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Uranium Mining/Milling/Tailings and Water Quality Issues



Presented By:

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Presentation



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- **Legacy Issues**
 - Mining
 - Milling
 - Environmental Impacts
 - Human Health Impacts
- **Current Mining – Northern Arizona**
- **Nuclear Fuel Cycle**
 - In Situ Leachate Mining
 - Uranium Enrichment
 - Depleted Uranium (DU)
- **Radon**



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Legacy Issues

Open Pit Mining



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Tunnel Mining



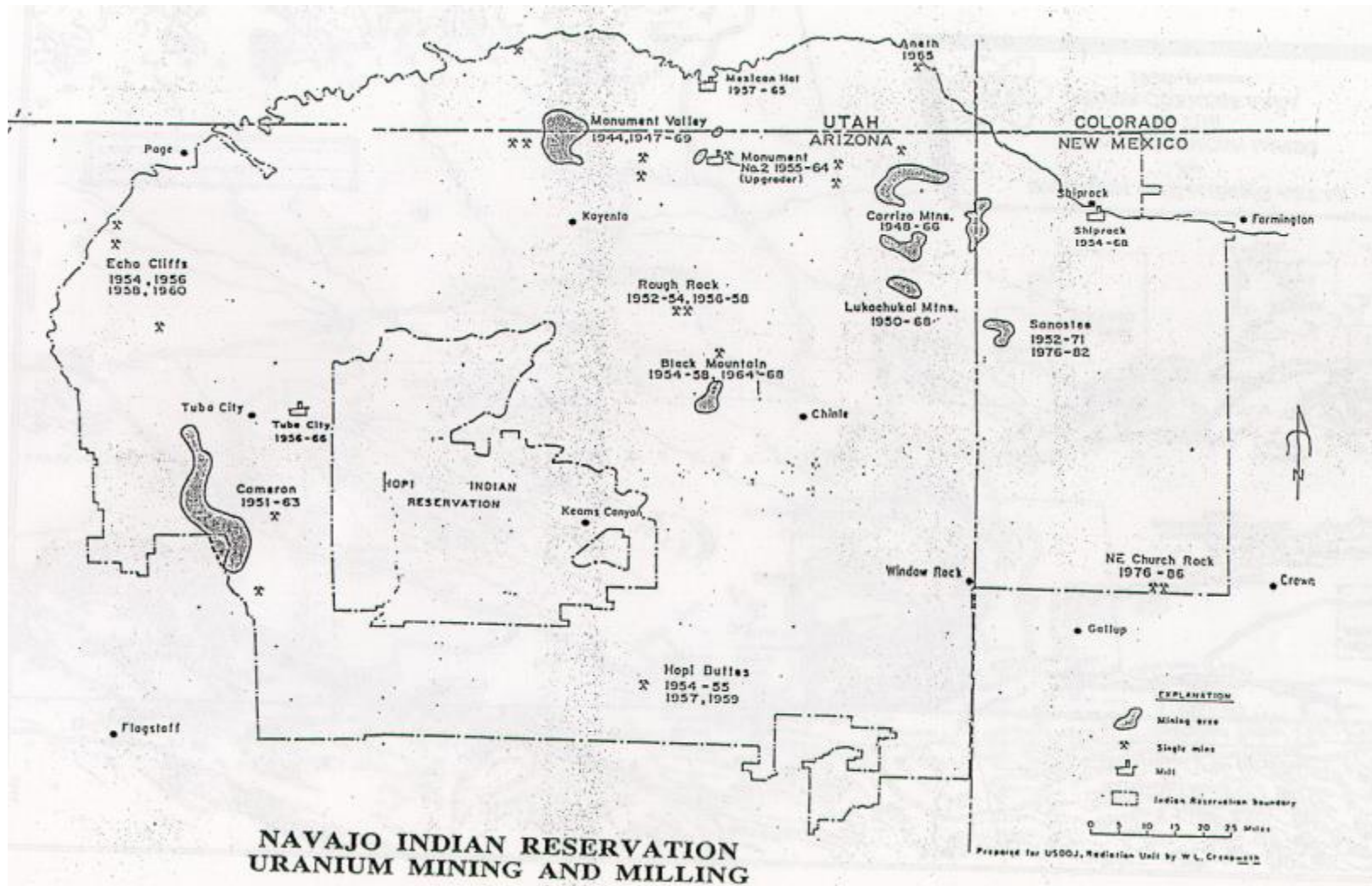
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Mining and Milling on Navajo



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Abandoned Mines



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Abandoned Open Pit Mines



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Uranium Mill Sites



- Tuba City : Rare Metals 1955 - 1966
- Mexican Hat : Texas-Zinc Minerals Corp. 1956 - 1965
- Monument Valley : VCA 1955 - 1968
- Shiprock : Kerr McGee & Foote Minerals 1954 - 1963

Tuba City – Rare Metals



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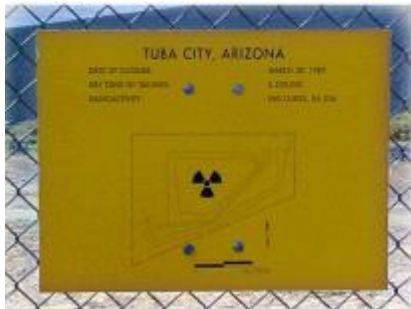
Rare Metals Clean Up



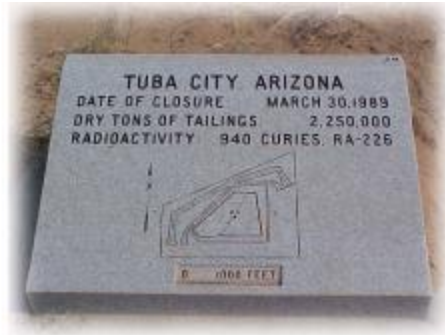
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- Ground water clean-up continues
- Eliminated
 - Blowing dust
 - Radiation
 - Radon



Rare Metals



The clean-up continues

Spread to dump????

Ground water contamination



Outreach to Navajo Students



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- Seeing the Unseen
- Half-life
- Electromagnetic Spectrum
- Gamma Radiation
- Atomic Theory
- Protection



Outreach to Community



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Continuing Legacy



Water Sampling



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Northern Arizona University **ANS**



Continues Research

Ground water and
surface water
contamination



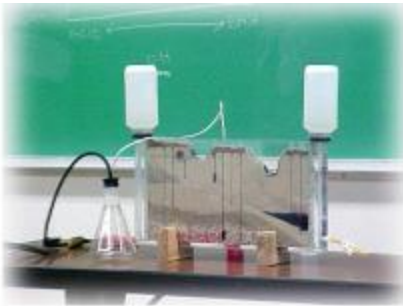
Cancer Partnership with
University of Arizona -
Health impacts of
Uranium



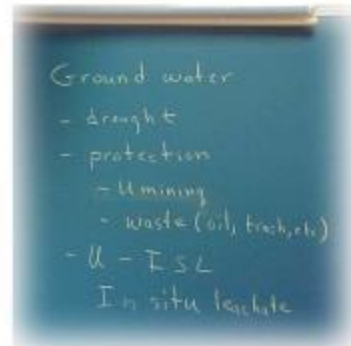
Ground Water Contamination



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- Investigations continue



- Clean-up continues



Radon Protection



- Radon impacts on the lungs
- Lost miners and millers in communities due to radon exposure
- Radon continues to be an issue



Mining – Contaminated Structures



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- Homes
- Driveways
- Roadways



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Current Mining

Uranium Mining Today



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- Uranium prices increasing
- New mining methods developed
- Environmental impacts continue to be a concern
- Health impacts continue to be a concern
- Navajo Nation – no mining, but.....
- Efforts to slow mining expansion near the Grand Canyon
- Active mining in Northern Arizona / New Mexico

Current Mining in Arizona



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- Near Grand Canyon
- Plans to expand, but restrictions are in place
- Ore being hauled to Blanding, UT
- Inspection revealed concerns
- Permits still an issue
- Temporary shut-down?





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In Situ Leachate Mining

ISL Mining



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- In Situ Leachate
- In Situ = in place
- Leachate = solution containing material leached from earth material
- Leaching = process in which water removes and transports inorganic nutrients in solution

ISL Processing Plant



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ISL Pumping Field



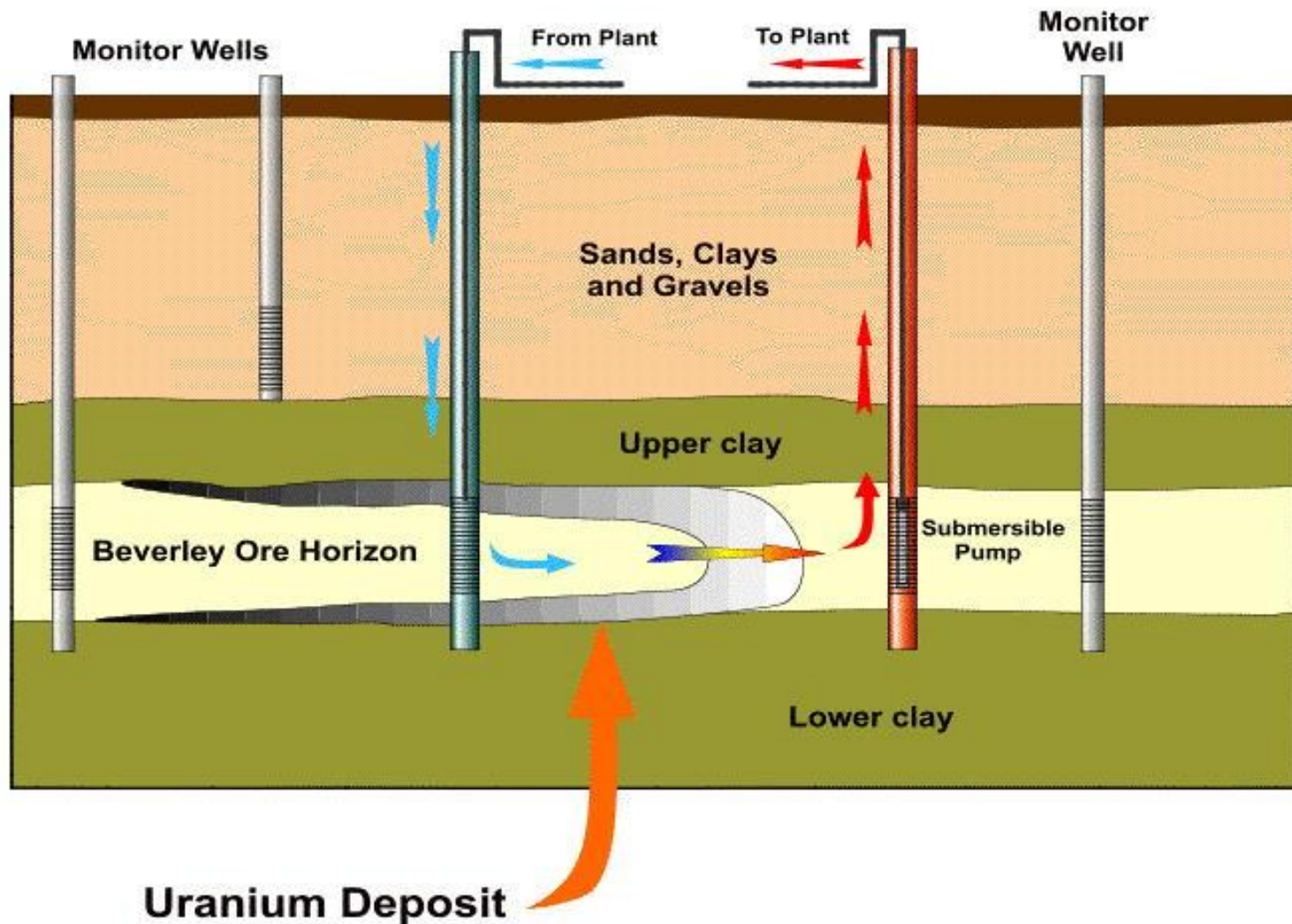
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ISL Process



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ISL Advantages



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- cheaper infrastructure requirements
- combines mining and milling into one step
- no large-scale tailings dams
- no large open cut or underground mine to rehabilitate
- lower occupational health and safety: accidents, dust, and radiation

ISL Disadvantages



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- risks of contaminating groundwater systems outside the mining zone
- inherent difficulties in the hydraulic and geochemical behavior of the deposit
- difficult to restore groundwater to pre-mining quality
- large volumes of waste water and solutions



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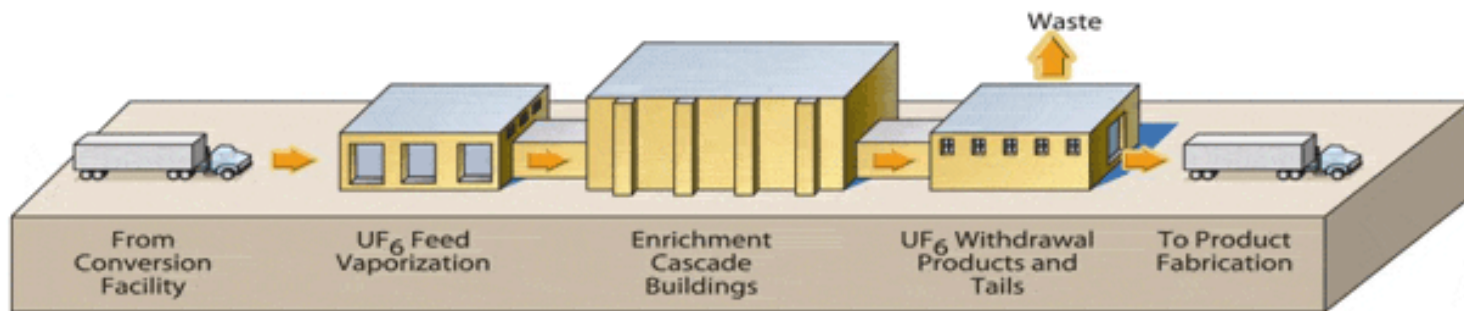
Uranium Enrichment

Uranium Enrichment



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Typical Uranium Enrichment Facility



- Uranium-235 (U235) – comprises less than 1 percent by weight of U that is mined
- Fuel for reactors – natural Uranium is enriched to increase U235 to 3 to 5 percent

Uranium Enrichment



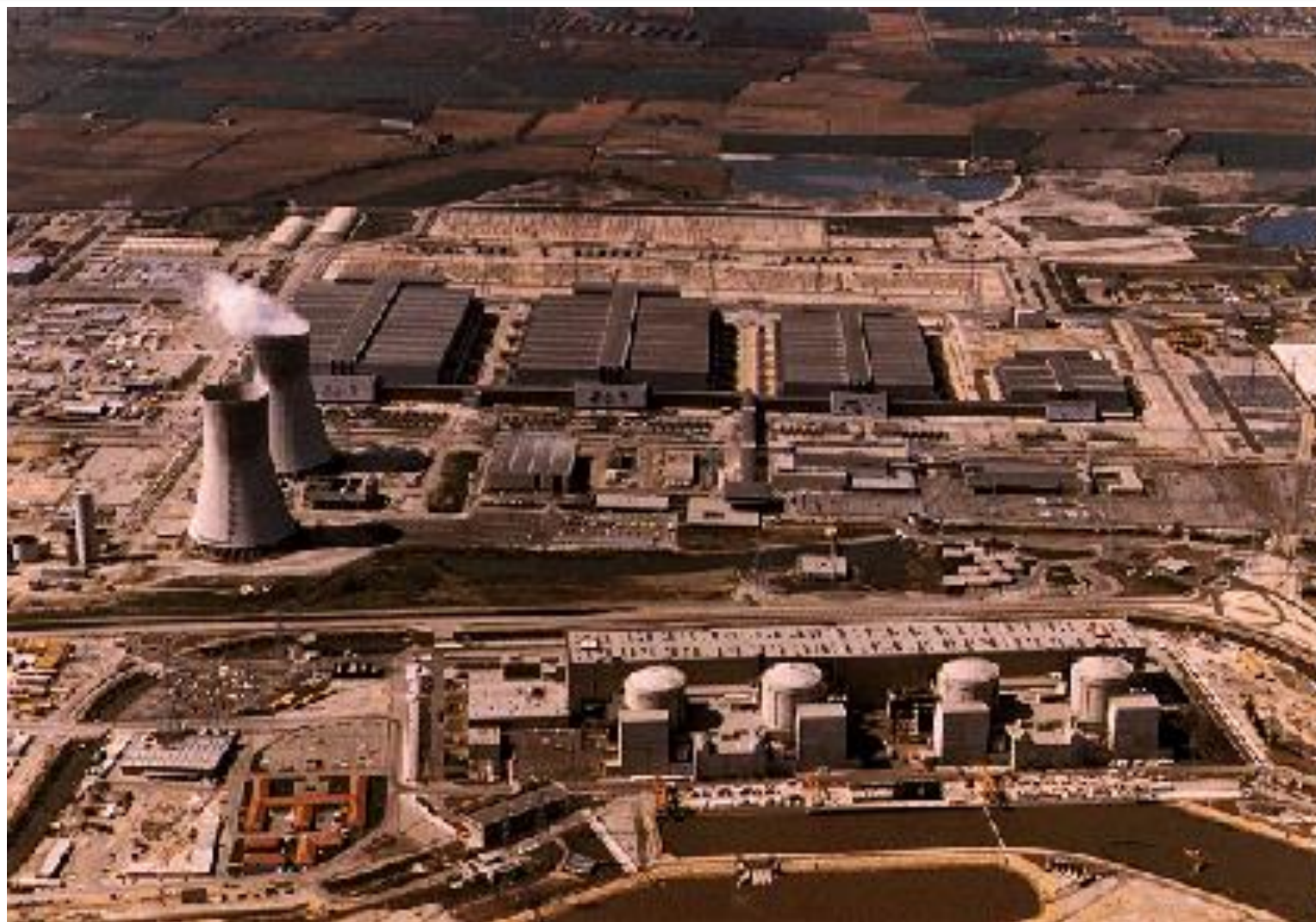
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- Yellow Cake - Uranium fuel cycle begins by mining and milling uranium ore to produce U_3O_8
- U_3O_8 is converted into uranium hexafluoride (UF_6).
- UF_6 is then enriched before being made into nuclear fuel
 - gas centrifuge
 - gaseous diffusion

Enrichment Plant



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Depleted Uranium (DU)

What is DU?



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- U-235 (Small portion of U) is used for nuclear power and weapons.
- The remaining U, known as depleted U (DU)
- Double the density of lead
- DU is 40 percent less radioactive than natural uranium
- DU is used for a number of military and technical applications
 - tank armor
 - balance weights for aircrafts.

Health Issues for DU



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- DU poses little risk when outside the body
- DU has about as much toxicity as other heavy metals, like lead
- DU can cause kidney damage if inhaled or ingested
- DU exposure should be avoided by humans and animals



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Radon

Radon



- Odorless, colorless
- Radon in air is ubiquitous
- Found in outdoor air and indoor air of buildings of all kinds
- No known safe level of radon

Radon Levels



- Red alert - radon level above 4 pCi/L (pico Curies per Liter)
- Yellow alert - radon levels between 2 pCi/L and 4 pCi/L
- Average radon indoor air is about 1.3 pCi/L

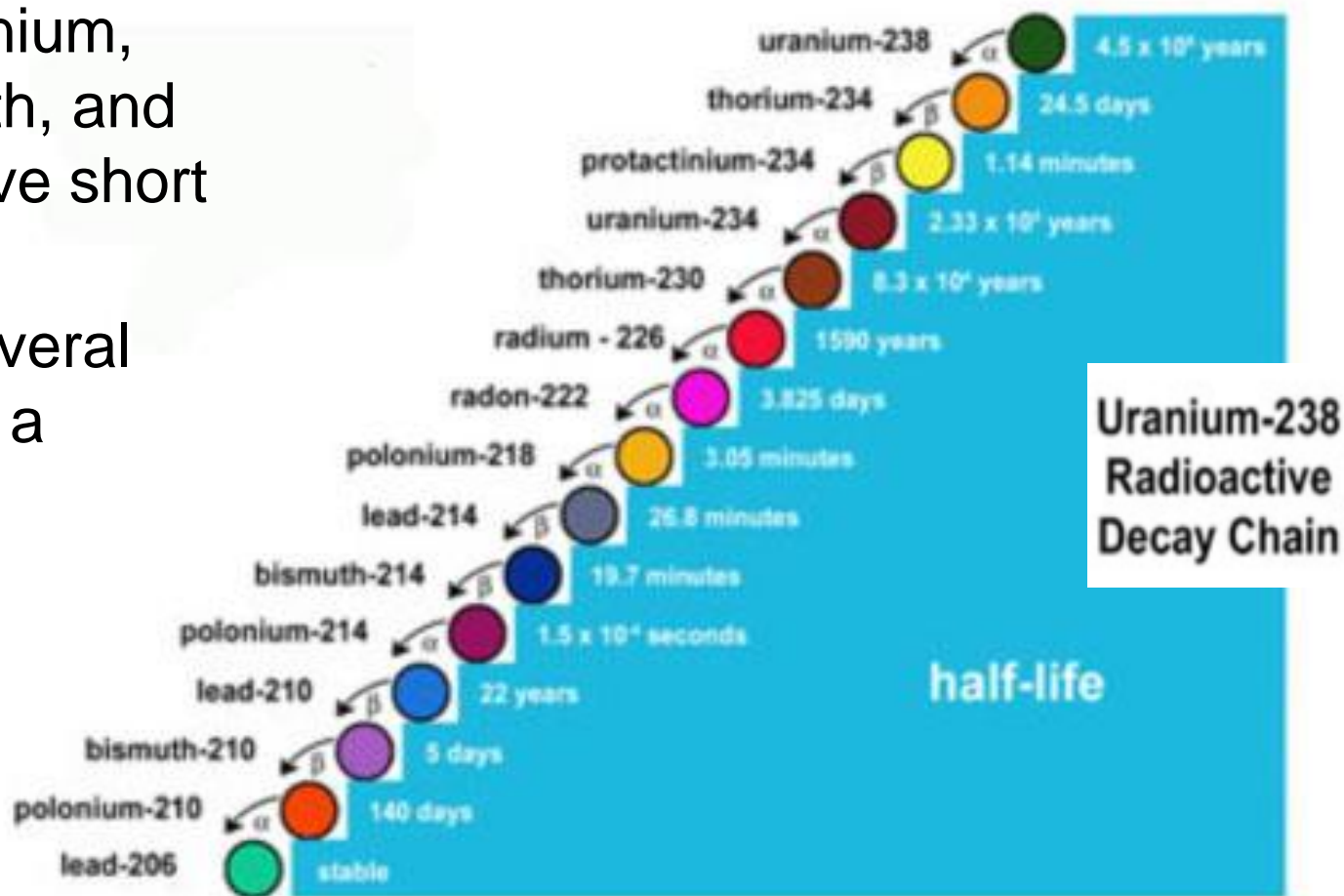
Radon “Daughters”



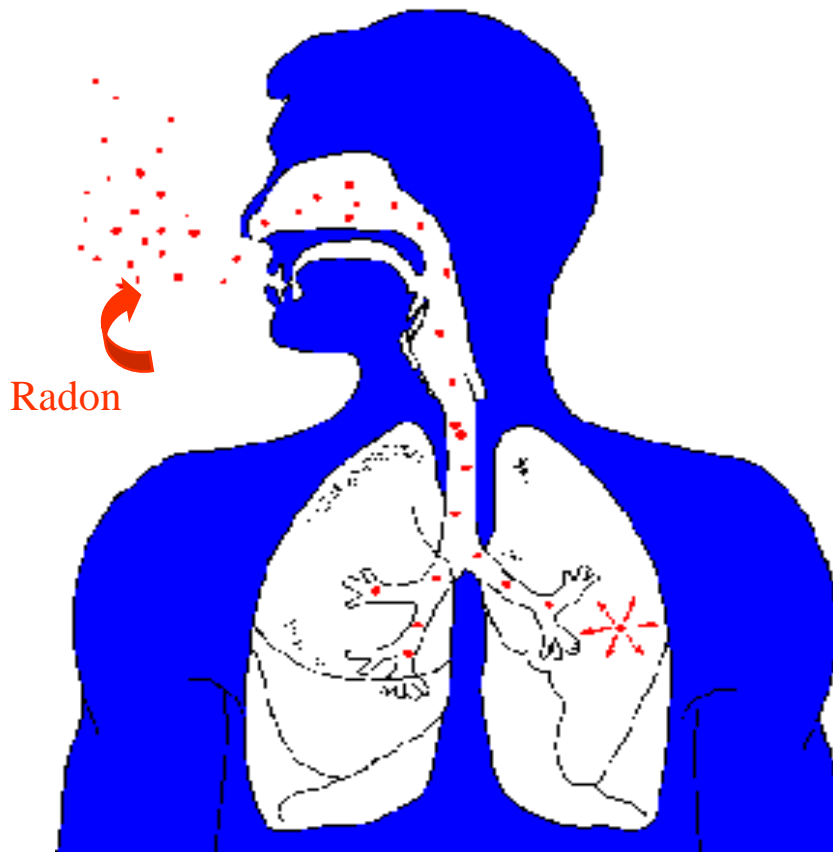
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Radon, Polonium,
Lead, Bismuth, and
Polonium have short
half-lives

Results in several
exposures in a
short time

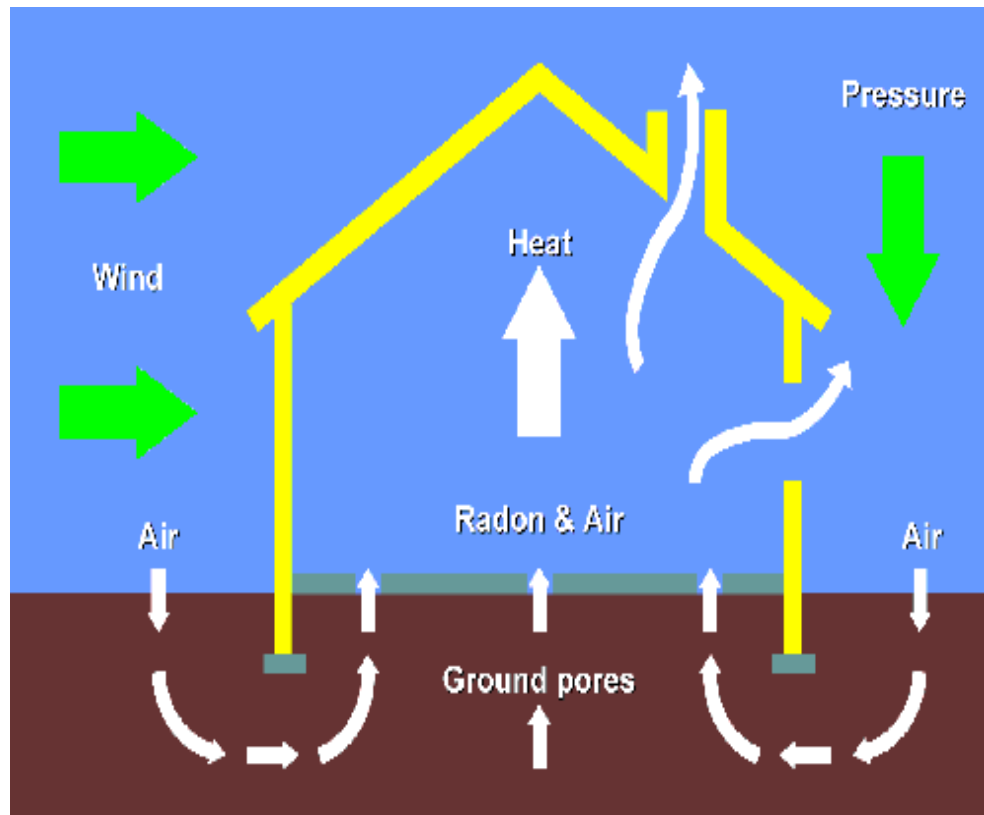


Radon in Lungs



- Radon or decay products inhaled
- Particles irradiate lungs
- Irradiation can cause lung cancer
- Cigarette smoking synergistic impact

Radon in Buildings



From the soil
Lower parts of
building at greatest
risk
“Stack effect”

Radon Testing

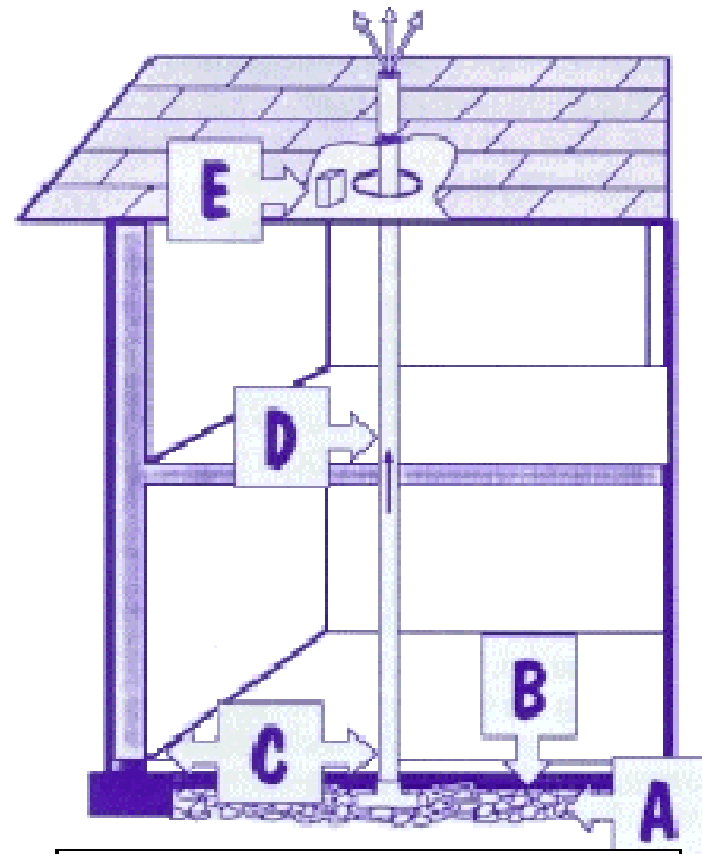
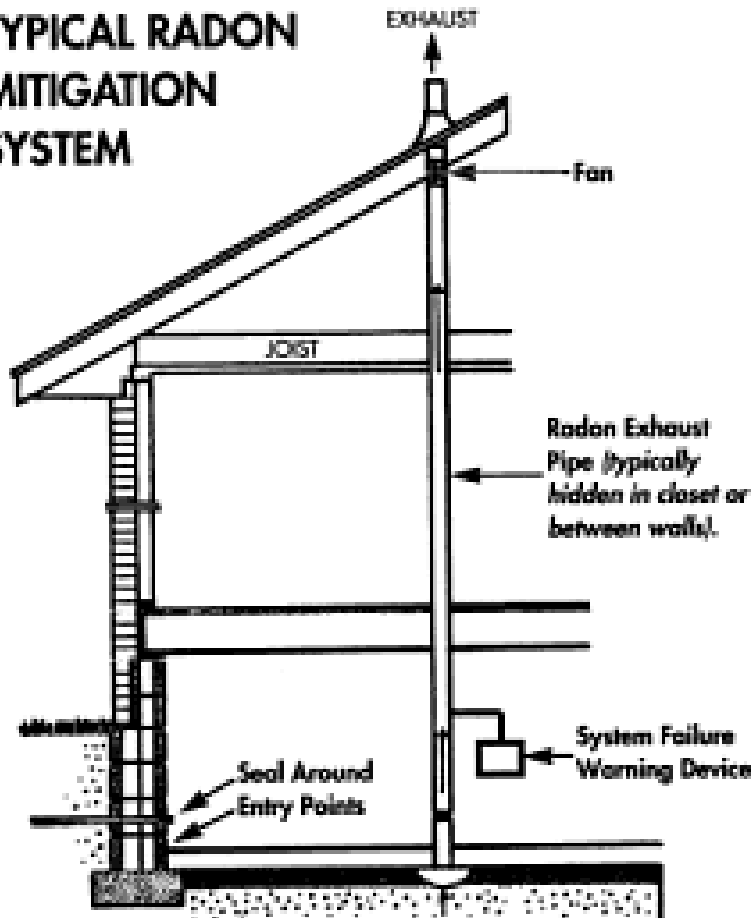


Radon Mitigation



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TYPICAL RADON MITIGATION SYSTEM



A gravel; B plastic sheeting;
C sealing; D passive stack;
E space for fan in stack

Contact



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