

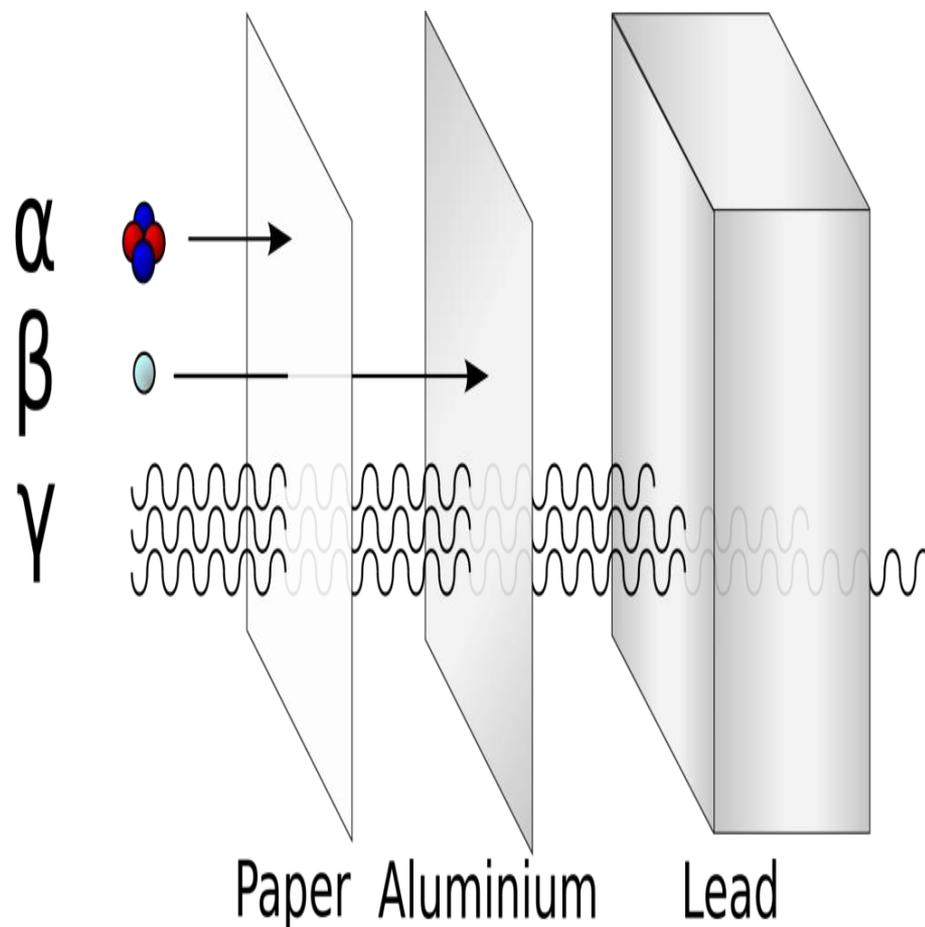


Department of
**Environment &
Conservation**

Use of Radiation Detection Devices

Types of Ionizing Radiation

- Alpha Radiation
 - Alpha radiation is a heavy, very short-range particle.
- Beta Radiation
 - Beta radiation is a light, short-range particle and is actually an ejected electron.
- Gamma and X-Ray Radiation
 - Gamma radiation and x rays are highly penetrating electromagnetic radiation.



Units of Radiation Measurement

- Units of external Exposure are in Roentgen (R)
- Units of exposure to the human body are in REM
 - Stands for Roentgen Equivalent Man- takes into account the biological effect on the body from different types of radiation
- Units of Absorbed dose (any material) are in RAD
 - Stands for radiation absorbed dose
- In air, $1R = 1REM = 1RAD$
- Units expressing number of disintegrations per minute by the radioactive material, CPM
 - Stands for counts per minute
- Any of the units may use prefixes
 - Milli (m) = 1/1000 of base unit
 - Micro (μ) = 1/1e6 of base unit

Importance of Radiation Monitoring Equipment

- Radiation cannot be detected by human senses
- No single instrument can detect or measure all forms of radiation
- Programs and procedures in place to detail what devices should be used
- Many types and manufactures exist
- Wide range of costs



Choosing the Right Tool for the Job

- Questions to Ask
 - Environment
 - Indoor, outdoor, vehicle, vacant lot, etc
 - Heavy equipment available
 - Surface to unload on
 - Site History
 - Is Nuclide ID information available?
 - Preliminary radiation readings, if any?
 - Where did it come from?
 - What form of scrap material involved
 - Cars, metal, trash, etc
- Decisions to make
 - **Instrumentation needed**
 - Staffing needed
 - PPE types
 - Sampling equipment

Typical Instrument Choices

- Ludlum 12s or similar micro R meter for gamma readings
 - Gamma only
- Ludlum 193-6 for hard to reach areas
 - Gamma only
- Ludlum Model 3 or 26-1 frisker probe for isolation of material or checking for removable contamination
 - Alpha, Beta, Gamma (low sensitivity)
- RIIDeye or similar handheld isotope identifier

Micro R meters

- Ludlum 19 or 12s
- Ludlum 193-6



Pancake Probes

- Ludlum Model 3



- Ludlum 26-1



All Inclusive Kit Option

- Ludlum Model 2241-3 Kit
 - Includes 4 probes
 - 43-65 (Alpha, Beta, limited gamma)
 - 44-9 (some Alpha, Beta, Gamma)
 - 44-2 (Gamma Only)
 - 44-38 (Beta, Gamma)
 - Other probes available for purchase



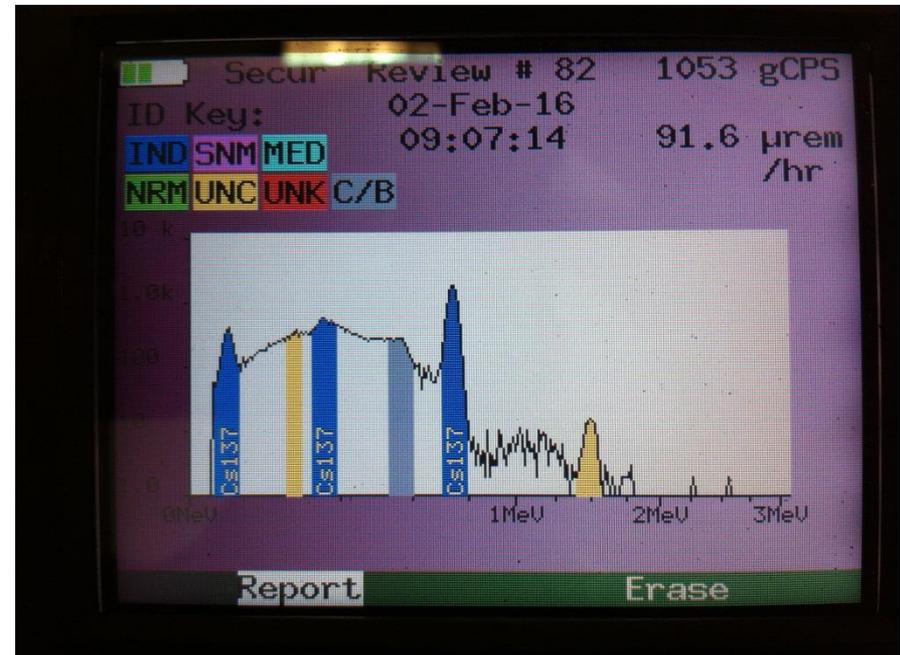
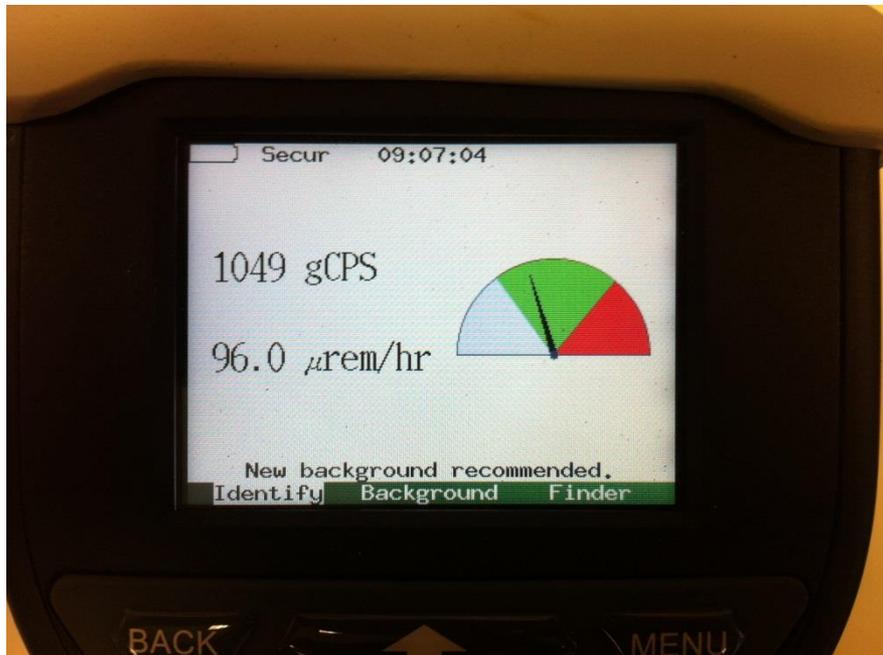
Gamma Spectroscopy Instrumentation

- Thermo RIID-eye
 - Hand held multi channel analyzer
 - Functions by assigning energies to channels
 - As energy is absorbed by the detector, the computer sorts it into the assigned channel on a spectrum
 - After enough counts have been collected the computer analyzes the spectrum and tries to identify which radionuclide is present
 - Only as good as the library installed
 - Best analysis when dial is in the “green zone”



Steps and Screen Shots

- Once in Green Zone select and press enter on Identify
 - Default is 30 seconds count; select +30 to increase count time
- Once counting is done the MCA will show a spectrum and report indicating Nuclide(s) present
- Have spectrum verified, MCA's are only as good as their library that is installed



Other Gear Needed

- Trowel
- Sediment Cups w/ tops
- Electrical Tape
- Duct tape
- Rad Tape
- Cable ties (zip ties)
- Plastic bags (ziplocks)
- Large Yellow Rad Bags / large trash bags
- Rubber Gloves
- Swipes and envelopes
- Hammer
- Chisel
- Tweezers
- Safety glasses
- Dust masks
- Work gloves
- Markers (Sharpies)
- Measuring tape

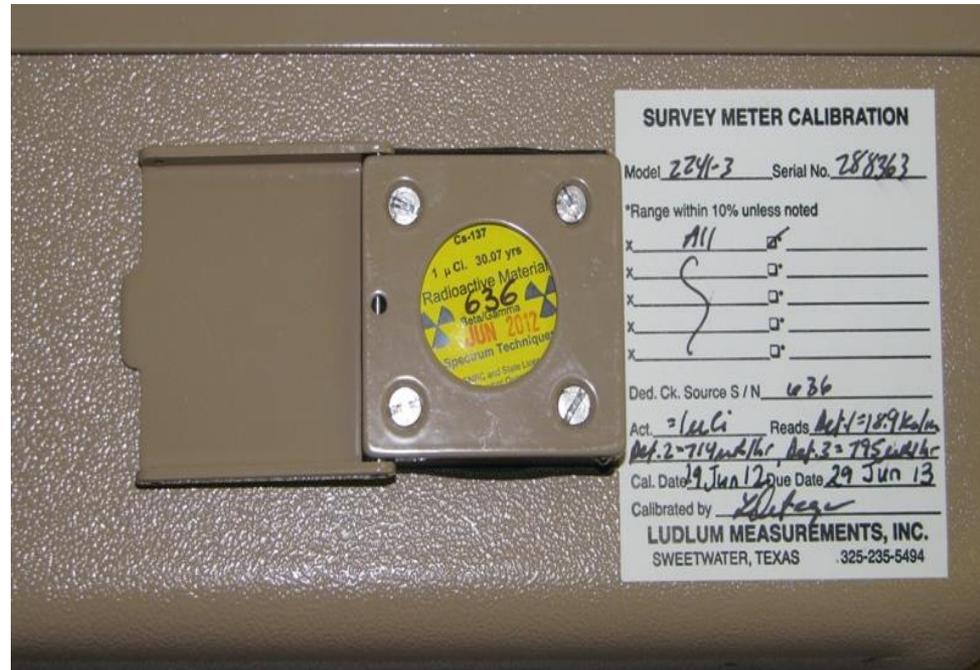


Upon Arrival at Site

- Some information is typically available
 - Type of material and associated hazards
 - Preliminary location of “source” in the load or trailer
 - This information is typically provided via the drive through portal monitor used to screen trailer loads
- Facility point of contact should:
 - Have a location available for one to survey and isolate the source
 - Preferably a smooth concrete or “cleanable” surface in the event of contamination.
 - If unavailable, tarps can be used to cover gravel
 - Have staff and machinery available to assist in the sorting

Before Work Begins

- Operationally check the instrument
 - Battery check
 - Response check
 - Calibration date check
 - Establish background
 - Operational checks could make the difference between life and death of a worker
- Establish background on each probe or instrument
- Define trip levels
 - Example: twice background or 300 cpm
- Establish turn-back limits
 - Stop and back up if you reach a turn-back limit.
 - These limits could save your life



Typical Survey and Separation Techniques

- Approach the vehicle or trailer with the meter on the most sensitive setting and the audio on; remember turn-back limits
- Begin survey at preliminary source location, but survey entire vehicle for verification
- Once source has been located from the outside of vehicle, attempt to use RIID to identify the radionuclide of concern
- Use available resources to carefully unload the material in the “source area” of the vehicle or trailer
- Note any immediate hazards pertinent to the material and bag item to prevent further contamination of area
- Once source has been bagged and segregated from the other material, begin making a nuclide/material identification
- Re-survey the trailer to ensure that no more radioactive material remains in the load of scrap

After Identification Decisions

- Where will the material be stored
 - Minor sources not dangerous to human health can be temporarily stored on site in a secure isolated area until disposal
 - Higher activity sources must be dealt with differently depending on situations
- Rad waste broker list available on CRCPD website

Radioactive Waste Broker & Decontamination Services¹

CRCPD Notes of July 28, 2015

Firm ²	Served ³	Contact	Voice Phone	E-mail	Mail out Test Kit	Leak Diable	Decon/Decont Bldgs & Grounds	Decon Vehicles	Deal with Radium	Deal with Mixed Waste	Store for Import/Export	Assist with Rad/N Provide Meters	Calibr Tmg	Encaps as Form	date as Spec	His QA
Ameriphysics	E & Mid-W	Annette Hansen	TN 865/470-4173	annette@ameriphysics.com	Yes	some	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Applied Health Physics	N,East	Anthony Hull	PA 412/835-9555	ahp.inc@comcast.net	Yes	some	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Bionomics	E & Mid-W	John McCormick	TN 800/578-6513	bionomicsjohn@comcast.net	No	Some	Yes	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Chase Environmental	All	John O'Neil	TN 865/481-8801	john@chaseenv.com	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes
Curie Environmental Services	All	Scott Logan	NM 505.688.8932	scott.logan@curieservices.com	no	some	some	yes	yes	yes	yes	yes	yes	no	NCRM	No
DeLuxe Services	All	Paul Jones	TN 865/813-1416	pjones@deluxe.com	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Ecology Services	East	Paul Marshall	MD 800/932-7299	pmarshall@ecologyservices.com	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Energy Solutions (Duratek)	East	Damie Brackett	TN 865/220-3336	dbrackett@energysolutions.com	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Environ. Mgt. Crts. (EMC)	N,CA,NV,CO	Richard Gallego	CA 714.907.8000	rgallego@epinc.com	Yes	No	Some	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Environ. Mgt. Services	All	Thom Das	CA 510.828-4962	tdas@sbglobal.net	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
New World Technol.	West	Mike Wilson	CA 925/443-7967	mike@newworld.org	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Next Generation Solutions	Mid-West	Robt. Krumberger	CO 303-353-1979	rkrumberger@ngs.us	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
NSS	All	Robt. Gallagher	TX 713/641-0391	rdgallagher@nssshouston.com	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Philotechnics	All	Meghan Turvey	TN 865/285-3064	mturvey@philotechnics.com	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Some	Yes
Philotechnics	All	Robert Trimble	CA 858/586-2582	rstrimble@philotechnics.com	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qal-Tek Associates	All	Travis Snowder	ID 888/523-5557	tsnow@qaltek.com	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Radiax Research	N,East	Ari Green	NY 718/963-2233 x207	agreen@radiax.com	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Radiation Safety Assoc.	Atlantic	Paul Steilmeyer	CT 860/228-4287	apstein@radpro.com	Yes	Yes	Yes	Yes	Some	Yes	No	Yes	Yes	Yes	Yes	Yes
RAM Services	All	Jerry Wilis	MI 800/896-3889	twil@ram-services.com	Yes	Yes	Some	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes
R.M. Weaver	Mid-West	Joak Koch	MO 636/929-9628	joak@rmweaver.com	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Rocky Mt. H.P. Consultants	Rocky Mts.	Edd Johnson	UT 801/560-3778	edjohn@rd@aol.com	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
RSO, Inc.	East	David Wellner	MD 301/953-2482 x306	dwellner@rsocinc.com	Yes	No	-	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RSO, Inc.	East	Greg Smith	MD 301/953-2482 x322	gsmith@rsocinc.com	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Soluzient Technologies	All	Dell Reuss	OH 330/497-5905	rich@soluzientech.com	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	Some	Yes	Yes
Thomas Grey Assoc.	West	Richard Gallego	CA 714/997-8090	rich@tgsinc.com	Yes	Some	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Visionary Solutions,LLC	All	Anne Weaver	TN 865-482-8670	aweaver@vs-llc.com	No	No	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Waste Cont'l Specialists LLC	All	Lisa Berta	TX 432/525-8650	lberta@wstexas.com	No	No	No	Some	Yes	Yes	Yes	Yes	No	No	Yes	Yes

¹ All firms inspect materials, identify radionuclides, deal with leaking sources and associated contamination, provide packaging, contract for manufacturer's acceptance or waste processing and disposal as applicable, arrange transport and disposal permits, and report material transfer. Additional firms that specialize in NORM scale are on www.crcpd.org "Tree Documents," "Commercial Services," see "Radioactive Site Investigation and Decontamination Services." Energy Solutions has a program for rental of radiation meters and other instruments. <http://www.shopping.net/site.com/instrumentation>

² A firm is listed here if it has staff and equipment to provide the services, described in footnote 1 and columns, to the general public in multiple states and has good reputation among radiation control authorities.

³ Principal region served: North-East = north of Virginia, East = east of Mississippi River, Mid-west = from Rocky Mt. to Appalachians, West = west of great plains.

Conference of Radiation Control Program Directors, Inc. (CRCPD) www.crcpd.org

This information is not to be construed as an endorsement by CRCPD, Inc., of the services identified in this list.

Sources Found in Tennessee

Radium - 226



Japanese Military Radio



Dashboard Gauges & Navy Clock



Radium Scale Buildup in Pipe



Compasses



Refractory Brick



Unknown



Check Sources and Licensed Material



Boeing 777 Cabin Air Filter



GL device found at landfill



Staff Contact information

- Division of Radiological Health Main Line
 - 615-532-0387
- Jerry Bingaman, Tennessee Tower
 - 615-532-7521
- Trevor Jackson, Tennessee Tower
 - 615-532-0394
- Ryan Crihfield, Tennessee Tower
 - 615-532-0387
- TDEC-Radiological Health Website:
<http://www.tn.gov/environment/section/rh-radiological-health>
- CRCPD Website: crcpd.org
- Nuclear Regulatory Commission: nrc.gov