On-scene Accident Response

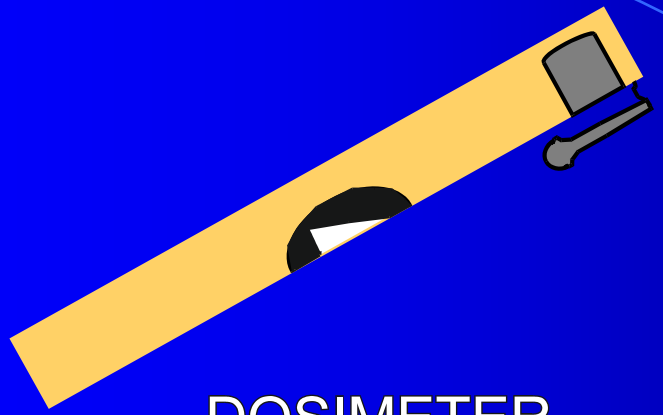
- If a package is (or is suspected to be) leaking:
  - Stay away—do not touch.
  - Keep other people away.
  - Tell anyone who may have touched the package that they need to remain to be checked for contamination.
  - If you touched the package (or nearby objects) wash hands with lukewarm water.

Survey Meters

Uses and Limitations

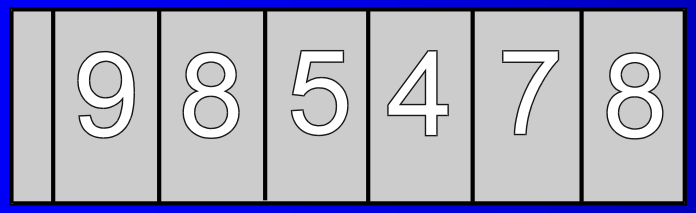
Topic 1: Instrumentation

- Identify & operate the survey meters, dosimeters, and the dosimeter charger.
- Discuss the uses and limitations.
- Provide proper care and maintenance.
- Demonstrate a hands-on capability in the use of dosimetry and survey instruments.

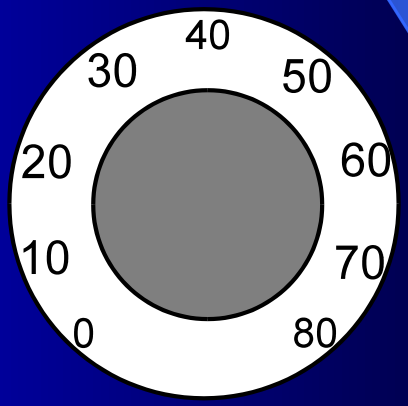


DOSIMETER

METER



ODOMETER

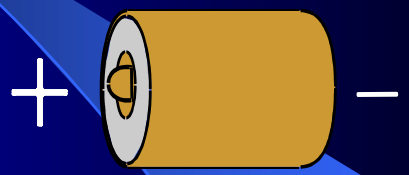


SPEEDOMETER

CD V-715

CD V-715 Operational Check

Step 1: Turn meter off. (Check Calibration).



Step 2: Open unit, install battery (observe polarity).

Step 3: Turn selector switch to “0”; wait two minutes for warm-up.

CD V-715 Operational Check

Step 4: Adjust needle position to "0" on face. Zeroing assures accuracy. When zeroing meter, detector does not respond to radiation.

Step 5: Hold selector switch to Circuit Check position to test battery strength, proper installation, and meter circuits. Observe a needle deflection on meter face near red area marked Circuit Check.

CD V-715 Operational Check

Step 6: Test operation of each range by rotating selector switch to each position, observing meter deflection.

When not in radiation field, needle should not move further than 0.3 on X100, X10, and X1 scales and .6 on the X0.1 scale.

CD V-715 Characteristics

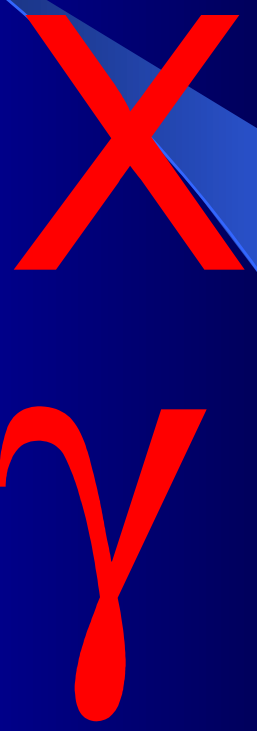
Range 0 - 500 R/hr

Use

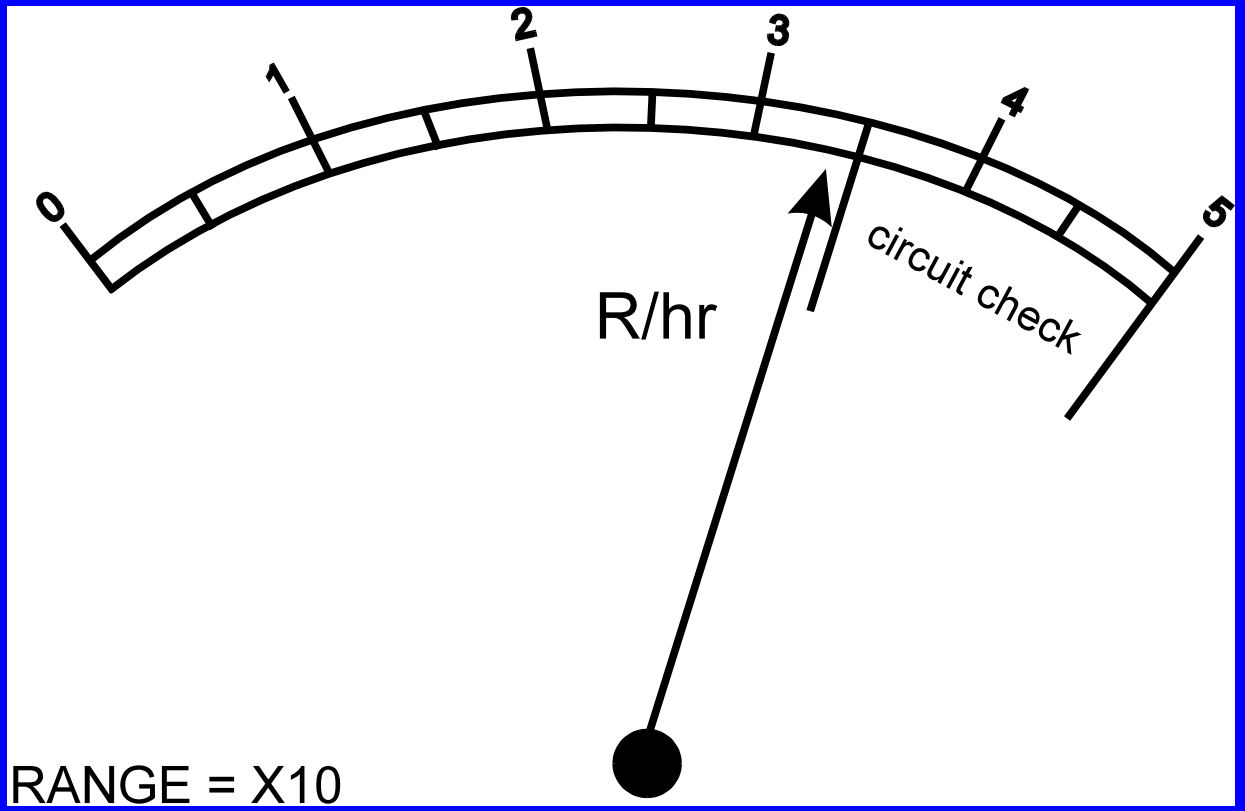
- High level radiation
- Backup to CD V-700 when entering unknown radiation environment

CD V-715 Limitations

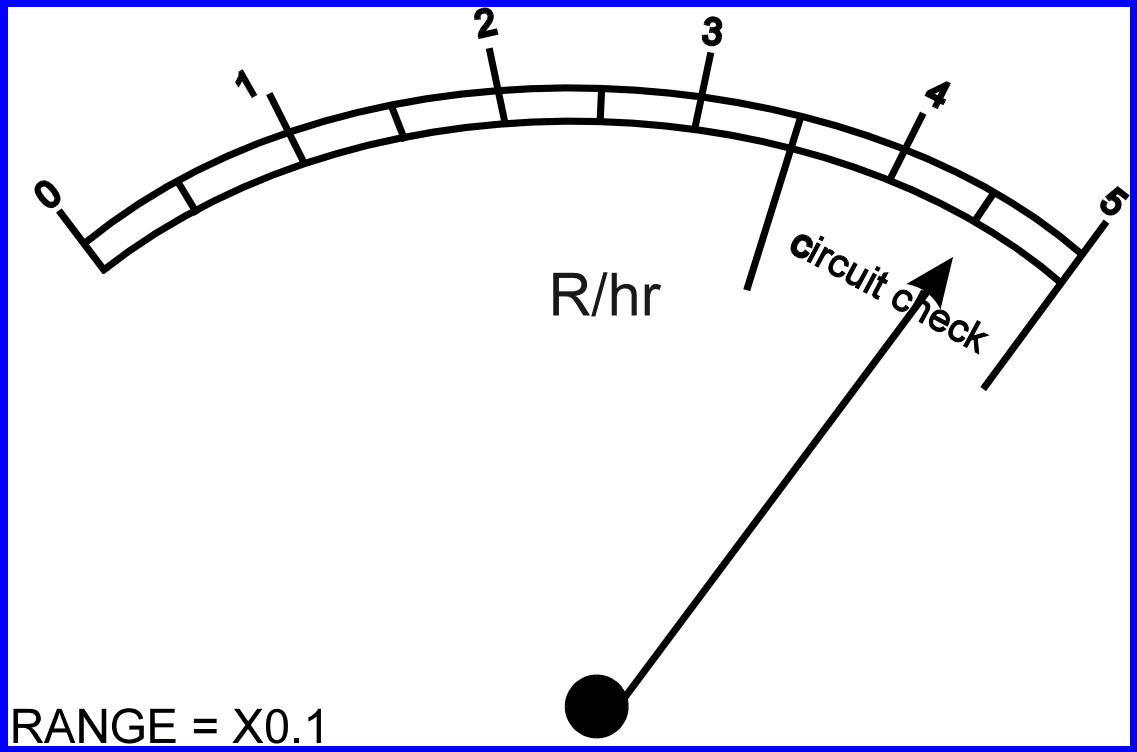
- Detects and measures:
  - X-rays
  - Gamma radiation



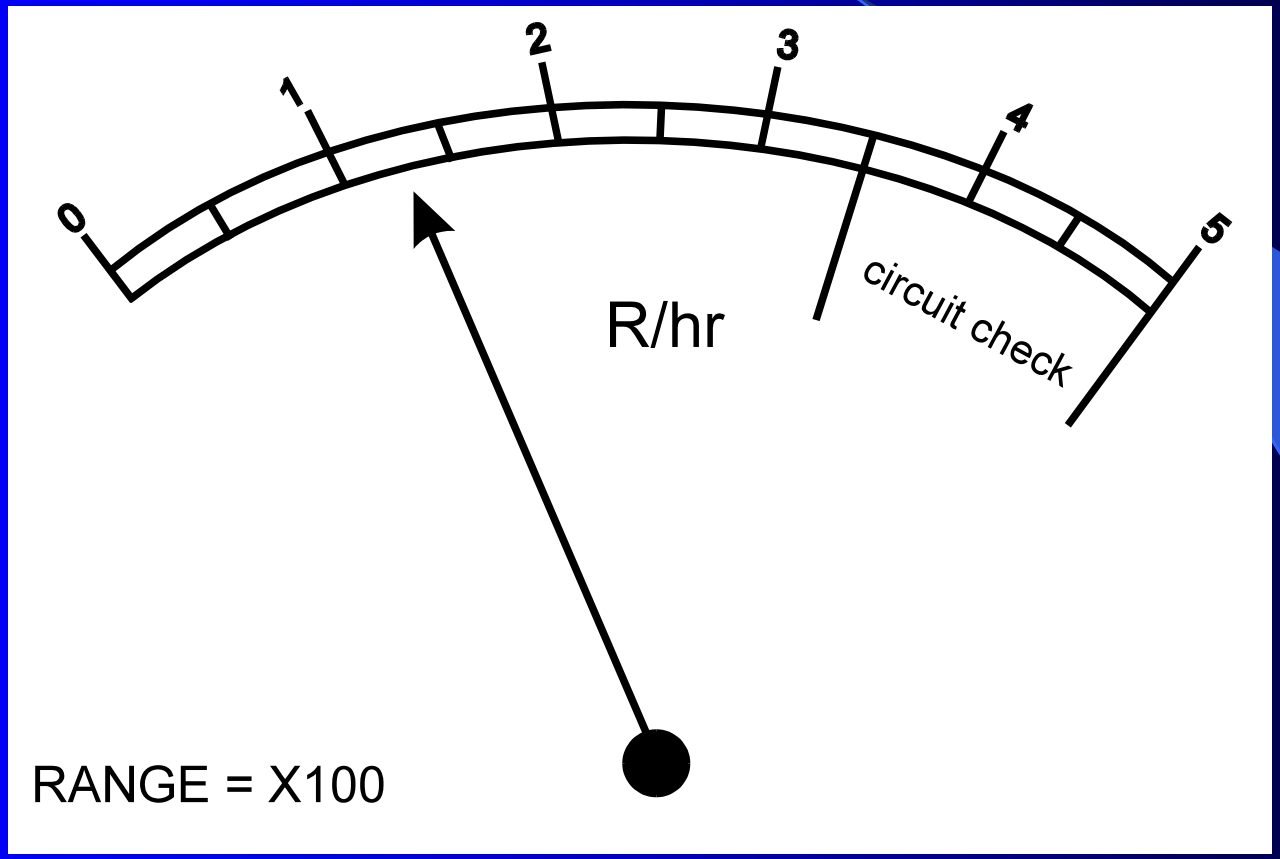
Meter Face #1



Meter Face #2



Meter Face #3



CD V-700 SURVEY METER

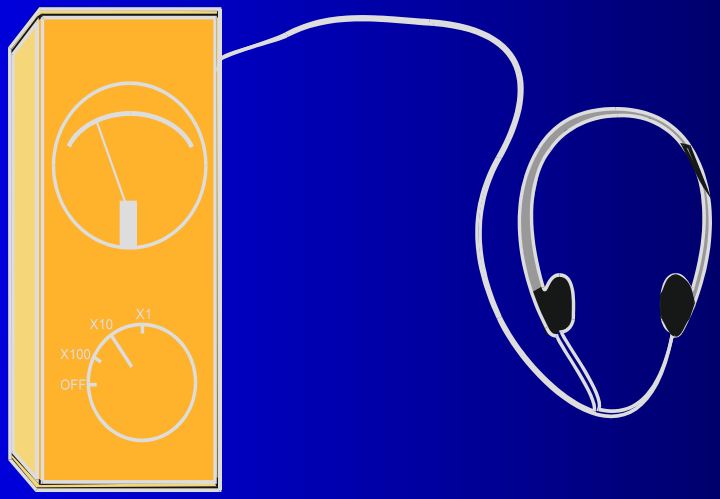
CD V-700 Operational Check

Step 1: Turn OFF meter. If you don't, you may get a strong electrical shock. (Check Calibration)

Step 2: Remove battery support bar to install batteries. Check polarity. Reassemble.

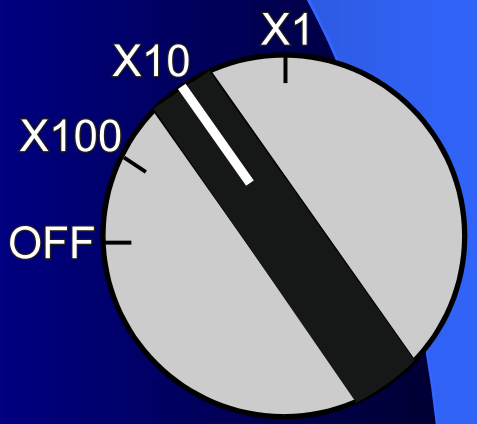
CD V-700 Operational Check

Step 3: Try on headphones and check for radiation without reading meter face.



CD V-700 Operational Check

Step 4: Turn range selector to X10, wait 30 seconds. Open beta window, place it over check source on side of meter case. Observe a reading about halfway up meter face scale.



CD V-700 Characteristics

Range 0 to 50 mR/hr gamma radiation

Uses
- Monitoring incidents where exposure rates are not likely to exceed 50 mR/hr
- Training

Detection Gamma and beta radiation

CD V-700 Limitations

- Cannot perform operational check in a radiation field.
- Measures up to only 50 mR/hr.
- May become saturated in higher field of radiation and act erratically.
- Will not respond to all radioactive material commonly transported.

CD V-700 Care

- Perform regular operational checks.
- Turning meter off and remove batteries (for storage).
- Place end of GM tube with wire over center of meter (for storage).

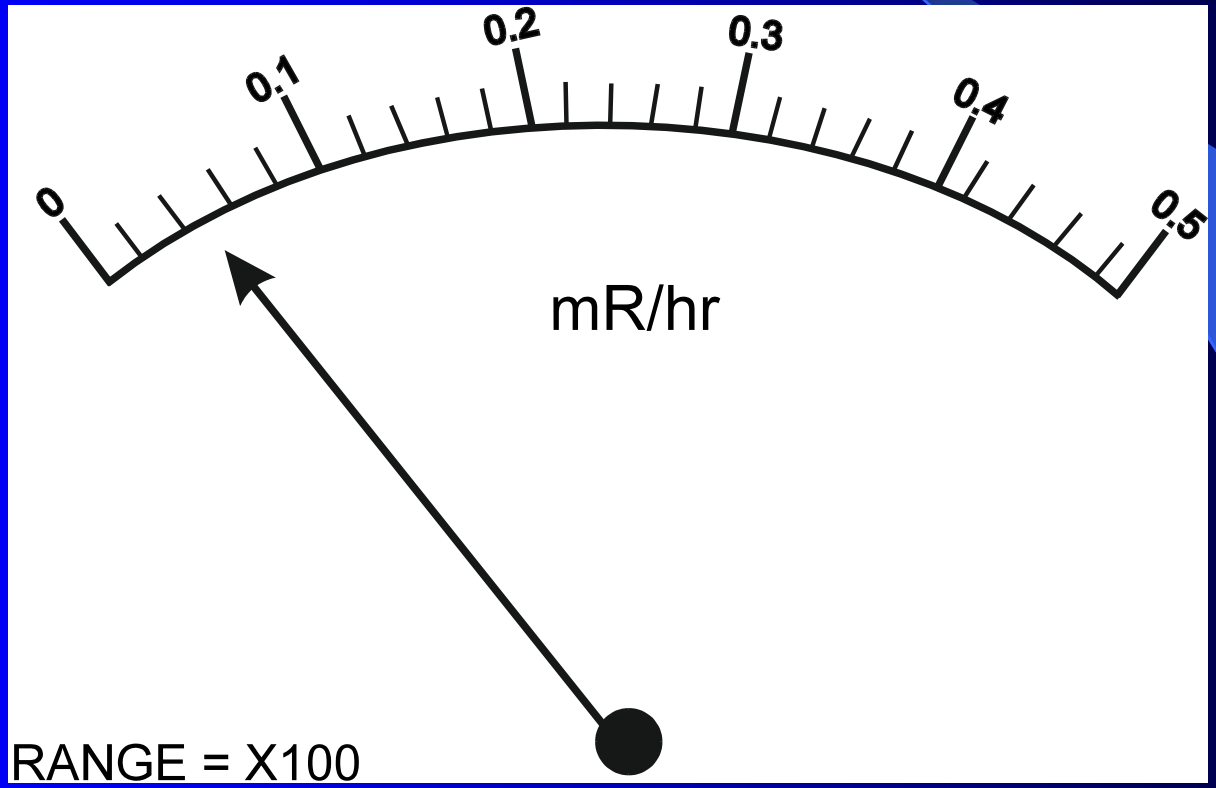
Instrument Use

- Probe may remain in handle clip and held waist high. (May hold probe in hand while surveying high and low areas.) Do not dangle probe by cord.
- In areas of unknown radiation, use high- and low-range instruments in tandem.

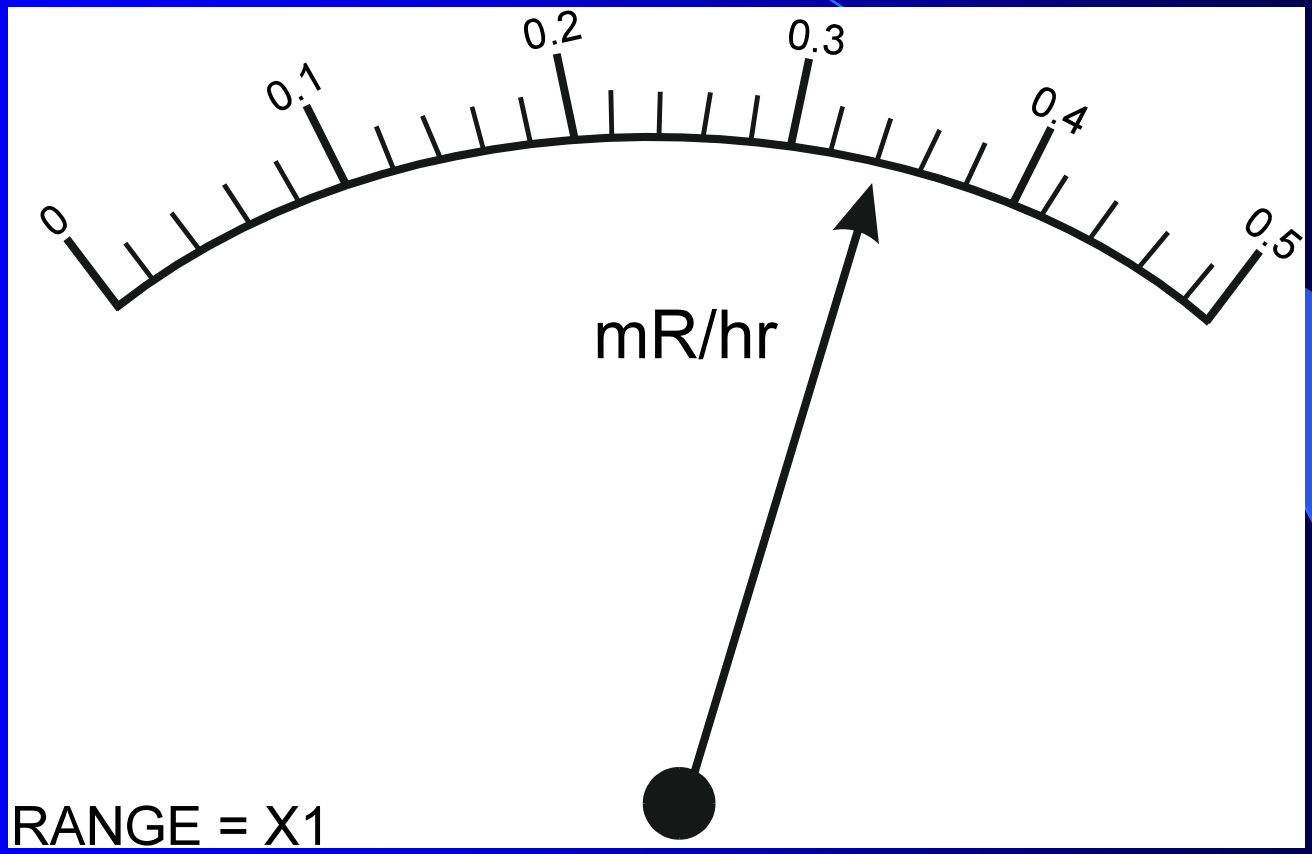
Instrument Use

- Begin on the X1 range. If radiation registers, switch to the X10 range. If it rises again, switch to the X100 range.
  - Multiply the meter face reading by the range to determine exposure rate in mR/hr.
- If the needle peaks, earphones squeal, and needle drops, the meter has probably been saturated.

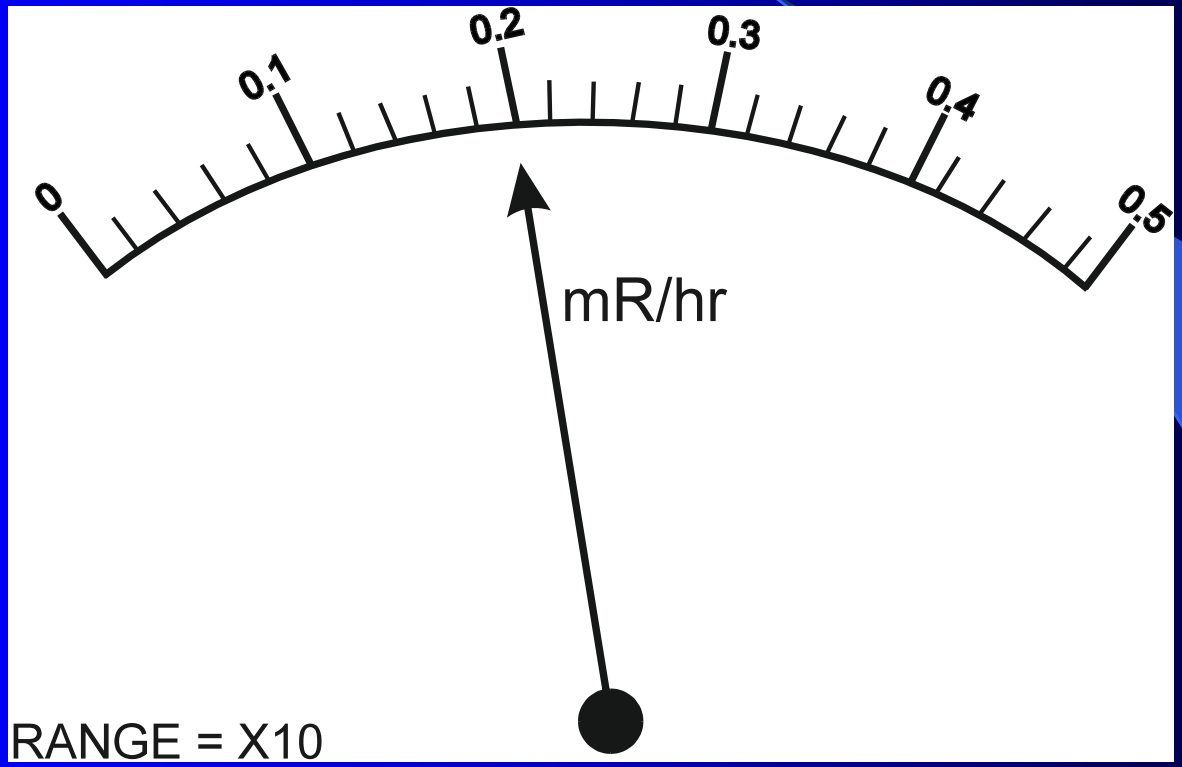
Meter Face #1



Meter Face #2



Meter Face #3



Counts Per Minute, CPM or C/M

- Read on lowest scale
- A steady reading
- Florida's background radiation is between 40-50 cpm

Dosimeters

Those commonly available include:

- CD V-742
- CD V-138

Dosimeter Difficulties

Problem

Hairline moves as the dosimeter is removed from the charger.

Solution

Set hairline to the left of ZERO—a distance equivalent to the shift.

Dosimeter

Use:

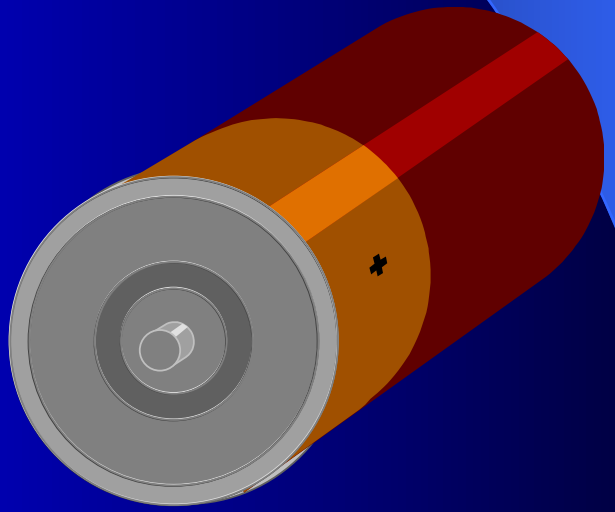
- Needle must be AT OR ABOVE ZERO for initial reading.
- Note START and STOP readings.
  - Find exposure by subtracting.

CD V-750 Dosimeter Charger

Preparation for Use

Step 1: Install one D cell battery.

- Remove center screw and open unit.
- Observe polarity.



Preparation for Use

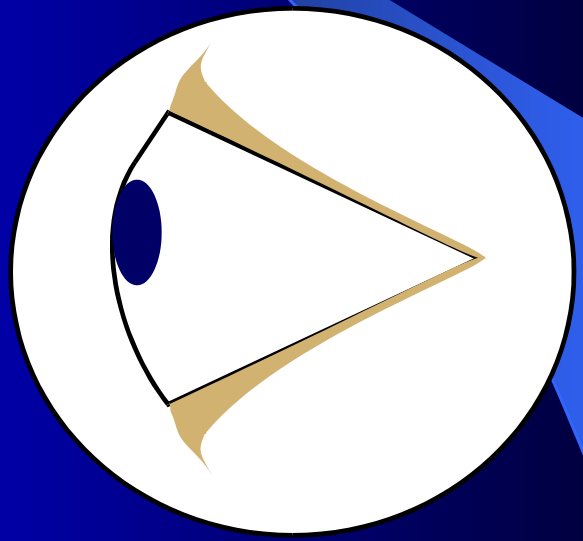
Step 2: Remove cap, top left corner. Hold with pocket clip, press FIRMLY onto charging contact.

.

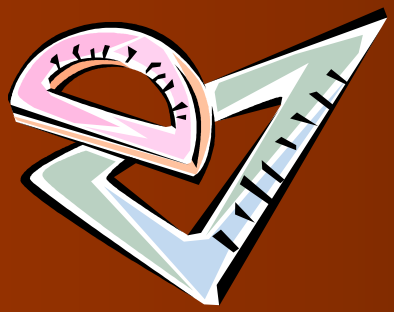
Step 3: Turn knob until meter reads 0.

Reading the Dosimeter

Light Source



Tactics and Strategies



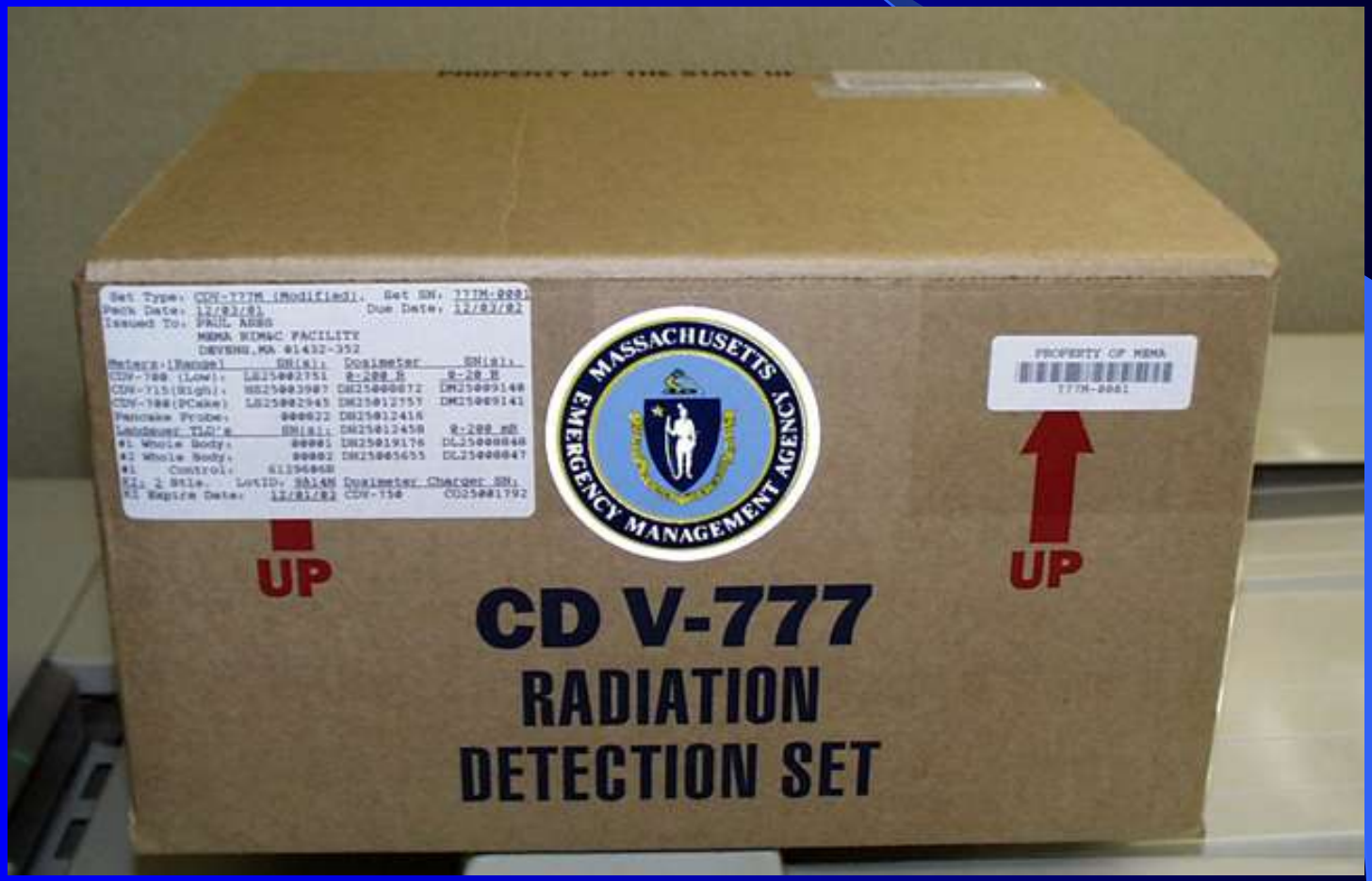
On-scene Accident Response

- Course of action:
  - Help injured people
  - Notify the authorities
  - Isolate the area

Learning goals

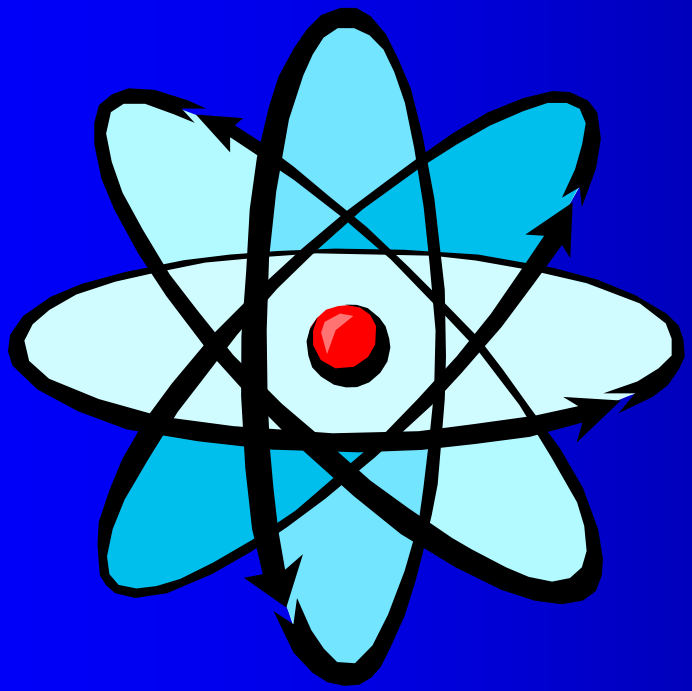
- Identify & operate the survey meters, dosimeters, and the dosimeter charger.
- Discuss their uses and limitations.
- Identify and explain TLD Dosimeters for Dose assessment and use of KI for Thyroid protection.
- Provide proper care and maintenance.
- Demonstrate a hands-on capability in the use of dosimetry and survey instruments.

The CD V-777 (Modified) Radiation Detection Set



Set Designed for All Radiation Hazards W/Emphasis on WMD Response

Specially equipped with:

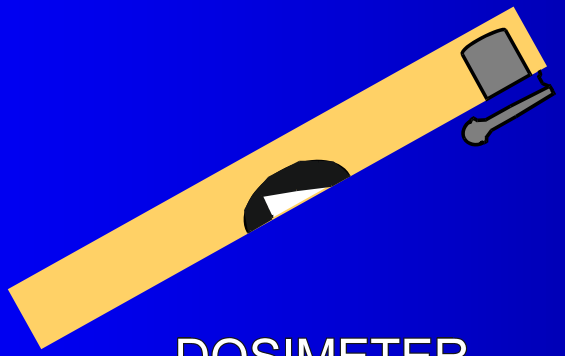


- Radiation Survey and Contamination Meters.
- Personnel Dosimetry for control and legal documentation of radiation exposures .
- Potassium Iodide for thyroid protection.

Radiological Instruments

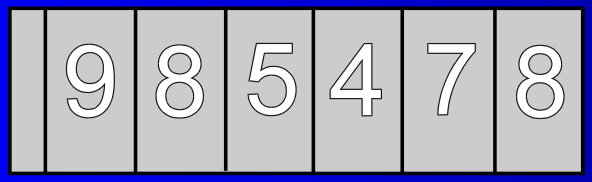
Two Types of Information

“Total Exposure ” and “ Exposure Rate ”

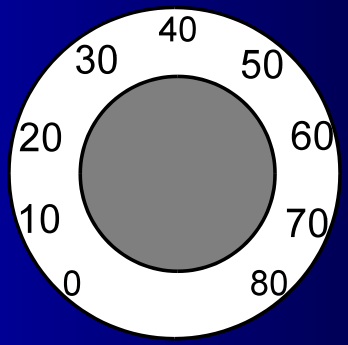


DOSIMETER

METER



ODOMETER



SPEEDOMETER

Survey and Contamination Rate Meters

(Three Meters Per Set)

- 1 ea. CD V-700 Survey Meter. for measuring Low level Gamma Exposure Rates and some beta detection.
- 1 ea. CD V-715 Survey Meter. for measuring high level Gamma / X-Ray Exposure Rates.
- 1 ea. CD V-700 Count Rate Meter with a Special Pancake probe for contamination monitoring.

CD V - 700 Characteristics

- Range: 0-50 mR/h Gamma Radiation or 0-30,000 CPM Beta plus Gamma.
- Use where incident exposure rates are not likely to exceed 50 mR/h.
- Use in tandem with CD V-715.
- Refer to FEMA's Good, Some , None Table (Forms Pack) for determining response to various RAM's.

CD V - 700 Characteristics

Probe Window Closed Vs. Probe Window Opened

Measures Gamma Radiation Only

Detects Gamma plus Beta above 250 Kev

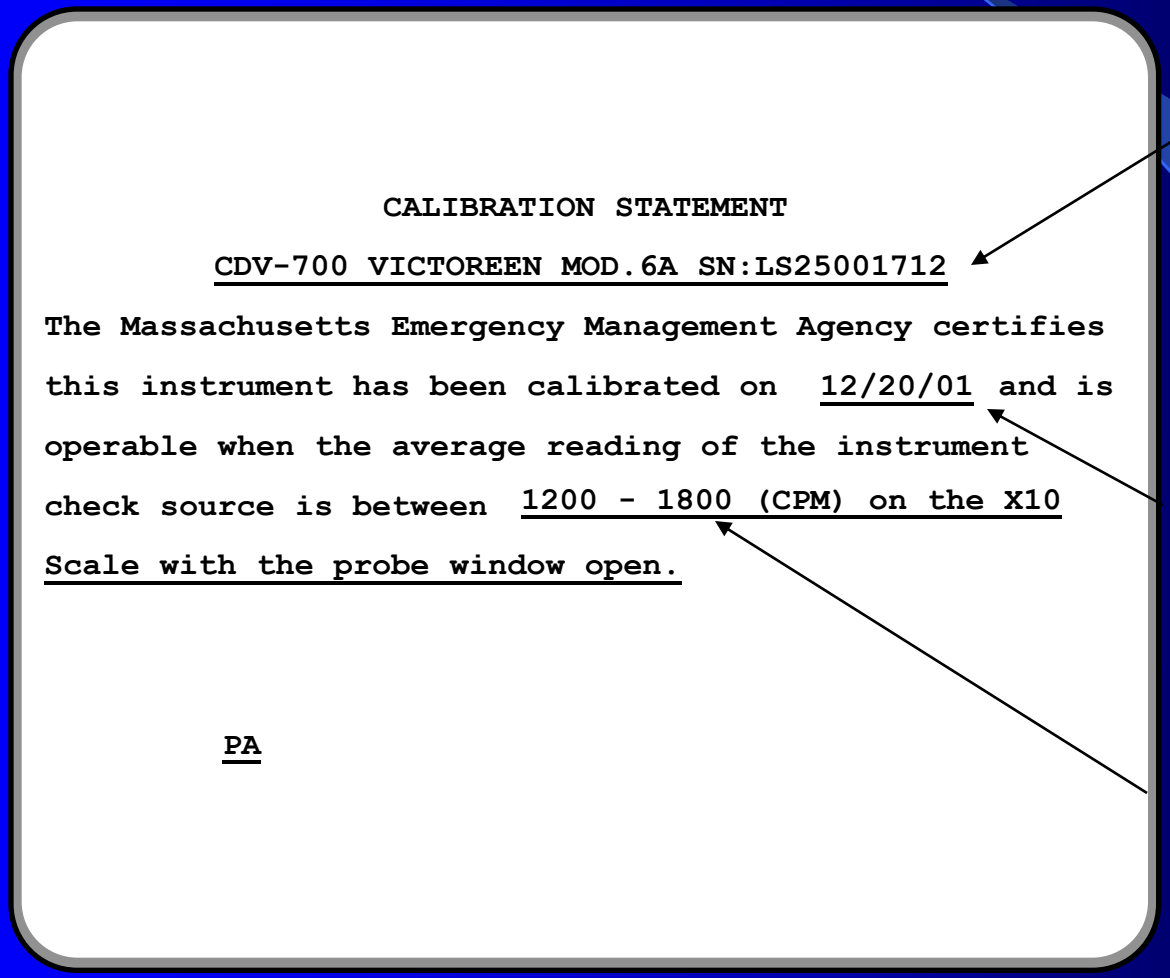
CDV-700 Operational Check

1. Turn OFF meter. (If you don't you may get a strong electrical shock).
2. Remove battery retainer clips(s) to install batteries. Check polarity. Replace Clips.
3. Close case and attach headphone.

CD V-700 Operational Check (Cont'd)

- Step 4: Turn Range selector Switch to X10. Wait 30 second Open beta window and place open probe directly on the checl source .
- Step 5: Move probe very slowly. Take the highest average reading in (CPM). Readings should agree with the range of CPM values listed on the calibration label.

Typical
CD V-700 Calibration Label



CALIBRATION STATEMENT

CDV-700 VICTOREEN MOD.6A SN:LS25001712

The Massachusetts Emergency Management Agency certifies this instrument has been calibrated on 12/20/01 and is operable when the average reading of the instrument check source is between 1200 - 1800 (CPM) on the X10 Scale with the probe window open.

PA

- Bar code label on CDV-700 printed on the calibration label.
- Calibration date of CDV-700 from calibration data base.
- Check Source Readings in CPM at the time of calibration.

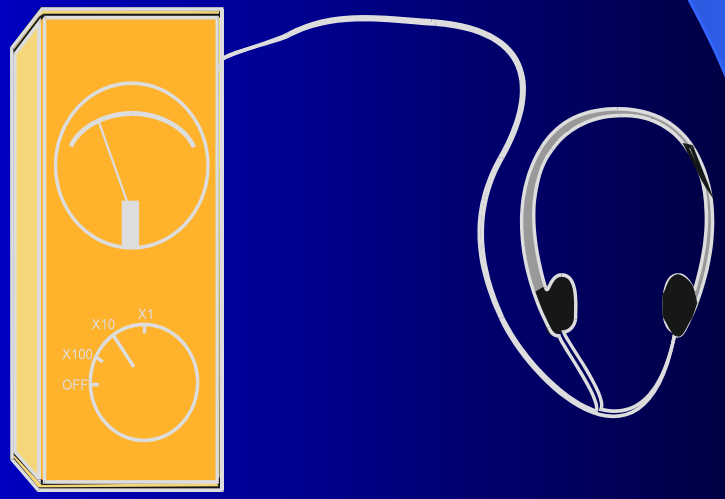
CD V-700 Meter converted to read in CPM for Operational Check

CD V-700 Checking Background

✓Once you have completed the Operational Check

Step 7: Try on headphones and check for radiation without reading meter face.

- Listening to headphone is the **Best** method for determining background and finding radiation.



CD V-700 Operational Check

Determining Background Counts Per Minute (CPM)

1. Set the CDV-700 range selector switch to **X1**.
2. Open the beta shield.
3. Ensure that a "clicking" sound is heard in headphone.
4. Count the clicks for fifteen (15) seconds.
5. Multiply the total of clicks by four (4) to determine background Counts Per Minute (CPM).

CD V-700 Operational Check

Determining Background Counts Per Minute (CPM)

for example

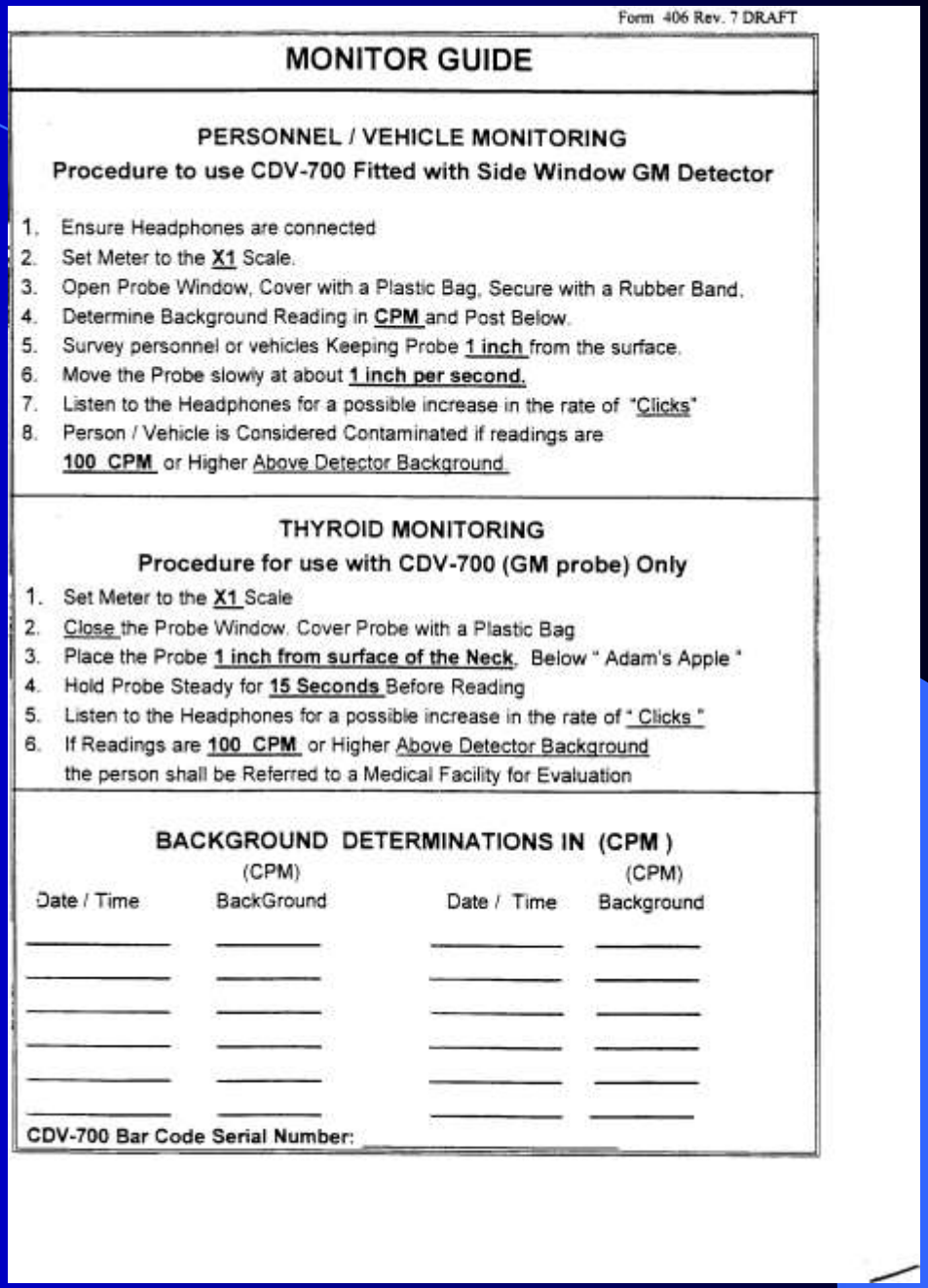
If total counts in fifteen seconds equal 8
8 x 4 = 32 Counts Per Minute (CPM)

Background is “32” Counts Per Minute (CPM)

- Record the background CPM obtained on your “Monitor Guide” Form 406 Rev. 7. Re-check background every 30 minutes to eliminate errors due to contamination of the probe or monitoring area.

Form 406 Rev.7 for Standard CD V-700

- Provides specific instructions on how to monitor using V-700.
- Provides procedure to monitor for thyroid uptake, if suspected.
- Use this form to record background levels prior to monitoring.
- Log background in CPM here >



Form 406 Rev. 7 DRAFT

MONITOR GUIDE

PERSONNEL / VEHICLE MONITORING

Procedure to use CDV-700 Fitted with Side Window GM Detector

1. Ensure Headphones are connected
2. Set Meter to the **X1** Scale.
3. Open Probe Window, Cover with a Plastic Bag, Secure with a Rubber Band.
4. Determine Background Reading in **CPM** and Post Below.
5. Survey personnel or vehicles Keeping Probe **1 inch** from the surface.
6. Move the Probe slowly at about **1 inch per second.**
7. Listen to the Headphones for a possible increase in the rate of "Clicks"
8. Person / Vehicle is Considered Contaminated if readings are **100 CPM** or Higher Above Detector Background

THYROID MONITORING

Procedure for use with CDV-700 (GM probe) Only

1. Set Meter to the **X1** Scale
2. Close the Probe Window. Cover Probe with a Plastic Bag
3. Place the Probe **1 inch from surface of the Neck**. Below " Adam's Apple "
4. Hold Probe Steady for **15 Seconds** Before Reading
5. Listen to the Headphones for a possible increase in the rate of " Clicks "
6. If Readings are **100 CPM** or Higher Above Detector Background the person shall be Referred to a Medical Facility for Evaluation

BACKGROUND DETERMINATIONS IN (CPM)

Date / Time	(CPM) BackGround	Date / Time	(CPM) Background

CDV-700 Bar Code Serial Number:

CD V-700 Instrument Use
Area Surveys

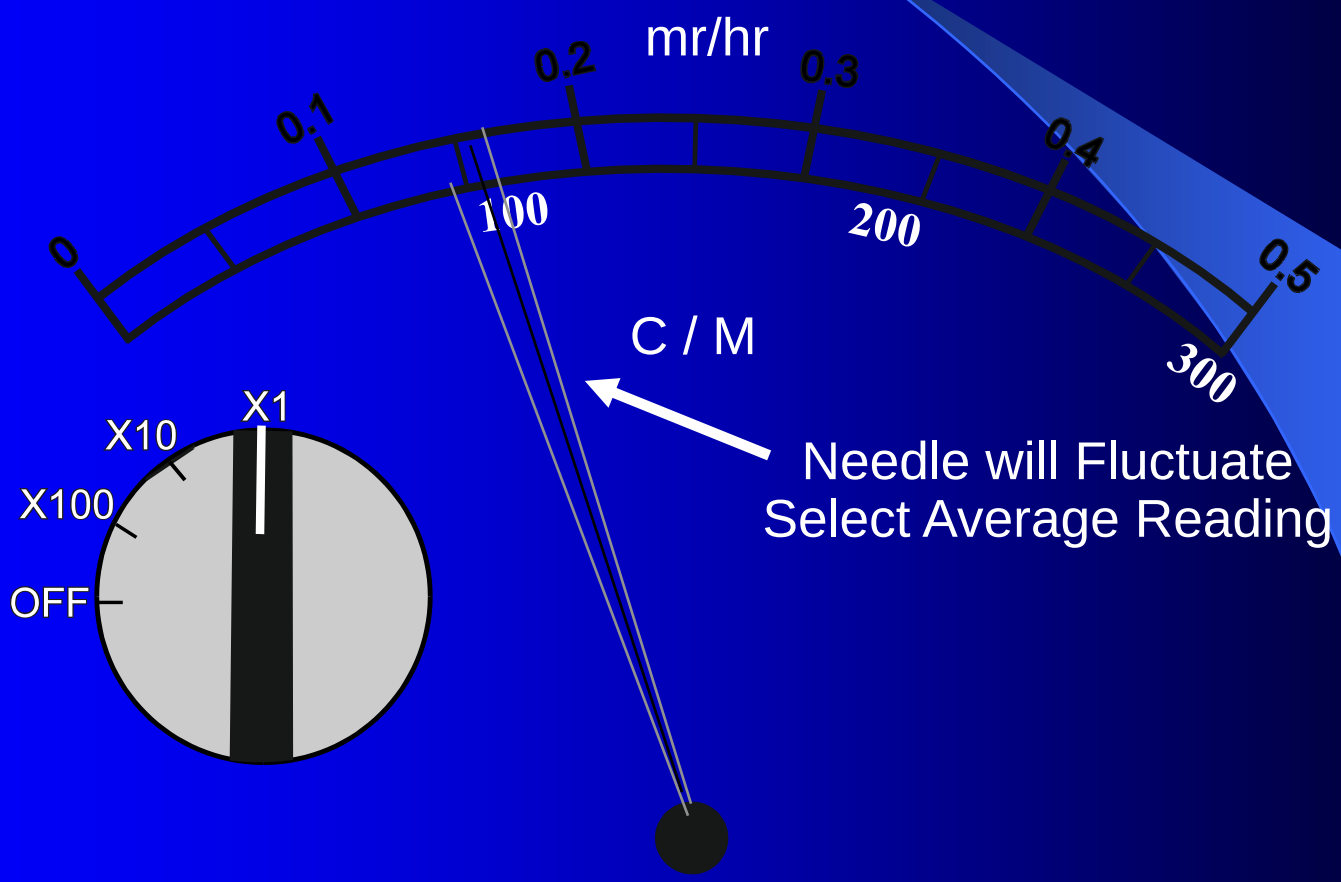
- Probe may remain in handle clip and held waist high.
- If holding probe in hand orient probe parallel to surface. Do not dangle probe by cord !
- Always cover probe with a plastic baggie to prevent contamination of the probe.
- In areas of unknown radiation, use high- and low-range instruments in tandem.

CD V-700 Instrument Use

- Begin on the X1 range. If radiation goes full scale, switch to the X10 range. If it rises again, switch to the X100 range.
  - Multiply the raw meter face reading by the range to determine exposure rate in mR/hr (Probe Closed) or CPM (Probe Open).
- If the needle peaks, earphone squeals, and needle drops, the meter has probably been saturated (above 2 R/hr).
- Check your high range meter (CD V-715) immediately !

CD V-700 Practice Meter Reading

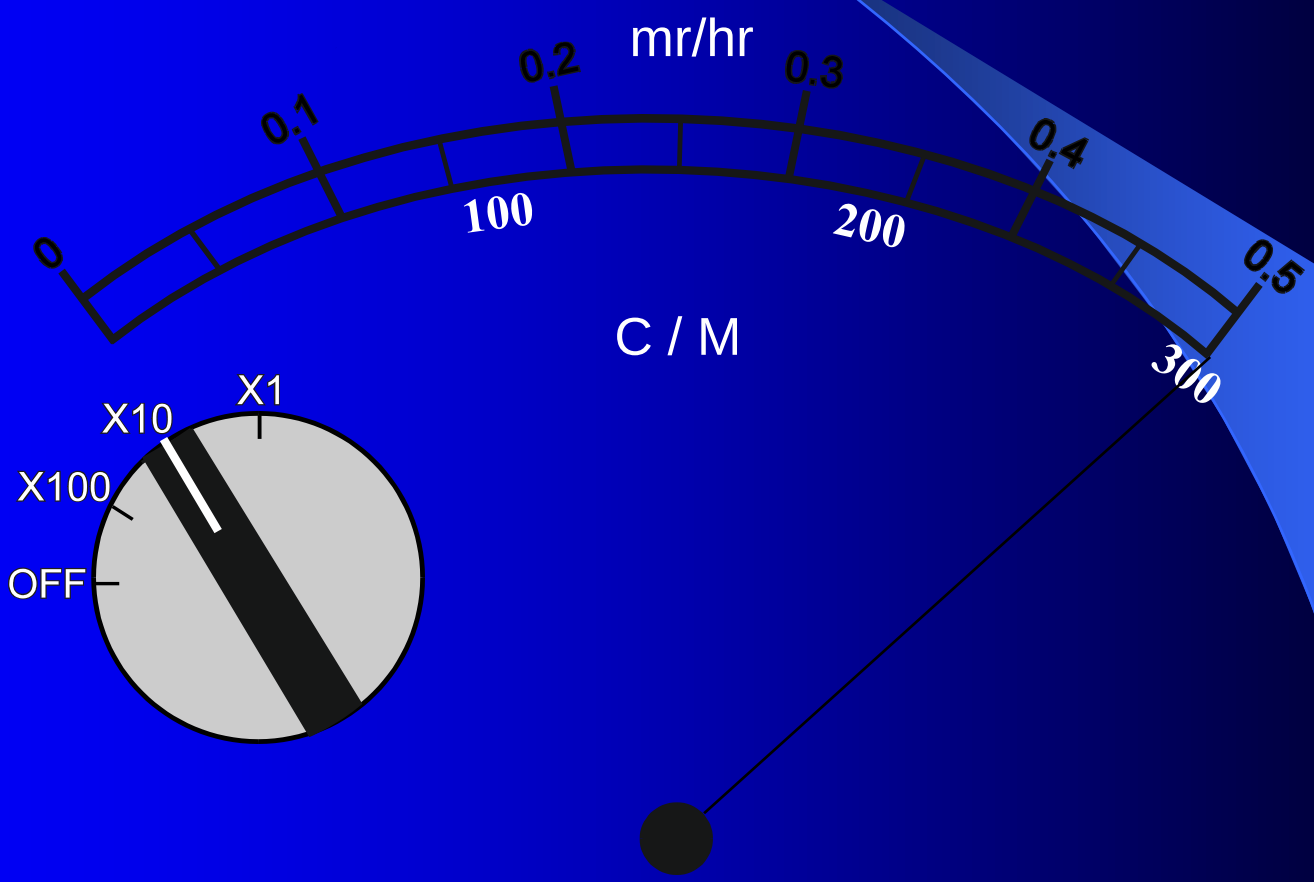
100 on C / M Scale



100 X 1= 100 Counts Per Minute (CPM)

CD V-700 Practice Meter Reading

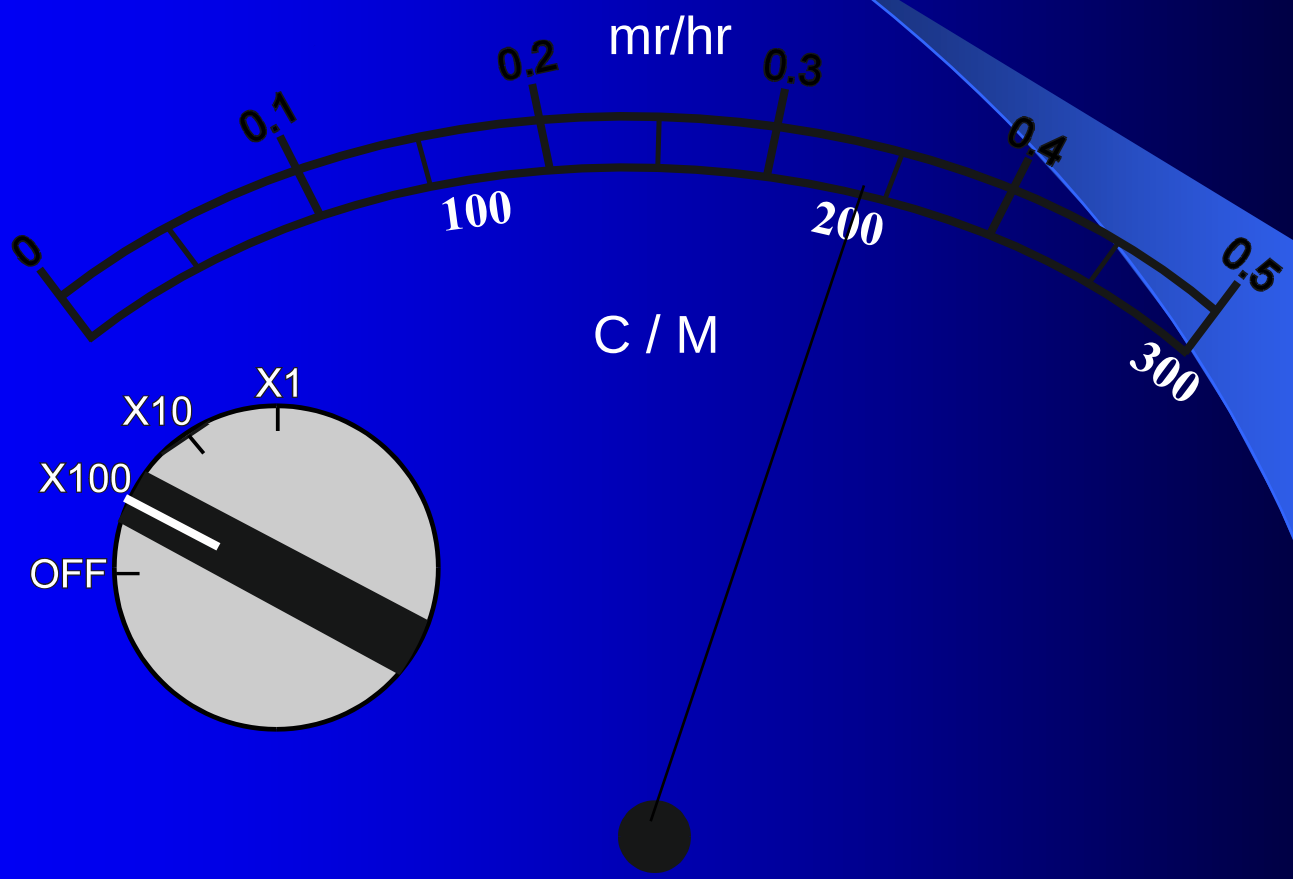
300 on C / M Scale



300 X 10 = 3,000 Counts Per Minute (CPM)

CD V –700 Practice Meter Reading

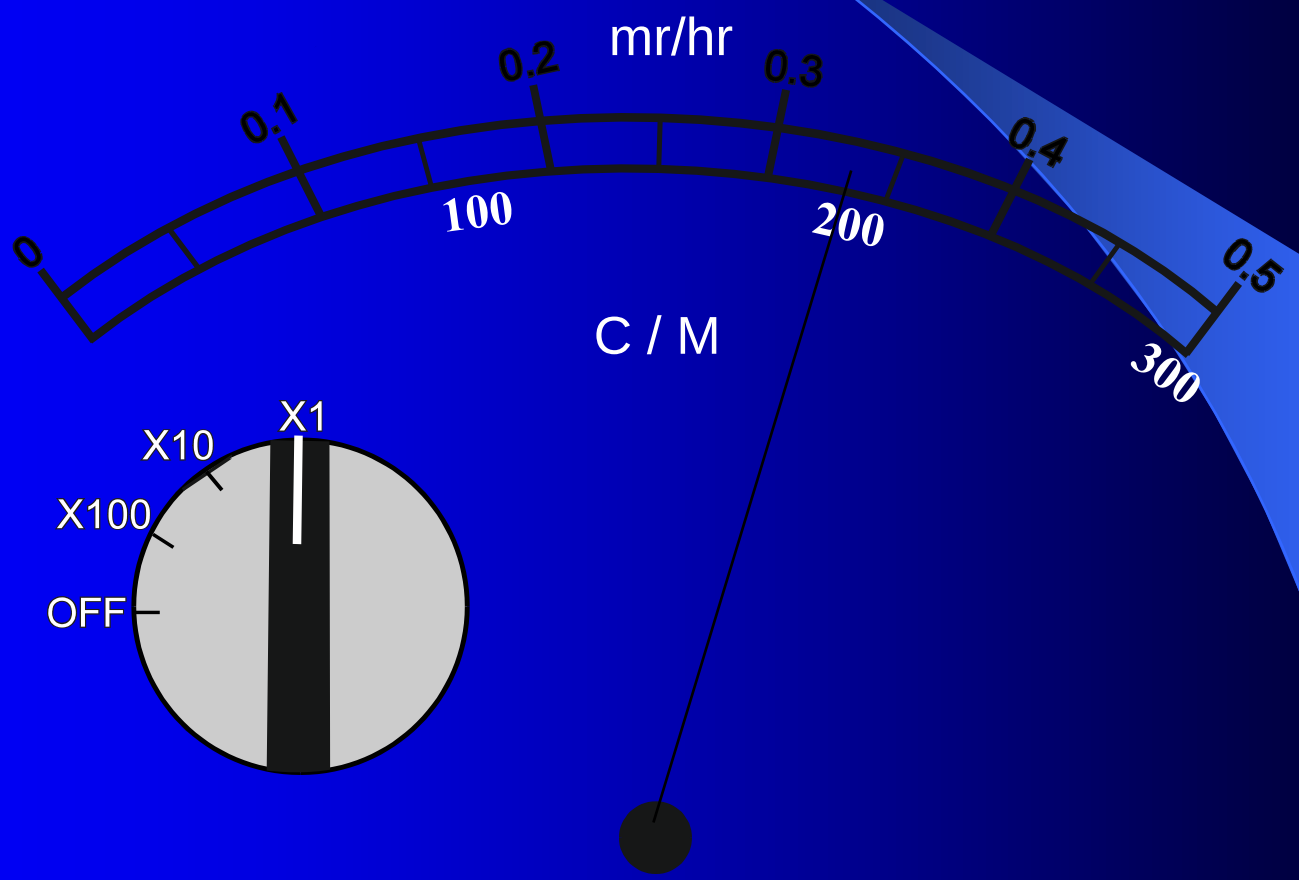
200 on C / M Scale



200 X 100 = 20,000 Counts Per Minute (CPM)

CD V-700 Practice Meter Reading

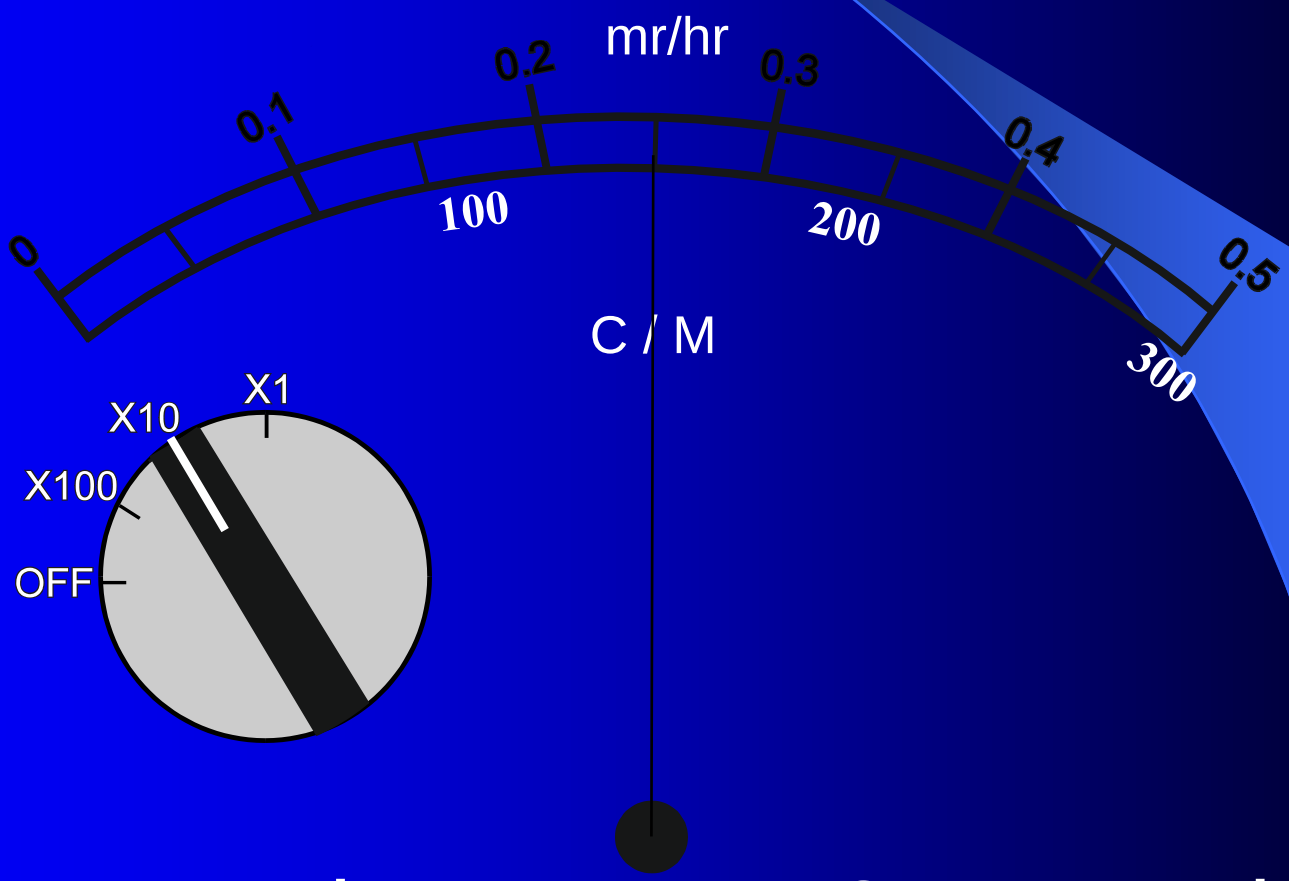
Raw Meter Reading = _____ on C / M Scale



_____Read X _____ = _____ Counts Per Minute

CD V-700 Practice Meter Reading

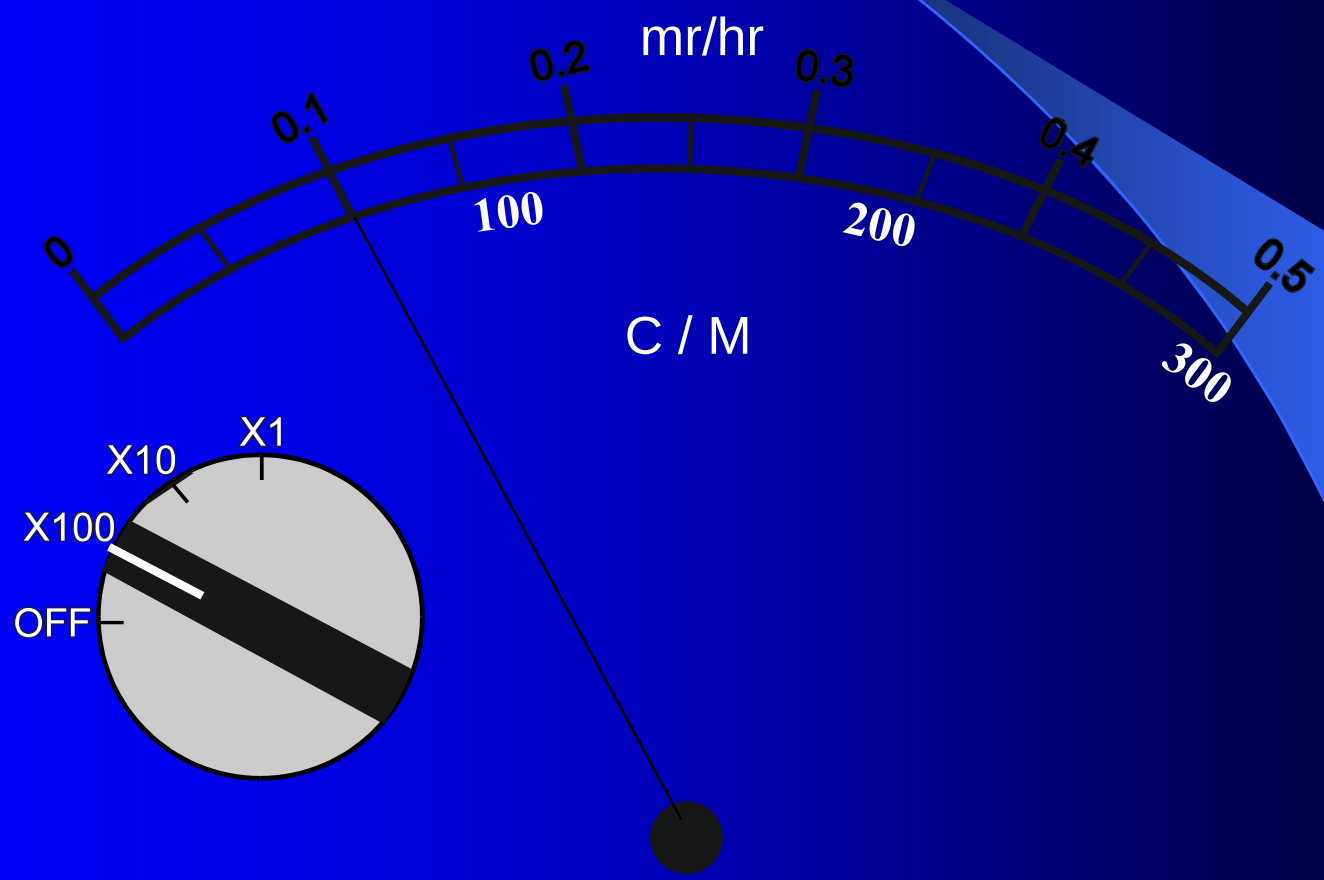
Raw Meter Reading = _____ on C / M Scale



_____Read X _____ = _____ Counts Per Minute

CD V-700 Practice Meter Reading

Raw Meter Reading =_____ on C / M Scale



_____Read X _____ = _____ Counts Per Minute

CD V-700 - Performing surveys of Personnel, Equipment or Vehicles

1. Ensure Headphone is connected.
2. Switch to the X1 Scale.
3. Open probe window.
4. Be sure to cover probe with plastic baggie.
5. Re-check background.
6. Keep probe 1 inch above surface.
7. Survey move probe slowly at about 1 inch/second.
8. Listen in headphone for increase in clicks or counts.
9. Suspect contamination if levels are 100 CPM or higher above background.

CD V-700 Limitations

- Cannot perform operational check in a radiation field.
- Measures up to only 50 mR/hr.
- May become saturated in higher field of radiation and act erratically.
- Will not respond to all radioactive material commonly transported. Refer to FEMA's Good, Some, None Table. (see forms pack).

CD V-700 Care

- Perform regular operational checks.
- Log results on your Quarterly Operational Check Form (Refer to Forms Pack).
- Turn meter off and remove batteries (for storage).
- Place end of GM tube with wire over center of meter (for storage). Prevents wire breakage.

CD V-700 Equipped With Pancake Probe Detector

- Plug-in Modification for the CD V-700 for enhanced Contamination Monitoring.
- Detects * Alpha, Beta, Gamma and X-ray Contamination.
- Can also be used for area monitoring.
- Introduced by FEMA after development of the FEMA Good, Some None Table.

Connecting CD V-700 RP Probe

Probe Socket

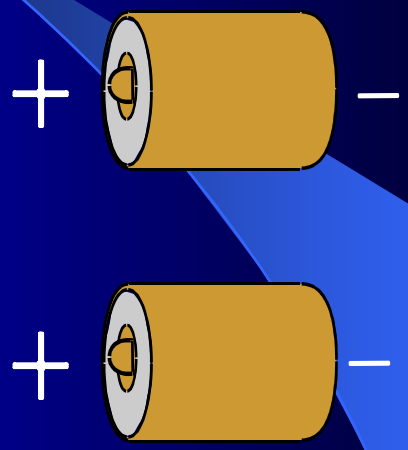
Probe Connector Pins

- Switch must be "Off".
- Unwind cable from stem.
- Remove CD V-700 RP probe from it's protective Bubble Wrap Bag.
- Match Pancake Probe Connector Pins with Probe Socket Holes.
- Gently attach probe to base and secure by rotating screw to base.

CD V-700 RP Operational Check

Specially equipped with Pancake Probe Detector

1. Turn OFF meter. (If you don't you may get a strong electrical shock).
2. Remove battery retainer clip to install batteries. Check polarity. Replace Clips.
3. Close case and attach headphone.

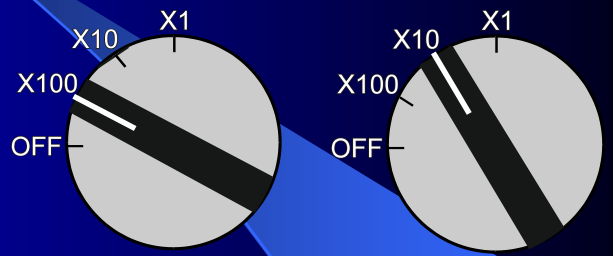


Note:

The Lionel Model CD V-700 uses only 2 ea. HD "D" Cell batteries.

CD V-700 RP
Operational Check (cont'd)

4. Turn Range selector Switch to X100 or X10 . Check Calibration label for proper scale. Wait 30 seconds.



5. Remove Red Plastic Cap from Probe and place directly on the Operational check source .

6. Take the highest average reading in CPM. Readings should agree with range of CPM values listed on the calibration label.

CD V-700 RP Operational Check

Determining Background in Counts Per Minute (CPM)

1. Set the CDV-700 RP range selector switch to **X1**.
2. Be sure Red Plastic Cap has been removed.
3. Ensure that a "clicking" sound is heard in headphone.
4. Count the clicks for fifteen (15) seconds.
5. Multiply the total of clicks by four (4) to determine background Counts Per Minute (CPM).

CD V-700 RP Operational Check

Determining Background in Counts Per Minute (CPM)

for example

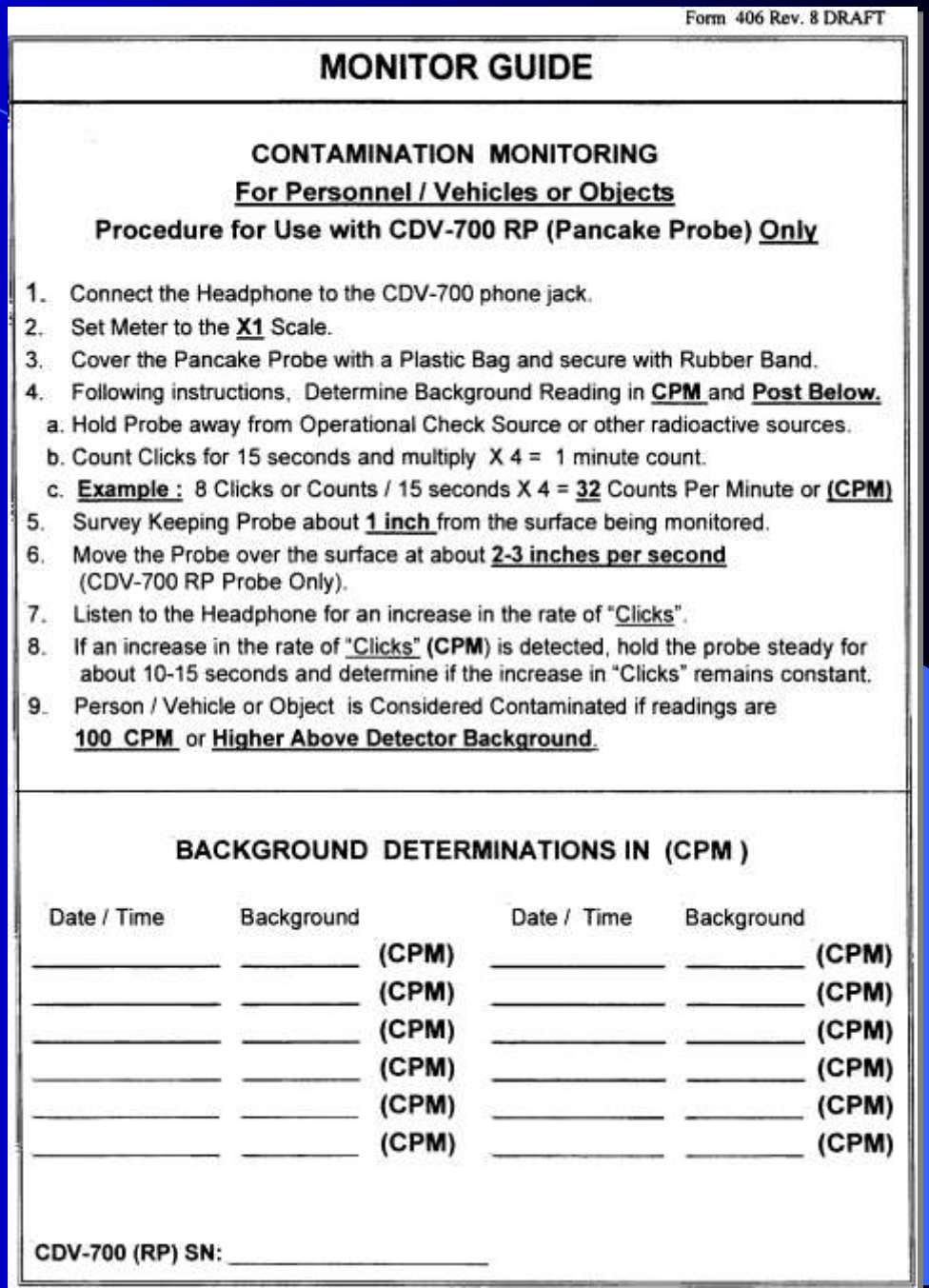
If total counts in fifteen seconds equals 10
10 x 4 = 40 Counts Per Minute (CPM)

Background is “40” Counts Per Minute (CPM)

- **Record the background CPM obtained on your “Monitor Guide” Form 406 Rev.8 . Re-check every 30 minutes to eliminate errors due to contamination of the probe or monitoring area.**
- **Background may be slightly higher for the Pancake Detector vs. CD V-700 equipped with standard probe.**

Form 406 Rev.8 for CD V-700 RP

- Use only with CD V-700 RP Pancake.
- Follow monitoring procedure steps 5-9 for this probe.
- Can also make general area surveys in CPM.
- Log background in CPM here >



Form 406 Rev. 8 DRAFT

MONITOR GUIDE

CONTAMINATION MONITORING

For Personnel / Vehicles or Objects

Procedure for Use with CDV-700 RP (Pancake Probe) Only

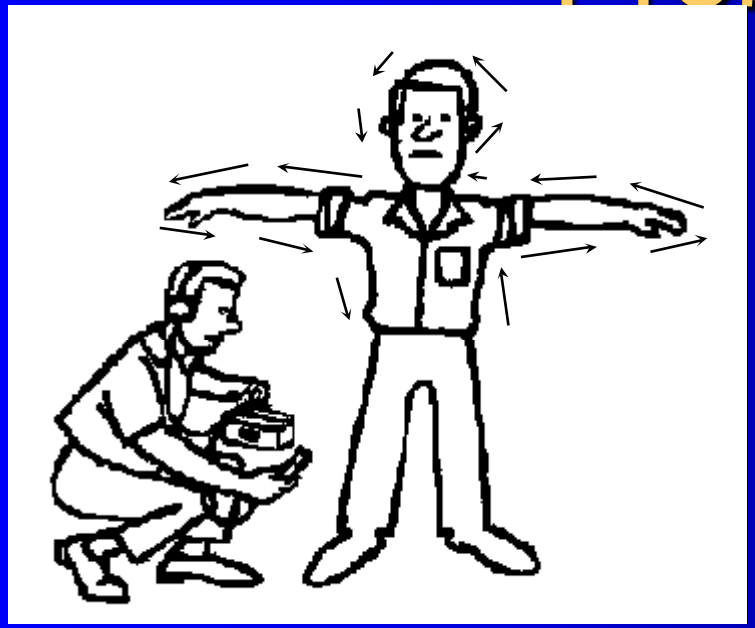
1. Connect the Headphone to the CDV-700 phone jack.
2. Set Meter to the **X1** Scale.
3. Cover the Pancake Probe with a Plastic Bag and secure with Rubber Band.
4. Following instructions, Determine Background Reading in **CPM** and **Post Below.**
   a. Hold Probe away from Operational Check Source or other radioactive sources.
   b. Count Clicks for 15 seconds and multiply X 4 = 1 minute count.
   c. **Example :** 8 Clicks or Counts / 15 seconds X 4 = **32** Counts Per Minute or **(CPM)**
5. Survey Keeping Probe about **1 inch** from the surface being monitored.
6. Move the Probe over the surface at about **2-3 inches per second** (CDV-700 RP Probe Only).
7. Listen to the Headphone for an increase in the rate of "Clicks".
8. If an increase in the rate of "Clicks" **(CPM)** is detected, hold the probe steady for about 10-15 seconds and determine if the increase in "Clicks" remains constant.
9. Person / Vehicle or Object is Considered Contaminated if readings are **100 CPM** or **Higher Above Detector Background.**

BACKGROUND DETERMINATIONS IN (CPM)

Date / Time	Background		Date / Time	Background	
_____	_____	(CPM)	_____	_____	(CPM)
_____	_____	(CPM)	_____	_____	(CPM)
_____	_____	(CPM)	_____	_____	(CPM)
_____	_____	(CPM)	_____	_____	(CPM)
_____	_____	(CPM)	_____	_____	(CPM)
_____	_____	(CPM)	_____	_____	(CPM)

CDV-700 (RP) SN: _____

Contamination Monitoring with CD V-700 RP (Pancake Probe)



- Readings must be reported in CPM .
- Ensure Headphone is connected.
- Switch to X1 Scale.
- Re-Check Background.
- Survey moving probe 2-3 inches per second @ 1” above the surface.
- Consider Person / Vehicle or Object contaminated if readings are 100 CPM or greater above background.
- Probe will only detect Alphas with Plastic Bag removed ! Increasing risk of contamination ! Be Careful !!

CD V-715 Survey Meter

CD V-715 Characteristics

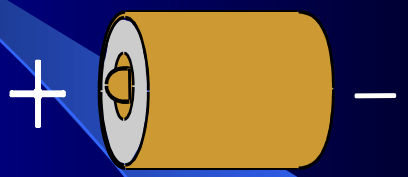
Range 0 - 500 R/hr

Use

- High level Gamma / X -Radiation related to:
  - **WMD Attacks**
  - **Industrial Accidents**
- Backup to CD V-700 when entering unknown radiation environment

CD V-715 Operational Check

Step 1: Turn meter off.



Step 2: Open unit, install battery (observe polarity).

Step 3: Turn selector switch “ Zero ”; wait two minutes for warm-up.

CD V-715 Operational Check

Step 4: Adjust needle position to "0" on face. Zeroing assures accuracy. When zeroing meter, detector does not respond to radiation.

Step 5: Hold selector switch to Circuit Check position to test battery strength, proper installation, and meter circuits. Observe a needle deflection on meter face near red area marked Circuit Check.

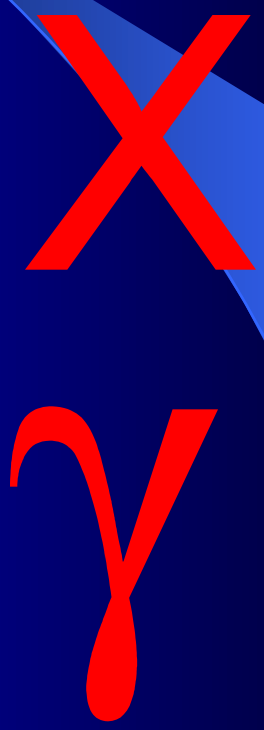
CD V-715 Operational Check

Step 6: Test operation of each range by rotating selector switch to each position, observing meter deflection.

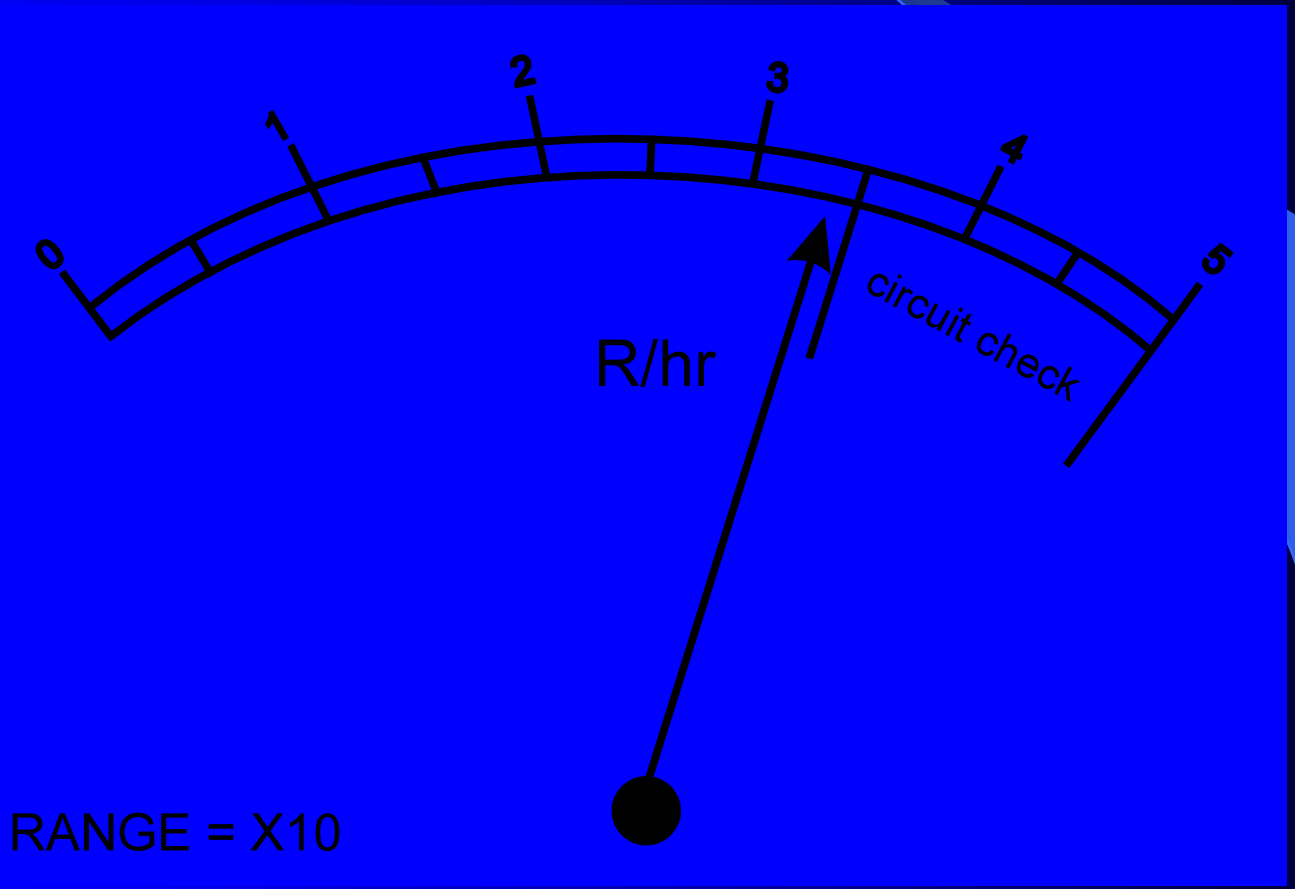
When not in radiation field, needle should not move further than 0.3 on X100, X10, and X1 scales and .6 on the X0.1 scale.

CD V-715 Limitations

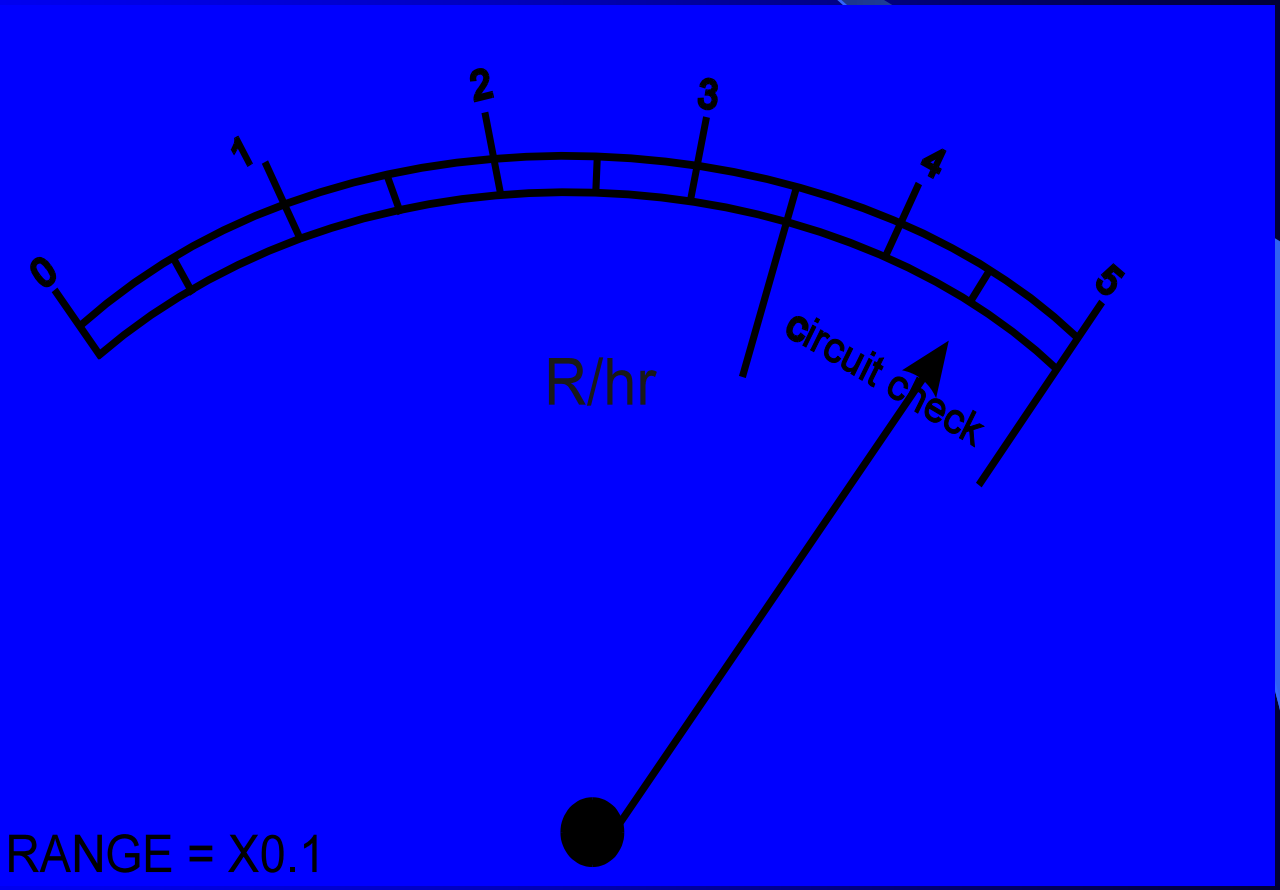
- Detects only:
  - Radiation
  - Gamma radiation



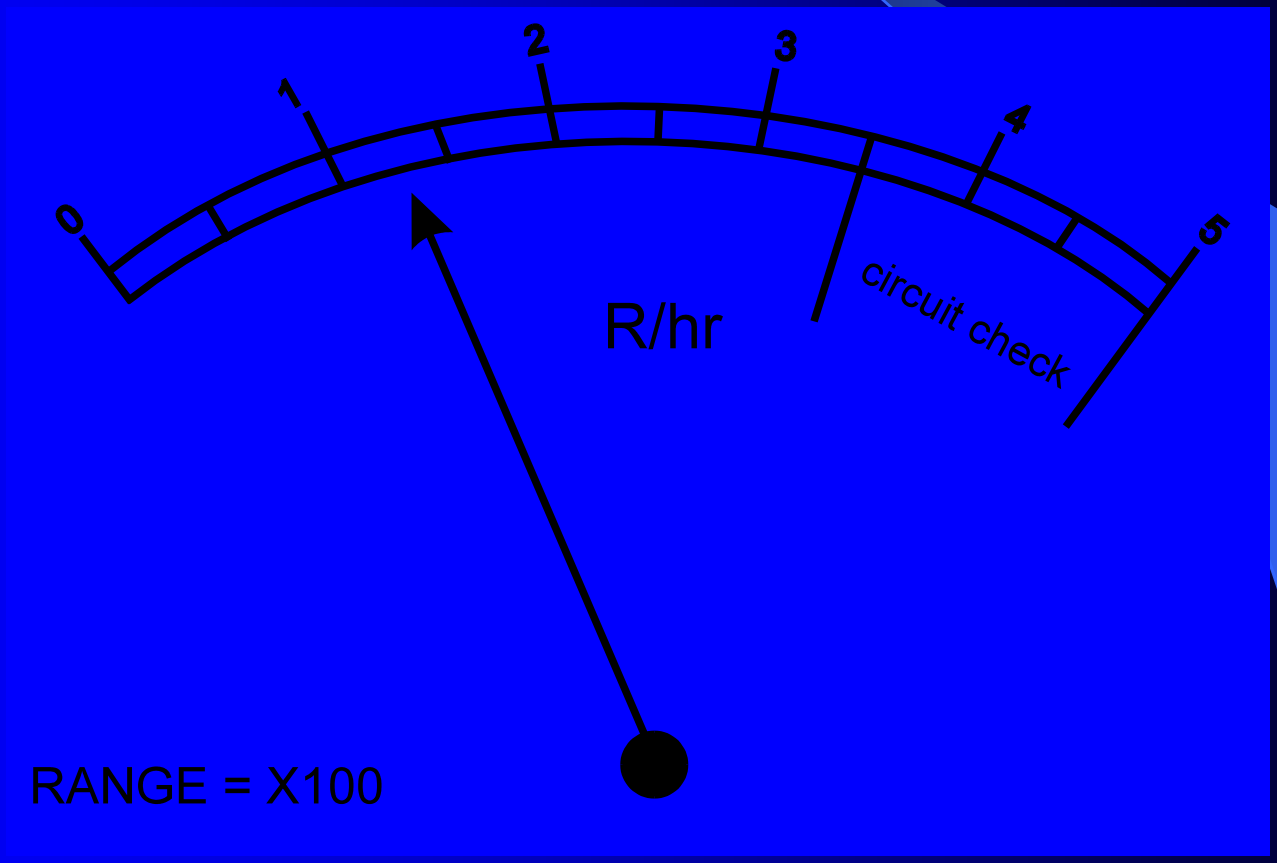
CD V-715 Meter Face #1



CD V-715 Meter Face #2



CD V-715 Meter Face #3



Other Survey Meters

- CD V-718A / ADM300
- Eberline RO-20 Ion Chamber
- Ludlum Model 3
- Ludlum Model 19 Micro R
- Ludlum Model 2241

Dosimetry & Exposure Control

Monitoring and Controlling your Radiation Exposures

Direct Reading Dosimeters

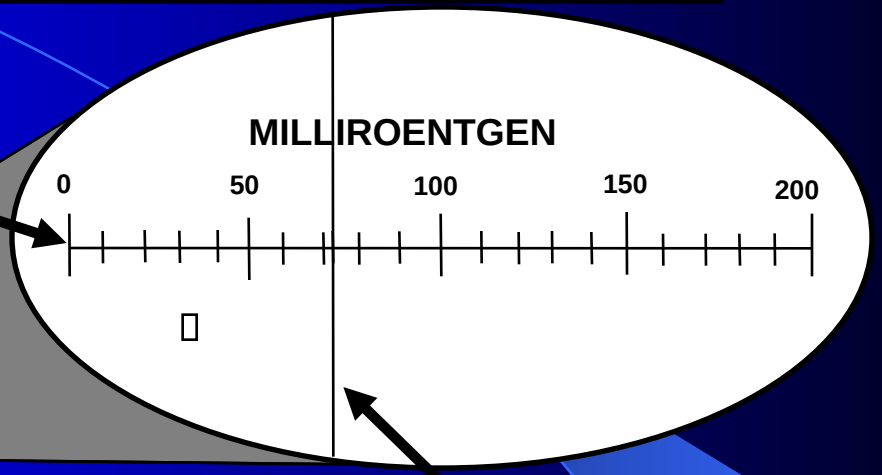
- Measure Gamma/X-Radiation.
- Come in varying ranges.
- Provide continuous real-time radiation exposure information.
- Are worn in pairs (200 mR and 20R) by emergency responders.
- Can be re-used and transferred to other emergency workers.
- Are tested and calibrated annually by MEMA.

CD V- 730 - 20 R

CD V- 138 - 200 mR

Direct Reading Dosimetry Indication

SCALE

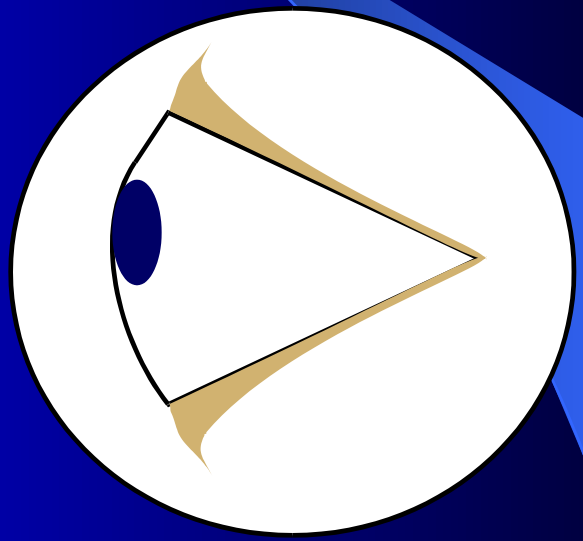


Low Range DRD

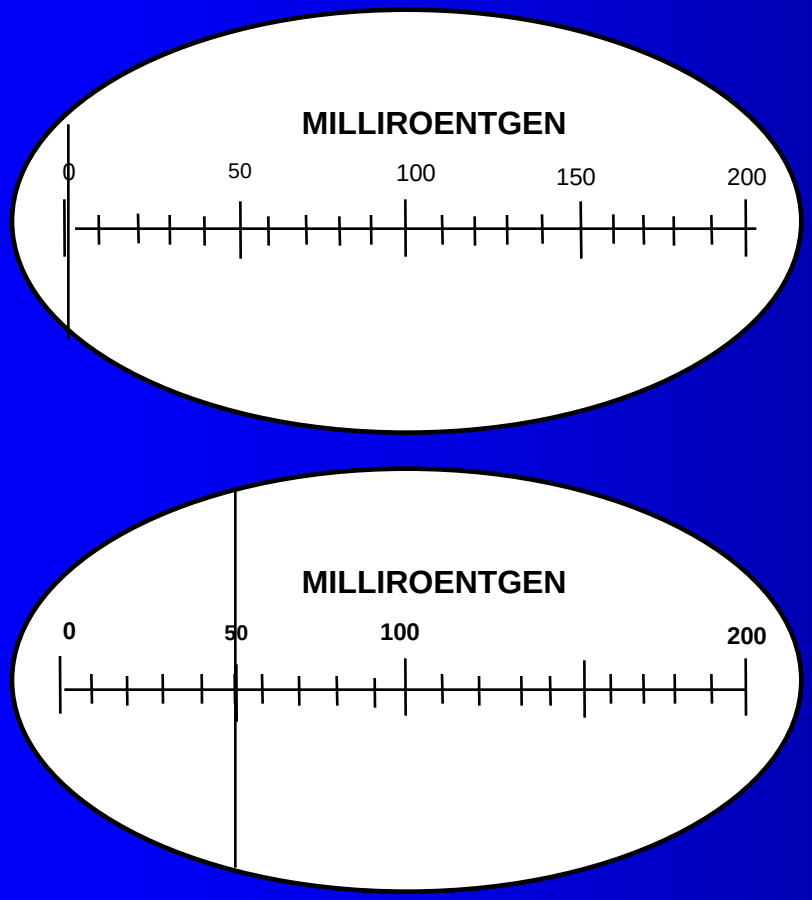
HAIRLINE
Indicating total external exposure

Reading the Dosimeter

Light Source



Reading the Direct Reading Dosimeter



Instrument: Low Range
Model: CDV-138

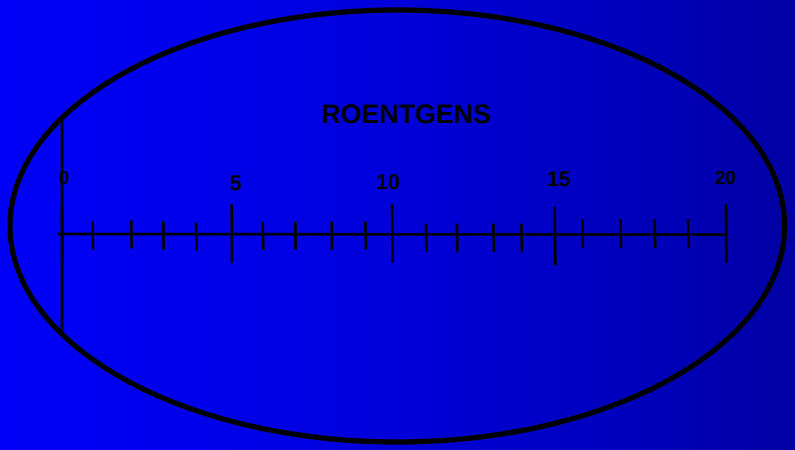
Scale: 0-200 mR

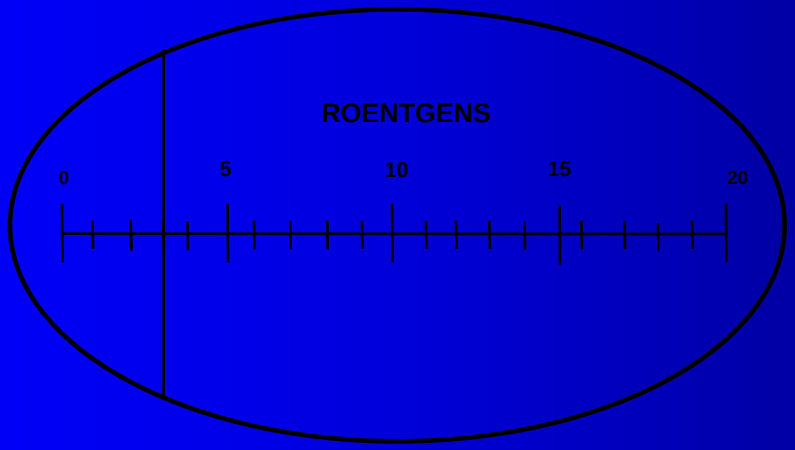
Initial Reading :0 mR

Final Reading: 50 mR

Total Dose: 50 mR

Reading the Direct Reading Dosimeter





Instrument: Mid Range
Model: CDV-730

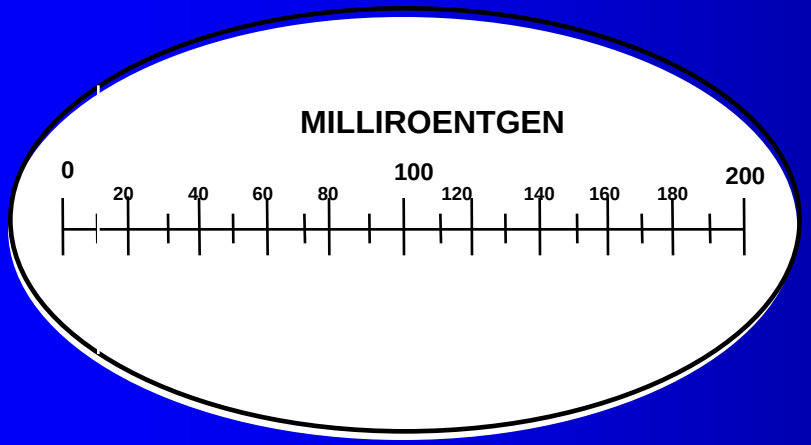
Scale: 0-20R

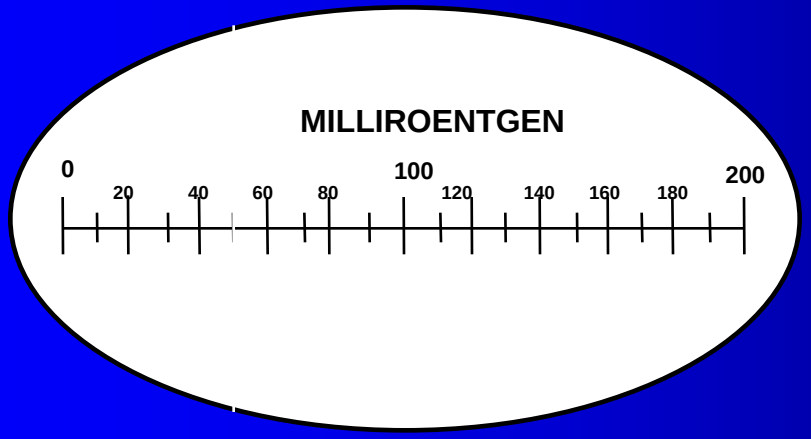
Initial Reading: 0 R

Final Reading: 3 R

Total Dose: 3 R

Reading the Direct Reading Dosimeter





Instrument:_____

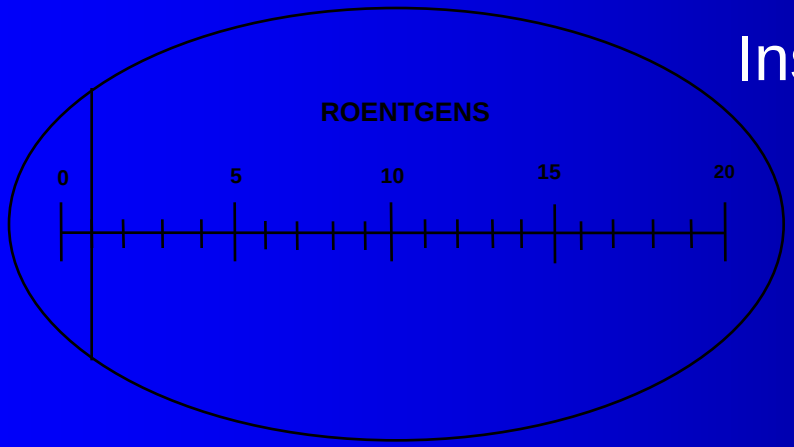
Scale:_____

Initial Reading:_____

Final Reading: _____

Total Dose: _____

Reading the Direct Reading Dosimeter

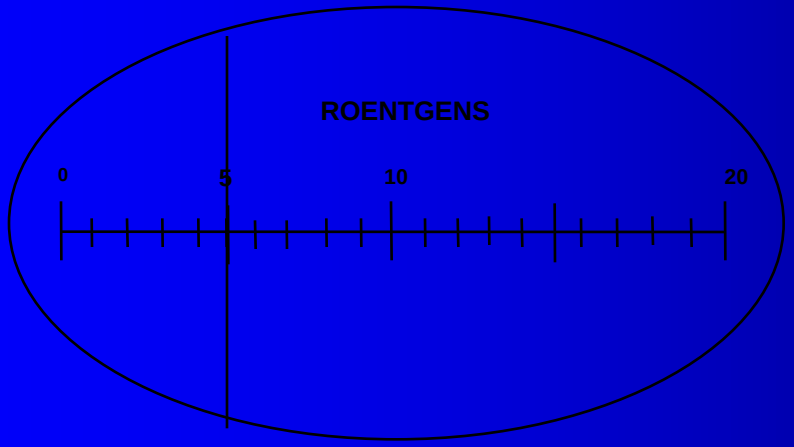


Instrument:_____

Scale: _____

Initial Reading

_____



Final Reading:_____

Total Dose: _____

CD V-750 Dosimeter Charger

Charging Contact

Case Fastener

Cap and Chain

Dosimeter

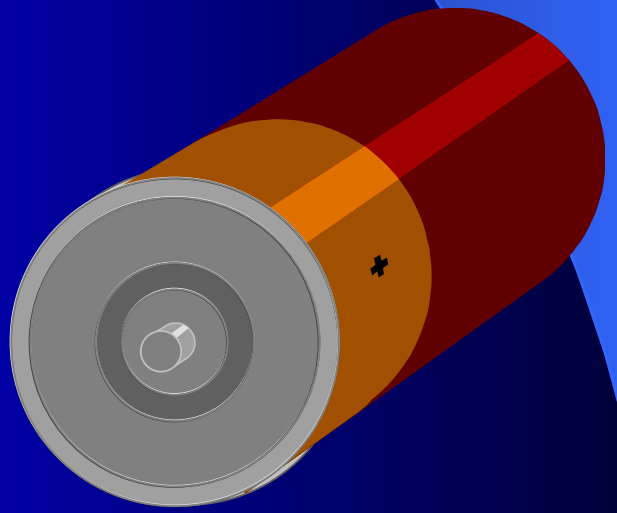
Zero Adjust Knob

HD "D" Cell

CD V-750 Preparation for Use

Step 1: Install one D cell battery.

- Remove center screw and open unit.
- Observe polarity.



CD V-750 Preparation for Use

Step 2: Remove cap, top left corner. Press dosimeter FIRMLY onto charging contact .

Step 3: Turn knob until meter reads “0”.

Dosimetry Packet Contents

1 Low Range DRD

1 Mid Range DRD

1 TLD

1 Neck Chain

1 Emergency Worker Exposure Form

1 Potassium Iodide (KI) Tablet *

* If advised by MPDH

DRD Limits for Emergency Workers

Initial DRD Limit
175 mR

DRD Reporting Levels

100mR	**low range DRD**
175mR	**low range DRD**
Each 1R increase	**mid range DRD**

Higher limits may be established during the emergency by MDPH.

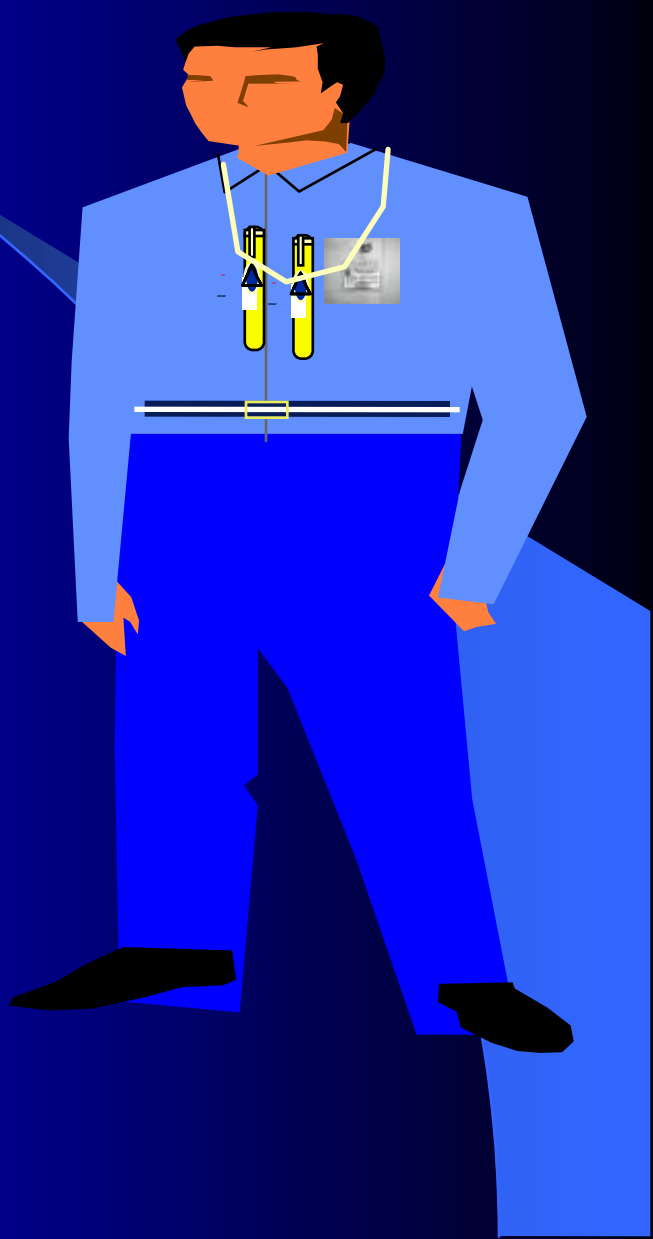
Higher limits may be set for all emergency workers or for individuals who are performing special missions.

Dosimetry Placement

Dosimetry should be placed:

- in the center of the chest
- between the neck and waist
- on the outside layer of clothing

** Wear all dosimetry in the same location



Emergency Worker Responsibilities

- When directed - read DRDs every 15 minutes
- Report the following readings to your Dosimetry Coordinator:
  - 100 mR on Low Range DRD
  - 175 mR on Low Range DRD
  - Each 1R increment on Mid Range DRD.

Thermo Luminescent Dosimeters (TLD's)

Thermo Luminescent Dosimeters (TLD's)

- Provides the Legal Permanent Record of an emergency workers' Radiation Exposure.
- Passively and Continuously Measures Beta and Gamma Radiation Exposures.
- Have a separate Beta and Gamma chip for radiation measurement.
- Cannot be read in the field by Emergency Workers. Must be read by a NVLAP Accredited Facility (Landauer, Inc.).
- Are identical to the TLD's used by Emergency Workers in the Pilgrim EPZ..

Whole Body and Control TLD's

- 6 ea. Whole Body Wallet TLD's and 1 ea. Control TLD per Set..
- Ideal plan is to issue 2 ea. TLD's Per shift x 3 shifts for 24 hour coverage.
- Can issue all 6 TLD's for larger staffing if emergency warrants.

Landauer TLD (Front View)

- Donned by Emergency Workers along with DRD's.
- Must Clip to TLD and place on neck chain.
- Are not transferable to other emergency workers.
- Must be returned annually to MEMA for exchange.

Anneal or Start Date

TLD Serial Number

Landauer Wallet Whole Body TLD (Rear View)

Assignment Instructions

Return To Instructions

Control TLD's (1 Issued Per Set)

- Always stored in CDV-777 carton with other TLD's .
- Should never be issued to personnel .
- Are used to subtract normal background from emergency worker field exposures.
- Control TLD must be kept away from the " Hot Zone " to avoid exposures.
- To avoid exposures leave CDV-777 in "*COLD*