



SAND2010-0478C



Radiation Instrumentation and Monitoring

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
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Topics



- **Categories of Radiological Survey Instruments**
- **Proper Application and Limitation of Contamination Survey Instruments**
- **Proper Application and Limitation of Radiation Exposure Survey Instruments**
- **Commonly Used Dosimetry Device**



Introduction

- Radiation can not be detected by our senses
- Survey instruments can:
 - Easily and accurately measure radiation and contamination
 - Help evaluate radiological hazards



Radiological Surveys

- Two categories of instruments available:
 - Those that measure radiation
 - Those that measure contamination
- Some survey instruments are designed to do both





Contamination Survey Instruments

- Typically read in counts per second (CPS)
- Very sensitive
- Detects alpha, beta, & gamma radiation
- Window is very fragile
- Not designed for measuring radiation exposure





Application of Contamination Survey Instruments



- Locating contamination on personnel and equipment
- Determining the effectiveness of decontamination
- Verifying contamination control boundaries
- Determining the extent and magnitude of a contaminated area





Application of Contamination Survey Instruments



- Follow procedures for pre-operational check of the instrument
 - Physical damage
 - Calibration
 - Battery condition
 - HV (if applicable)
 - Source response check





Application of Contamination Survey Instruments

- Verify the instrument is on and set to the lowest (most sensitive) scale
- Check for audio and visual response





Application of Contamination Survey Instruments



- Verify the background radiation level
- Hold the probe 1 cm ($\frac{1}{2}$ inch) from surface
- Move the probe slowly, 2.5 – 5 cm (1 – 2 inches) per second
- Pause if the count rate increases





ASP-1 with HP-260 GM Detector





ASP-1 with AC-3 Alpha Scintillation Detector



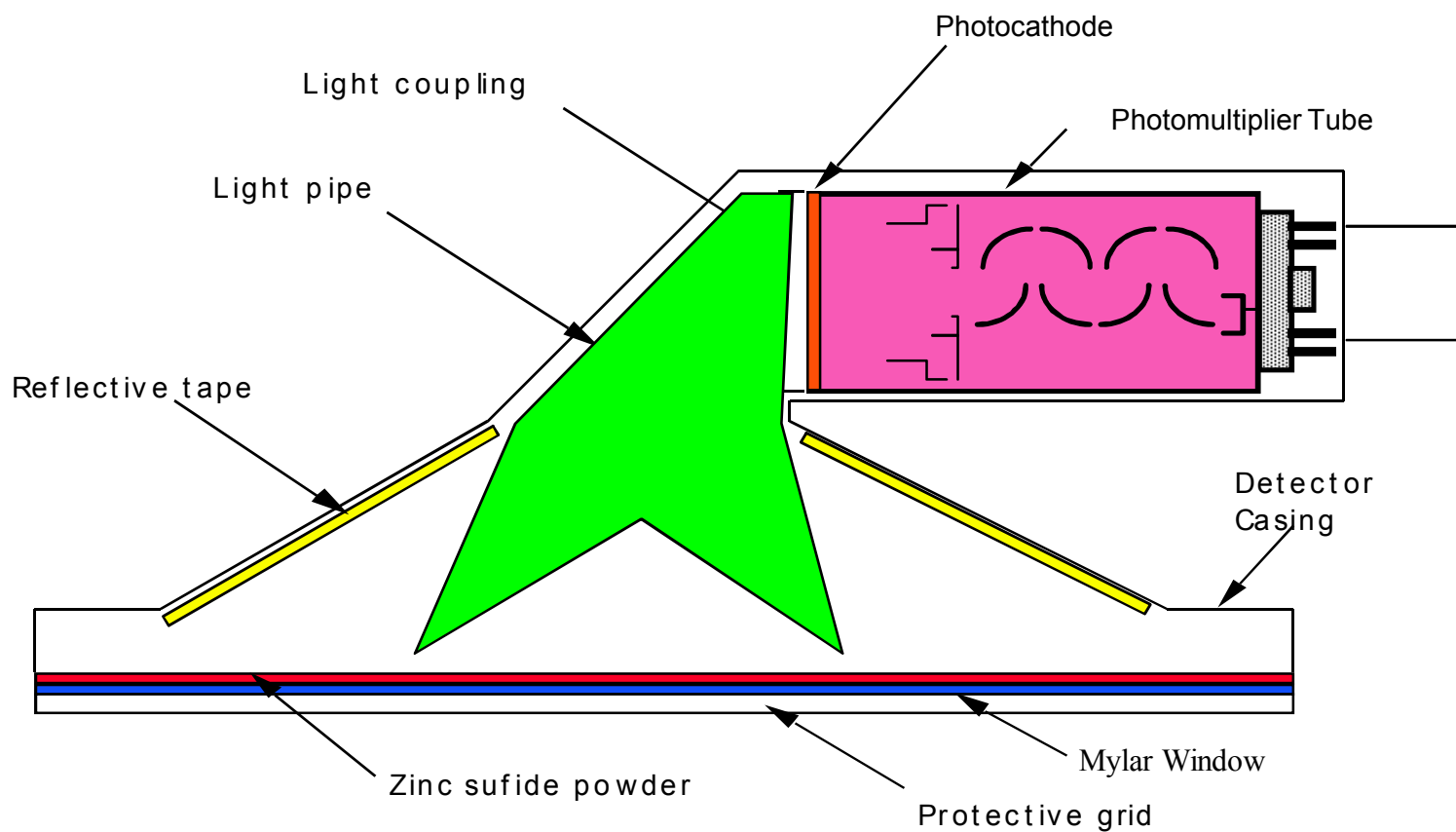


Eberline ASP-1 with SPA-3



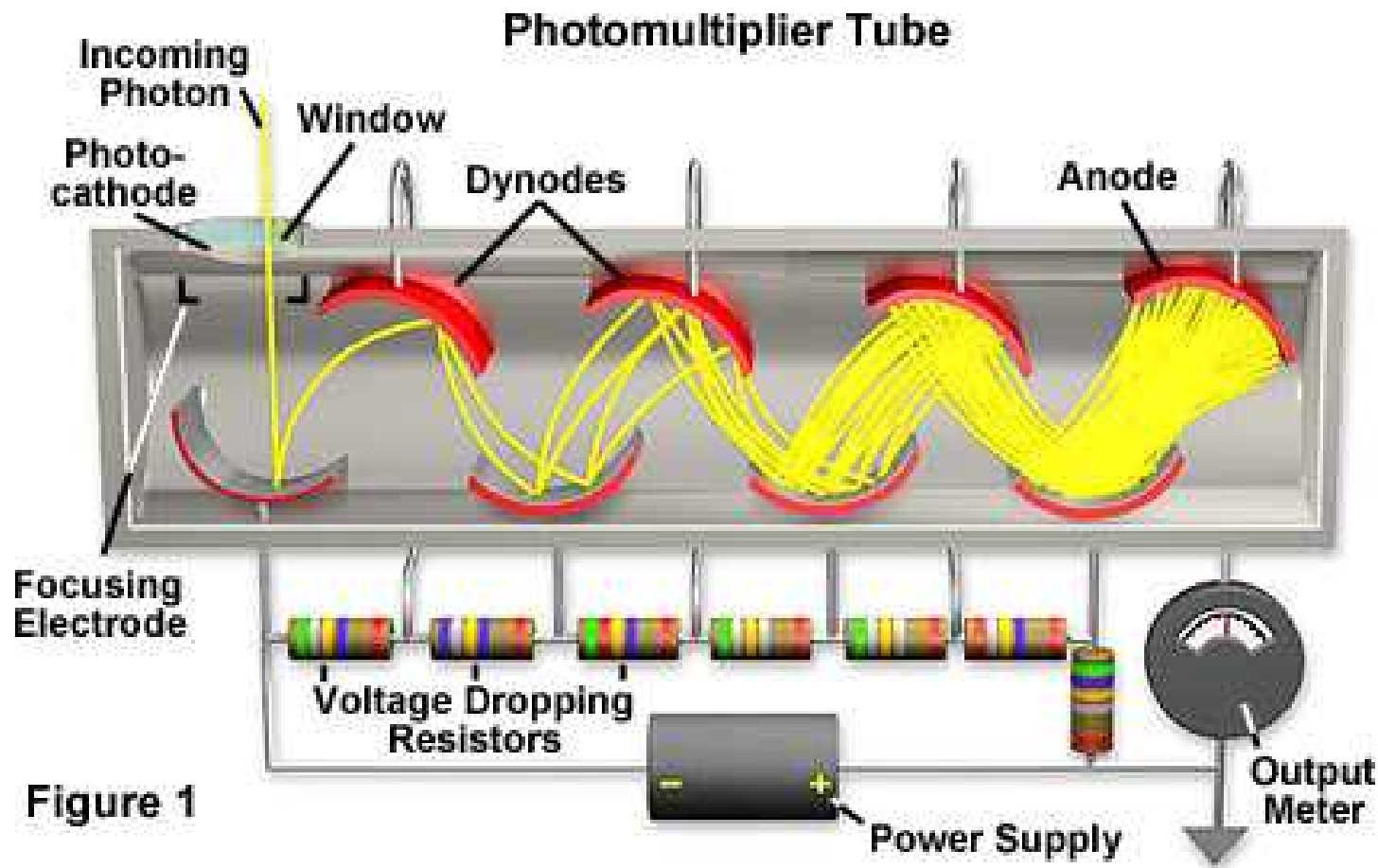


Scintillation Detectors





Scintillation Detectors





Reading the Meter Face



- Often require the user to multiply the displayed reading by a multiplier, based upon which scale the instrument is set.



Operator Adjustable Controls



- Battery check
- HV
- Range/Scale Selector
- Fast/Slow response
- Speaker





Reading the Meter

Scale = BAT

Meter = 0.7

Reading = BAT. O.K.





Reading the Meter

Scale = HV

Meter = 9.5

Reading = 950
(read bottom scale HV
X 100)







Reading the Meter

Scale = X1M

Meter = 0.4

Reading = 400000
CPS







Reading the Meter

Scale = X10K

Meter = 0.9

Reading = 9000 CPS





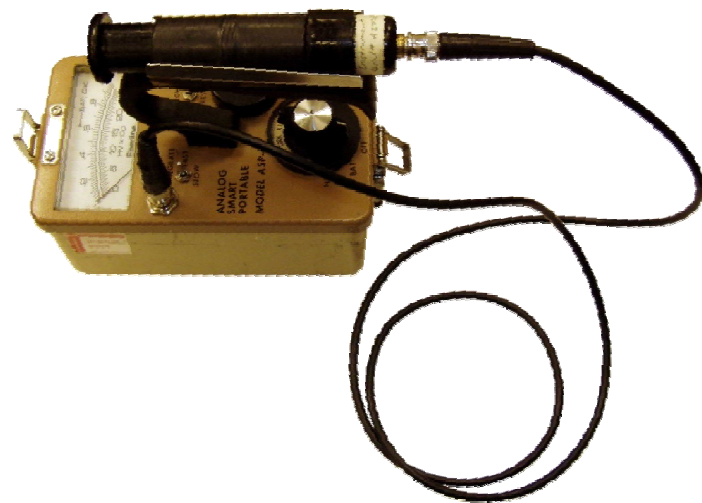




Radiation Exposure Survey Instruments

- Typically read in:
 - microSievert ($\mu\text{Sv/h}$)
 - milliSievert/hour (mSv/h)
 - Sievert/hour (Sv/h)

Best suited for use when entering a field of radiation





Application of Radiation Exposure Survey Instruments

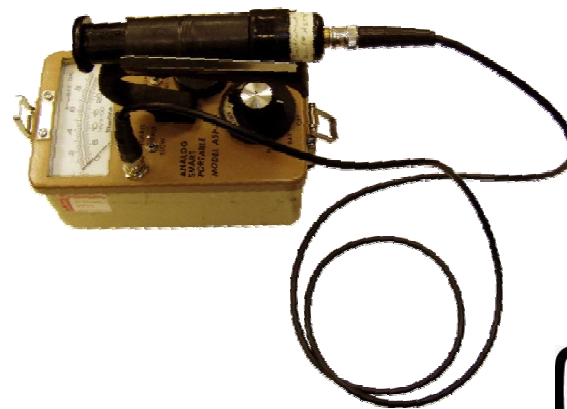
- Locating & marking positions of DU
- Establishing control zone boundaries
- Controlling personnel exposure





Application of Radiation Exposure Survey Instruments

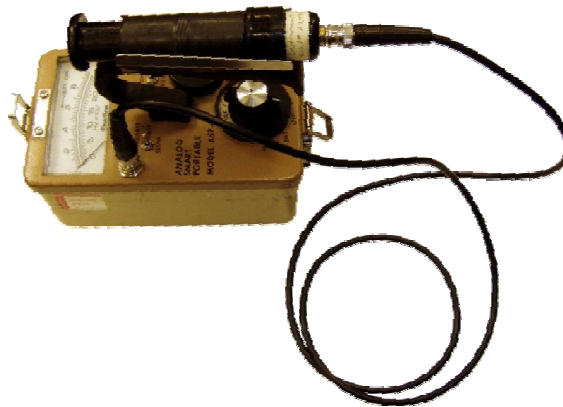
- Start with low-range survey instrument
- Follow procedures for pre-operational check of the instrument
 - Physical damage
 - Calibration
 - Battery condition
 - HV (if applicable)
 - Zero (if applicable)
 - Source response check





Application of Radiation Exposure Survey Instruments

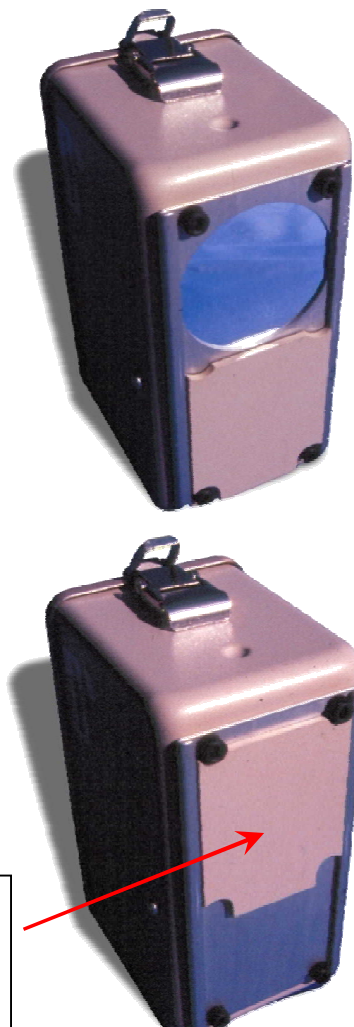
- Verify the instrument is on and set to the highest scale
- Check for audio and visual responses
 - Adjust scale to a lower setting as needed





Application of Radiation Exposure Survey Instruments

- Many instruments employ a movable beta shield to differentiate beta and gamma radiation
- With shield open, beta and gamma admitted
- With shield closed, gamma only admitted
- Open window reading minus closed window reading = beta contribution

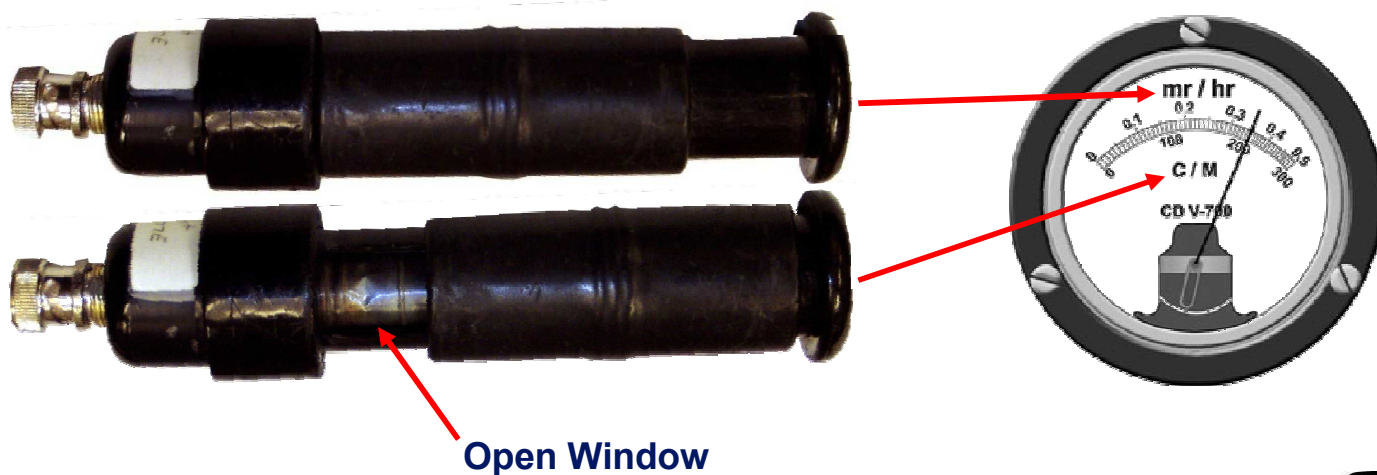


Movable
beta shield



Application of Radiation Exposure Survey Instruments

- Many survey instruments have meter faces that read in both CPM and mR/hr
- When using a side window GM probe, readings should be recorded in mR/hr when the probe window is closed, and in CPM when the probe window is open



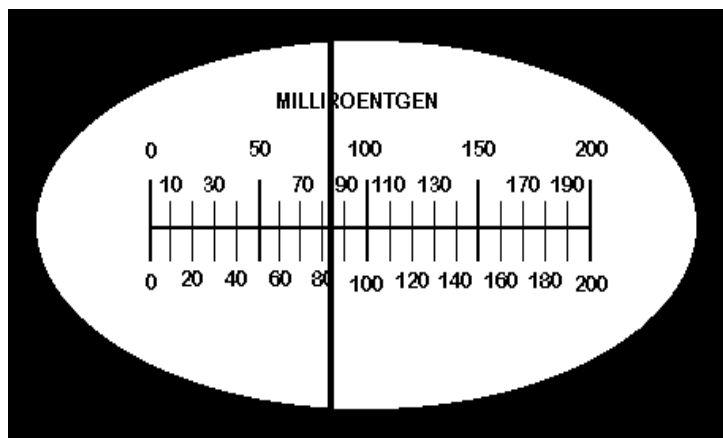


Dosimetry Devices



Self-Reading Dosimeter (SRD):

- Measures accumulated dose
- Hold up to light and look through the eyepiece to read
- Check frequently while in area





Dosimetry Devices



Electronic Dosimeter (ED):

- Measures accumulated dose
- Utilizes digital readout
- Many options available
- Audible response - chirp rate varies with radiation dose rate





Dosimetry Devices

Thermoluminescent Dosimeter (TLD):

- Measures accumulated dose
- Does not provide on-the-spot indication of dose
- Specialized equipment required to “read” TLD

