Illinois
TENORM Operator Training

The Essentials

Kurt Rhea
RSO/CEO

RADPROS

ABOUT RAD PROS

- Environmental company – national/international
- Hazardous and radioactive waste management
- Site & dose assessments, regulatory assistance, compliance & consulting
- Field services – media exchanges, decommissioning, decontamination, remediation & reclamation
- Water treatment media/residuals management
- Serving water treatment, oil & gas, mining, phosphate & rare earths, and manufacturers

RADPROS

WHY CARE ABOUT RADIUM

- Proactive awareness training.
- Learn about protective measures you can take to minimize any and all risk.
- Learn about measures water treatment plants are taking to verify working conditions are completely safe (empirical measurement).
- Potentially fulfills requirements from Part 622 regulations that will benefit you personally and professionally (adding to your resume!)

RADPROS

TENORM TRAINING OBJECTIVES

Section 1: Essential Definitions

Section 2: A Radioactive World

Section 3: Measuring Radiation

Section 4: Just the Physics

Section 5: Am I Safe?

Section 6: TENORM in Water Treatment

Section 7: TENORM Transportation & Disposal

Section 8: TENORM Regulations

RADPROS

ESSENTIAL DEFINITIONS

Talking the Talk

DEFINITIONS

- **NORM** - Naturally Occurring Radioactive Material
- **TENORM** - Technologically-Enhanced NORM
  - Radionuclide concentration increased by or as a result of past or present human practices
  - TENORM is regulated in Illinois and many other states
- **RSO** - Radiation Safety Officer
- **Radiochemistry** – lab testing for radionuclides

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DEFINITIONS

- **Radiation** – a form of energy
- **Radioactive decay** – the process by which a radioactive atom releases energy in the form of some radiation to become more stable (sometimes referred to as disintegration)
- **Progeny** – decay ("daughter") product of another radioactive ("parent") isotope, e.g., radon

WHY WE EVEN CARE ABOUT TENORM

1) Worker Safety
2) Public Safety and Perception
3) Environmental Protection
4) Regulatory Compliance
5) Liability

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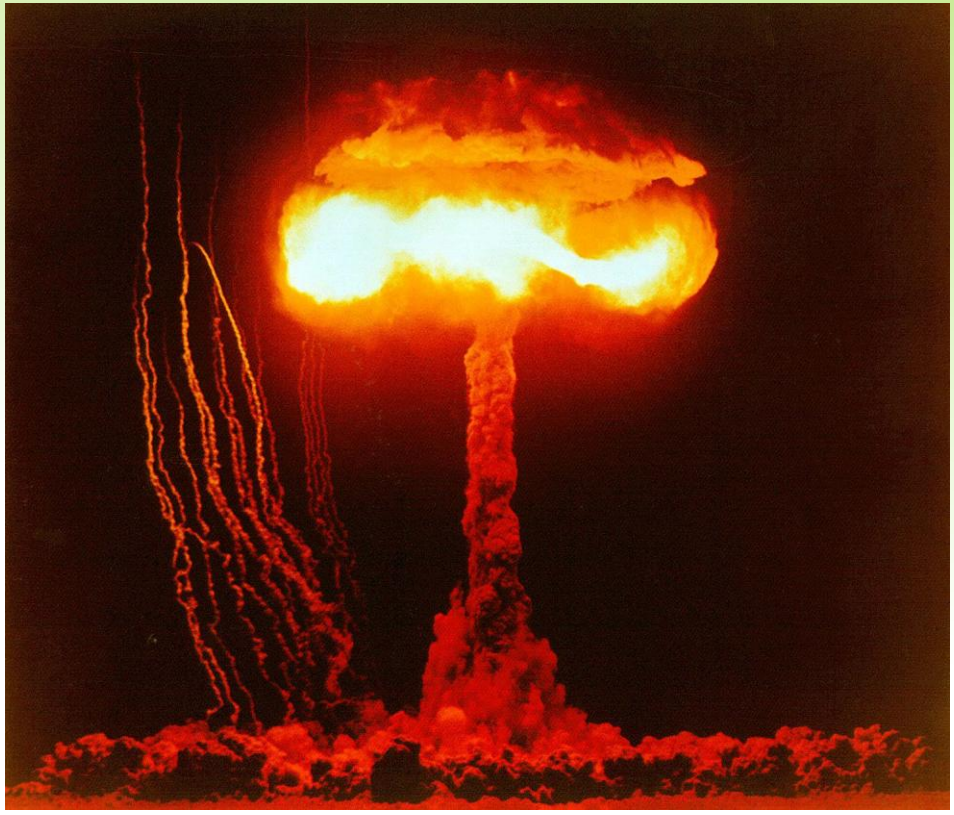
RADIATION – What Comes To Mind?



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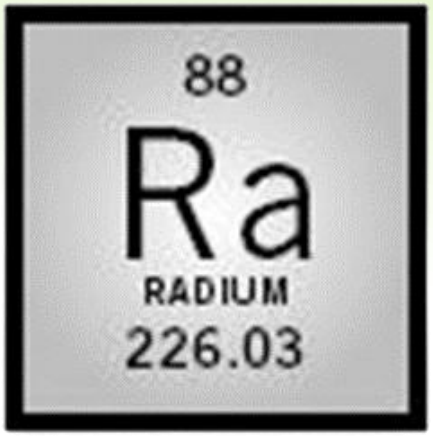
A RADIOACTIVE WORLD

Seeing the Unseen

THE “R” WORD

- Radiation makes people nervous
- Can’t see it, feel it, smell it, or taste it
- Radionuclides all around us
  - Radium, Uranium, Radon, Lead, Thorium, etc.
- Naturally occurring



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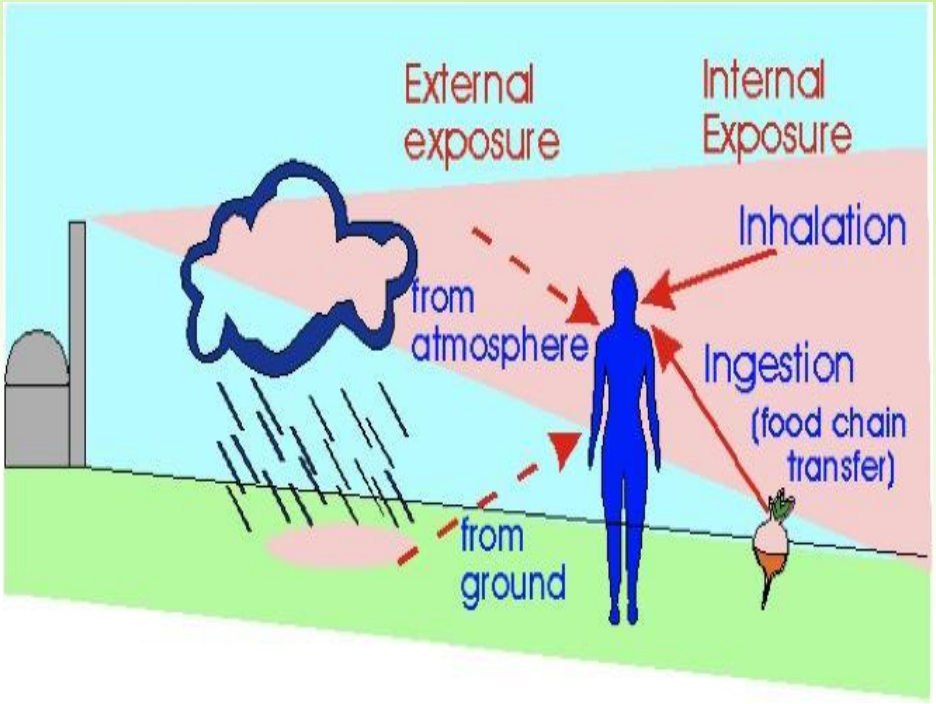
WE LIVE IN A RADIOACTIVE WORLD

It's always been that way!

- Continuously bombarded with radiation from **space**



- U, Th and their progeny in **rocks and soil**
- Present in **food and water** we consume everyday
- **Background radiation** across the U.S.

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BANANA EQUIVALENT DOSE

Bananas:
A radiation hazard?

Average "K-40 Dose"
= 20 – 30 mrem/yr !

- One banana contains 422 mg of potassium
- The naturally occurring radioactive isotope, potassium, K-40, has a natural occurrence of 0.0117%
- 0.05 mg is radioactive or 13.3 Bq (about 400 pCi) of radioactivity per banana
- A "bunch" = 10 bananas, or 130 Bq (4000 pCi) of K-40 per bunch
- Your body contains 4000 Bq of radioactive K-40 (250,000 decays every minute!)
- 5 oz of uranium ore of 0.1% grade, contains as much radioactivity as K-40 in ten bananas (60 to 80 oz)

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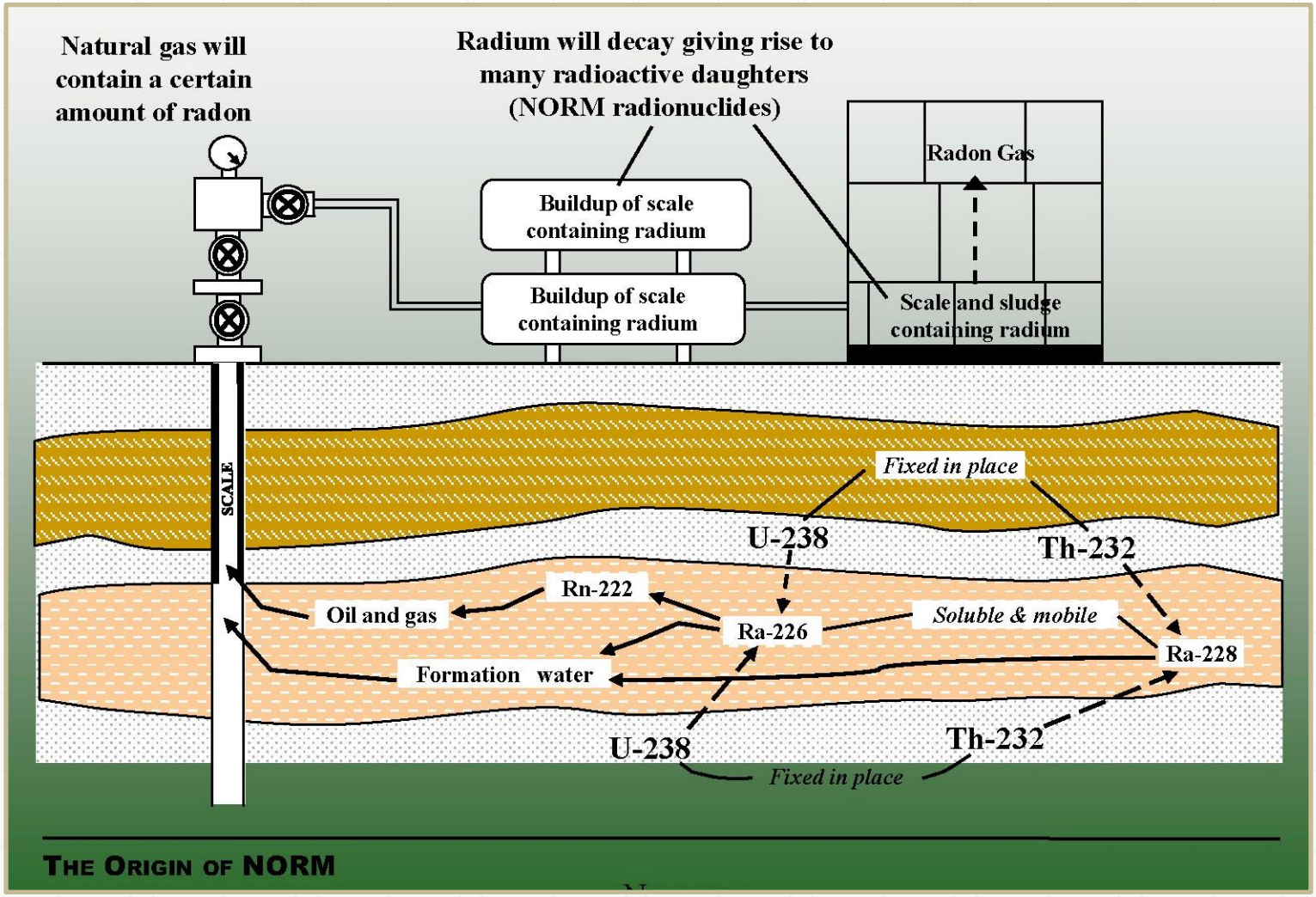
Where is Radiation Found?

- Cosmic
- Terrestrial
- Radon
- Medical
- Industrial Sources
- Other Sources

TENORM IN VARIOUS INDUSTRIES

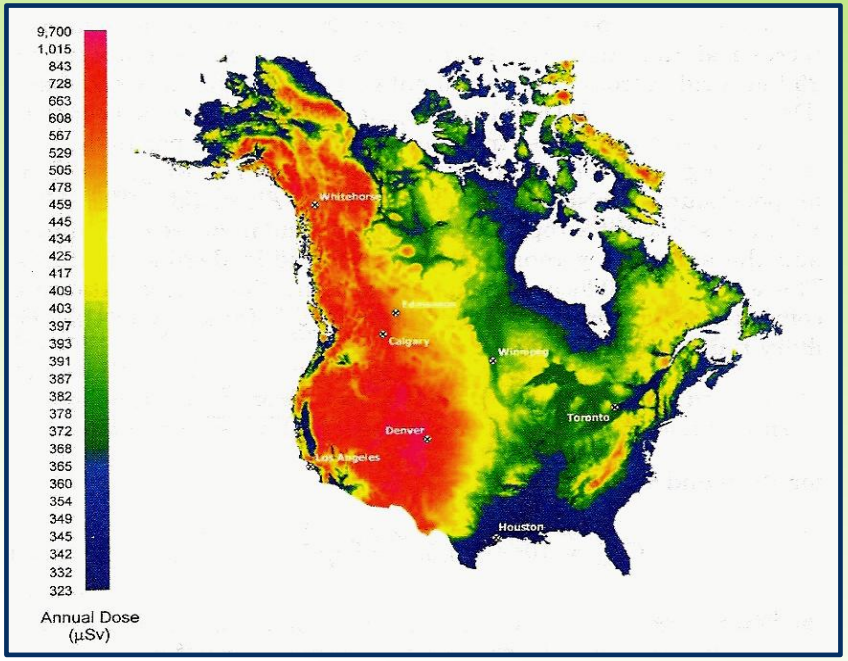
- Oil & Gas Production
- Mining/Ore Processing
- Metal Recycling
- Municipal Water Treatment
- Forest Product Combustion
- Thermal Electric Production
- Fertilizer Production
- Ceramics

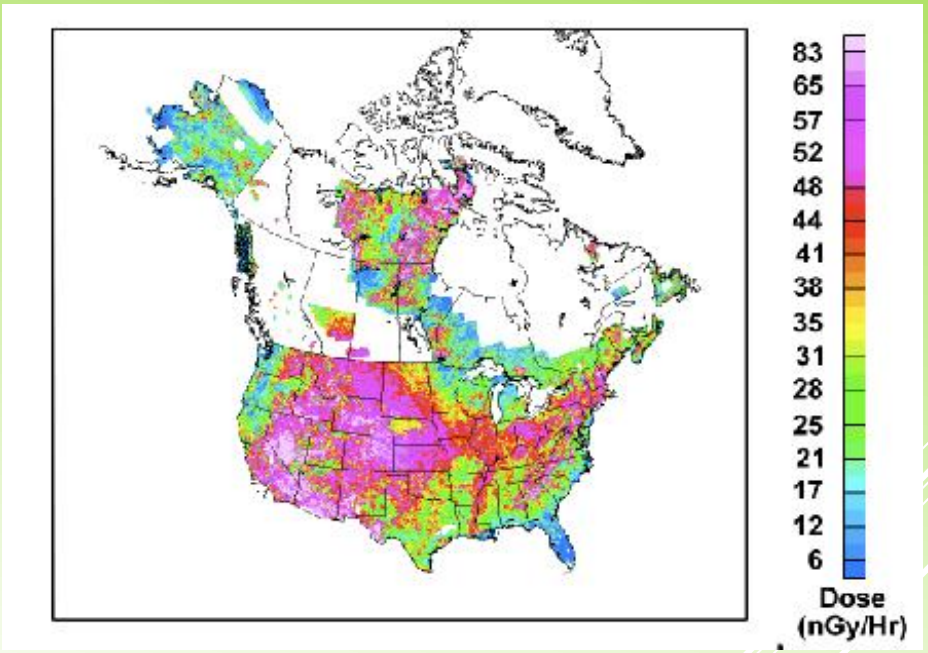
Where TENORM Originates



COSMIC RAY AND TERRESTRIAL

Background Across the U.S.





National Council on Radiation Protection and Measurements; NCRP Report No. 160, "Ionizing Radiation Exposure of the Population of the United States", 2006

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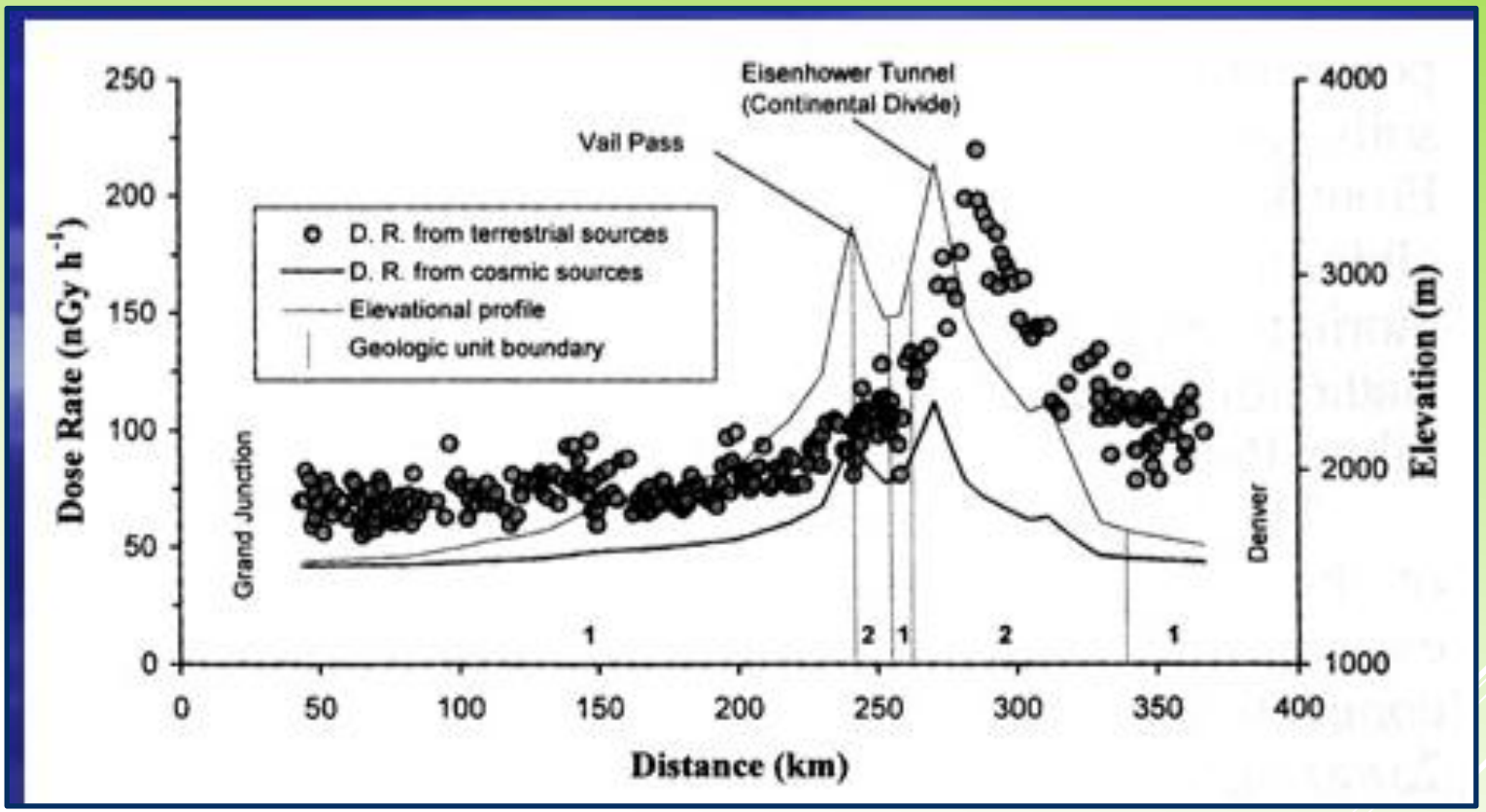
ELEVATION & MINERALIZATION

I-70 from Grand Junction to Denver



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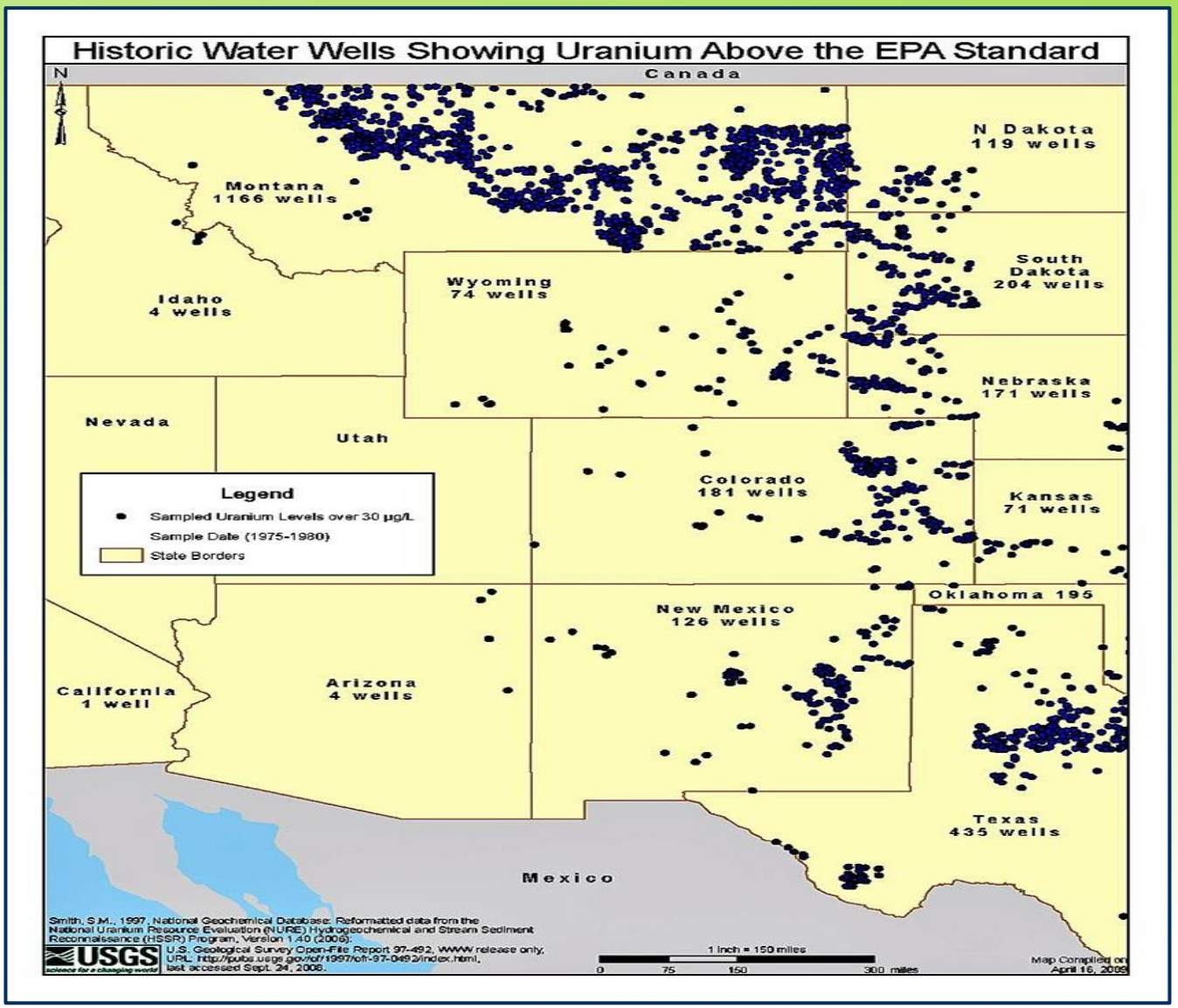
GEOLOGY – THE BIG DRIVER

Uranium > EPA Drinking Water Standard (30 *u*g/l)



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RADIATION: Where You Least Expect It

- **Humans are radioactive** (approximate for 70kg)
  - 100,000 to 200,000 pCi ^{40}K
  - 30 pCi each U and Ra
  - 100,000 pCi ^{14}C
  - 600 pCi ^{210}Pb
- **Annual Uranium intake in foods** (pCi)
  - Meat: 50 to 70
  - Fruit: 31 to 50
  - Potatoes: 67 to 74
  - Bakery products: 39 to 44
- **Household smoke detector** (Americium)
  - Average of 1 million pCi
- **Range of annual background in the United States**
  - 200 mrem (on coastal plains) to 600+ mrem (in Colorado)

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NATURAL BACKGROUND COMPARISON

Source	U.S Avg.* (NCRP, 2009)	Colorado Avg.* (EPA, 2005)
Cosmic Radiation	28	**47**
Terrestrial Radiation	28	**43**
Internal Radiation including Radon	200	**610**
Totals	**256**	**700**

- **Regulatory Limits:**
  - **> EPA drinking water standard = 4 mrem[1]**
  - **> EPA limit for all exposure pathways = 25 mrem[2]**
  - **> NRC and CDPHE Limit = 100 mrem**

***mrem/yr - millirem is a unit of effective radiation dose. One rem is 1,000 mrem.**

NCRP 2009:National Council on Radiation Protection and Measurements. Ionizing radiation exposure of the population of the United States. NCRP Report No. 160
EPA 2005:US Environmental Protection Agency. Assessment of variations in radiation exposure in the United States.
[2] Moeller D, Sun LSC. Comparison of natural background dose rates for residents of the Amargosa Valley, NV, to those in Leadville, CO, and the states of Colorado and Nevada. Health Phys 91:338-353; 2006.

[1] U.S. Environmental Protection Agency. Radionuclides in drinking water. Available at: http://www.epa.gov/safewater/radionuclides/index.html.
[2] U.S. Environmental Protection Agency. Environmental radiation protection for nuclear power operations, 40 CFR 190.10; 2006.

RADPROS

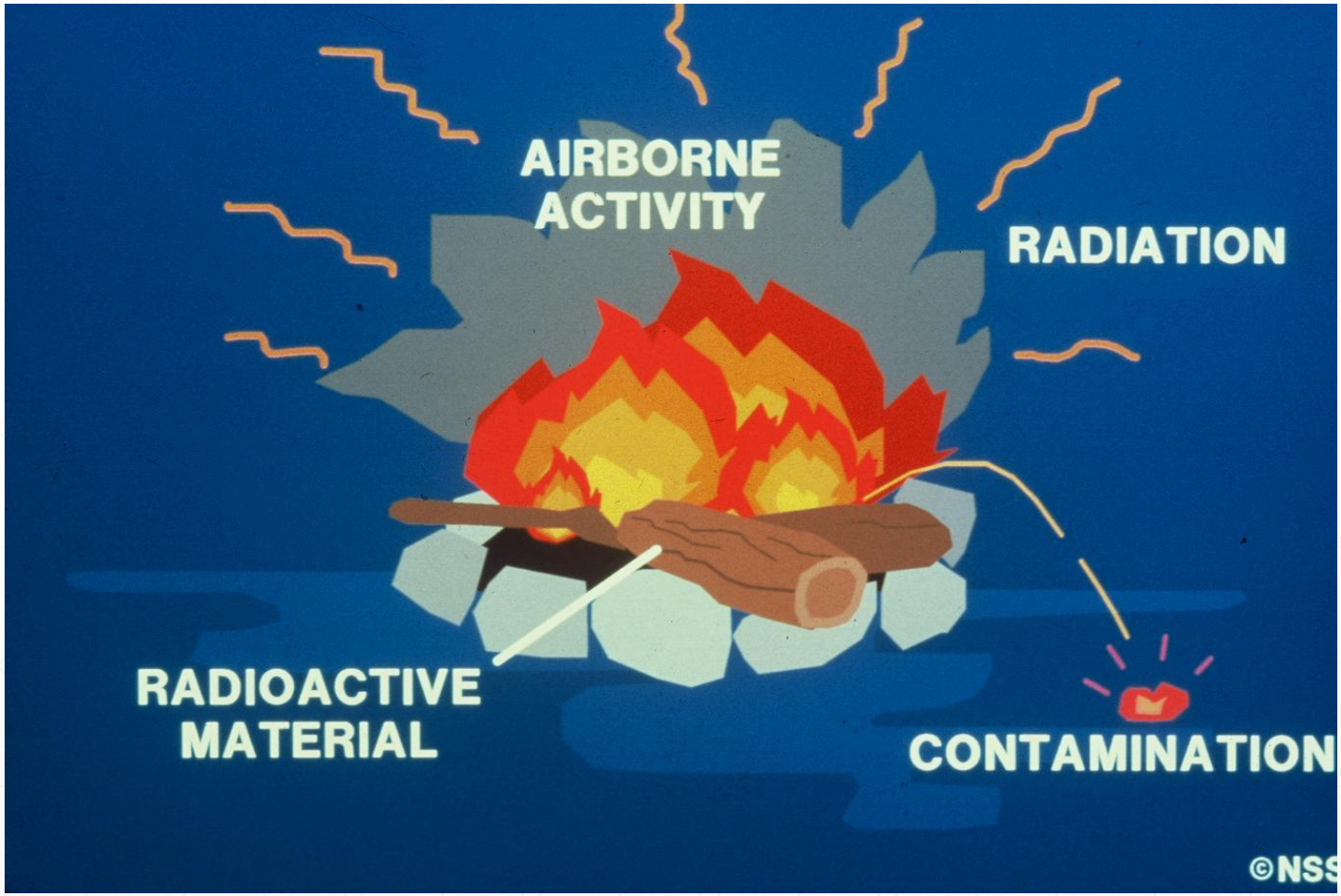
MEASURING RADIATION

Why All the Different Measurements?

Context is Everything!!

Why the Prefixes Matter

How We Measure Radioactivity



MEASUREMENT FUNDAMENTALS

- **Radioactivity** = the number of decays (or disintegrations) per unit time
  - curie (Ci) = 37 billion d/s (3.7×10^{10} d/s)
  - picocurie (pCi) = 0.037 d/s (3.7×10^{-2} d/s)
- 1 pCi = 2 atoms decay in 1 minute
- The **concentration** of radioactivity in a material
  - U in soil expressed as **pCi/g**
  - U in air expressed as **pCi/l**
  - U in water expressed as **pCi/l**

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UNITS OF MEASURE

pCi/g – picocurie per gram - units of (radio)activity

- Not mass - concentration
- Measured in a lab
- pCi, uCi, Ci – total activity

***u*R/hr** – micro Roentgen per hour – gamma detection

- Measured with a scintillator (gamma) probe (most common) - Ludlum

CPM (or CPS) – counts per minute (or second)

- Measured with meter with a G-M (or pancake) probe
- Detects alpha, beta, and gamma

mrem – millirem – dose

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What Does “Hot” Mean

- Were you driving fast?
- Just because you can measure it, doesn’t make it inherently dangerous!

MEASUREMENT OF RADIATION

Radium is present at "ultratrace levels"

- Atomic and subatomic particles – we are measuring ***very small units***

Unit Prefixes	**Used**
Milli (m) = 0.001 (10^{-3}) one-thousandth	mrem
Micro (*u*) = 0.000001 (10^{-6}) one-millionth	*u*R/hr
Pico (p) = 0.000000000001 (10^{-12}) one-trillionth	pCi/g

JUST THE PHYSICS

What is the Science Behind Radioactivity?

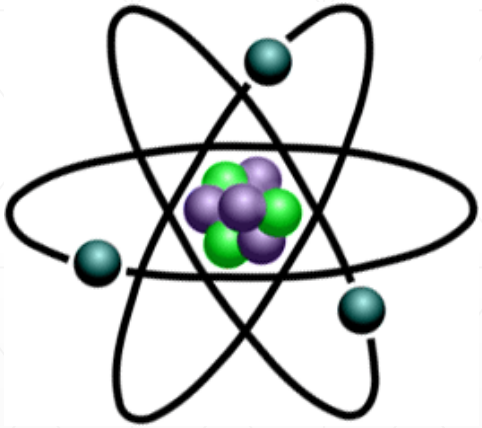
Understanding Radiation

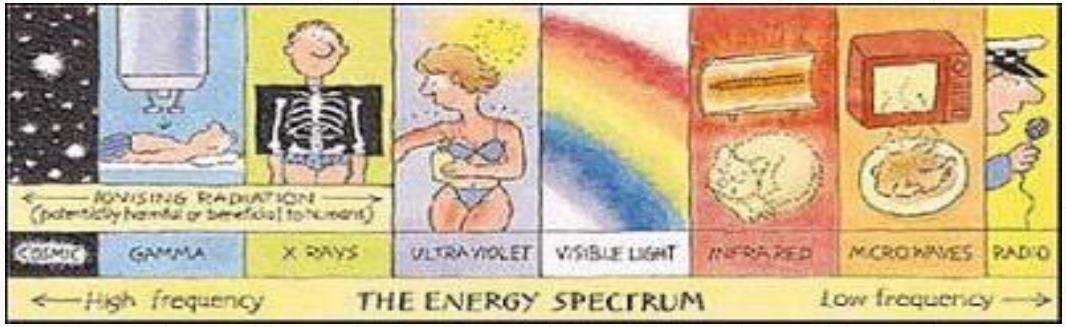
Ionizing Radiation

- ✓ Radiation with enough energy that it can remove electrons from the orbit of an atom, causing the atom to become charged or ionized.

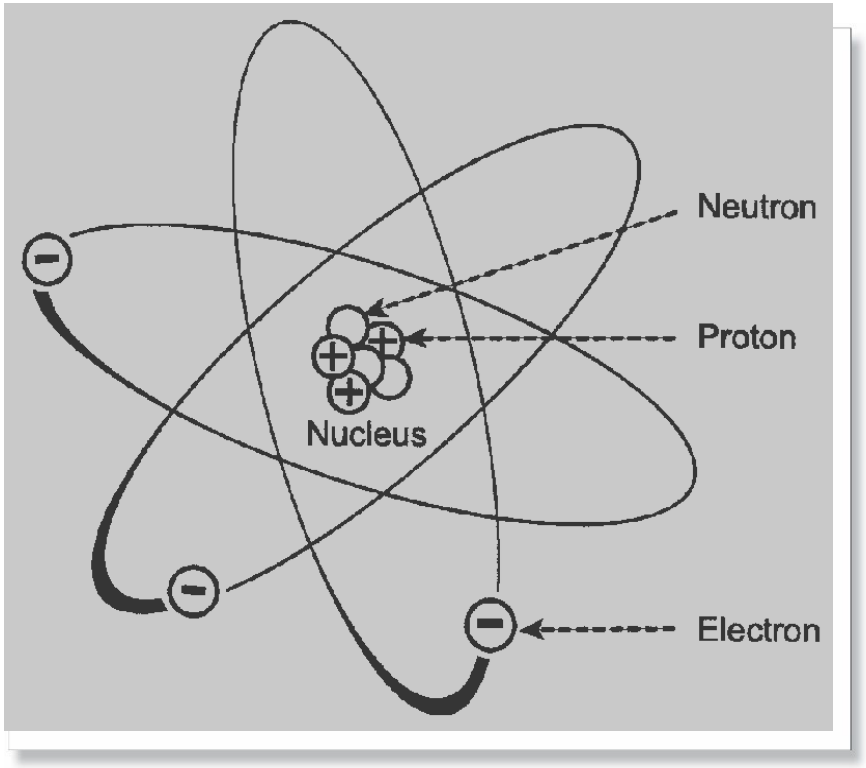
Non-Ionizing Radiation

- ✓ Radiowaves, microwaves, infrared, ultraviolet.





Radioactivity – Ionizing Radiation



Why Is Radium an Issue?

TENORM Isotopes

Ra-226 & Rad-228 (different decay chains)

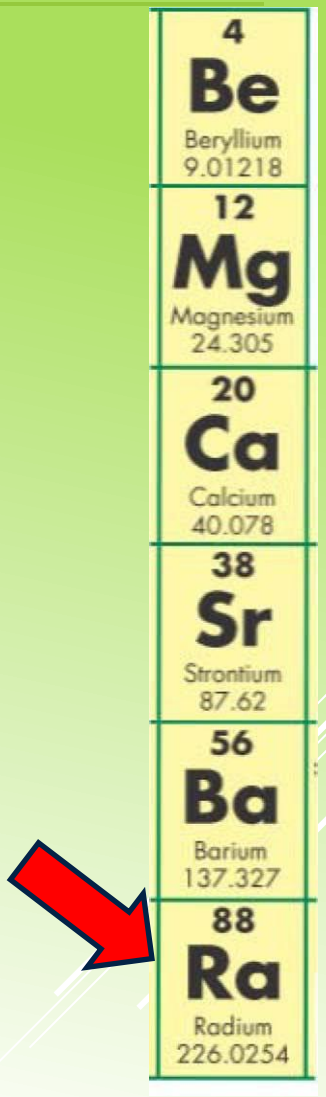
- ***Found in water and crude oil production***
- Radium-228 has 88 protons and 140 neutrons
- Ra-228 Half-Life is 5.7 years
- Radon Half-Life 3.82 days
- Ra-226 Half-Life is **1620 years** – landfill issue!

No magic wand – **laws of physics apply**

- Can't destroy it
- Can't accelerate decay process
- Can't alter via chemicals or matrix change

Pb-210 and Po-210

- ***Found in natural gas and their waste streams***
- Radon present



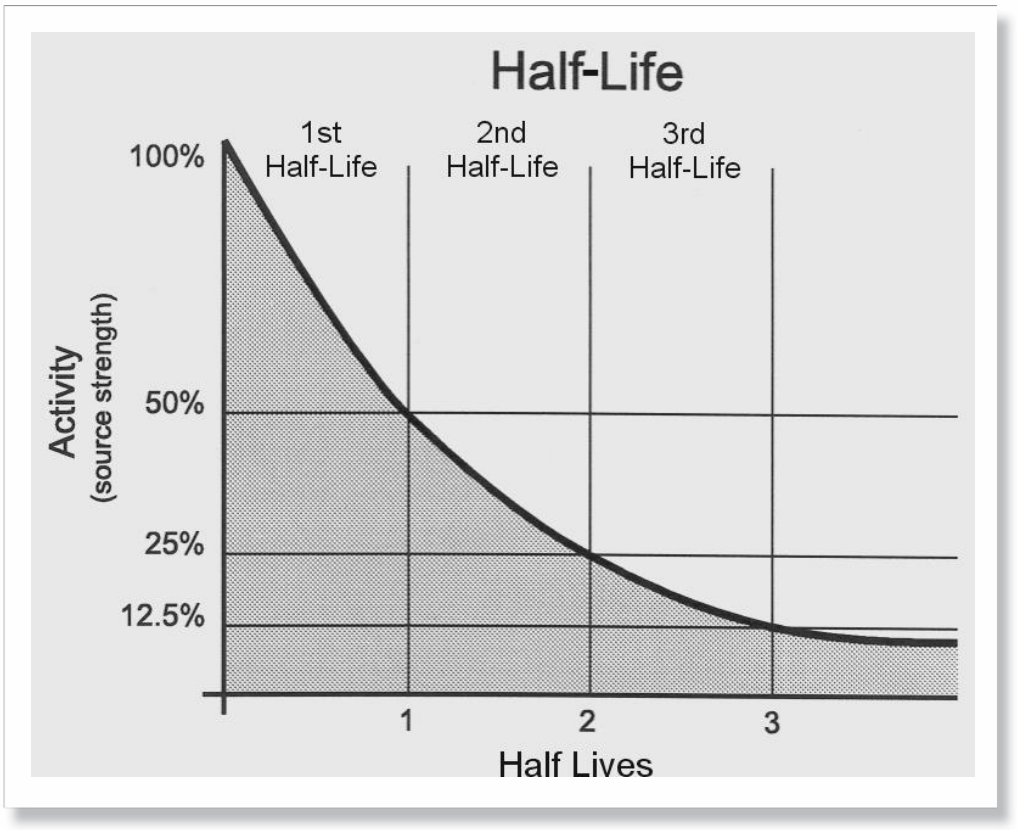
RADPROS

MULTIPLE HALF-LIVES

Radioactive Half-Life

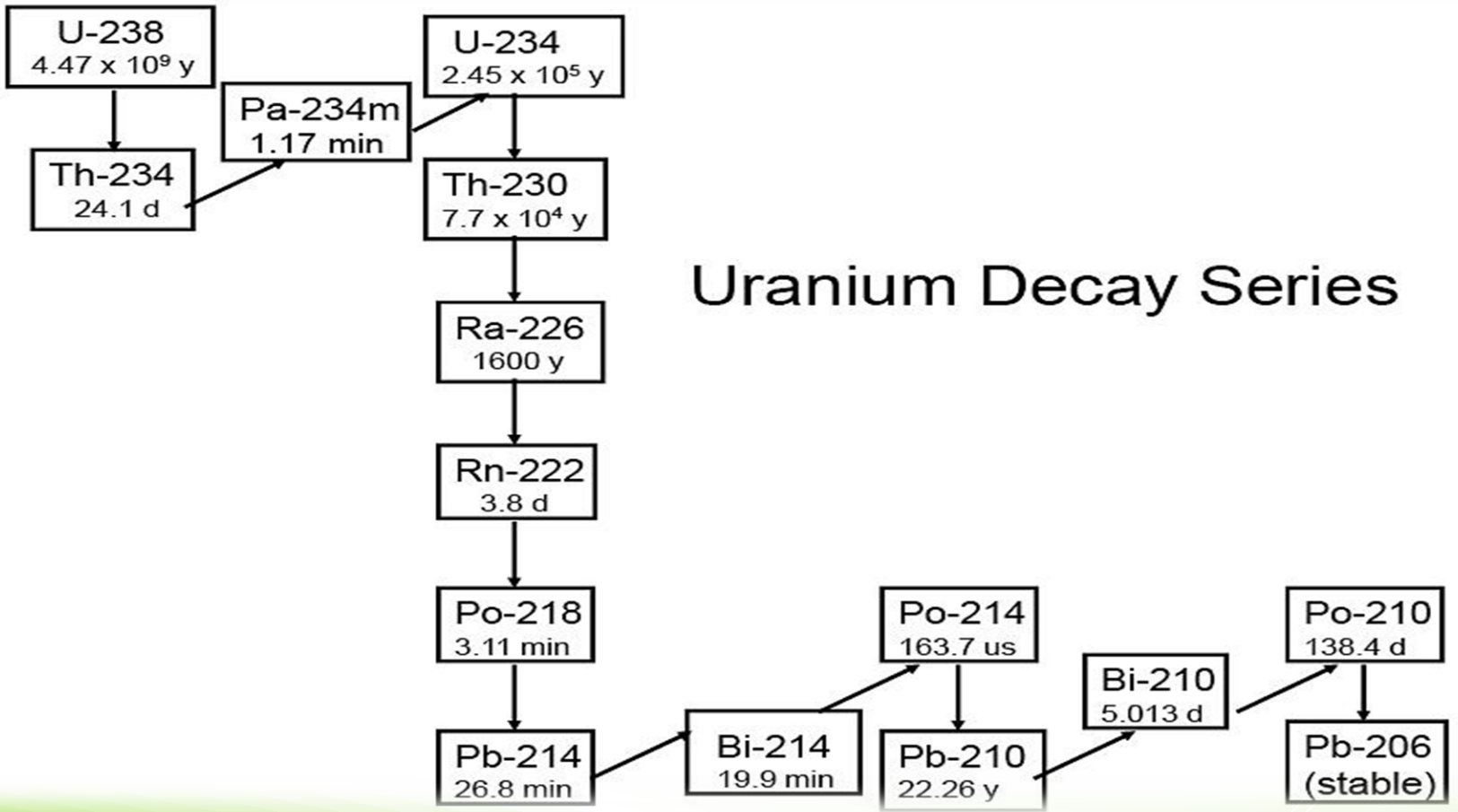
- Time ($T_{1/2}$) required for radioactivity of sample to decay to half of original concentration.

- $T_{1/2}$ of ^{226}Ra = 1620 yrs
- $T_{1/2}$ of ^{210}Pb = 22.3 yrs



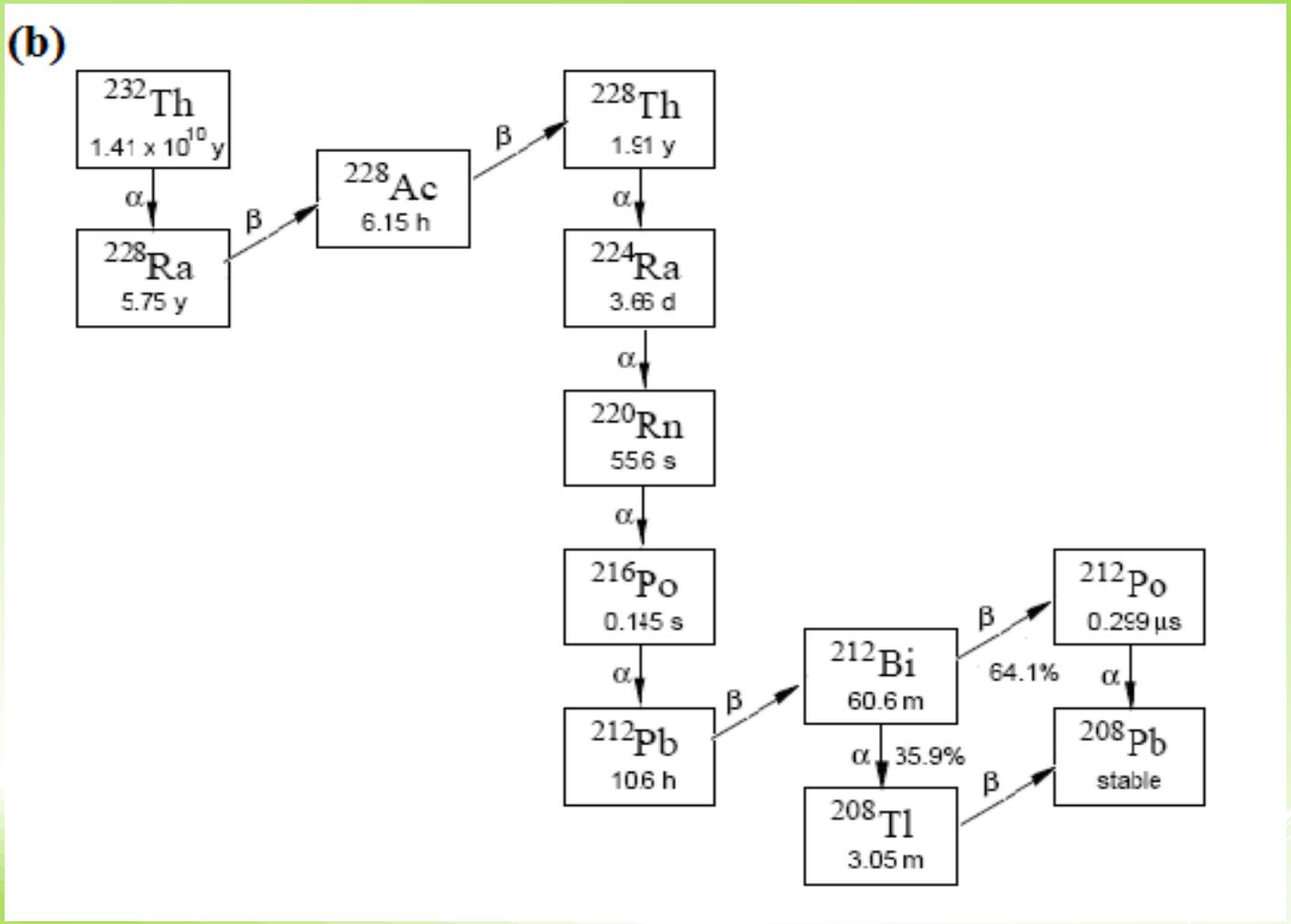
RADPROS

DECAY CHAIN – URANIUM SERIES



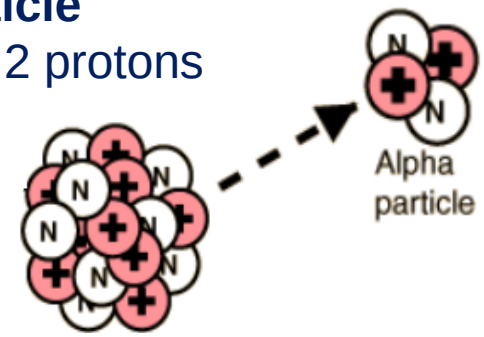
RADPROS

DECAY CHAIN – THORIUM SERIES

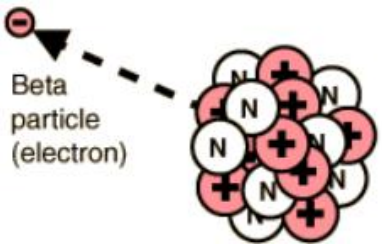


RADIOLOGICAL DECAY MECHANISMS

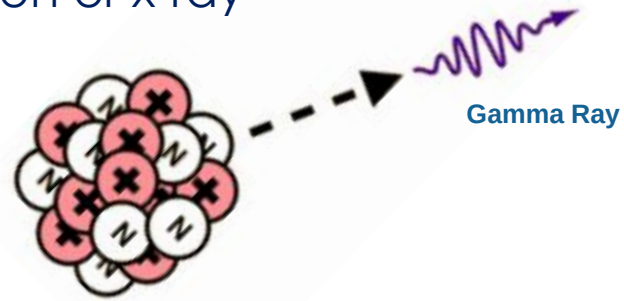
1) Alpha Particle
2 neutrons & 2 protons



2) Beta Particle
1 electron



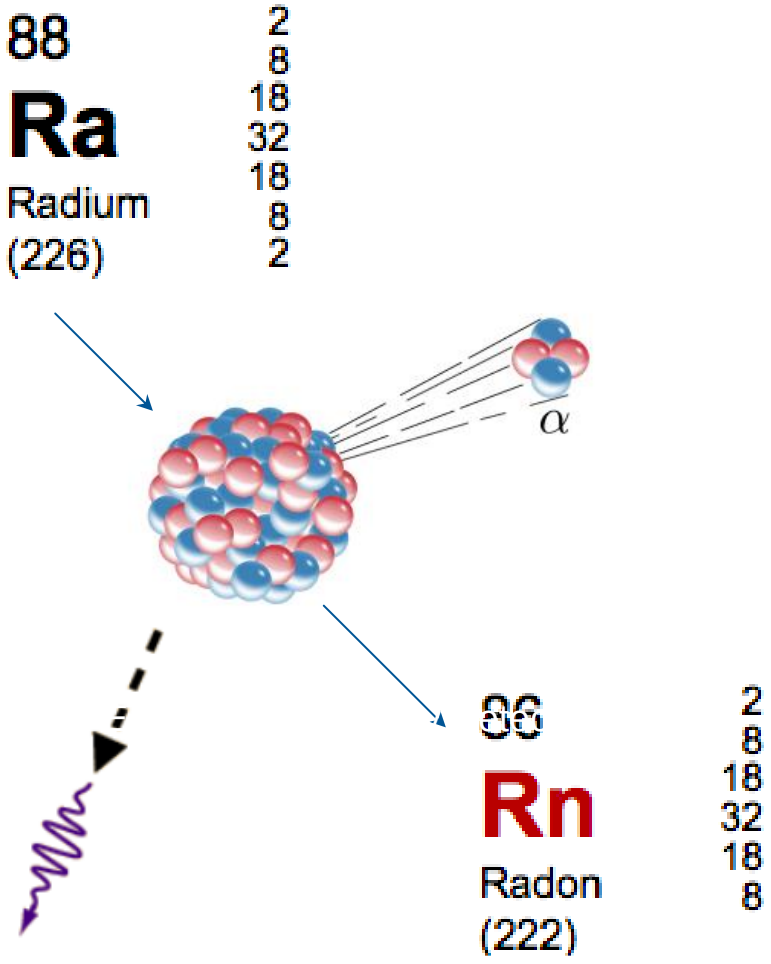
3) Gamma Ray
photon or x-ray



RADPROS

RADIUM 226

Alpha and Gamma Emitter



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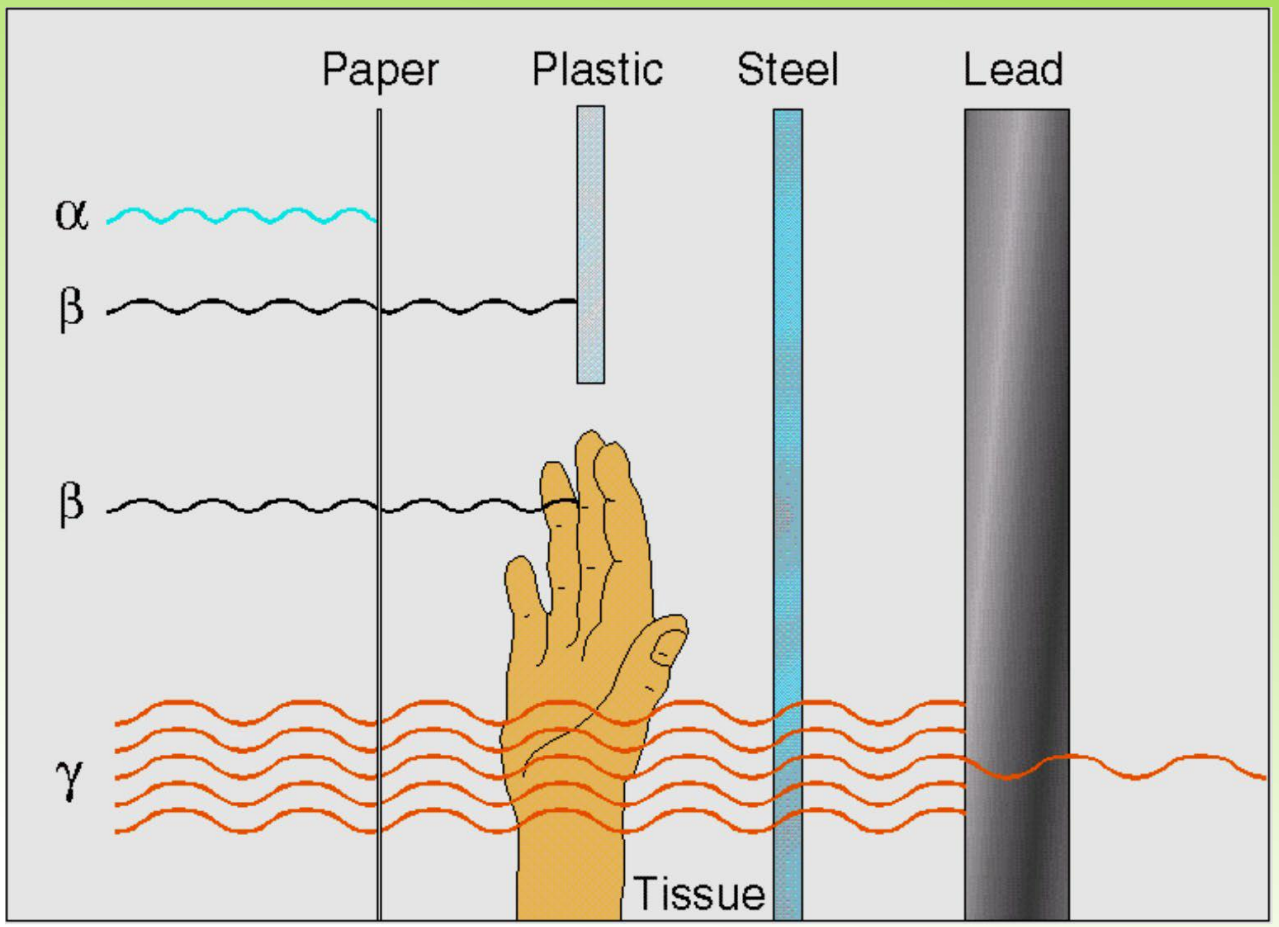
AM I SAFE?

The Most Studied Hazard, Ever!

Radiation Shielding Properties



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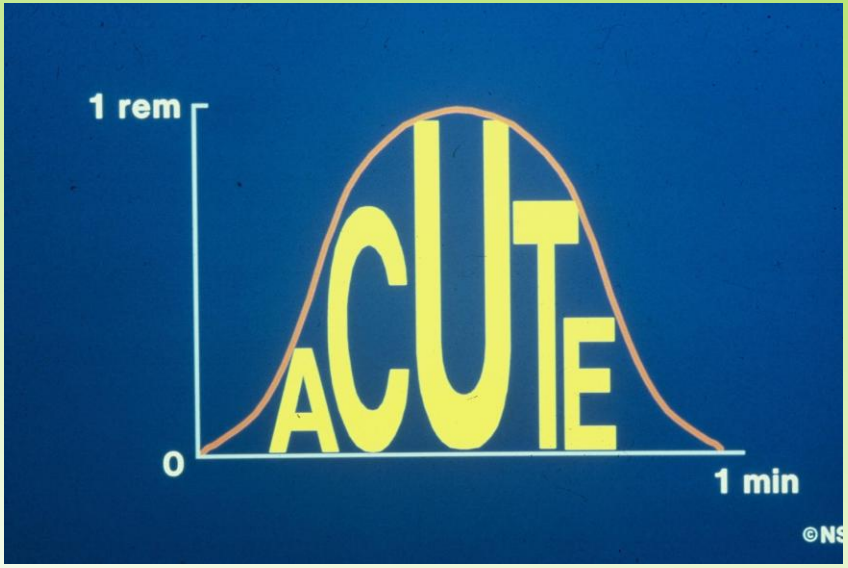
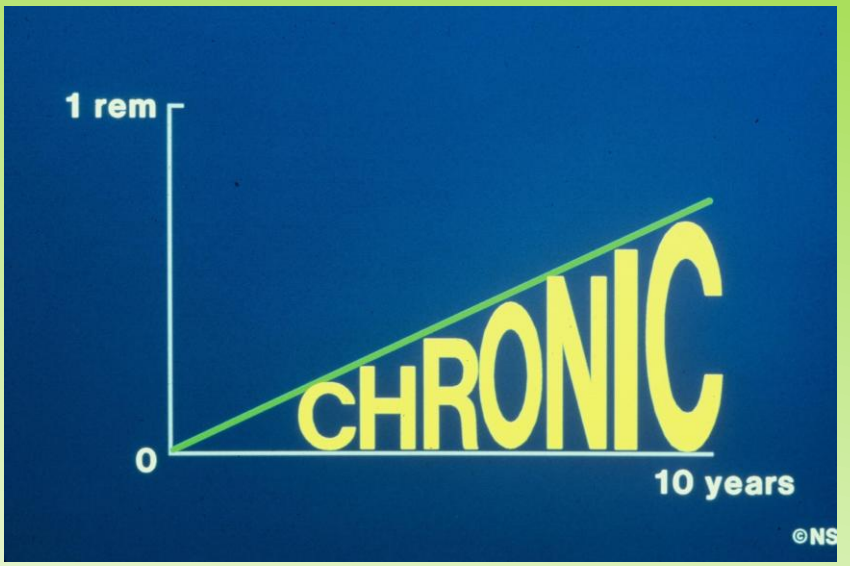
ACUTE VS. CHRONIC EXPOSURE





TENORM does <u>not</u> deliver an acute dose!

(Chernobyl was acute)

Levels and exposure time at your facility are extremely limited! No chronic dose either.

RADPROS

WHY INTERNAL EXPOSURE IS LIMITED
(Inhalation or Ingestion)

Pathways for exposure generally don't exist! No open sources. Proper housekeeping and **good hygiene** practices control potential for internal exposure

- Work gloves when handling radioactive material
- Washing hands prior to eating, drinking ,smoking
- Surveying personnel and rinsing hands and boots with water if leaving a controlled area
- Clean up spills before they dry

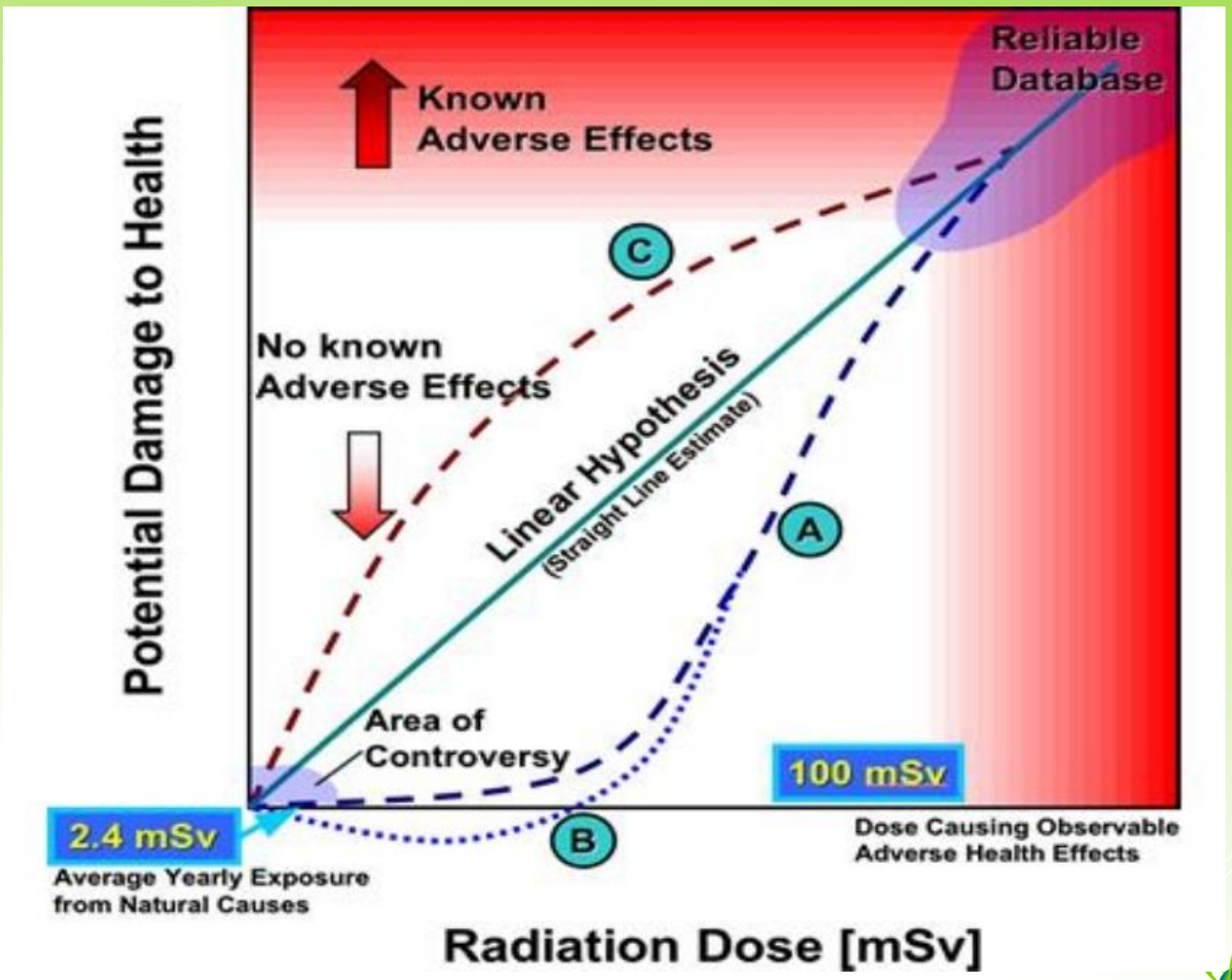
Alpha and most Beta particles will not penetrate skin.

Radioactive material must be inside body to receive dose from these particles.

Radon residential threshold = 4 pCi/L

RADPROS

DOSE EFFECT THEORIES



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ALARA
(As Low as Reasonably Achievable)

ALARA

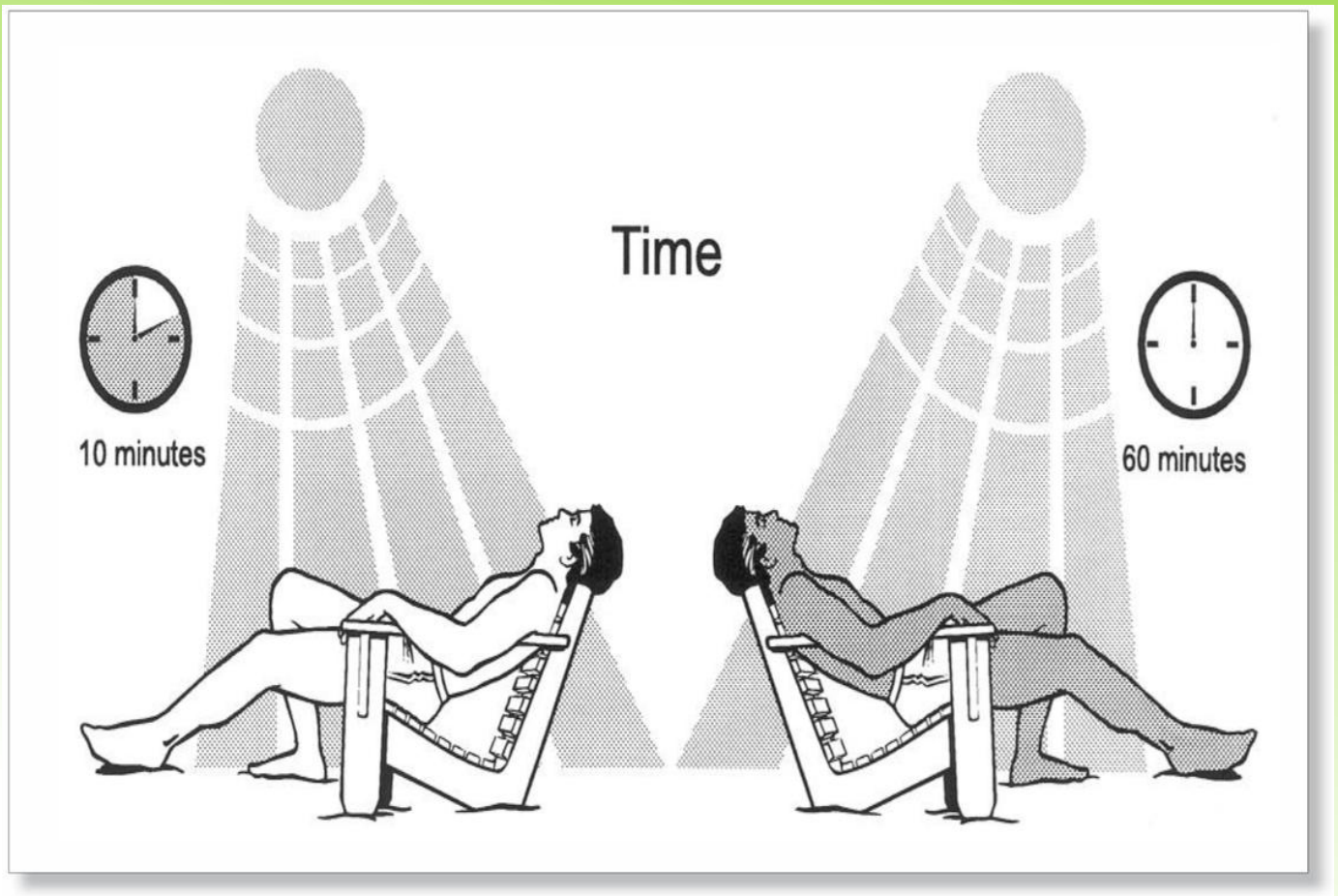
As defined in Title 10, Section 20.1003, of the *Code of Federal Regulations* (10 CFR 20.1003), ALARA is an acronym for "as low as (is) reasonably achievable," which means making every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest. For additional detail, see Dose Limits for Radiation Workers and Dose Limits for Radiation Workers.

Page Last Reviewed/Updated Monday, December 10, 2012

- **Take reasonable measures to limit dose**
- **You do <u>not</u> need to take *unreasonable* measures**

RADPROS

REASONABLE MEASURES



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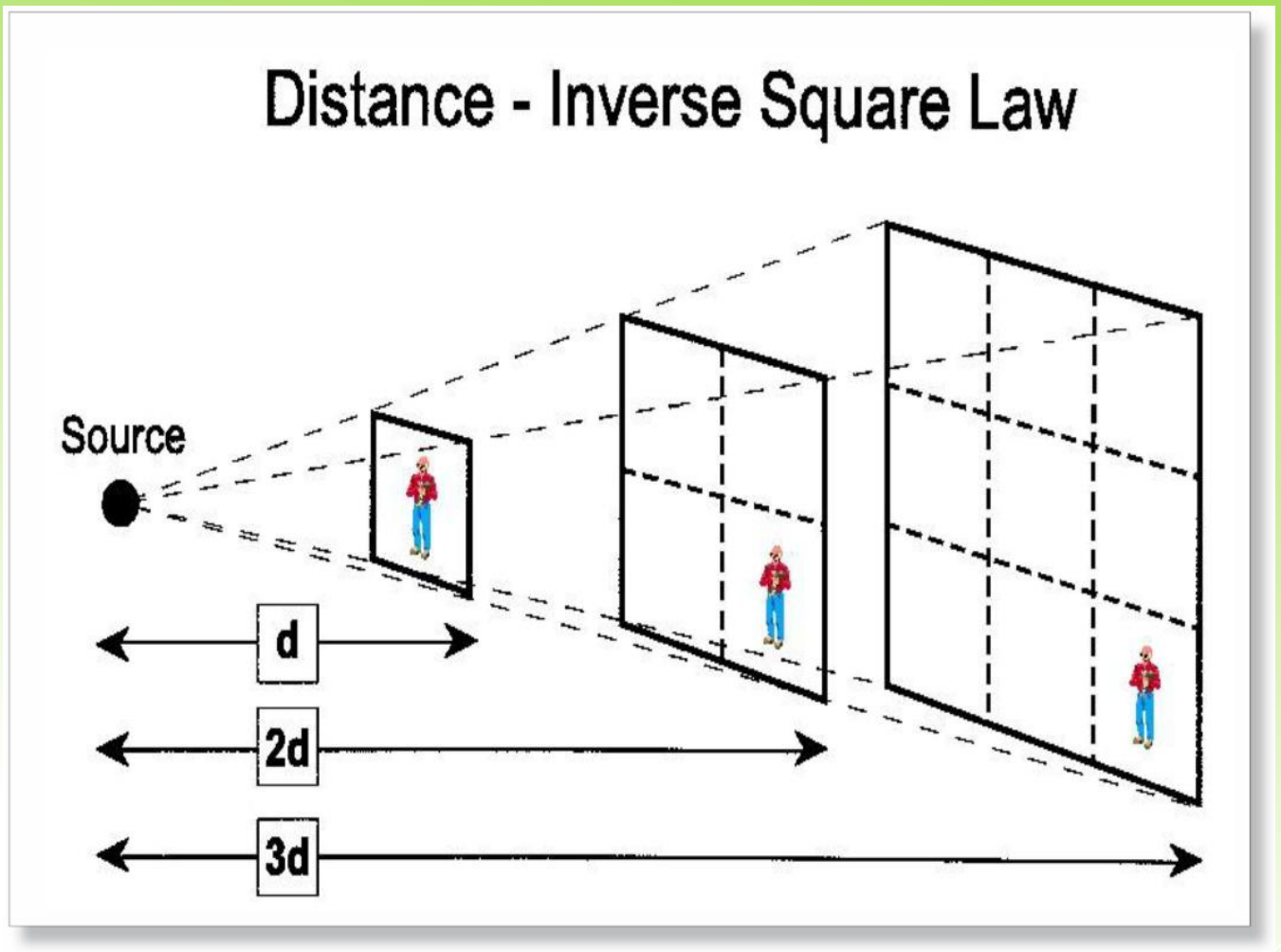
REASONABLE MEASURES



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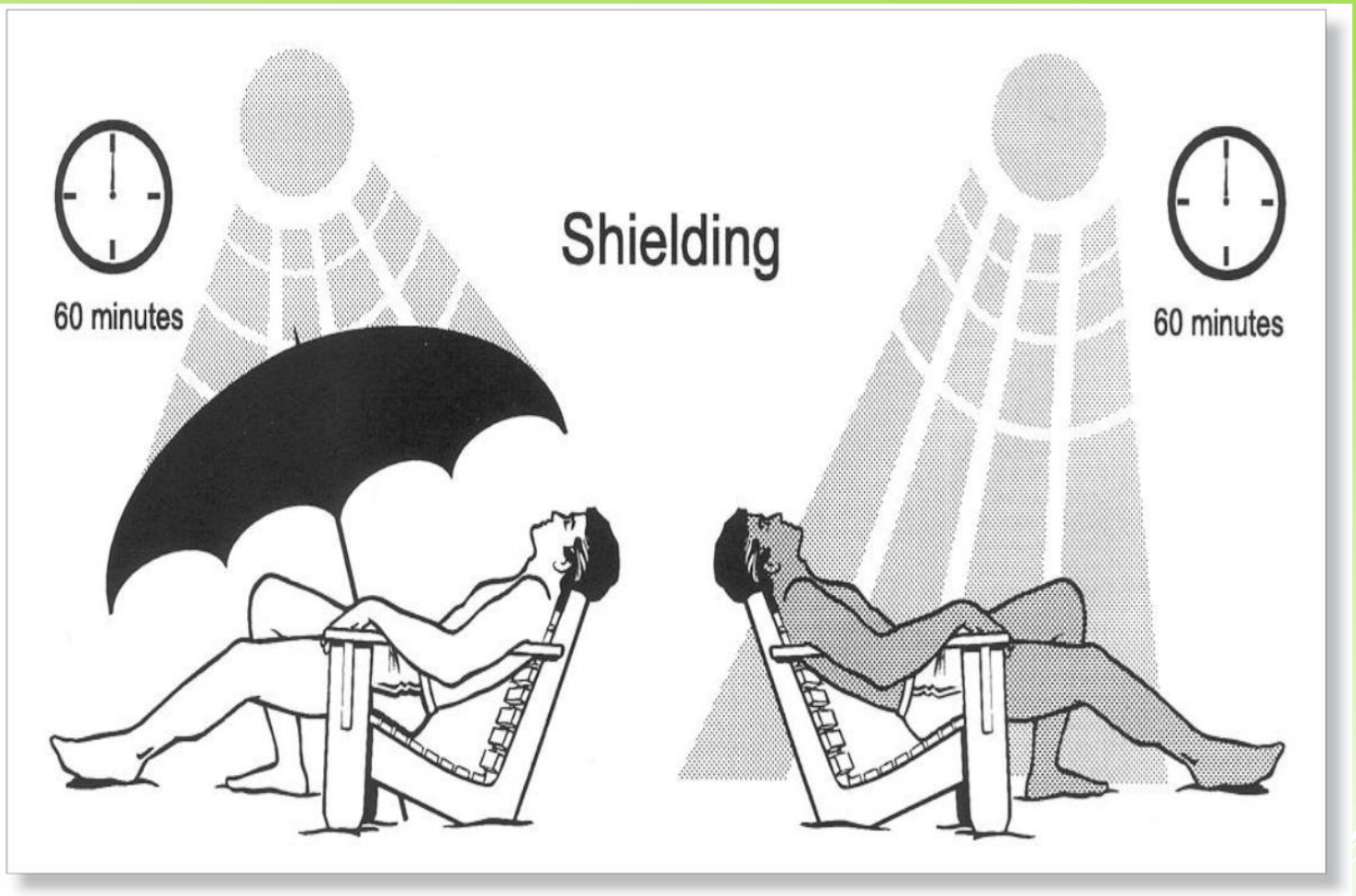
REASONABLE MEASURES



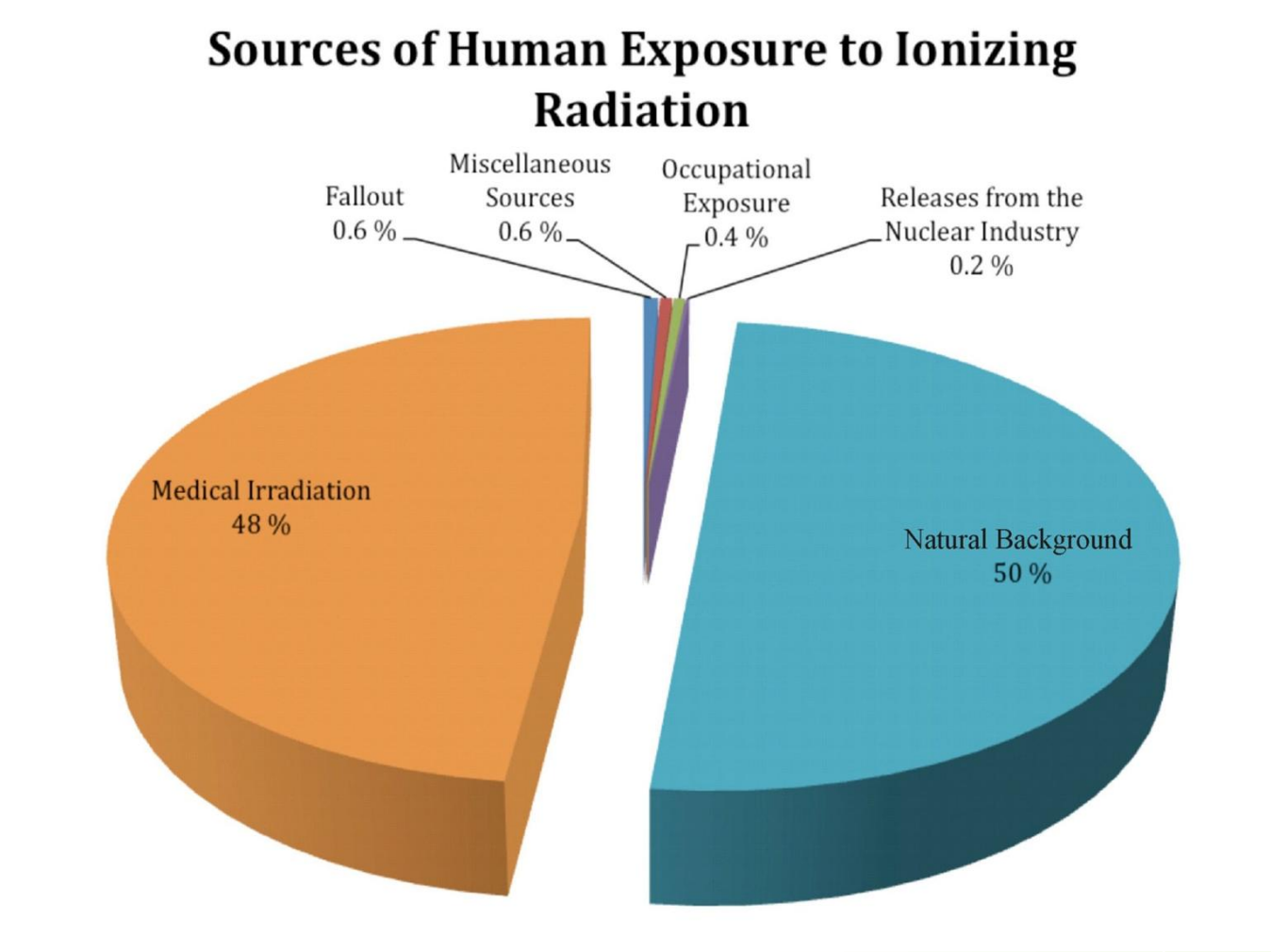
Typical PPE and precautions also work for TENORM

- ✓ **Respirators**
- ✓ **Safety goggles** / glasses / face mask
- ✓ Latex rubber and / or neoprene **gloves**
- ✓ **Rubber work boots**
- ✓ **Coveralls**: Rubber, PVC slicker suits or impermeable disposable suits.
- ✓ Duct tape cuff openings
- ✓ **Tyvek** – potential for heat stress

- Avoid skin contact and spreading of material
- Wash hands after handling, before eating

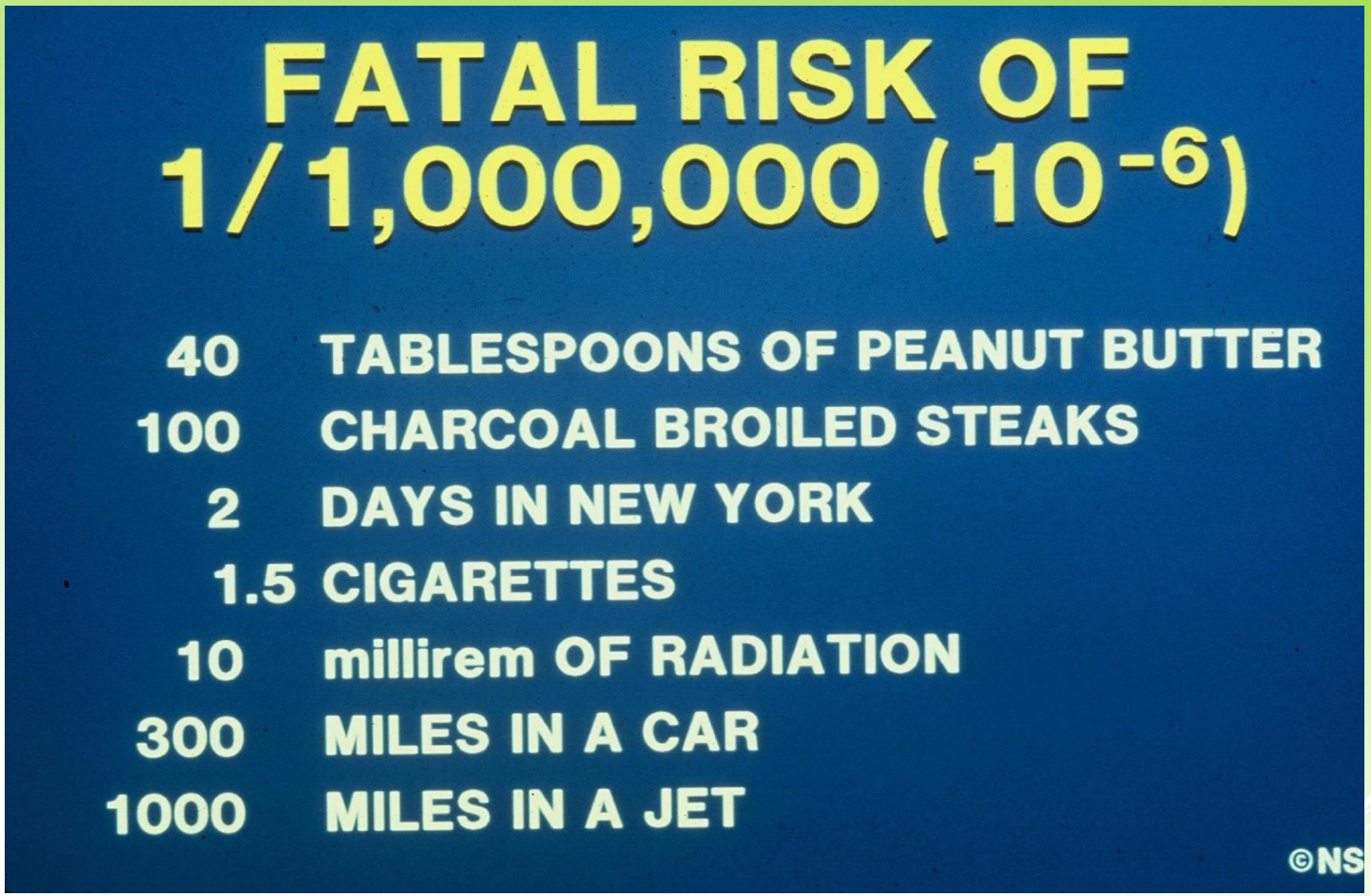
RADPROS

CONTEXT IS ESSENTIAL!



RADPROS

RELATIVE RISKS

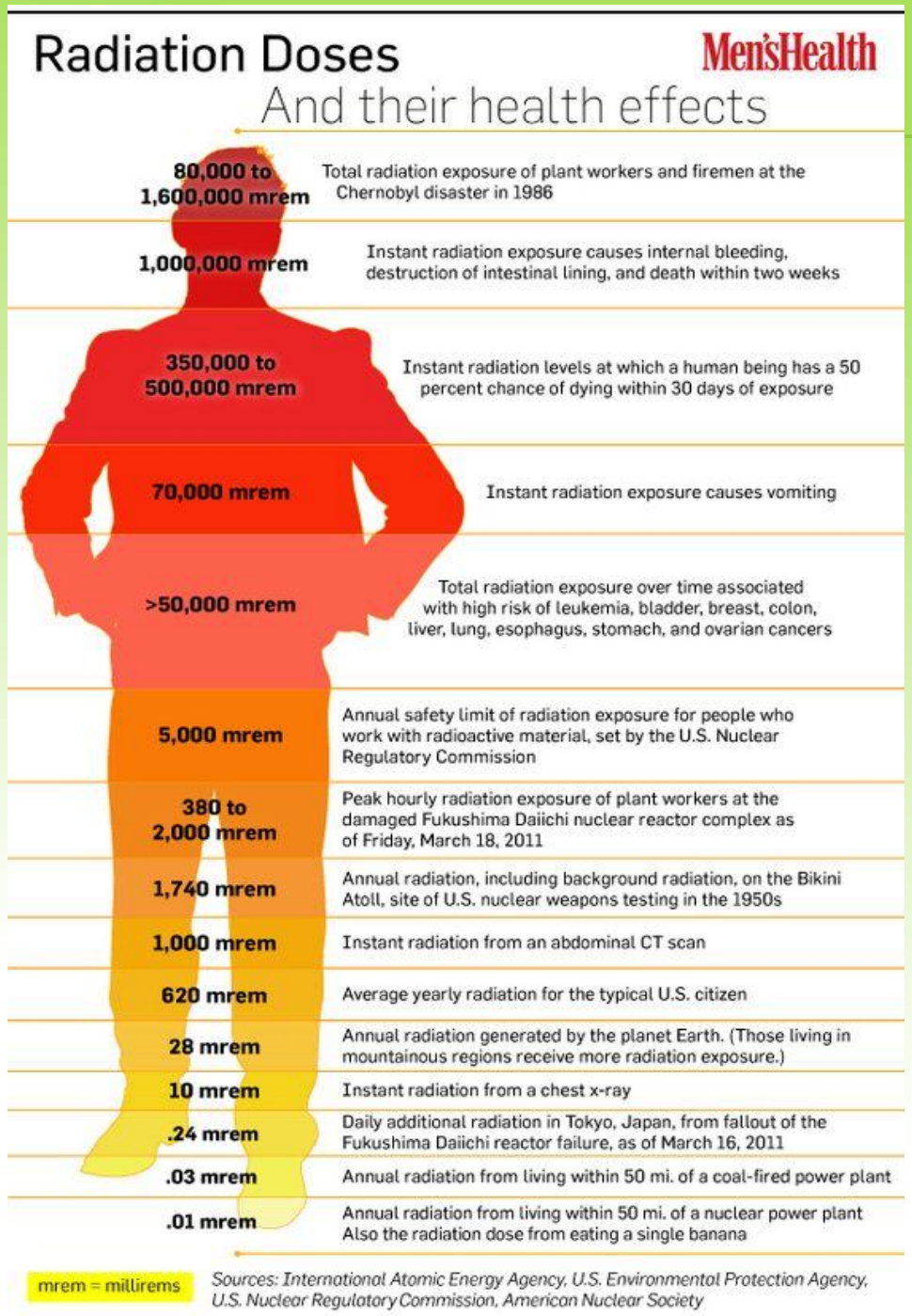


RADPROS

Reduction of Life Span from Various Causes

Activity	Average Reduction
Smoking (one pack per day)	9 years
Living in city vs. country	5 years
Being single vs. married	5 years
Desk job vs field job	5 years
Being male vs. being female	3 years
Radiation	
Cosmic	20 - 30 days
Terrestrial	50 - 100 days
Medical	30 days
Luminous watch	< 26 days
World fallout	< 1 day

RADPROS


Radiation Doses
Men'sHealth
And their health effects
80,000 to 1,600,000 mrem
Total radiation exposure of plant workers and firemen at the Chernobyl disaster in 1986
1,000,000 mrem
Instant radiation exposure causes internal bleeding, destruction of intestinal lining, and death within two weeks
350,000 to 500,000 mrem
Instant radiation levels at which a human being has a 50 percent chance of dying within 30 days of exposure
70,000 mrem
Instant radiation exposure causes vomiting
>50,000 mrem
Total radiation exposure over time associated with high risk of leukemia, bladder, breast, colon, liver, lung, esophagus, stomach, and ovarian cancers
5,000 mrem
Annual safety limit of radiation exposure for people who work with radioactive material, set by the U.S. Nuclear Regulatory Commission
380 to 2,000 mrem
Peak hourly radiation exposure of plant workers at the damaged Fukushima Daiichi nuclear reactor complex as of Friday, March 18, 2011
1,740 mrem
Annual radiation, including background radiation, on the Bikini Atoll, site of U.S. nuclear weapons testing in the 1950s
1,000 mrem
Instant radiation from an abdominal CT scan
620 mrem
Average yearly radiation for the typical U.S. citizen
28 mrem
Annual radiation generated by the planet Earth. (Those living in mountainous regions receive more radiation exposure.)
10 mrem
Instant radiation from a chest x-ray
.24 mrem
Daily additional radiation in Tokyo, Japan, from fallout of the Fukushima Daiichi reactor failure, as of March 16, 2011
.03 mrem
Annual radiation from living within 50 mi. of a coal-fired power plant
.01 mrem
Annual radiation from living within 50 mi. of a nuclear power plant
Also the radiation dose from eating a single banana
mrem = millirems
Sources: International Atomic Energy Agency, U.S. Environmental Protection Agency, U.S. Nuclear Regulatory Commission, American Nuclear Society

RADPROS

RISK HIERARCHY

- Chemicals – RCRA
  - ✓ Toxic
  - ✓ Corrosive
  - ✓ Reactive
  - ✓ Ignitable

- Slips, Trips, and Falls
- Pressurized Systems
- Heavy Equipment
- **TENORM –** Only if improperly managed

RADPROS

YOUTH, FEMALES & BABIES

- Allowable dose for a trained and monitored worker = 5,000 mrem
- Lower thresholds of monitoring for youth – 10% of allowable dose for adults (500 mrem/yr)
- Nursing and pregnant women – same lower threshold
- Notify RSO if you are pregnant or nursing
- Duties can be adjusted to minimize exposure
- Additional monitoring can be implemented
- Dose at your WTPs are often monitored at 100 mrem/yr

RADPROS

TENORM IN WATER TREATMENT

Where it Shows Up in Your World

ATTRIBUTES OF RADIUM

- ^{226}Ra and ^{228}Ra chemically identical
  - Same treatment and removal characteristics
- Ra-226 is an “alpha emitter” - as it decays it produces radon
  - Permanent, continuous source of radon
  - Groundwater sources

Filtration and Residuals

REQUIRED POSTINGS

- **Formal Restricted Areas do not exist** at most WTPs. Dose rates simply do not approach this classification – they are low!
- **No postings are required.**
- Signage may still be placed to alert employees to elevated areas.

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AREAS FOR POTENTIAL IMPACT

Frequently elevated levels:

- Storage of sludge or residuals
- Filters & filter media
- Pipe

Potentially elevated levels (areas we check):

- Pumps/equip where mineral scale may accumulate
- Lagoons
- Flocculation tanks
- Sedimentation tanks
- Pumping stations
- Facilities where filter backwash, brines, or other contaminated water accumulates

RADPROS

EMERGENCY PROCEDURES

- **Follow your established protocol.**
- **Employee safety first.**
- **Take any safe, mitigating actions possible** (stop water flow, put out the fire, introduce additional containment, etc.).
- **Contact RSO if there has been any kind of release or spread of contamination (residuals).**
- **Management or the RSO will notify the appropriate regulators.**

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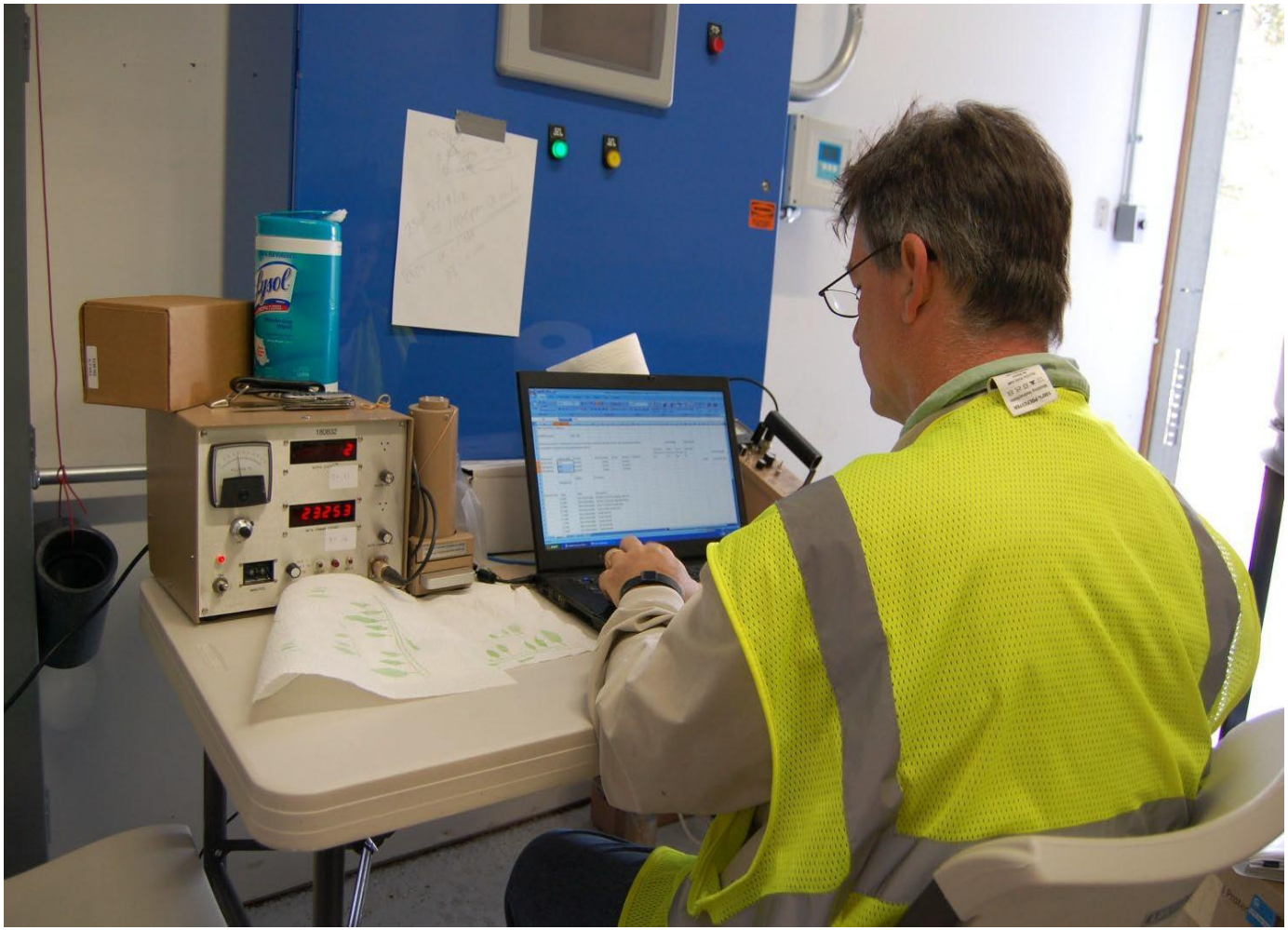
High Levels in Filter Media

RADPROS

Packaged and Secured

RADPROS

Science at Work in the Field



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Impacted Settling Pond

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When Can We Stop Digging?

RADPROS

Ready to Build!

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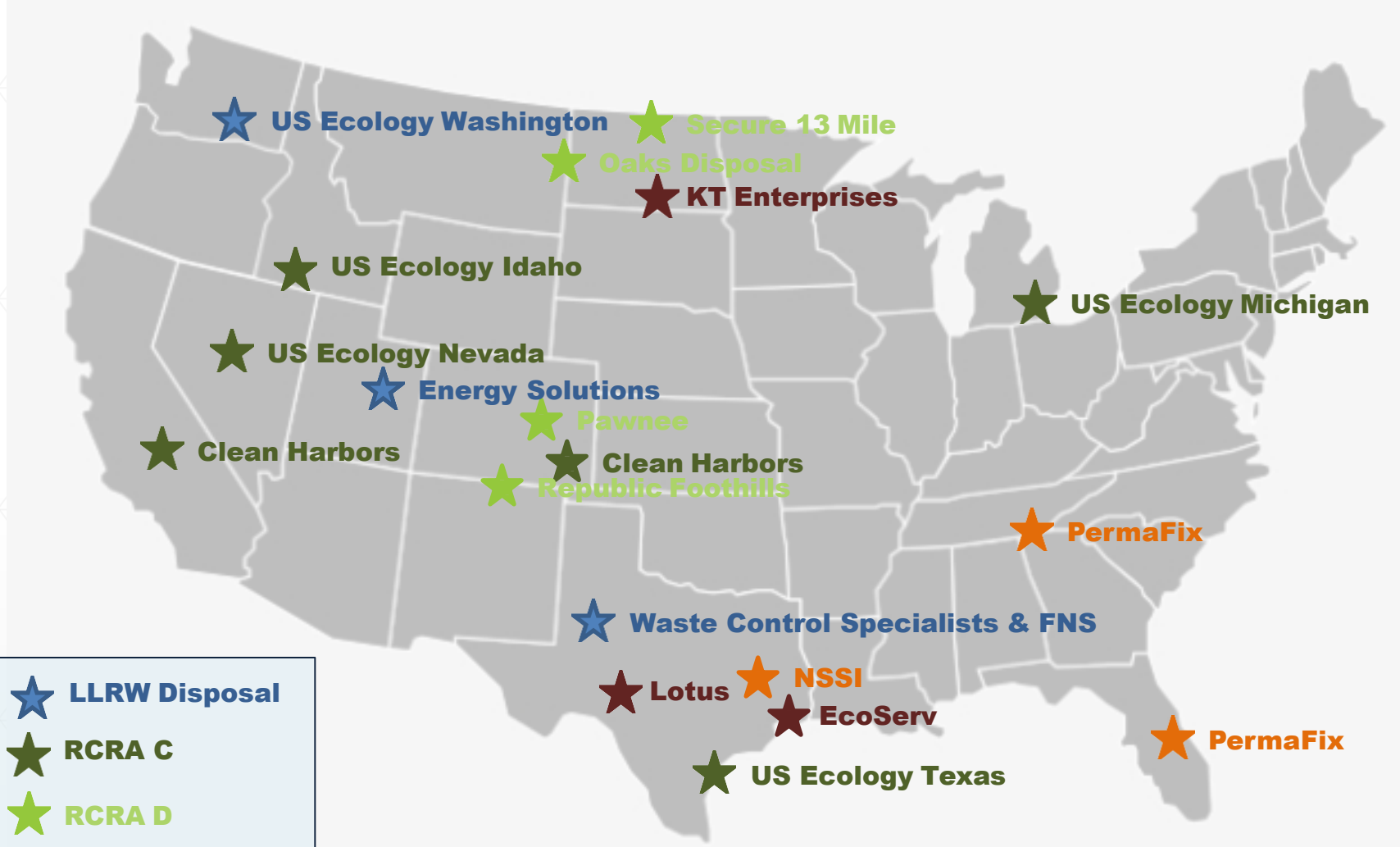
TENORM TRANSPORT & DISPOSAL

Cradle-to-Grave Responsibilities

Transportation

Limited U.S. TENORM Disposal Options



Waste Transport & Disposal

The BIG Issues:

1. Transportation regulations, permitting, costs, & logistics
2. Waste acceptance criteria (at targeted facility)
3. Facility registration in place?
4. Land application constraints
5. Waste matrix
6. Authorized radioactive materials shipper and manifest needed?

TENORM REGULATIONS

What You Need to Know About Compliance

Why Regulators Regulate

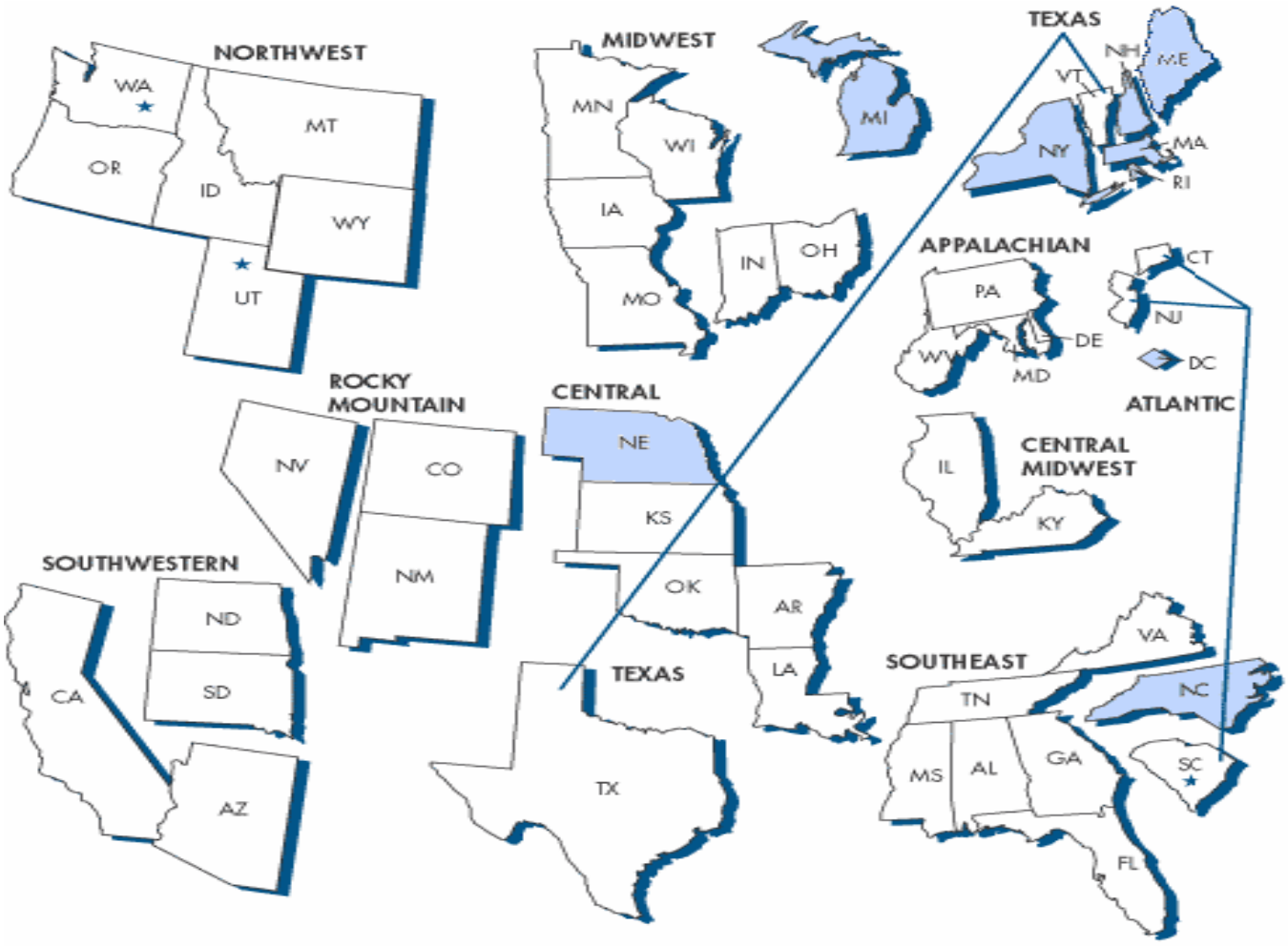
- **Public Health**
  - Uneducated in technical matters
  - Unaware of the questions to even ask
  - Lack of tools and access
- **Worker Health**
- **Environmental Protection**
  - Physical plant
  - Grounds
  - Downstream
  - Landfills
- **Not all hazards require the same level of scrutiny**

What Regulators Look At - Licensees

- Training records**
- Dosimetry records
- Survey records
- Inventory records
- Shipping papers (if appropriate)**
- Waste records (if appropriate)**
- Work plans and practices
- Meter calibration and maintenance records
- Equipment service records (if appropriate)

***Registrants*

COMPACT REGIONS



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Other Regulatory Agencies

- NRC/state agencies regulate most uses of radioactivity (10 CFR 20 and others)
- DOT regulates transportation of radioactive materials (49 CFR 171-173)
- EPA definition some environmental discharges or contamination – dose levels
- States regulate most NORM/TENORM and radiation-generating machinery
- FDA regulates medical devices that emit radiation

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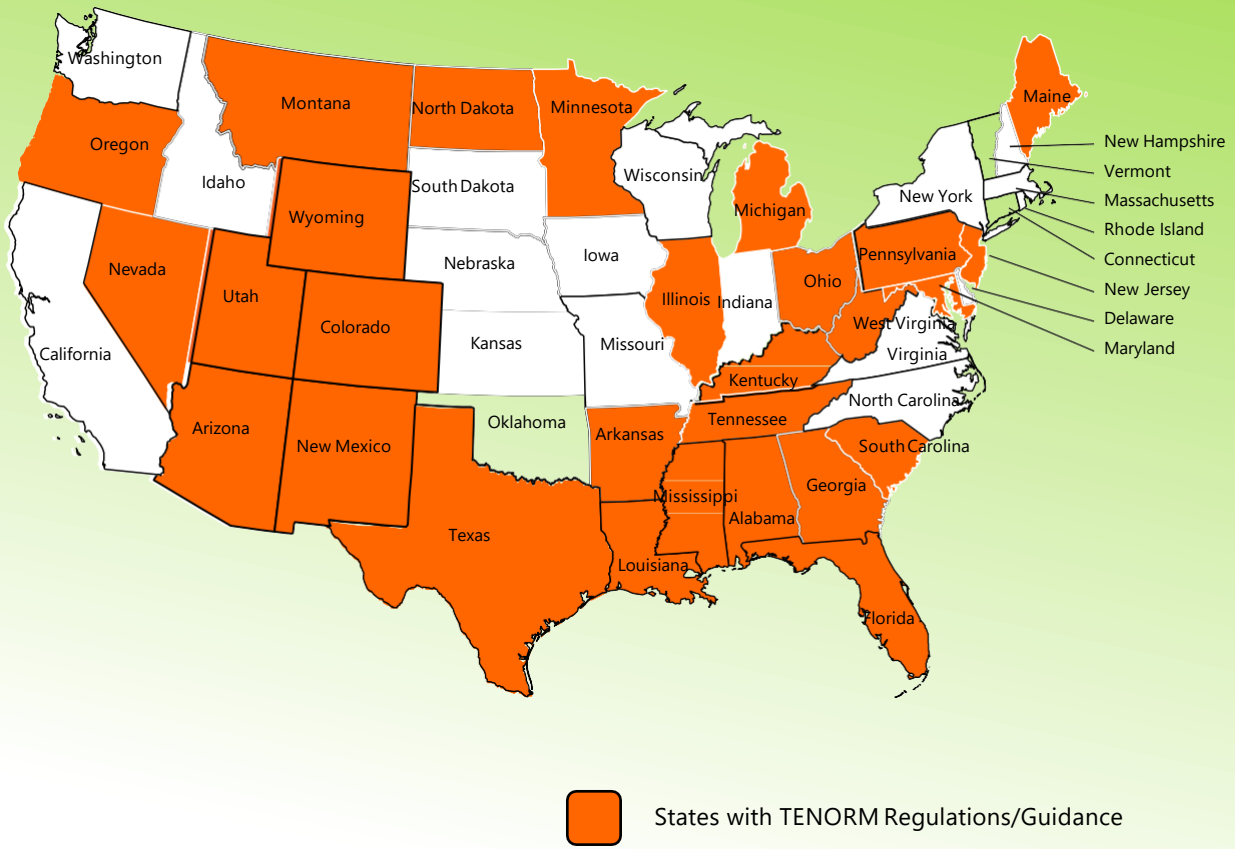
TENORM - REGULATED BY INDIVIDUAL STATES



TENORM Rules & Regulations

- Regulate worker dose levels and dose to members of the public
- Regulate the proper management & disposal of residuals and any waste or contaminated equipment.
- Compliance and monitoring by Radiation Control regulators – IEMA under Illinois Administrative Code (32 IAC 622). See also Part 330 for licensing.
- Radon – licensed separately
- Landfills and land applicators have their own rules to play by
- State and county governance applies to landfills

RADPROS

Licensing of Facilities and Contractors

- **General License** – issued to operators, typically by location, but may be issued broadly to an entity

- **Facility Registration or Licensing** – e.g., some water treatment plans, a research laboratory, radiography (x-ray/CT scan) or nuclear medicine facility, industrial application, TENORM waste processor or landfill, etc.

- **Contractor/Service License** – to serve others at licensed, registered, and unlicensed facilities – e.g., waste management, brokering, decommissioning & decontamination

  Licensed contractors (service providers) assume much of the compliance responsibilities when working for clients

- **TENORM Transporter's License** – Only in some states

- **Reciprocal License** – leverage a single state license to work in other states

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Licensed vs. Unlicensed Activities

Know the difference!

ILLINOIS REGULATIONS

- **Regulated radionuclides: Ra-226, Ra-228, Uranium, and their progeny**
  - **All regulated radionuclides should follow the maximum contaminant level (MCL) if present in drinking water:**
    - Beta/photon emitter: MCL = 4 mrem/yr
    - Alpha emitter: MCL = 15 pCi/L
    - Combined radium (Ra-226 + Ra-228): MCL = 5 pCi/L
    - Uranium: MCL = 30 *u*g/L
  - **There are no combined radium concentration exemptions from registration; therefore, the generation of any low-level waste by a facility requires they be registered with IEMA.**
- **TENORM must be disposed of at a commercial solid waste facility registered to accept it,** or at a facility authorized to receive it through a specific license or registration.

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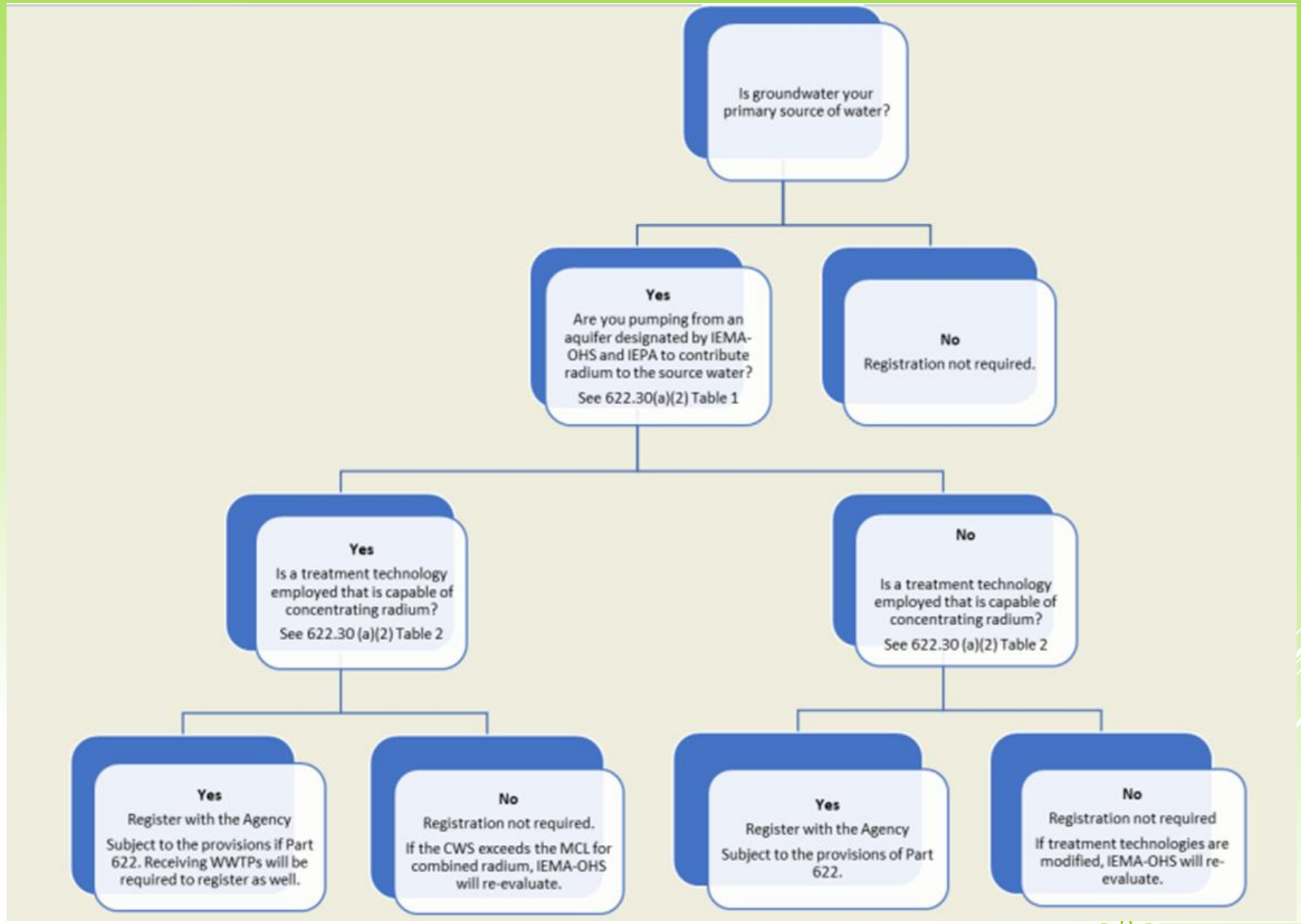
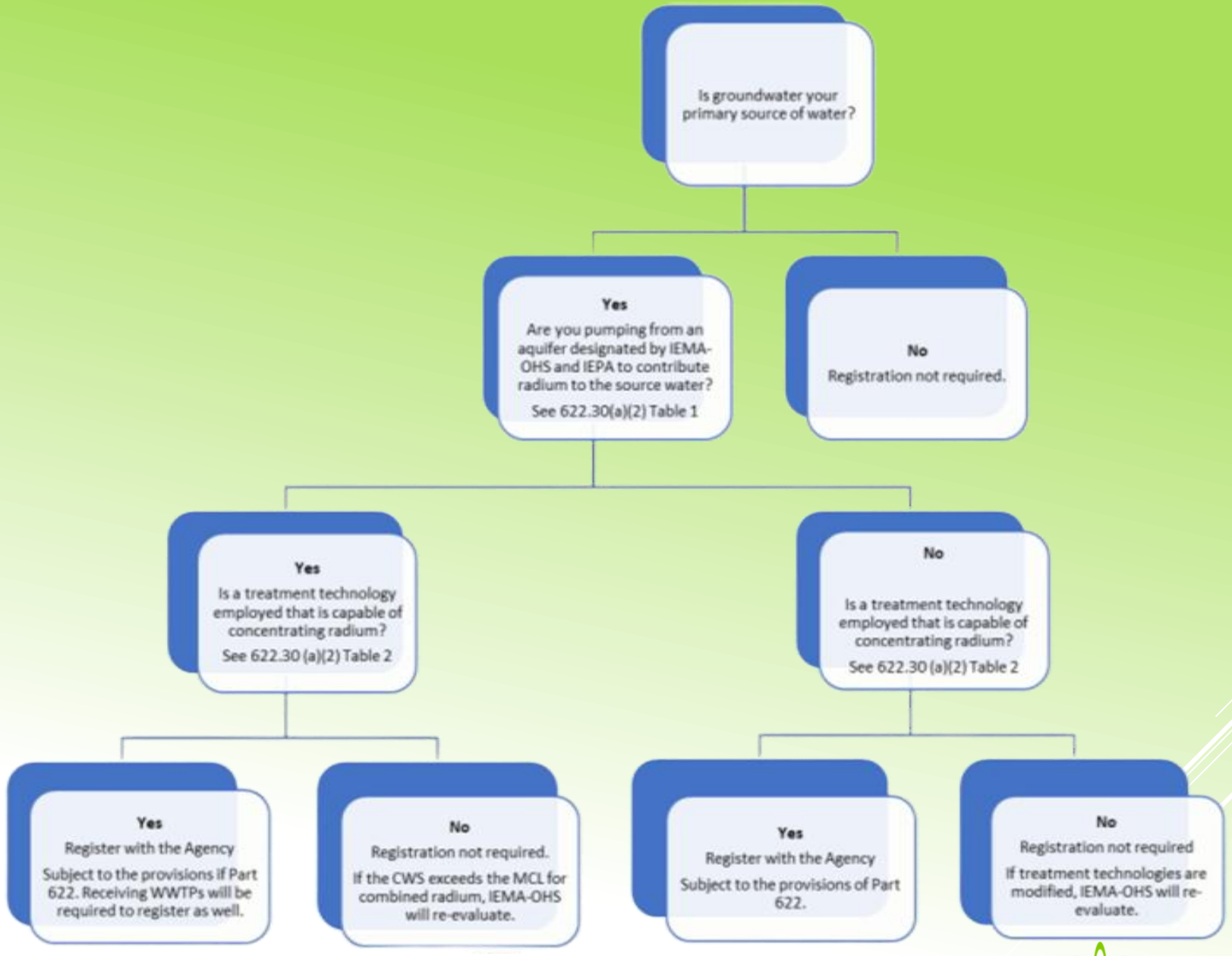
ILLINOIS REGULATIONS

Amount/Type	Exemption
Combined Radium concentration ≤ 3.1 pCi/g	Exempted from disposal requirements
Combined Radium concentration ≤ 200 pCi/g	Exempted from licensing
Storage of RAM whose half-life ≤ 120 days	Exempted from registration
Groundwater wells used as emergency/backup source	Exempted from registration

RADPROS


Is groundwater your primary source of water?
Yes
Are you pumping from an aquifer designated by IEMA-OHS and IEPA to contribute radium to the source water?
See 622.30(a)(2) Table 1
No
Registration not required.
Yes
Is a treatment technology employed that is capable of concentrating radium?
See 622.30 (a)(2) Table 2
No
Is a treatment technology employed that is capable of concentrating radium?
See 622.30 (a)(2) Table 2
Yes
Register with the Agency
Subject to the provisions if Part 622. Receiving WWTPs will be required to register as well.
No
Registration not required.
If the CWS exceeds the MCL for combined radium, IEMA-OHS will re-evaluate.
Yes
Register with the Agency
Subject to the provisions of Part 622.
No
Registration not required
If treatment technologies are modified, IEMA-OHS will re-evaluate.

RADPROS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WHO IS REGULATED?

Public Water Treatment Facilities Using These Technologies:

- Ion exchange
- Reverse osmosis
- Lime softening
- Green sand filtration
- Co-precipitation with Barium sulfate
- Electrodialysis/electrodialysis reversal
- Pre-formed **hydrous manganese oxide (HMO) filtration**
- Activated alumina
- Enhanced coagulation filtration
- Any other treatment technology that increases the combined radium concentration or resulting water treatment residuals beyond that which is naturally present.

RADPROS

WHO IS REGULATED?

Public Water Treatment Facilities Leveraging Groundwater Sources from these Aquifers:

- Cambrian
- Ordovician
- Devonian
- Silurian
- Any other aquifer that gives rise to a MCL for combined radium

RADPROS

WHO IS REGULATED?

Other Entities (not WTPs):

- Facilities allowed by the IEPA and receiving treatment process from a treatment facility.
- Municipal solid waste landfills, allowed by the IEPA, if used by the aforementioned facilities to dispose of waste.
- Land applicators allowed by the IEPA who apply water treatment residuals generated by the aforementioned facilities.
- No exemptions exist, if you generate it.
- Anyone who the IEPA says needs to register.

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EXEMPTIONS (AND DISPOSAL OPTIONS)

- If groundwater sources are only for backup, emergency supply purposes
- If disposal is at a licensed LLRW facility
- If residuals are ≤ 3.1 pCi/g (DWB), no disposal or re-purpose conditions apply.
- If ≤ 100 pCi/g (DWB), release at a facility's sanitary sewer may be approved by IEPA.
- Land application allowed:
  - With landowner disclosure
  - Approved transportation, lab testing, and application by IEPA
  - Incremental radium ≤ 1.0 pCi/g; total soil concentration ≤ 3.1 pCi/g

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MORE DISPOSAL OPTIONS

- If residuals are > 100 pCi/g (DWB) and ≤ 200 pCi/g may be disposed of at IEPA-approved facility or alternative method, or by sanitary sewer release (subject to Federal and State solid or hazardous waste rules).

Note: An EPA-approved lab is required for all lab testing.

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DOSE & SURVEY REQUIREMENTS

- Dose in unrestricted areas must be < 0.02 mSv/hr.
- Employees to be trained before handling radioactive or hazardous materials (and provided proper PPE).
- Institutional and engineered controls must be in place to limit exposure.
- Surveys of the entire facility must be performed annually.
- Surveys of restricted work areas done before, during, and after work requiring entry and/or potential contamination.
- Survey instruments calibrated annually.

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TRAINING REQUIREMENTS

- 1-2 hours of Awareness Training
- Policies/procedures to maintain ALARA
- Must cover:

- Storage, transfer, and use of radioactive material and sources.
- Health risks and protective measures and procedures to minimize dose to workers and a fetus, including functions of dosimeter and mechanism to ensure regulatory dose limits are not exceeded.
- Stop work authority.

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IN SUMMARY

TENORM

- Subject to Lab Analysis for proper management determination
- A Compliance Issue
- A Waste Management Issue
- Proper Training, Awareness, and Management, and use of licensed contractors can fully mitigate most any TENORM hazards.

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QUESTIONS?

RADPROS