

Background Radiation at the DuPont Chambers Works FUSRAP Site

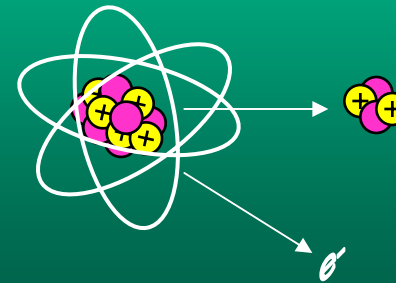


Restoration Advisory Board Meeting

April 10, 2008

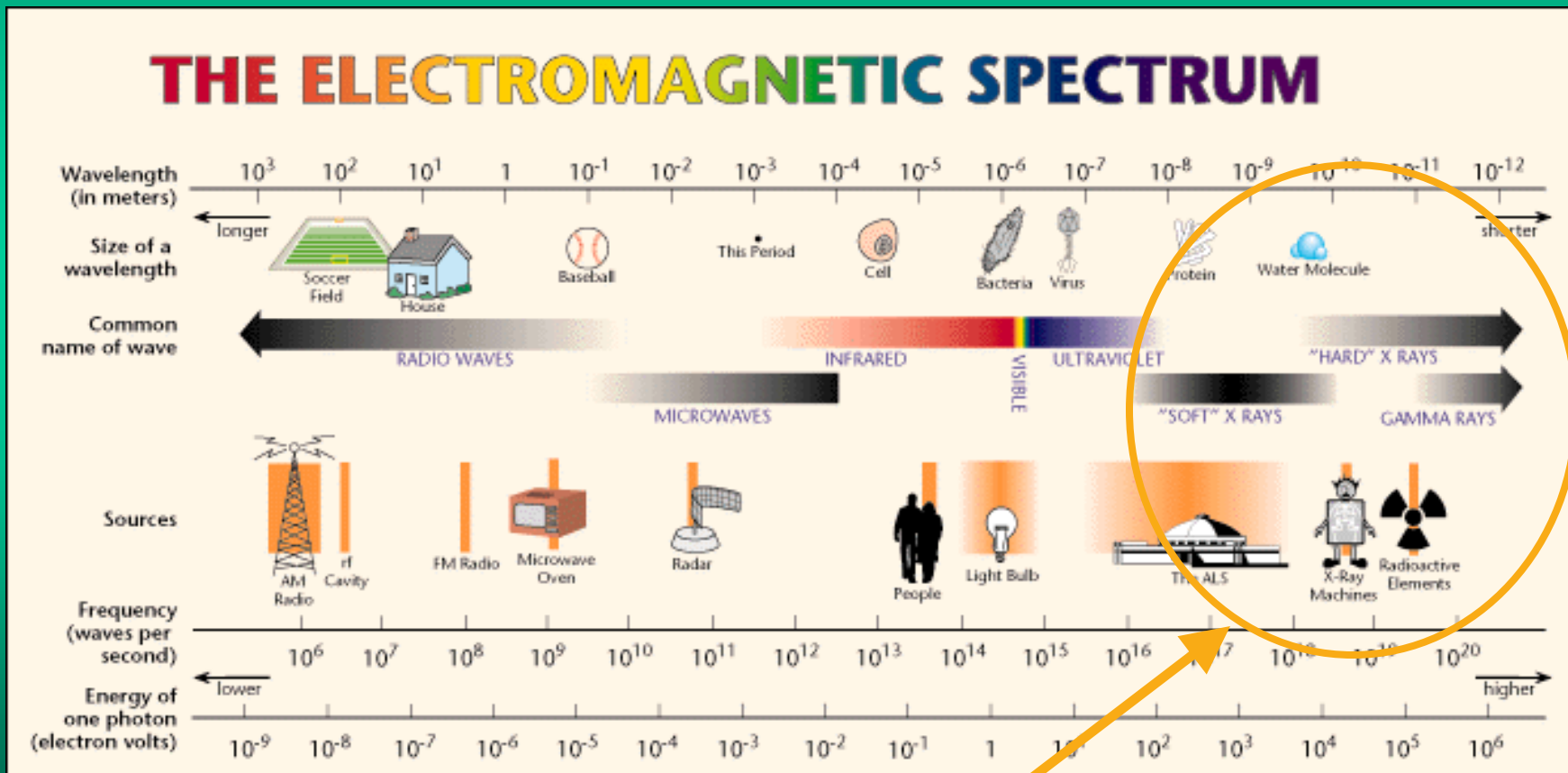
What is Background Radiation?

- Background radiation is all around us! It's energy that we all are exposed to from living on Earth
- Our world is radioactive and has been since the beginning
- There are over 60 radioactive elements in nature, in three basic categories:
 - Primordial (of the earth)
 - Cosmogenic (from space)
 - Human Produced



What is Radiation?

- Radiation is the emission of energy and can have many forms

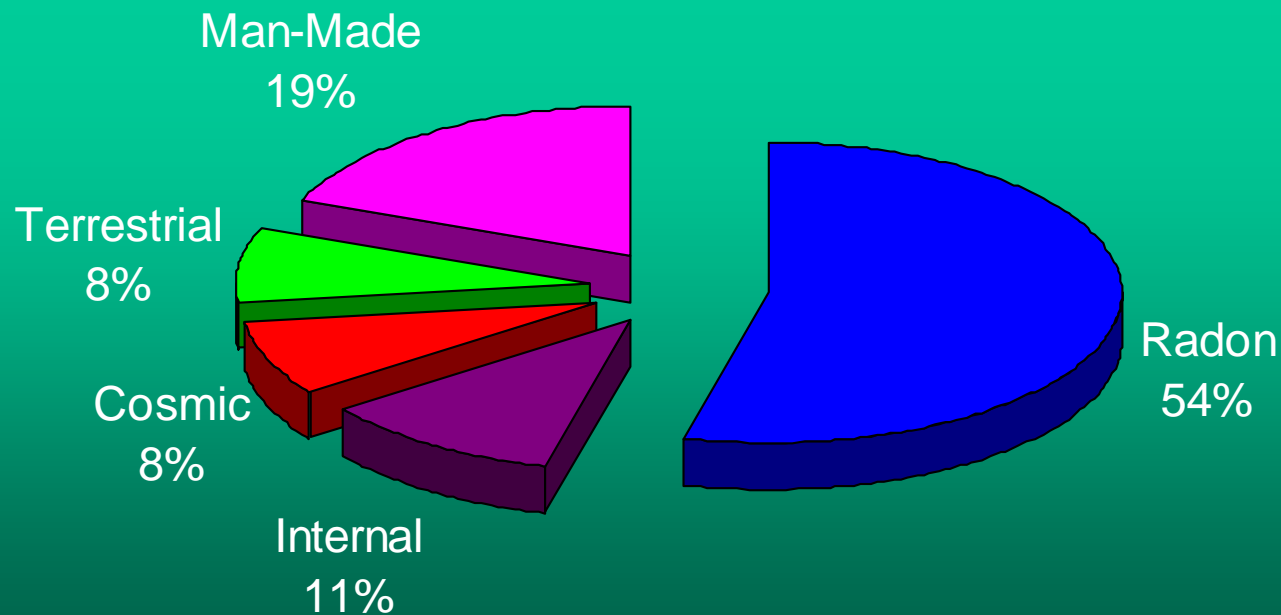


Ionizing Radiation



Where Does Ionizing Radiation Come From?

- Ionizing radiation comes from many sources
- The sources are both natural and man-made
- On average, people in the U.S. receive about 360 mrem/yr (a measure of radiation dose)



Natural Background Radiation

(from NCRP Report 93)

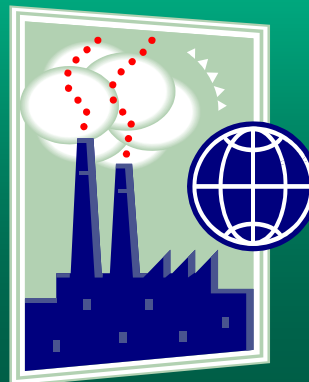
- **Cosmic** - from the sun and outer space - 28 mrem/yr
- **Terrestrial** - from the earth's crust - 28 mrem/yr
- **Radon** - from radium in the soil - 200 mrem/yr
- **Internal** - from natural sources in the body - 39 mrem/yr



Man-Made Radiation Sources

(from NCRP Report 93)

- Medical radiation -53 mrem/yr
- Consumer products -10 mrem/yr
- Industrial uses -less than 3 mrem/yr
- Testing of nuclear weapons -less than 1 mrem/yr
- Nuclear power -less than 1 mrem/yr



Consumer Products Containing Radioactivity

- Smoke Detectors
- Watches and Clocks
- Ceramics and Pottery
- Fertilizers
- Lantern Mantles
- Food
- Certain Types of Glass
- Antique 'Curatives'



Background Radiation in Southern NJ

- Radium and Radon are very common radioactive natural products in Southern NJ
- Concentrations of Radium (Ra-226/-228) and Radon (Rn-222) in soils and groundwater are unusually high due to the region's geology
- USGS studied groundwater conditions between 1988 – 1996:
 - 33% of samples had Total Ra > EPA MCL (*5 pCi/L*)
 - 14% of samples had Gross Alpha > EPA MCL (*15 pCi/L*)



Background Radiation in Southern NJ

DuPont Chambers Works Site



Radium-226 and Radium-228 in Shallow Ground Water, Southern New Jersey

Concentrations of total radium (the sum of radium-226 and radium-228) and gross alpha-particle activities in drinking water that exceed the U.S. Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) are known to cause cancer. Results of investigations by the U.S. Geological Survey (USGS) in cooperation with the New Jersey Department of Environmental Protection (NJDEP) indicate that concentrations of total radium in water samples from 33 percent of 170 wells in the Kirkwood-Cohansey aquifer system in southern New Jersey exceeded the MCL of 5 pCi/L (picocuries per liter) (fig. 1). Wells containing water in which concentrations of total radium were greater than the MCL typically are found where the Bridgeton Formation crops out, in or near an agricultural area, where ground water is acidic (pH less than 5), and where nitrate concentrations generally exceed 5 mg/L (milligrams per liter). Leaching of nitrogen, calcium, and magnesium from agricultural chemicals (fertilizer, lime) applied to cropland may increase the mobility of radium in ground water. Gross alpha-particle activities exceeded the USEPA MCL of 15 pCi/L in water from 14 percent of 127 wells. A statistically significant 2:1 ratio between gross alpha-particle activity and concentration of total radium indicates that gross alpha-particle activity can be used as a screening tool to predict the presence of water that may have a high total-radium concentration.

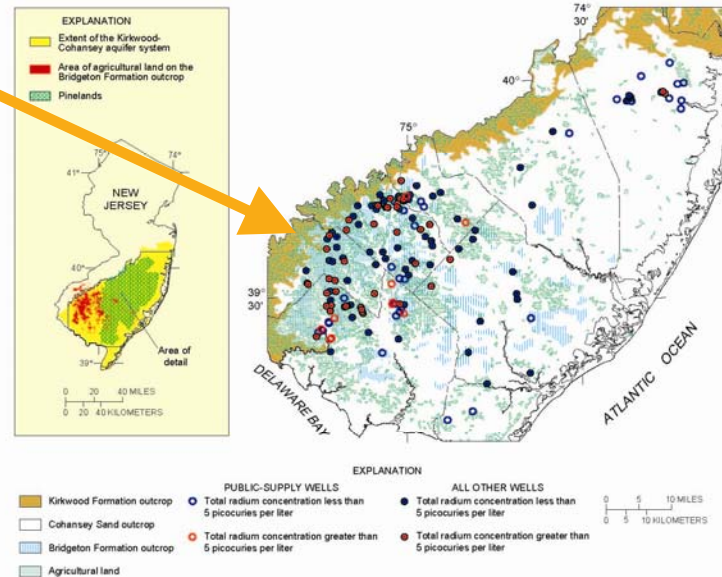


Figure 1. Extent of the Kirkwood-Cohansey aquifer system in New Jersey, areas of agricultural land use, and locations of wells sampled for analysis of radium concentrations, 1988-96.

U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet FS-062-98
June 1998



Philadelphia District
US Army Corps of Engineers

Radionuclides of Concern at DuPont Chambers Works

- All Radionuclides of Concern at DuPont Chambers Works are also found in nature
 - Uranium Isotopes (U-238, U-235, U-234)
 - Thorium-230 (Th-230)
 - Radium-226 (Ra-226)
- All sample results for Soils, Groundwater, and Debris have to be corrected for natural background contributions



Background Levels at DuPont Chambers Works

- 20 Soil and 10 Groundwater Samples collected
- Samples taken in areas unaffected by MED
- Onsite background levels are actually lower than offsite due to large quantities of fill material used to develop Chambers Works

Matrix	Units	Total U	Ra- 226	Th- 230
Soil	pCi/g	2.99	1.79	1.28
Groundwater	pCi/L	0.75	0.58	ND

Note: Total U = U-234 + U-235 + U-238



Additional Sources of Information

- USGS NJ Groundwater Fact Sheet
 - <http://nj.usgs.gov/publications/FS/fs-062-98.pdf>
- Health Physics Society – Ask the Experts
 - <http://hps.org/publicinformation/ate/cat10.html>
- EPA – Naturally-Occurring Radiation: Overview
 - <http://www.epa.gov/radiation/natural-radiation-overview.html>
- IAEA – Radiation, People, and the Environment
 - <http://www.iaea.org/Publications/Booklets/RadPeopleEnv/index.html>



QUESTIONS ??

