

ESRL User Level Radiation Safety

- Rhonda Carpenter, C.I.H.
- Radiation Safety Officer
- Field Safety Manager
- Safety and Environmental Compliance Office
- CAO



Agenda

- NRC Inspections
- Duties
- What is radiation?
- ALARA
- Regulations
- Licenses
- What we have
- Security
- Biological Effects
- Summary

Nuclear Regulatory Commission (NRC) Inspections

- 8/1998; 6/06 – telephone audits; no violations (sealed sources, low risk)
- 9/16 /08– Reported 3 missing Ni 63 sources to NRC
- 10/8 & 9 – Preliminary NRC Inspection
- 10/30 & 31 – NRC Expanded Inspection
- 11/21 – high levels on wipe test Idaho Falls Field Research Lab Ni63 source; notified NRC (.011 uci; reportable .005 uci)
- 12/3 – NRC inspection Idaho Falls
-more to come

Potential Violations

- Security
- Annual Audit
- Labeling
- Custom GCs

Radiation Safety Officers

- Rhonda Carpenter, SECO X3912
- Michael O'Neill, GMD X6369
- Ann Middlebrook, CSD X7324

RSO Duties

- Stop Unsafe Activities
- Supervise decontamination
- Ensure security
- Control disposal
- Interact with NRC, other authorities
- Maintain records
- Audit program annually
- Perform surveys
- Train personnel
- Investigate abnormal events

Authorized Users

- James Elkins
- Bill Kuster
- James Roberts
- Michael O'Neill
- Tom Ryerson (to be removed)
- John Nowak (to be removed)
- Andy Neuman (to be removed)
- Roger Carter (to be removed)

Authorized Users

- Supervises the use of licensed material
- Materials used safely
- Materials used in compliance with regulatory requirements
- Ensure procedures and engineering controls keep
 - occupational and public doses ALARA (as low as reasonably achievable)
- Security
- Respond to events to reduce spread of contamination

Radiation User Duties

- Notify RSO when purchasing new material
- Responsible for material from cradle to grave
- Keep track of material
- Keep materials secure (locked or under surveillance) at all times
- Keep materials sealed DO NOT TAKE THEM APART
- Dispose of properly DO NOT THROW THEM AWAY
(polonium)

Definition:

- Ionizing Radiation – consist of highly energetic particles or waves that can detach (ionize) at least one electron from an atom or molecule. Ionizing ability depends on the energy of the particles or waves, not their number.
- Examples: beta, neutrons, alpha, gamma, x-ray

Ionizing Radiation Characteristics

- Alpha
 - slow moving
 - move a few cm in air
- Beta
 - same mass as electron
 - + or – charged
 - highly variable
 - can move 20 feet

Ionizing Radiation Characteristics

- Gamma
 - can travel thousands of feet in the air
 - no mass no charge
 - can ionize matter
 - originate from nucleus
- X-ray
 - originates from electron

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ALARA

- *As Low As Reasonably Achievable*
- *Time/Distance/Shielding/Containment*

Uses:

- Medical and dental x-rays
- Construction
- Research
- Atmospheric testing
- Static Elimination

Regulations

- OSHA:
 - 29 CFR 1910.1096

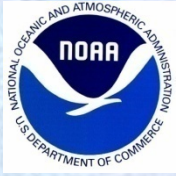
- Nuclear Regulatory Commission:
 - License
 - Federal facilities
 - 10 CFR 19, 20, NUREG 1556, vol 7

Nuclear Regulatory Commission License

- Wipe test every 6 months $<.005$ uci
- Training
- Inventory
- Moving/transporting
- Security
- Purchasing
- Material control and accountability
- Audits annually
- Disposal

What we have

- Nickel 63 – beta emitter
 - Gas chromatographs
 - Sealed Source
 - Very low risk
- Polonium 210 – alpha emitter
 - To be removed from specific license
 - Static eliminators
 - Chemical ionization mass spectrometers
 - Sealed source
 - Very low risk



Typical ECD cells (~1" diameter, 1" long)

Shimadzu ECD



Valco ECD



Station staff: **Wipe tests must be done every 6 months on working ECDs. Wipe tests are done before shipping and after shipment to final destination.** The test sheets should be wiped on the exhaust port on the outside of the can or ECD. Unused ECDs are stored in a locked cabinet in David Skaggs Research Center in Boulder, CO.

NRD Po-210 Sources

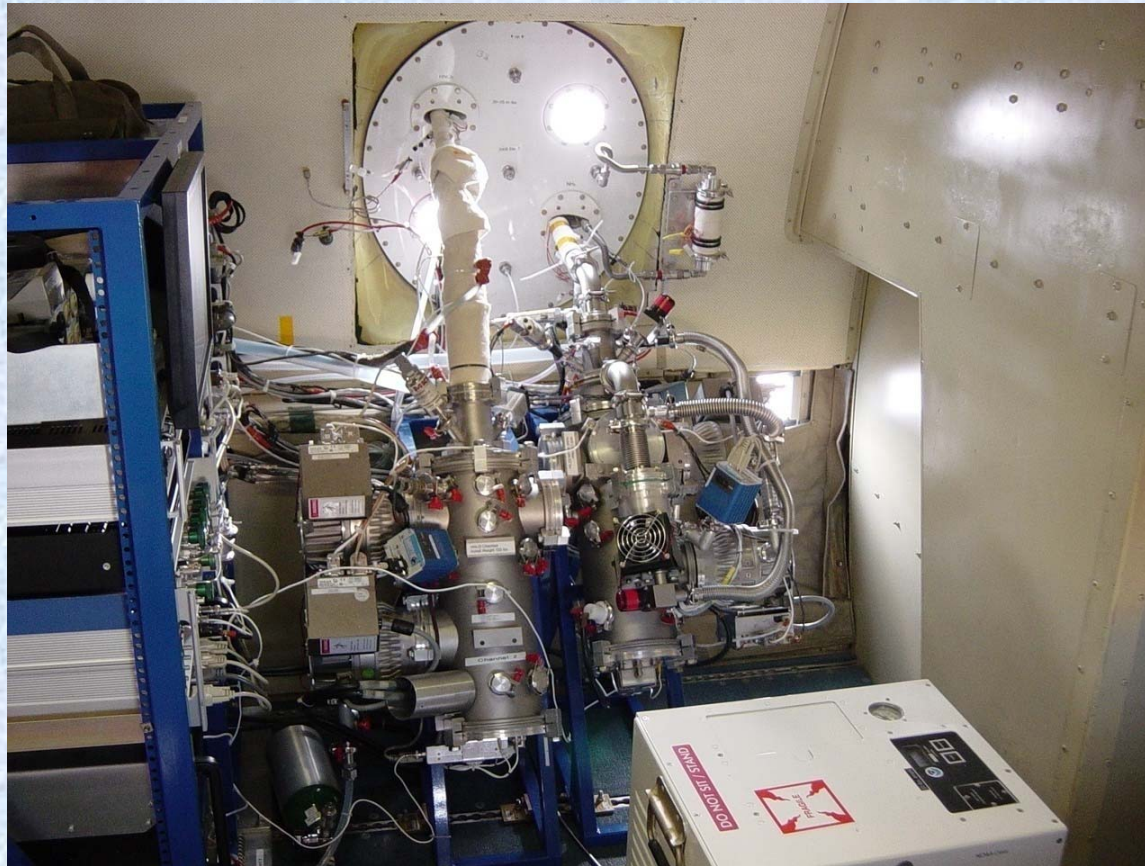
used in CSD DMAs and CIMS instruments



HN03 and NH4 CIMS Instruments

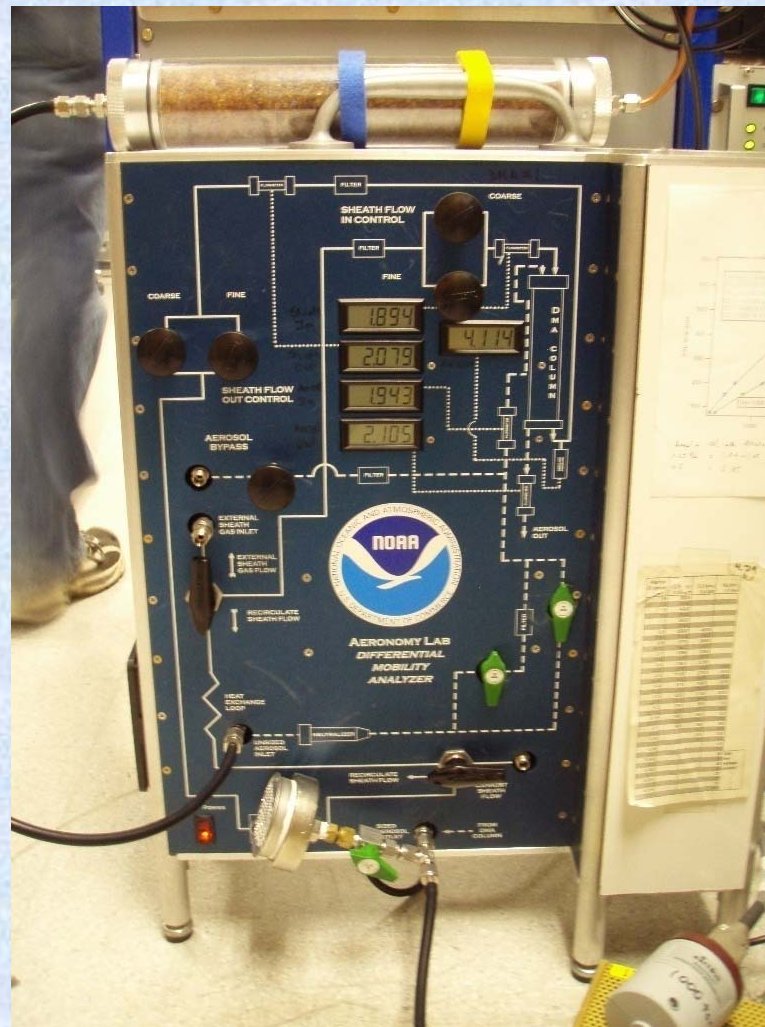
Andy Neuman and John Nowak, CSD

not shown PANs CIMS, Jim Roberts, CSD



DMA Instrument

Dan Murphy, CSD



Biological Effects

Depends on level of exposure

Affects the person exposed

Can affect future generations

Massive tissue damage and death

Results of Exposure

- Cell damage or cell death
- Abnormal cells – cancer
- Damage depends on time, dose, and organ exposed
- Evidence of exposure may not be noticed for years
- Long-term vs short-term exposure
- Causes other than radiation

Chronic Exposure

- Low levels of radiation over a long time period
- Effects observed some time after initial exposure
- Genetic effects, cancer, lesions, tumors, cataracts, congenital defects

Acute Exposure

- Large single dose of radiation
- Accidents or special medical procedures
- Immediate effects – radiation sickness
- Delayed effects – cataracts, sterility, cancer
- Death within a few hours or days

Emergency Procedures

- *If there is an injury, treat the injury first
- *Damage to sealed source holder
 - 1-Evacuate immediate vicinity
 - 2-Place a barrier safe distance (min. 5 meters)
 - 3-Put up radiation hazard sign
 - 4-Contact RSOs

Emergency Procedures (cont)

- *Personal Decontamination
 - - soap and water in a bucket
 - - do not abrade skin; blot dry
- *Spill and Leak Control
 - - notify everyone in area
 - - confine the problem
 - - clear area
 - - summon aid
- *Emergency Protective Equipment
 - - gloves, footwear covers, safety glasses, outer layer protective clothing

Annual Dose Limits for Occupational Exposed Person

- * 10 CFR 20.1201
- * Skin 50 rems
- * Elbows to hands 50 rems; * Knees to feet 50 rems
- * Eyes 15 rems
- * Internal Organs 50 rems
- * or Total effective dose equivalent 5 rem

- **For Polonium 210 estimated exposure is less than 2 mrem/yr if person is within 2 ft to the source for 8 hrs/day

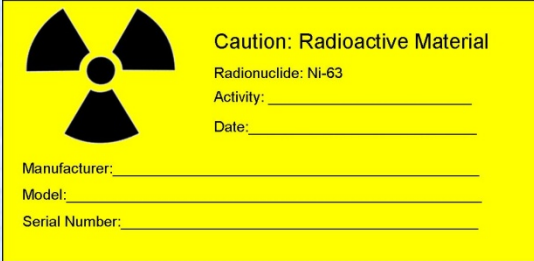
Ni 63 exposure - sealed

- Agilent:
- If it were unshielded (opened or melted):
 - Skin dose – skin would block all beta
 - Eye dose – eye membrane will block all beta
 - Inhalation dose – if vaporized and all vapors were inhaled, dose 93.75 rem
 - Ingestion dose – source eaten, 8.3 rem
 - Unshielded source 16 cm; require continuous exposure 1,471 hours = annual public dose 100 mrem

Common Exposures

- Chest X-ray 20 mrem
- Dental X-ray 200-700 mrem
- Jet flight
 - (cx country) 5-10 mrem
- Smoking cigarettes
 (1.5 packs/day) 22 mrem/day
- Pacemaker 2 mrem/day

Labeling

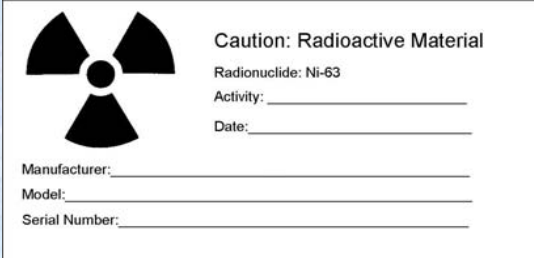


Caution: Radioactive Material
Radionuclide: Ni-63
Activity: _____
Date: _____
Manufacturer: _____
Model: _____
Serial Number: _____

NOAA will label all ECD sources that are not installed in heated zones with appropriate labels attached to the source. Sources that are installed in heated zones or cans will be labeled externally on the can or enclosure. In situations where a label constitutes a fire hazard, labels will consist of metal tags thin wired to the can. Both the source and cans will be labeled.

Each label will state:

- A. Caution, Radioactive Material;
- B. Shall contain the radiation symbol in black
- C. Radionuclide; Manufacturer's estimated activity; Date of purchase;
- D. ECD manufacturer's name, model number and serial number.



Caution: Radioactive Material
Radionuclide: Ni-63
Activity: _____
Date: _____
Manufacturer: _____
Model: _____
Serial Number: _____

SUMMARY

- License – what we have committed to
 - Wipe testing every 6 months
 - Record keeping
 - Deployment Records
 - Transfer Records
 - Location at any time
 - Inventory

Summary (cont)

Security – locked & authorized individuals only

Proper disposal

Annual Audits

Training

RSOs have stop work authority and delegated authority from management

Following written procedures for assembly/disassembly