Overview of Radon and TENORM Regulations

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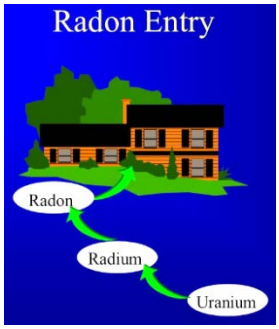
Today's Radon Goals



- What is it?
- Where does it come from?
- How does it get into our homes?
- What are the health effects?
- What can we do about it?

Michigan Indoor Radon Program

- Non-regulatory
- Focus on outreach and testing
- Funded by Environmental Protection Agency's State Indoor Radon Grant

What Is Radon?

- Radon is a tasteless, odorless, colorless, radioactive gas.
- Radon is an element that occurs naturally in soil and rock; comes from radioactive decay of uranium and radium.

How Radon Enters Your Home?

- Exposed soil or crawlspaces
- Cracks or flaws in foundation walls
- Around utility penetrations and support post
- Hollow objects such as support posts
- Cracks or flaws in subfloor
- Floor Drains and pumps
- Floor/wall joints

Negative Pressures in Building Normally Cause Radon Entry

- The same factors that increase outside air infiltration can pull air from soil into home (stack effect, exhaust systems, and weather)

Why Is Radon A Concern?

- Radon decays into radioactive particles known as radon decay products.
- These particles are easily inhaled and deposited in the lungs where they can damage sensitive lung tissue.

Atomic Particles Can Damage Lung Cells

- Lung Cell Will: Die, Heal Itself Correctly, Heal Itself Incorrectly

Radon Is the Second Leading Cause of Lung Cancer in the United States

- Radon is a KNOWN Human Carcinogen ("Class A" - like mustard gas, tobacco smoke, asbestos, benzene, and vinyl chloride
- Radon results in approximately
  - 21,000 lung cancer deaths in U.S. per year
  - 600 lung cancer deaths in Michigan per year

Lung Cancer Risk per 1,000 People

Lifetime Avg.	Smoker	Never-Smoker
20 pCi/L	260	36
10 pCi/L	150	18
8 pCi/L	120	15
4 pCi/L	62	7
2 pCi/L	32	4
1.3 pCi/L	20	2

(Info from Citizen's and Home Buyers & Sellers Guides)
DEQ MECC 2016 12

Your Chances of Getting Lung Cancer?

- How much radon is in your home
- The amount of time you spend in your home (or any indoor environment w/elevated radon levels)
- Whether you have ever smoked
- Much higher if you were ever a smoker
- Mitigation with active soil depressurization costs $800-$1500 and can be installed in less than a day

Today's TENORM Goals

- Today Identify source of radon and technically enhanced naturally occurring radioactive materials (TENORM)
- Identify how to mitigate exposure to these radon and TENORM
- Identify how managed radon and TENORM when encountered to meet the regulations

Technologically Enhanced Naturally Occurring Radioactive Material (TENORM)

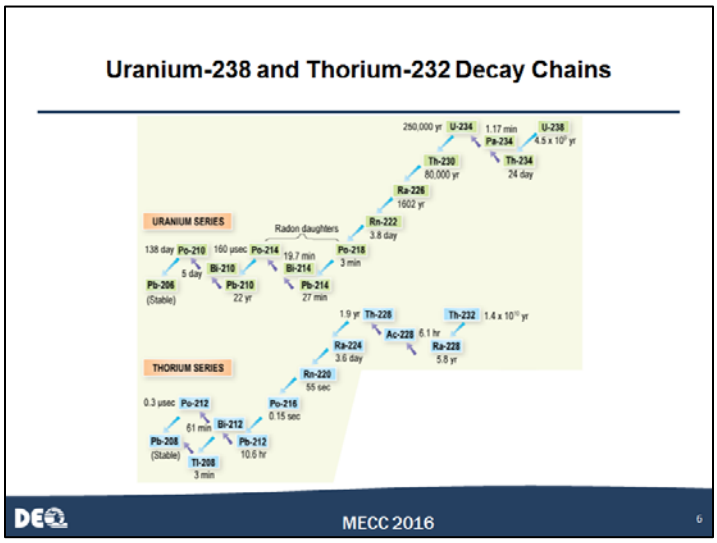
- TENORM is naturally occurring radioactive material whose concentrations are increased by or as a result of past or present human practices. It does not include background sources, the natural radioactivity of rocks and soils, or uranium and thorium in "source material" as defined in the Atomic Energy Act of 1954, as amended, and in the regulations of the U.S. Nuclear Regulatory Commission.
- Oil, gas, and brine production
- Drinking water treatment and bottling plants
- Other industries

Radium

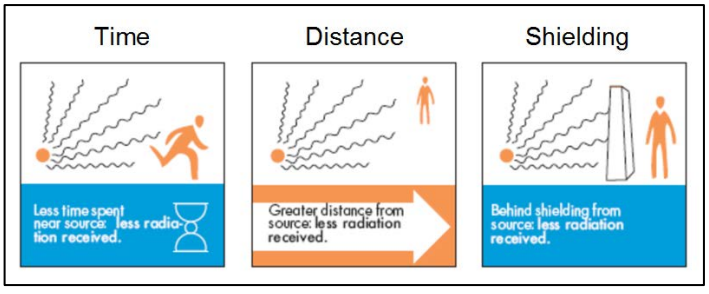
- Radium is more soluble than uranium or thorium in water so more of it is carried to the surface. Due to the reduction of temperature and pressure when the water comes to the surface, the radium plates out on the inside of pipes, tanks, and processing equipment as scale and sludge. When the pipes or equipment are dismantled, the facility or ground area can become contaminated.
- Radium-226 decays to radon-222 which is a noble gas. The radon-222 comes up from the ground with natural gas and cannot be filtered out before the gas is sent into the distribution lines. Radon-222 decays to lead-210. The lead accumulates on inner surfaces of gas lines and processing equipment - natural gas, propane, ethane, etc.

Ionizing Radiation

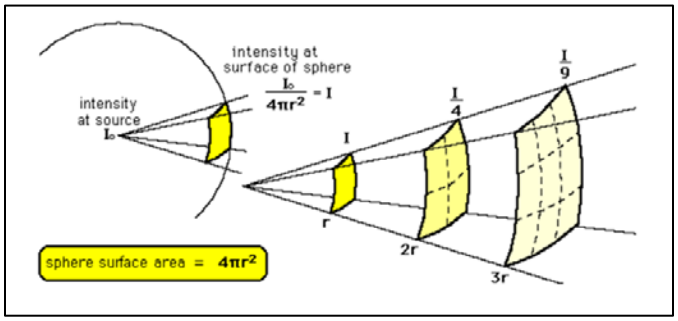
- Alpha: Large Particles (helium nucleus) – little penetrative ability, dangerous when taken into body (travel only 2-3 centimeters in air)
- Beta: Small particle (electron) – more penetrative ability than alpha, dangerous when taken into body (travel distance is about 2 meters in air)
- Gamma: Pure energy (photon) – high penetrative ability, dangerous to whole body. Emitted in waves and travel 500+ meters



Reduce Your Radiation Exposure



Inverse Square Law



Naturally Occurring Radioactive Material (NORM) at Michigan Oil and Gas Field Sites

- 1989 to 1991 - Radiological Protection and Geological Survey staff surveyed Michigan Oil and Gas sites. Staff visited 270 facilities (1,000 oil/gas wells).
    - Radium-226 in brine samples up to 9,000 picocuries/liter.
    - Radium-226 in tank sediments up to 5,500 picocuries/gram (pCi/g)
    - Radium-226 in contaminated soil around tanks up to 2,100 pCi/g
    - Radium-226 in scale up to 1,600 pCi/g
    - Gamma radiation rates as high as 3,200 µR/hr.

Cleanup and Disposal Guidelines for Sites Contaminated with Radium-226

- Issued in October, 1995
    - - 5 picocuries per gram for soil cleanup criteria
    - - 50 picocuries per gram of debris, rubble, soil, etc. can go into Type II landfills

Michigan TENORM Disposal Advisory Panel White Paper2014-2015

- Separate EQC-1602 into one document that provides cleanup guidelines and one document that provides disposal guidelines.
- Specify TENORM placed at least 10 feet below the bottom of the landfill cap.
- Restrict total volume to limit worker dose with process to allow additional volume based on worker safety plan.
- Require landfills accepting TENORM to monitor leachate and ground water monitoring wells for radium-226.
- Consider allowing hazardous waste landfills to accept > 50 pCi/g radium-226.
- Consider developing regulatory guidelines for the safe handling of TENORM contaminated with Lead-210.

USDOT Special Permits

- The Radiological Protection Section can issue a USDOT Special Permit to allow a shipment discovered at a scrap yard or a landfill containing scrap or waste that is radioactive to be shipped back to its place of origin or to another location. Call us.

TENORM Links

- www.michigan.gov/deqradon
    - Click on "**Radioactive Materials**" on the left navigation menu

RADON

Notes:

TENORM

Notes: