Radiation in Scrap Metal

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Accidental Melting of Radioactive Materials (global summary)

- Since 1982, 50 confirmed instances of accidental meltings of radioactive materials
- Of these, 29 occurred in the U.S., 21 reported foreign events (Taiwan, Mexico, Brazil (2), Italy (4), Ireland, India, Russia, Estonia, Kazakhstan, South Africa, Bulgaria, Poland, Canada, Sweden, Austria, Czech Republic, Germany, and Greece)
- 13 Co; 25 Cs; 4 Ra; 1 Acc.; 3 Th; 1 U; 2 Am; 1 ?
- 35 in steel mills; Al-7; Cu-2; Pb-2; Zn-1; Au-2; V-1
- Most U.S. events were discovered monitoring by-products (slags, dross or flue dust)

Accidental Meltings of Radioactive Materials in the USA

Year	Metal	Location	Isotope	Activity (GBq)
multiple	gold	multiple	Pb-210, Bi-210 Po-210	unknown
1983	steel	Auburn Steel, NY	Co-60	930
1983	gold	unknown, NY	Am-241	unknown
1984	steel	U.S. Pipe & Foundry, AL	Cs-137	0.37-1.9
1985	steel	Tamco, CA	Cs-137	56
1987	steel	Florida Steel, FL	Cs-137	0.93
1987	aluminum	United Technology, IN	Ra-226	0.74
1988	lead	ALCO Pacific, CA	Cs-137	0.74-0.93
1988	copper	Warrington, MO	accelerator	unknown
1989	steel	Bayou Steel, LA	Cs-137	19
1989	steel	Cyclomp, PA	Th	unknown
1990	steel	NUCOR Steel, UT	Cs-137	unknown
1991	aluminum	Alcan Recycling, TN	Th	unknown
1992	steel	Newport Steel, KY	Cs-137	12
1992	aluminum	Reynolds, VA	Ra-226	unknown
1992	steel	Border Steel, TX	Cs-137	4.8-7.4
1992	steel	Keystone Wire, IL	Cs-137	unknown
1993	steel	Auburn Steel, NY	Cs-137	37
1993	steel	Newport Steel, KY	Cs-137	7.4
1993	steel	Chaparral Steel, TX	Cs-137	unknown
1993	zinc	Southern Zinc, GA	depleted U	unknown
1993	steel	Floride Steel, FL	Cs-137	unknown
1994	steel	Austeel Lemont, IL	Cs-137	0.074
1994	steel	US Pipe & Foundry, CA	Cs-137	unknown
1996	aluminum	Bluegrass Recycling, KY	Th-232	unknown
1997	aluminum	White Salvage Co., TN	Am-241	unknown
1997	steel	WCI, OH	Co-60	0.9(?)
1997	steel	Kentucky Electric, KY	Cs-137	1.3
1997	steel	Birmingham Steel, AL	CS-137/Am-241	7 Bq/g
1997	steel	Bethlehem Steel, IN	Co-60	0.2
1998	aluminum	Southern Aluminum, AL	Th	unknown

Note: Table is compiled from database maintained by James Yusko, CHP, Pennsylvania Dept. of Environmental Protection, 400 Waterfront Drive, Pittsburgh, PA, 15222-4745, USA.

If you "Process" a Radiation Source...

- Health Effects-Workers can be killed or seriously injured if an industrial source is shredded or melted.
- Cleanup Costs-Depending on how soon the event is recognized, cleanup costs can be up to $20,000,000.
- Downtime Costs-Expect 1-4 weeks of shutdown.
- Disposal Costs-Adding insult to injury, no one wants your contaminated material.

What's the Chance?

- NRC estimates over 1.8 million sources
- About 200 reported lost every year
- Many more sources could enter scrap stream through theft or ignorance when companies close down.

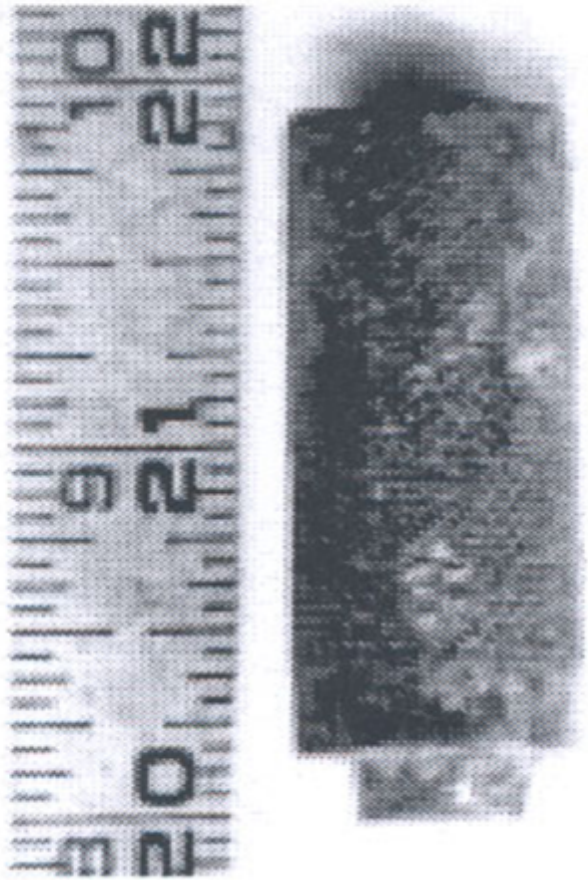
Industrial Sources: Public Enemy #1

Description:	Lunch-box appearance. Steel shell with integrated carrying handle and a round hose connector at each end.
Size:	Approx. 12" × 8" × 6" (30 cm × 20 cm × 15 cm)
Weight:	Approx. 45 lb (20 kg)
Color:	Variable, often orange.

More Industrial Sources

Description:	Steel container, normally cylindrical. May have lifting handles.
Size:	Approx. 8-15" (20-40 cm) in diameter, and 12-24" (30-60 cm) high
Weight:	55-300 lb (25-125 kg)
Color:	Variable.

Inside a Radiation Source



An unshielded caesium-137 found buried in gravel at a metal scrapyard in Illinois. The scale is in inches.

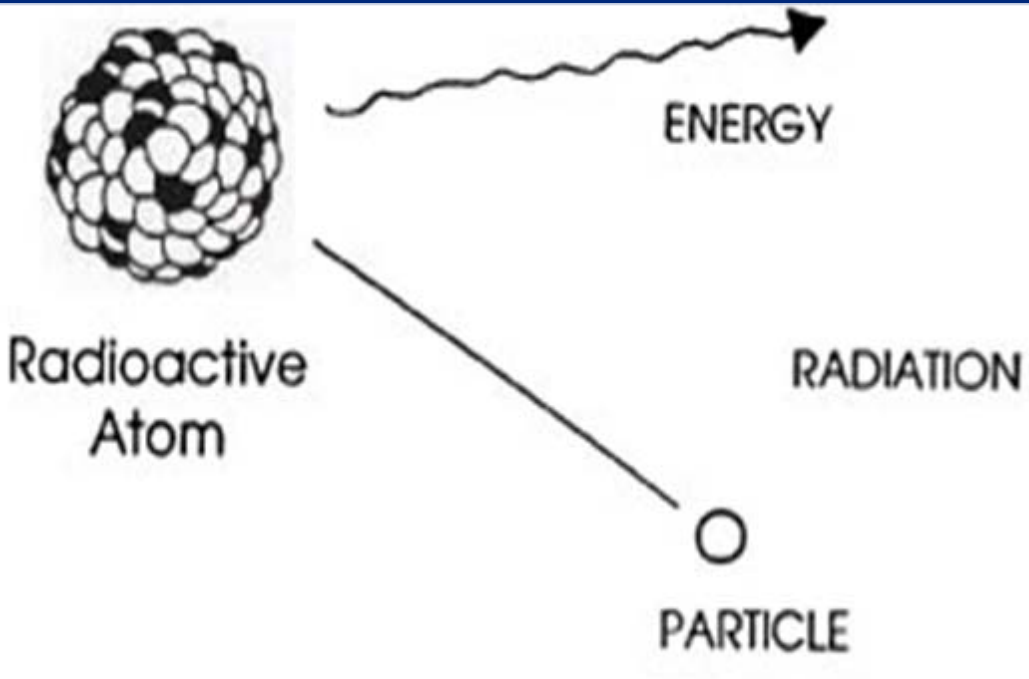
Radiation Questions

- What does it look like?
- What is it?
- Where is it found?
- What is “normal” Radiation?
- When is it dangerous?
- How do I measure it?
- When do I call for help?

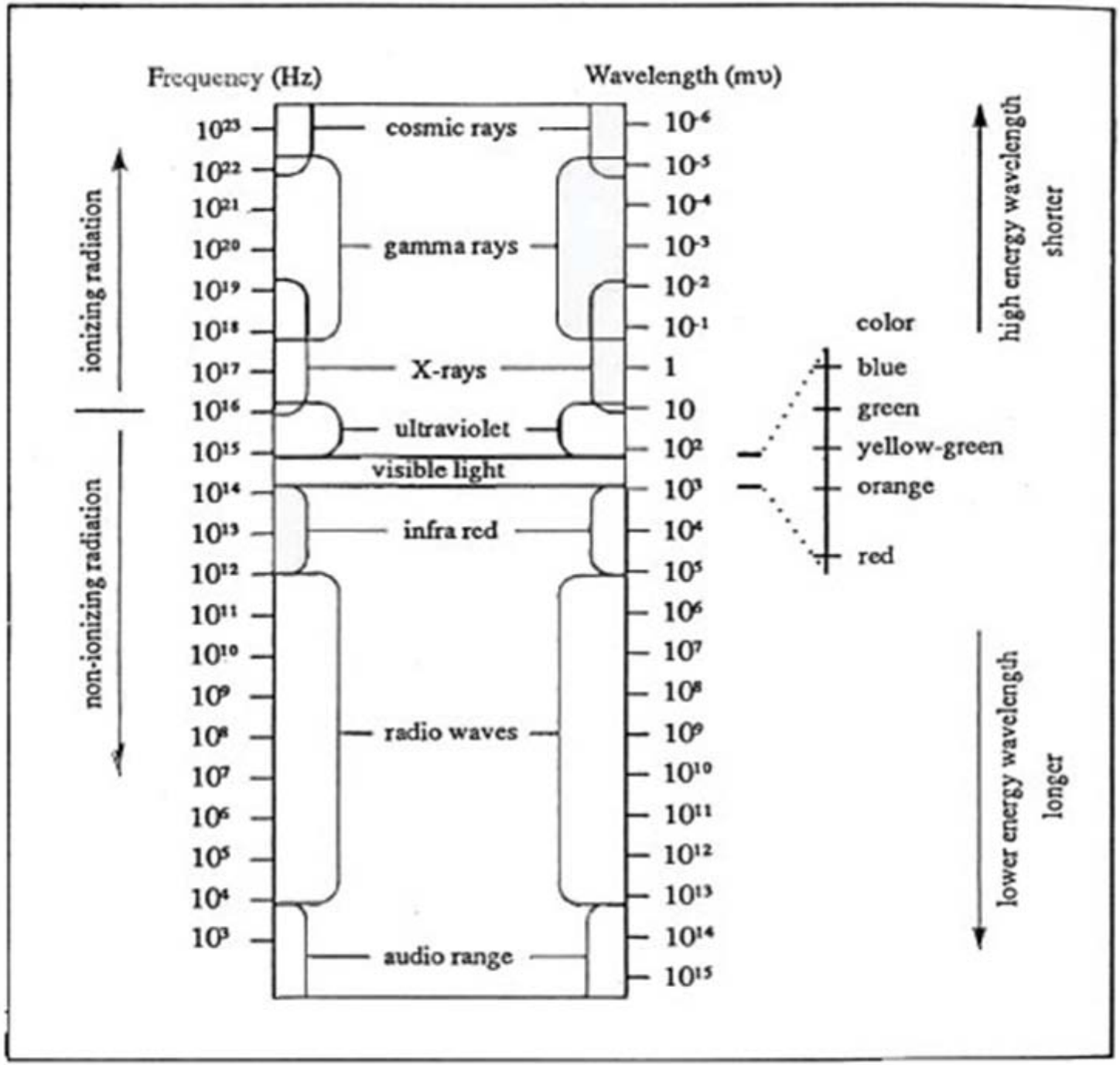
What Radiation looks like:

- A fact which incidentally pleases instrument manufacturers....

What Is Radiation?



RADIOACTIVE ATOMS are unstable due to some excess of energy in their nuclei. In an attempt to become more stable, a radioactive atom disintegrates (or decays) by ejecting particles or electromagnetic energy (photons). Radioactive material ejects particles and/or photon energy as it decays. The particles and/or energy emitted are **RADIATION**.



The Electromagnetic Spectrum

Where is Radiation?

- Tobacco products
- Welding rods and welds
- Cat Litter
- Brazil Nuts
- Pipe Scale
- Potassium Salts
- Marijuana
- Some Glass, Brick, Ceramic, and Porcelain
- Jewelry
- Fertilizer
- “glow-in-the-dark” paints
- All Life As We Know It

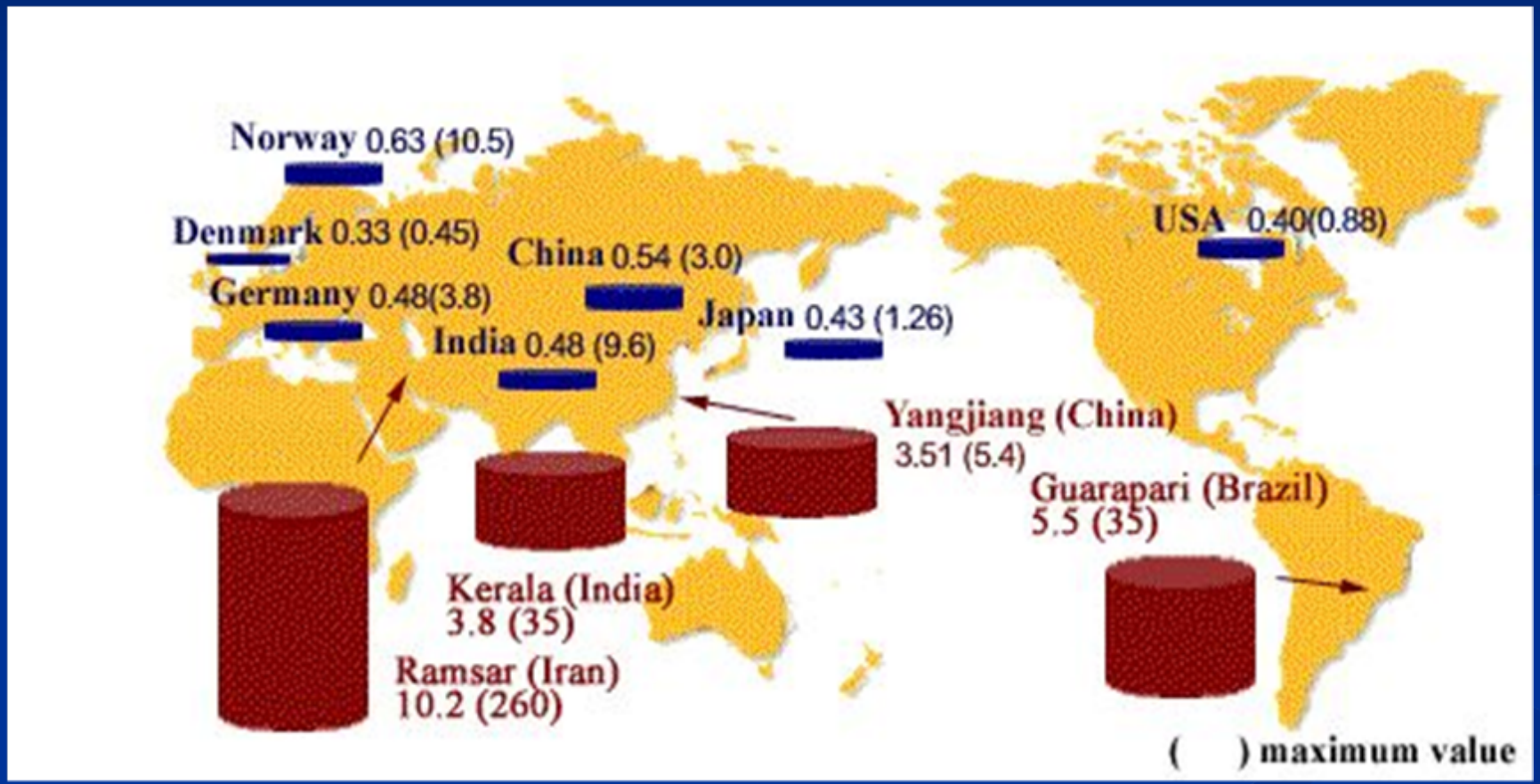
Makes you wonder what the phrase “nuclear-free” means...

“Normal Background”

- Nuclear Weapons Testing 1%
- Internal Radiation 4%
- Terrestrial Sources 10%
- Cosmic Sources 10%
- Radon 60%
- Medical Exposures 15%

- A lethal dose would be approximately equal to 500 years of normal exposure. Put another way, to receive a lethal dose in 1 hour, the “normal “ radiation level would have to be multiplied by about 5 million.

“Normal” Radiation



- Radiation dose varies by a factor of 30 throughout the world, without any observable medical effects.

What is SAFE?

- Government won't define a safe level of radiation.
- NRC (Nuclear Regulatory Commission) allows general public to be exposed from 5 μR/hr (background) to 500 μR/hr for up to 8 hours per day.
- Most scintillation radiation detectors measure radiation up to about 5000 μR/hr (or 5 mR/hr). Above that, it's best to stop, not allow anyone closer, and to call the state department of health, the EPA, or the NRC.

NORM (Naturally Occuring Radioactive Material)

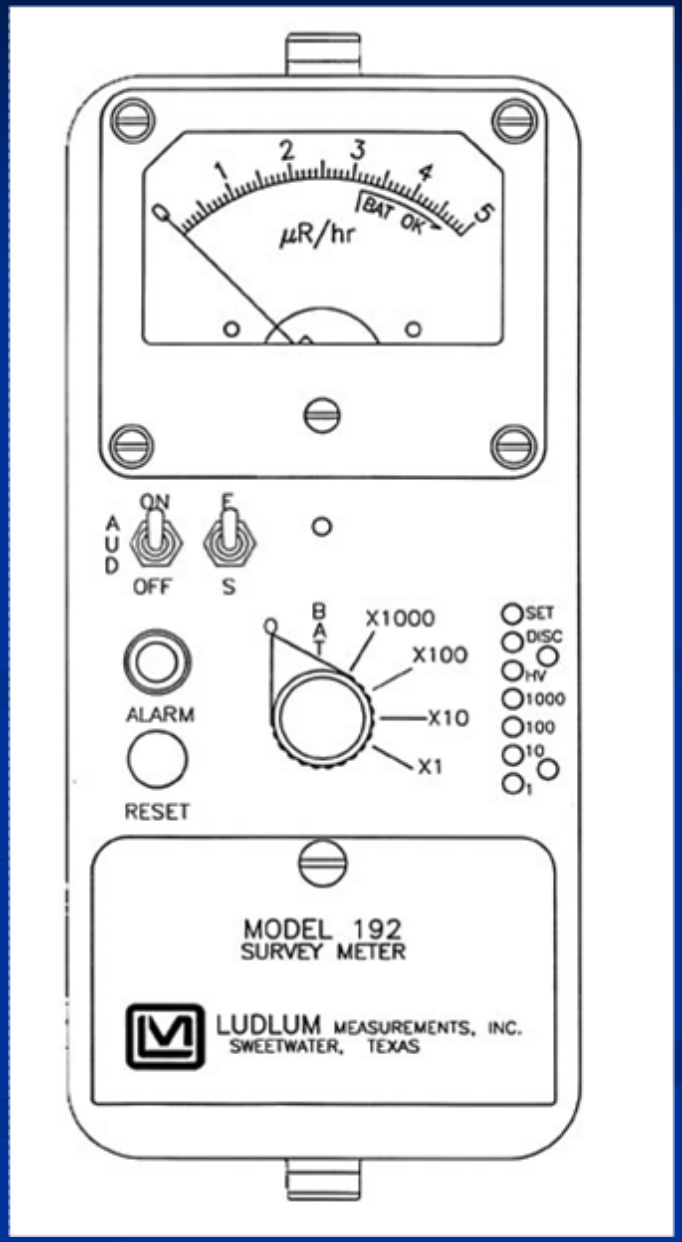
- Natural material inadvertantly concentrated by some industrial process
- Oilfield pipe is most common example, resulting from radium deposits deep in the earth.
- Other processes include mining and seawater processing.
- Many raw materials contain enough radium or potassium to set off alarms.

Radiation Instrumentation

- Instruments are widely available
- Can be classified as portable or fixed
- Can also be classified as detection, measurement, or identification
- Prices on portable detection/measurement units generally in the $1K-2K
- Prices on fixed detection systems can vary from $1K-$100K
- Training available from manufacturer or from private consultants

Portable Instrumentation

- Portables can be used as primary defense, or can be used to locate and determine intensity of radiation found by a fixed system.
- Preferred detector is a scintillation detector-GM or Geiger-type detectors just not sensitive enough.
- Detector can be internal, or connected to the electronics by a cable.
- A small “check” source can be purchased to periodically confirm proper operation.



Fixed Instrumentation

- Fixed systems very sensitive, don't depend as much on operator.
- Fixed systems only detect-they can't tell the difference between a deeply buried dangerous source and a relatively small NORM source.
- Despite cost, still not 100% effective in finding sources.

“False” Alarms

Fixed or portable radiation systems are bought with the intent of finding industrial radiation sources. But industrial sources are outnumbered by the thousands of materials that contain radiation. The most frequent alarms are caused by:

- NORM oilfield pipe
- Raw materials; rock, salts, minerals
- Welds
- Medical tests on driver or other personnel

Training

- Workers need to know how to use their equipment
- Workers need to know how to check if the instruments are working correctly
- Workers need to be trained to be alert to radiation symbols and heavy lead containers
- Workers need to know procedures, especially when to stop and call for help

Summary

- Radiation sources pose a health and cost risk to anyone who deals with recycled metals
- Proper instrumentation can help detect harmful radiation sources, but will also find many everyday sources of radiation
- Worker training is needed to help spot radiation sources, and to react appropriately
- Procedures need to be in place to react quickly and appropriately to limit damage