

ThermoFisher
S C I E N T I F I C

The world leader in serving science

Instrumentation

Post RDD Event Urban Reoccupancy

James P. Menge PE

Perception

- In the aftermath of a radiological emergency the public will see radiation and its potential hazards described in many confusing ways.
- The terms dose, exposure, stochastic, relative risk will create mis-understandings and fear.
- The Instrumentation utilized needs to provide information and not be called into question regarding its sensitivity, calibration or use.

Basic Information Required for Instrumentation Protocols

- Define type of radiation α , β , γ ,
- Define the area of contamination
 - Associated dose rates
 - Survey meter
 - General area contamination levels
 - Survey meter
- Define the Isotopic mixture – based on gamma energy
 - Handheld Isotopic Identification Unit
- Based on Isotopic mixture one contamination decon protocol option is
 - Half Life < 30 days - decay
 - Half Life >30 days – perform cleanup

Basic Instrumentation



number: 4250685



Items to Consider for Instrumentation Protocol

- The type of radiation will affect which Instruments are utilized
 - Alpha sources Po210, Am241, etc
 - Beta sources SrY90,

- Defining a baseline for contamination levels
 - Comparison to adjacent building structures
 - Comparison of building materials

- Location of contamination on outside building structures
 - Above 10 ft on building structures
 - Levels inside structure

- Outside Building Contamination decon methods
 - Hydro laser
 - chipping

Instrument sensitivity

- Need to ensure the type of instrument used has sufficient sensitivity to monitor levels of contamination.
 - Thin window GM detectors to look for alpha/beta particles
 - Ion Chamber with minimum sensitivity above ambient background.
 - Ambient Background
 - RDD Dispersal area
- Ensure instrument range is within monitoring parameters. Probe may meet sensitivity, but meter has higher scale.
- Instrument sensitivity and range of measurement needs to be documented. In addition, understand the detector response or efficiency to a given isotope.

Instrumentation

- Document instruments readings which then can be used to calculate dose values for EPA Protective Action Guidelines (PAGs) to initiate proper actions and be able to perform dose reconstruction.
- Contaminated areas may require a detailed release program such as Marisums to document areas to become releasable to public..
- In addition to instrumentation required for monitoring, personnel protective devices (PPDs) may be require such as lapel samplers, respirators, dosimetry (passive, electronic) to maintain personnel safety and minimize any additional over exposures.

Instrumentation QA program

- A QA program needs to ensure all instruments have proper documentation and calibration records.
 - Instrument and probe correlation
 - Instrument daily source check (qualitative)
 - Calibration standards are checked
 - Instrument calibration records fully documented
 - Calibration technicians have proper documentation to calibrate instrument.
- In addition, personnel performing measurements must have training certifications to ensure proper measurements are obtained.

Monitoring Methods

- Air
 - Ambient
 - Intake Ducts
- Survey Instruments
 - Dose Rate
 - Count Rate
 - Flat
 - Building walls
- Area
- Remote Monitoring

AIR/Duct Instrumentation

- Ambient Air within Contaminated Zone
 - Use of Portable CAMS (Continuous Air Monitors)
 - Alternative Portable Grab Samples
 - Need to develop frequency protocol and sample counting detection limits

- Building Intakes for Ventilation Ducts
 - Building intakes typically have filters. Particles <10 um will be concern.
 - Length of sample lines – particle plate out
 - Filter paper selection
 - Portable CAMS (Continuous Air Monitors)
 - Portable Grab Samples
 - Need to develop frequency protocol and sample counting detection limits

- Lab Counters for Grab samples
 - Minimal Detection Activity (MDA) needs to be defined.
 - Counting times become critical to ensure proper measurement results
 - Use of statistics is critical to ensure proper counting methodology

Air Monitor Example



Survey Instrumentation (dose rate)

- Ion Chambers - sensitive radiation detection devices for measuring dose rate (min energy dependence $>100\text{keV}$)
- Thick walled GM detectors - potential over/under response based on isotopic nature of contamination
- Newer GM based instrumentation incorporates the utilization of algorithms which minimizes this issue

Surface Contamination Instrumentation (count rate)

- **Geiger-Mueller (GM)** – GM detectors are sensitive radiation detection devices that can be capable of measuring alpha, beta, and gamma radiation. The GM detector, or Geiger counter, has a thin window probe (pancake).
 - Note there are other GM detectors with thick walled detector which are used to measure dose rates.
- Other type of Probes
 - 100 sq cm probes
 - Large area probes (600 sq cm)
- **Scintillation Detectors** – are more sensitive than GM detectors and have ability to detect alpha (ZnS) and beta particles (plastic).
- **Sodium NaI Detectors** – are more sensitive than GM detectors to measure gamma radiation from contamination.

Area Monitors

- Small Area Monitors
 - Stationary devices set up to detect radiation over a wide area continuously. An area monitor should be capable of reading below normal background, and be able to transmit data.
- Environmental area monitors
 - Monitoring devices set to detect radiation above environmental readings.

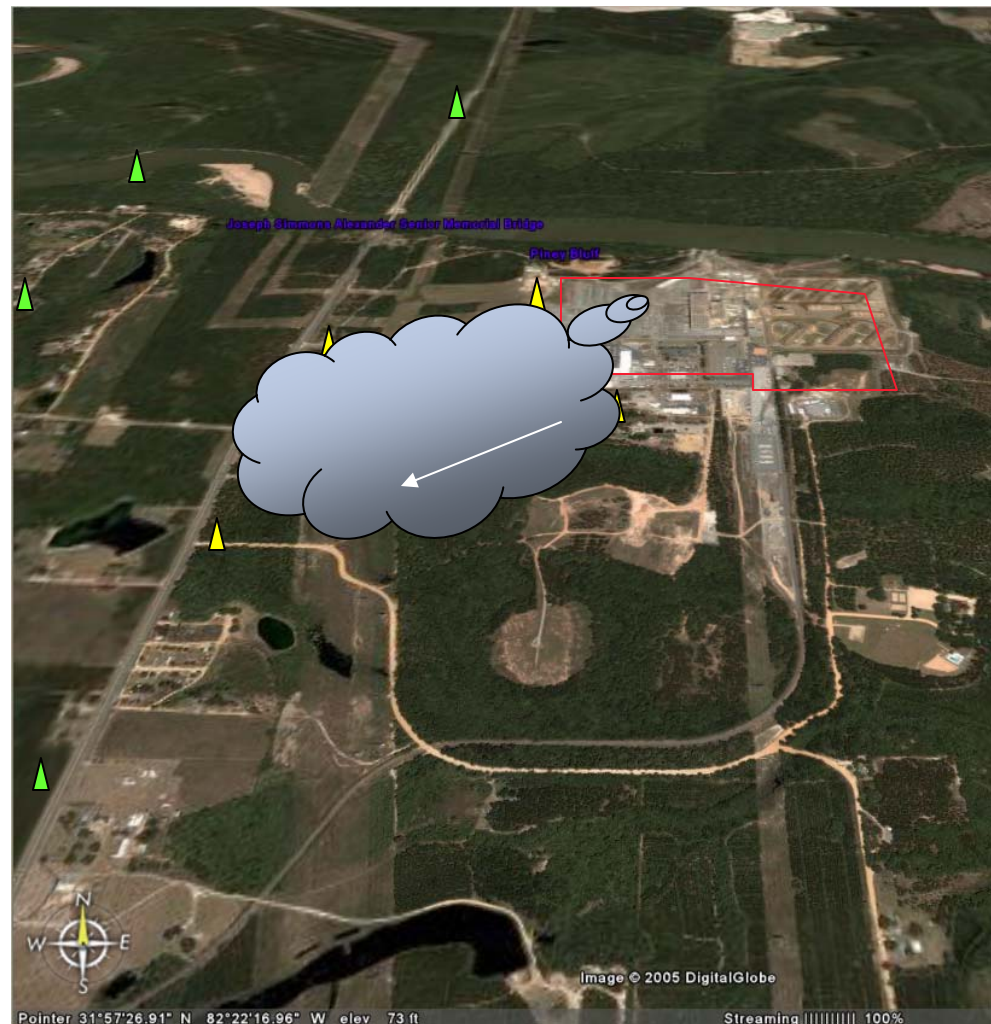


Remote Monitoring

- Various instrumentation that can communicate back to center site.
- Provide continuous reading of areas
- Decon crews using smart instruments which transmit direct back for record keeping.
- GPS tracking allows real-time monitoring and documentation.

Remote Monitoring and Emergency Operations Facilities

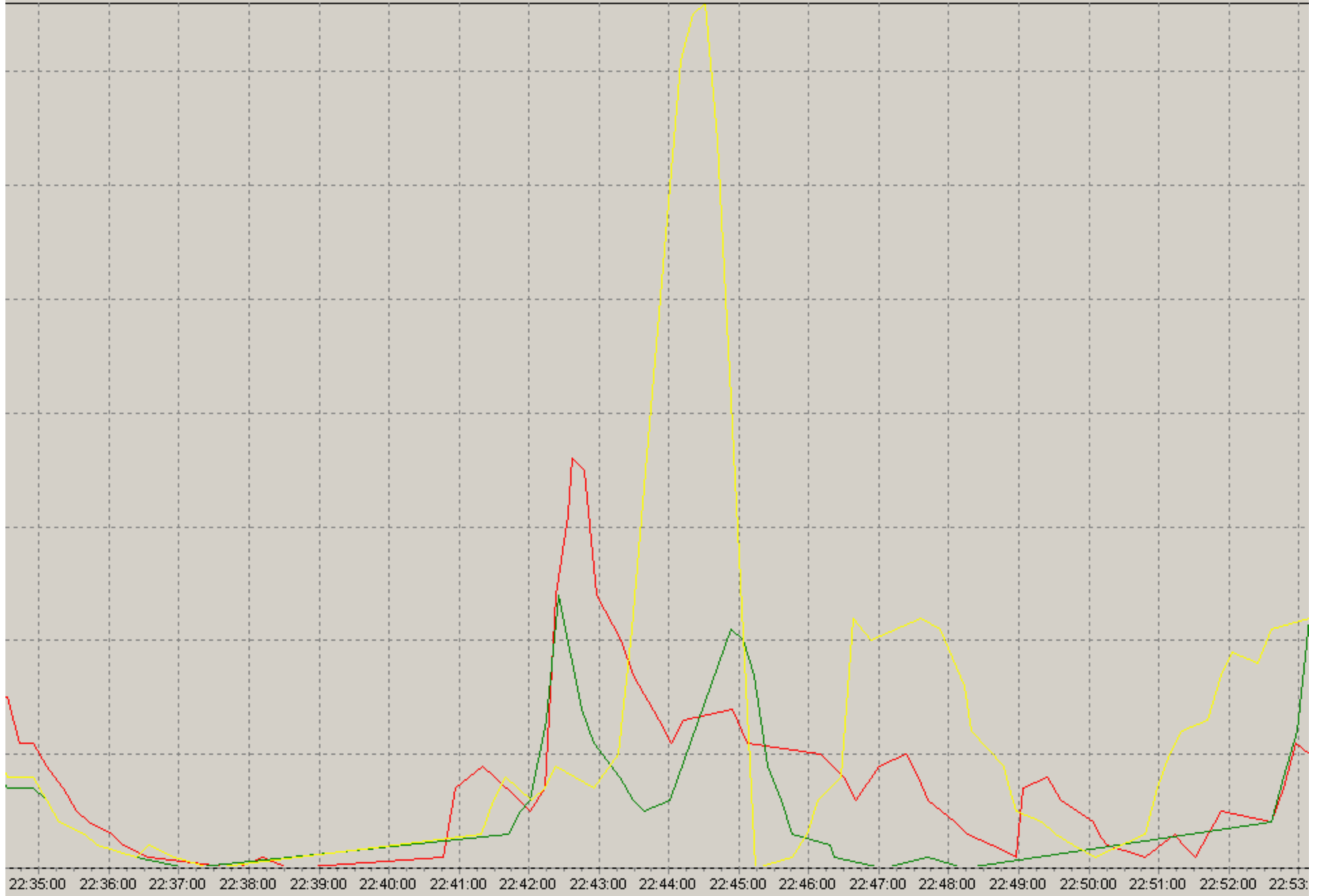
- Field teams briefed to deploy Probes
 - Probes can be pre deployed based on wind direction and speed.
 - Probes are quickly dropped out of the Field Team vehicle, turned on and left in place for monitoring.
- Emergency Operations Center (EOC) personnel monitor real-time radiation measurements from probes via ViewPoint Application with Mapping.
 - Data is transmitted back to the Emergency Operations Facility for Dose assessment personnel.
 - Data transmitted either by local wireless system or via satellite communications.



Remote Monitoring Applications/Uses

- Remote, real-time coverage of personnel working; supplement and/or replace in-field technician coverage;
- Real-time monitoring of dose rate areas; supplement or replace traditional manual and 'dose intensive' form of obtaining radiation surveys;
- Data Collection for records

Thermo EPD2 - D Rate(mrem/h)



Data Collection

- The data collected requires detailed format to ensure incoming data can be readily used.
- Data Filters may be required to quickly highlight areas of concern.
- The data needs to be correlated to individual instruments to ensure accuracy and proper documentation.

Questions?

- Jim Menge PE
- ThermoFisher RMSI