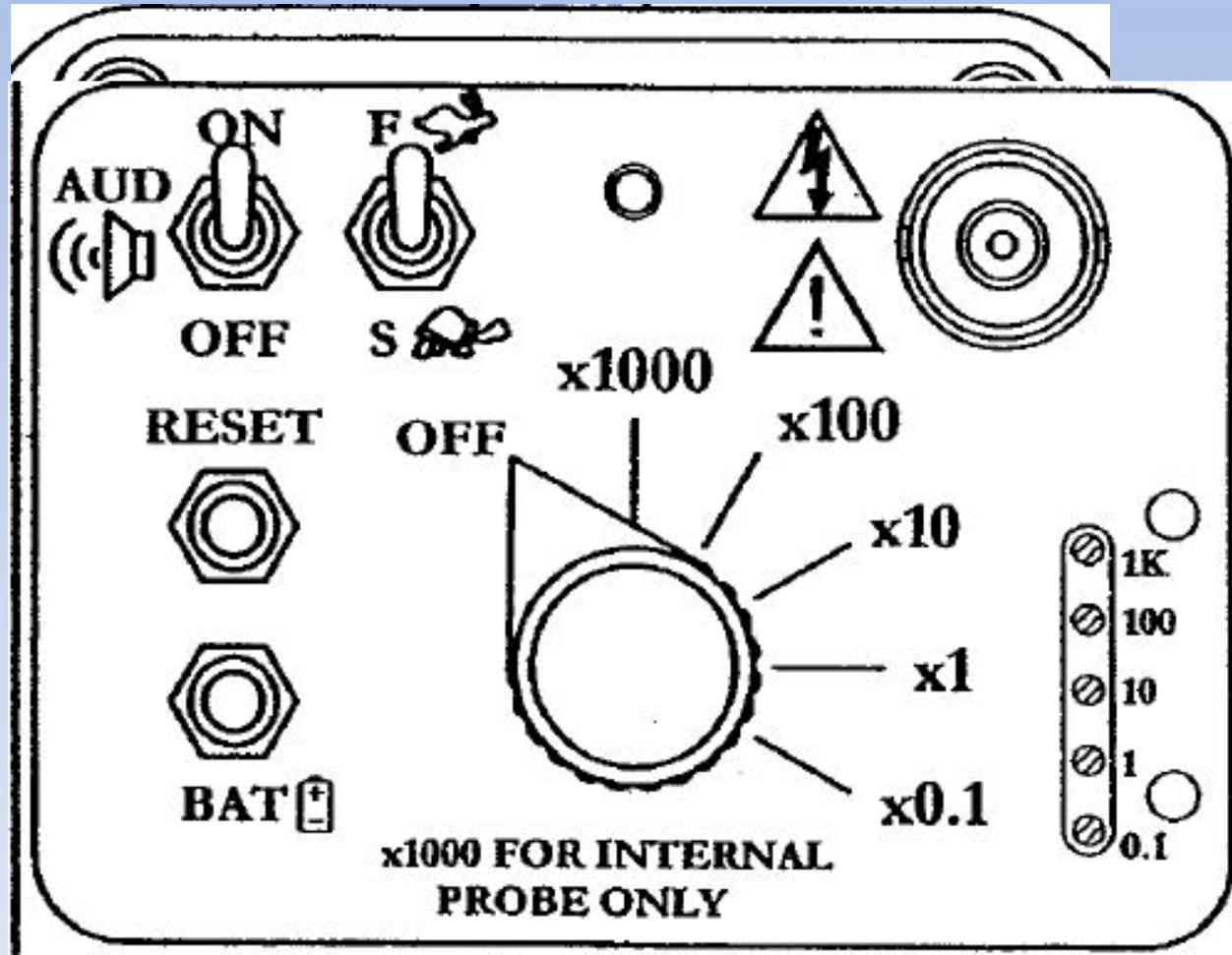
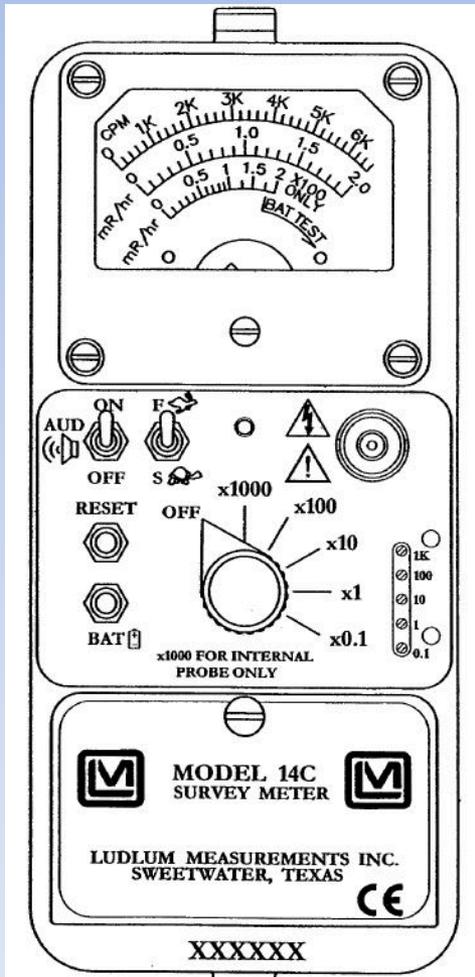
F/S response



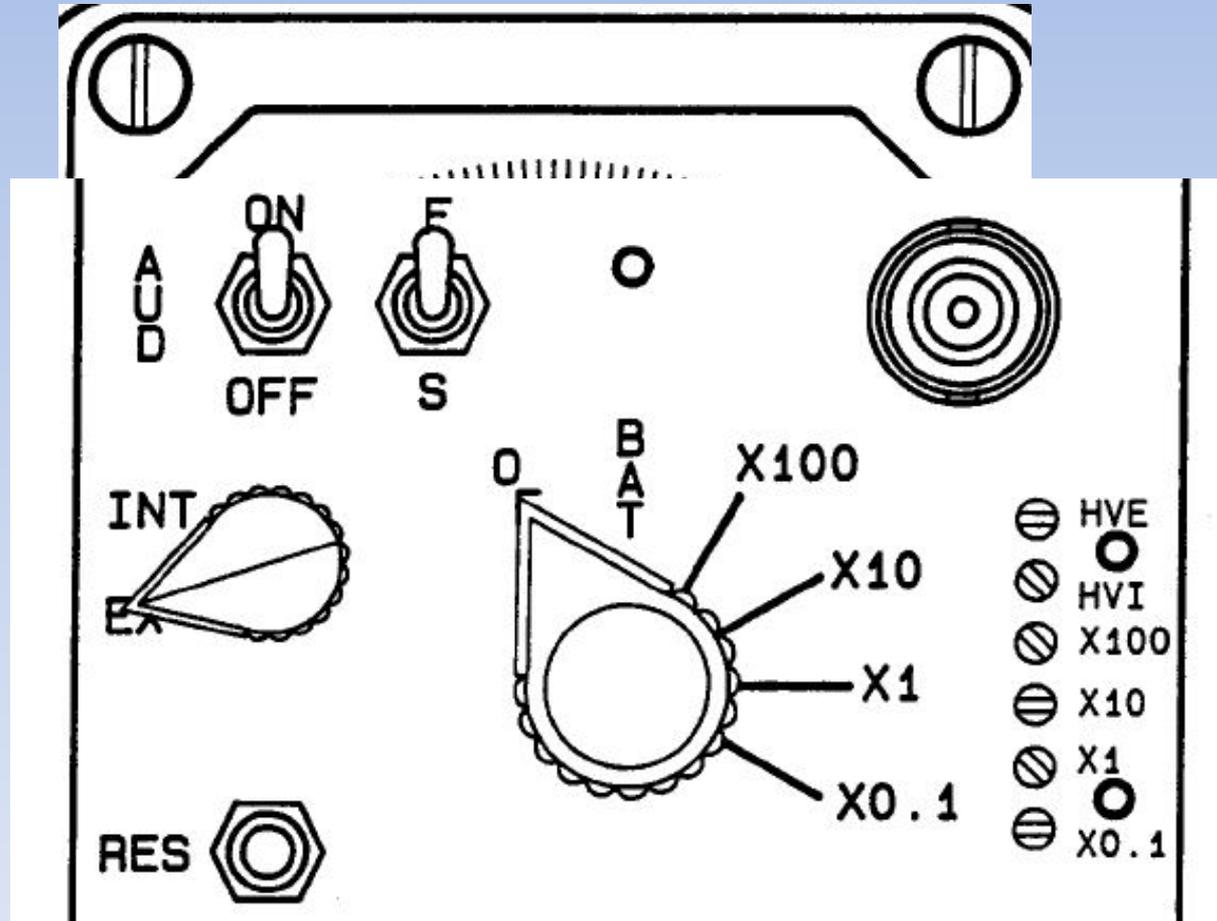
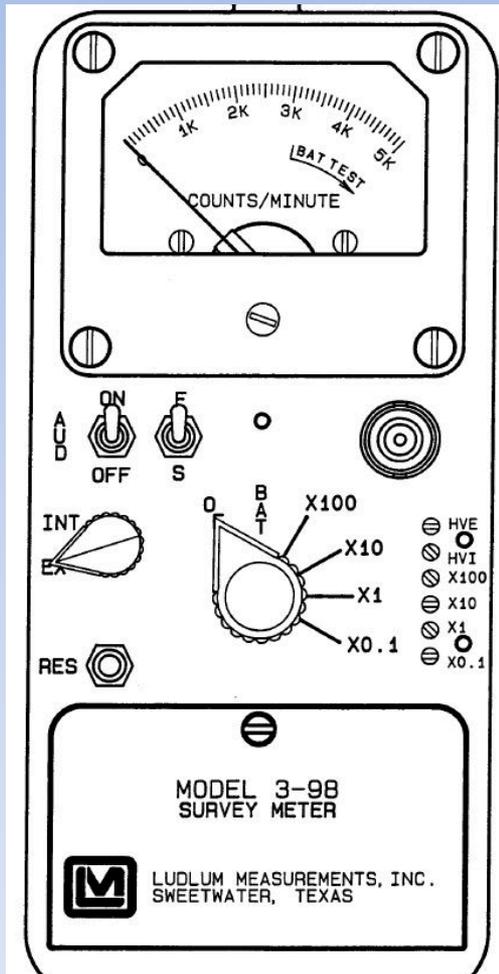
Meter Controls – Model 3



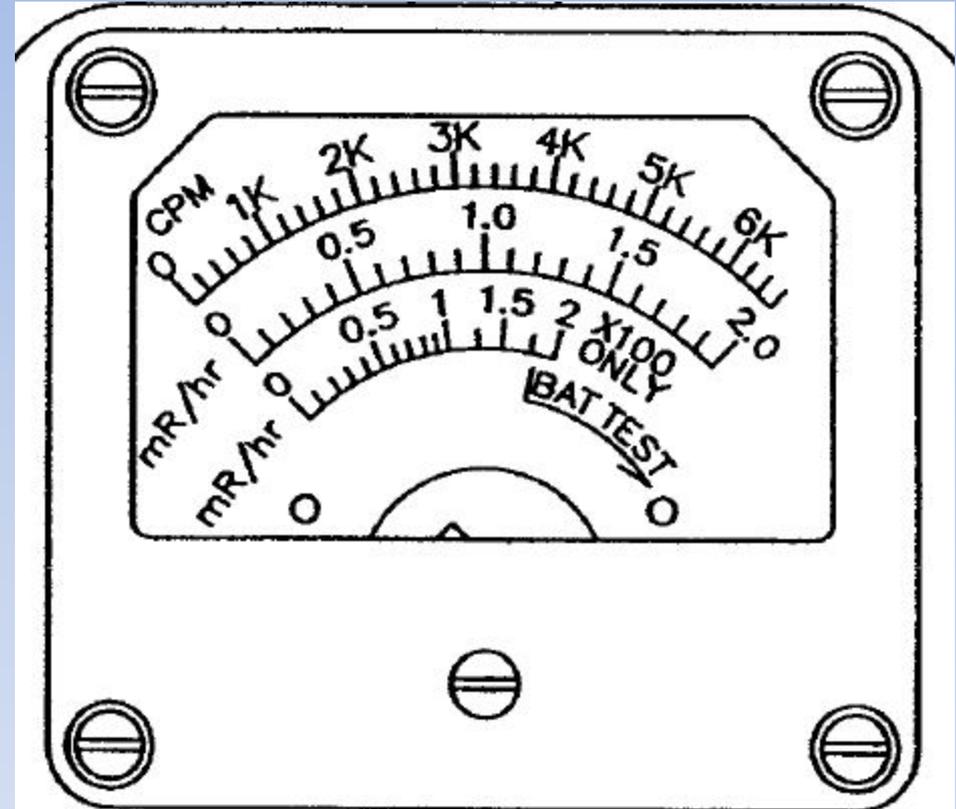
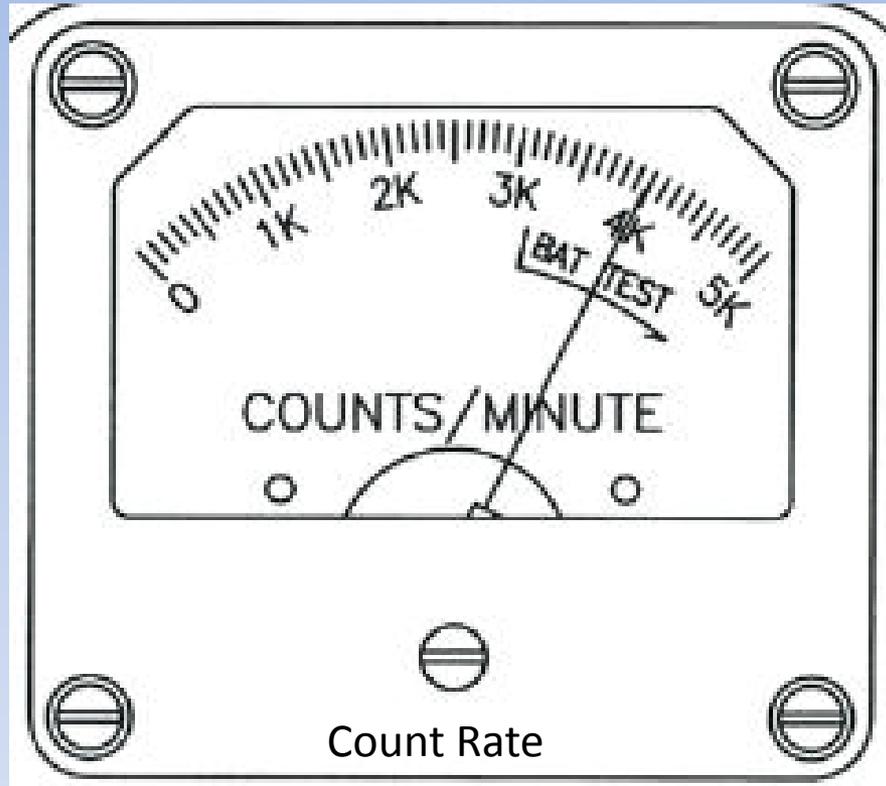
Meter Controls – Model 14c



Meter Controls – Model 3-98

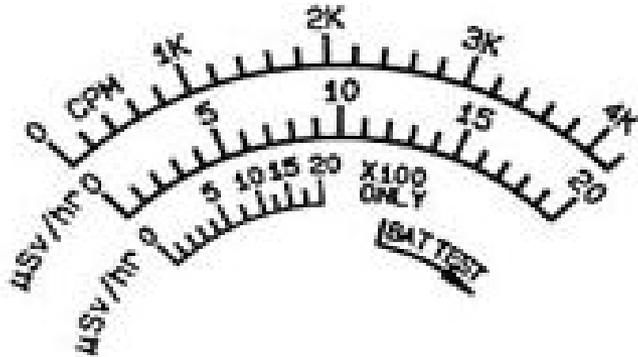


Meter Scales



Dual -- Count Rate and Exposure Rate

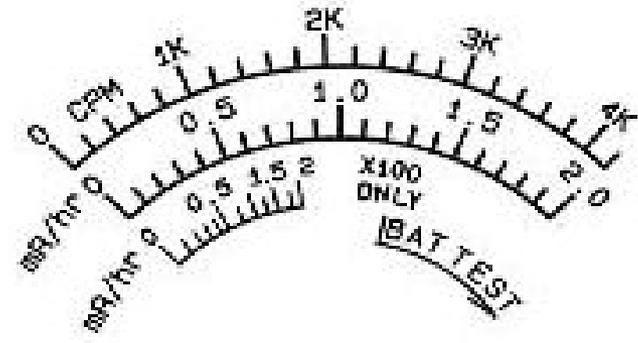
Meter Scales



202-676

202-676

**0-4k cpm; 0-20 μSv/h
For Model 44-7**



202-330

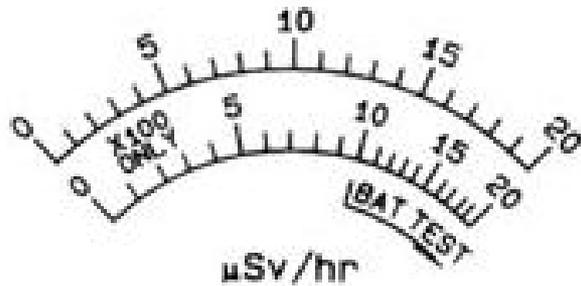
202-330

**0-4k cpm; 0-2 mR/hr
For Model 44-7**

1 uSv = 0.1 mR

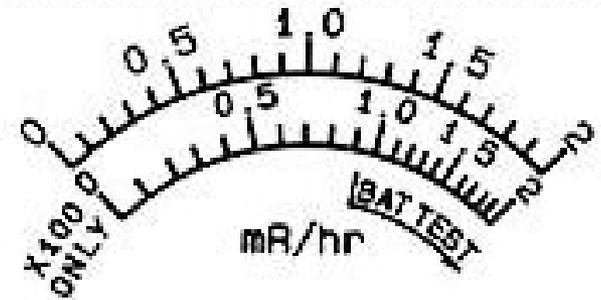


Meter Scales



202-379

202-379
0-20 μSv/h
For Model 44-6; 44-38



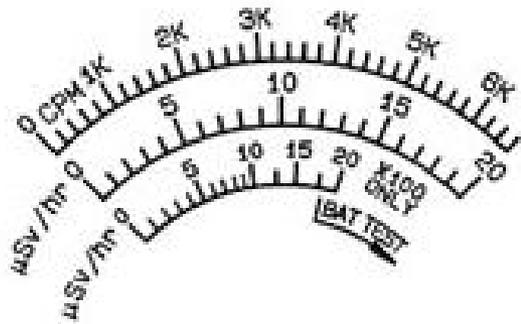
202-084

202-084
0-2 mR/hr
For Model 44-6; 44-38

SWGM – Side Window GM Probe
Scale: **EXPOSURE RATE ONLY**



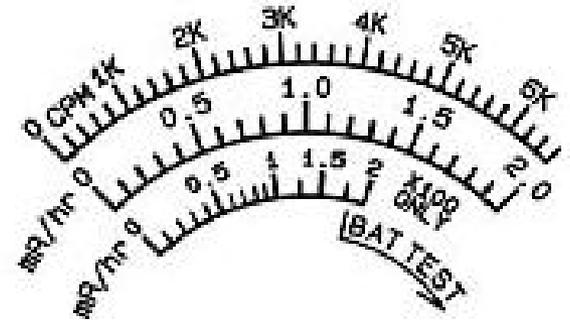
Meter Scales



202-664

202-664

0-6.6k cpm; 0-20 μ Sv/h
For Model 44-9; 44-9-18;
44-40; 44-88; 44-89; 44-94



202-608

202-608

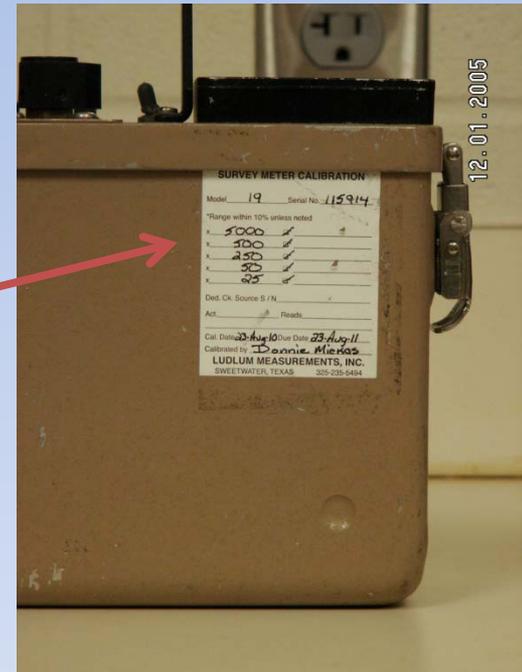
0-6.6k cpm; 0-2 mR/hr
For Model 44-9; 44-9-18;
44-40; 44-88; 44-89; 44-94

Proper Use of a Survey Meter

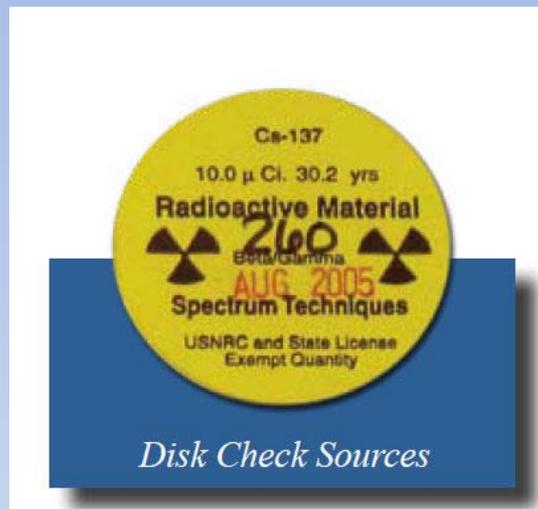
- Field Operations Check
- Measure Background
- Survey Techniques
- Reading the Meter
- Storage of Meter

Field Operations Check

- Condition of instrument
 - Free of damage
 - Check cables
- Calibration sticker check
- Battery check
- Source check



Check Source

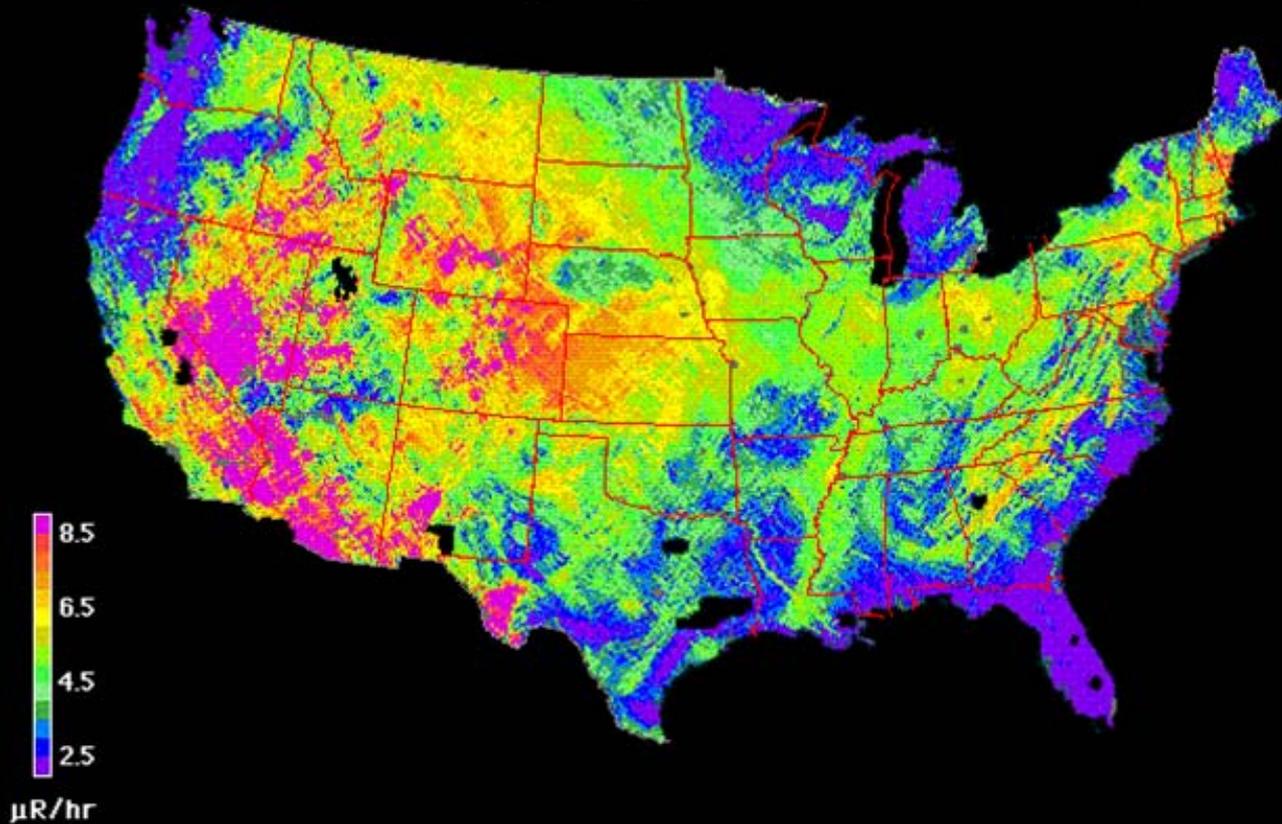


Source	
0.25 μCi	¹³⁷ Cs
1.0 μCi	¹³⁷ Cs
5.0 μCi	¹³⁷ Cs
10 μCi	¹³⁷ Cs
1.0 μCi	¹³³ Ba



Background

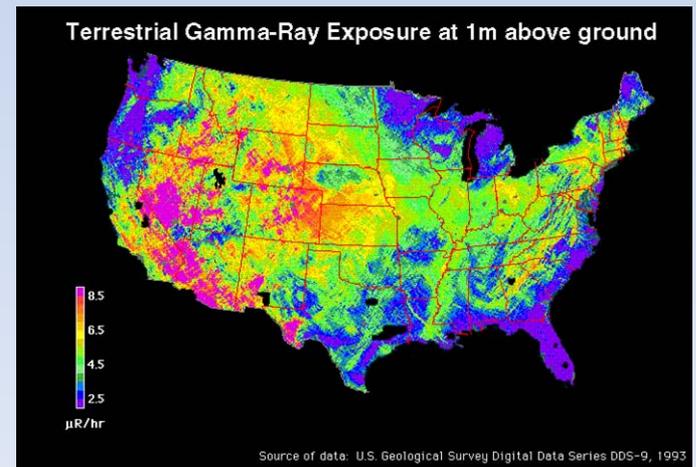
Terrestrial Gamma-Ray Exposure at 1m above ground



Source of data: U.S. Geological Survey Digital Data Series DDS-9, 1993

Background

- How to obtain a background
 - Take reading in general area survey is being conducted
 - Be sure to avoid source material
- Record background reading on masking tape
 - Place tape on meter
- Contamination
 - 2 x background
 - > 3300 cpm



Reading the Meter

- Set range multiplier on lowest scale
- Set response to “fast”
- Needle will “bounce”
 - Radiation decay is a random process
 - Report “average” reading of needle bounce
- Set response to “slow” for more accurate reading
- Use Speaker or Headphones
 - Eliminates having to watch meter closely while surveying

Survey Techniques

- Go SLOW
- Keep probe 1 – 2 inches away from subject
- Move probe 1 – 2 inches / second
- Monitor a person every 90 to 120 seconds
- Use finger tips as “SPACER”

Protect your meter from Contamination

- Story of hot particle
- Wrap the probe
 - Saranwrap -- secure with rubber band
- Wrap a portal
- Compare metering reading with bkg reading
- Reasons for reading difference
 - Meter is contaminated
 - Area is contaminated
 - People in area are contaminated
 - Meter is not working correctly
 - Broken cable



How to care for the meter

- Temperature, moisture, and humidity concern
 - Storage
 - Utilization
- Battery removal prior to storing
- Calibrations and maintenance
 - Annual

Survey vs Medical needs

- Responder dose
 - High doses from contamination unlikely
 - Time, Distance, Shielding and Contamination Control
- Monitoring highly contaminated persons
 - Injured
 - Risk of un Rx's Trauma >>> than exposure risk to responder or medical personnel
 - Not injured
 - Medical intervention not required
 - Remove bagged contaminated clothing from work area

Area Contamination Monitors

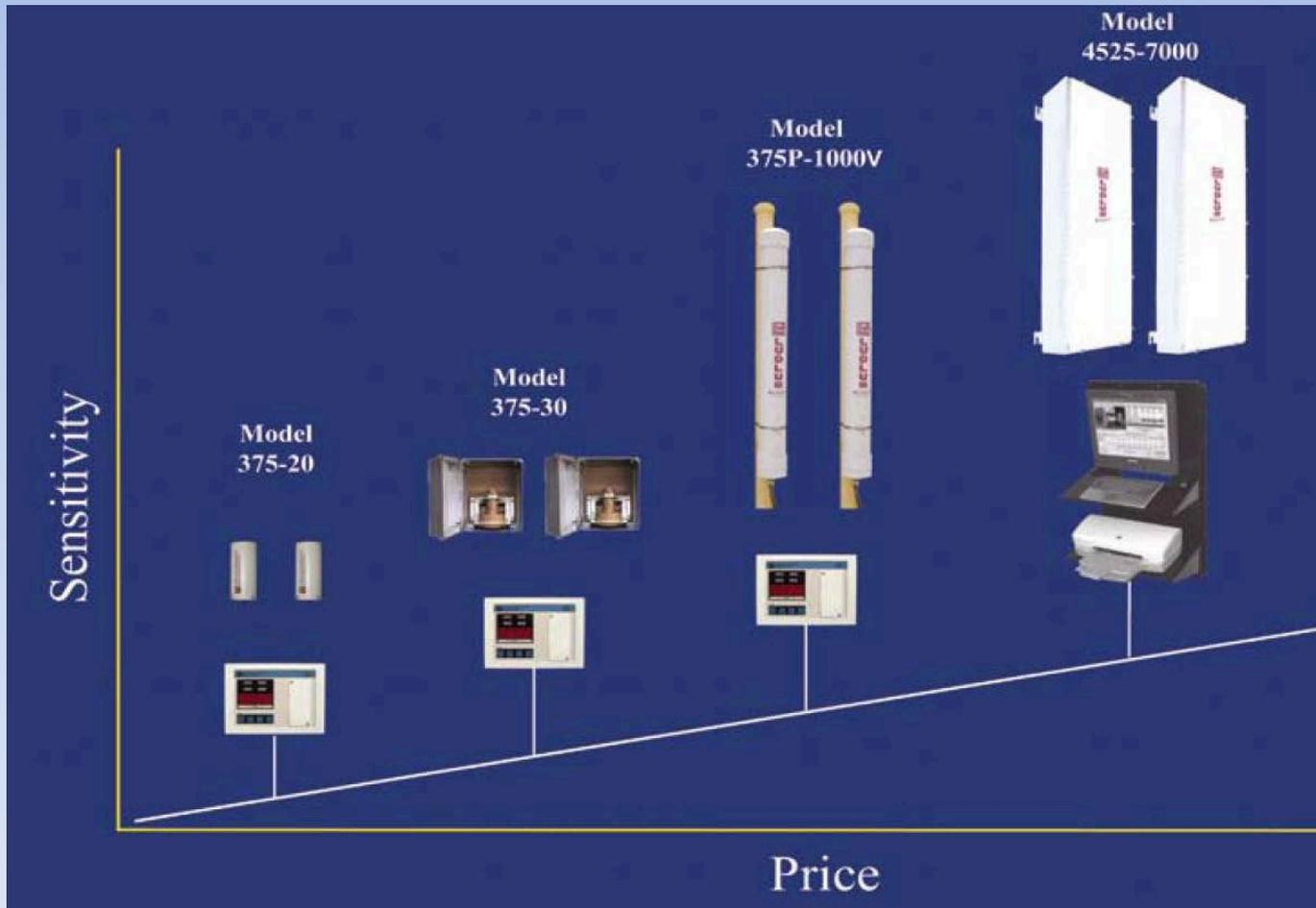
- Personnel
 - “portal monitor”
- Gateway
 - Large area detectors
 - Used to monitor transportation
 - Cars, Large Trucks, Railroad Cars



Portal Monitor



Gateway Monitors



Gateway monitors



Hallway monitor



4525-7000
Gate Monitoring System



Landfill Entrance Monitor



Rail car Monitor

Questions ??

Time for meter “HANDS-ON”