NUCLEAR ENERGY BASICS

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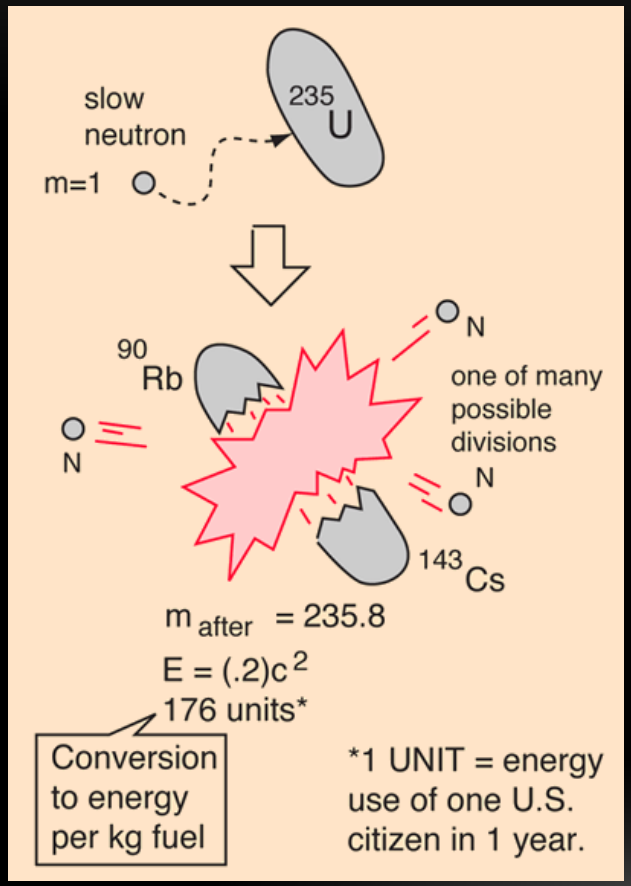
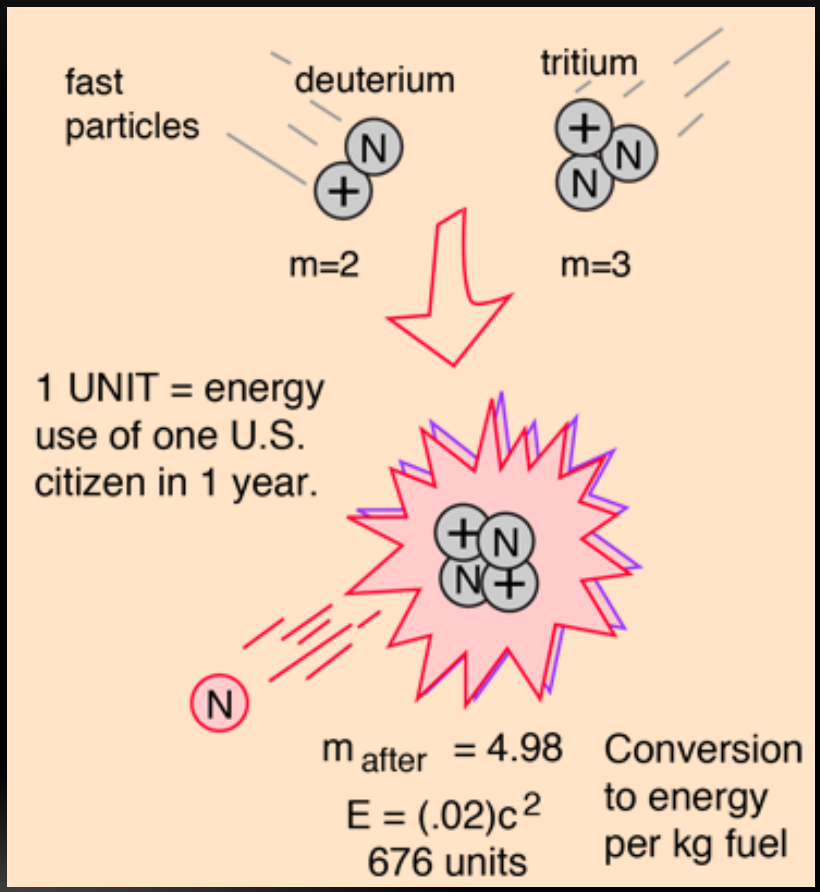
NUCLEAR POWER

- Clean & efficient way of boiling water to make steam – turns turbine to produce electricity
- Nuclear energy (strong force) Kinetic Energy Thermal Energy Mechanical Energy Electricity

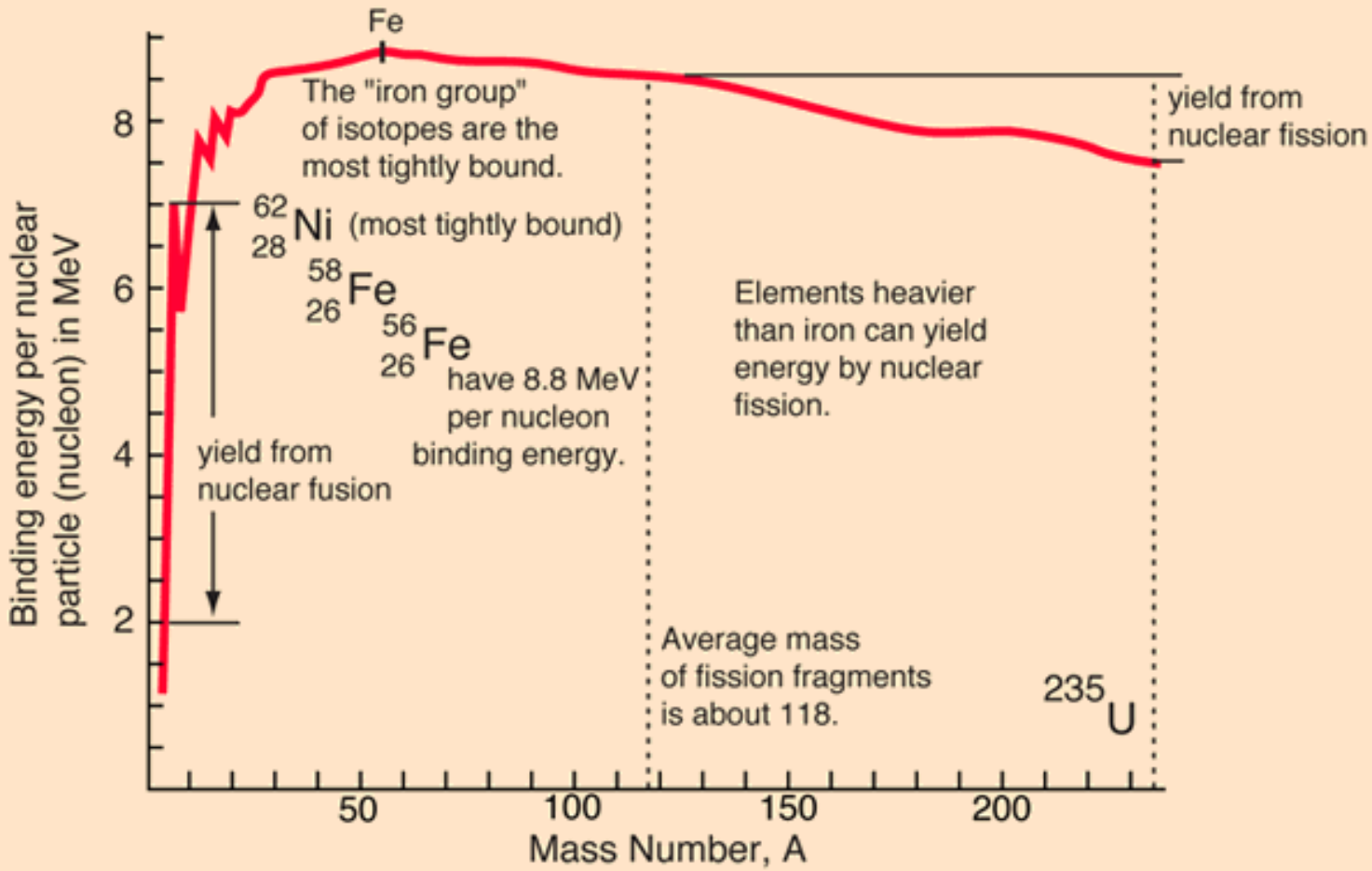
2 TYPES OF NUCLEAR ENERGY





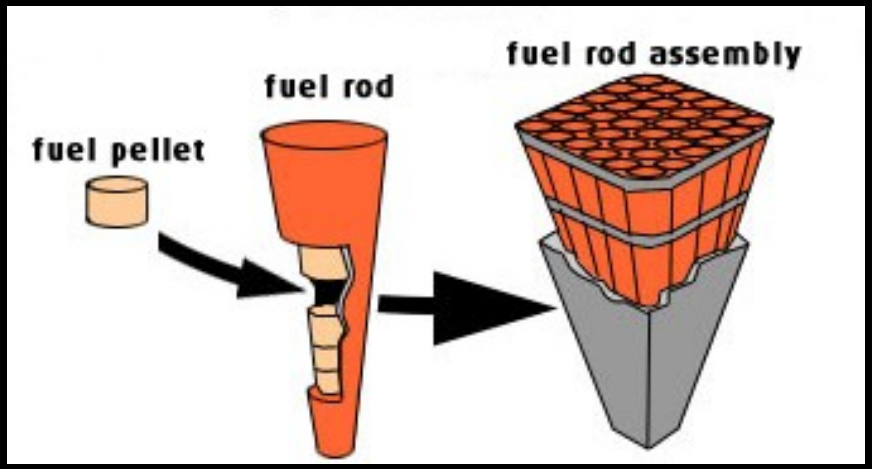
$$\frac{1}{2}m_a v_a^2 + \frac{1}{2}m_b v_b^2 = Q$$

Fission and fusion can yield energy



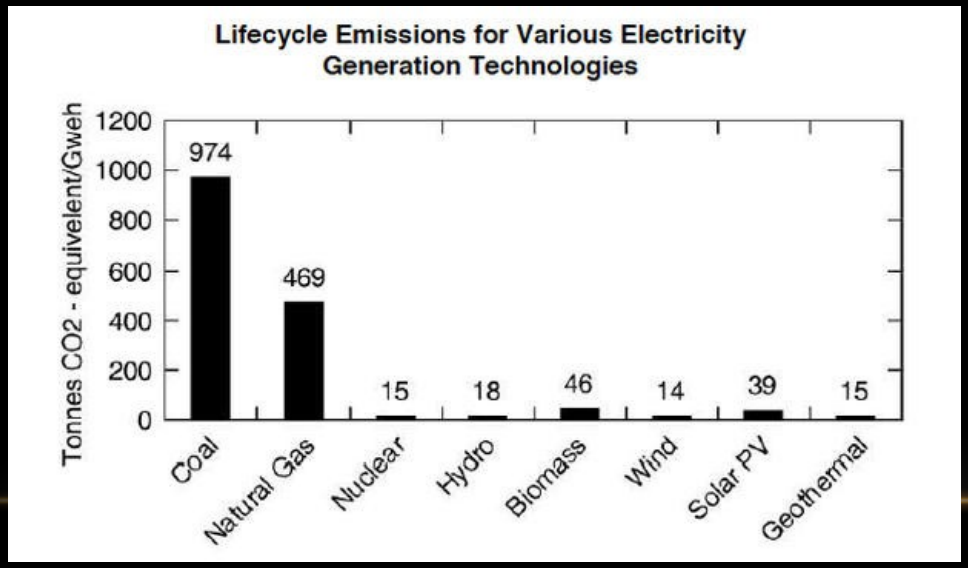
FUEL

- Consists of small, hard ceramic pellets that packed into long vertical tubes
- A single uranium pellet contains the same energy as a ton of coal, 3 barrels of oil, or 17000 ft^3 natural gas
  - Each pellet provides up to 5 years of heat for power generation



BENEFITS

- Does not burn material – no combustion byproduct
- Does not produce greenhouse gases
- Can continuously generate large-scale around-the-clock electricity for many months, without interruption

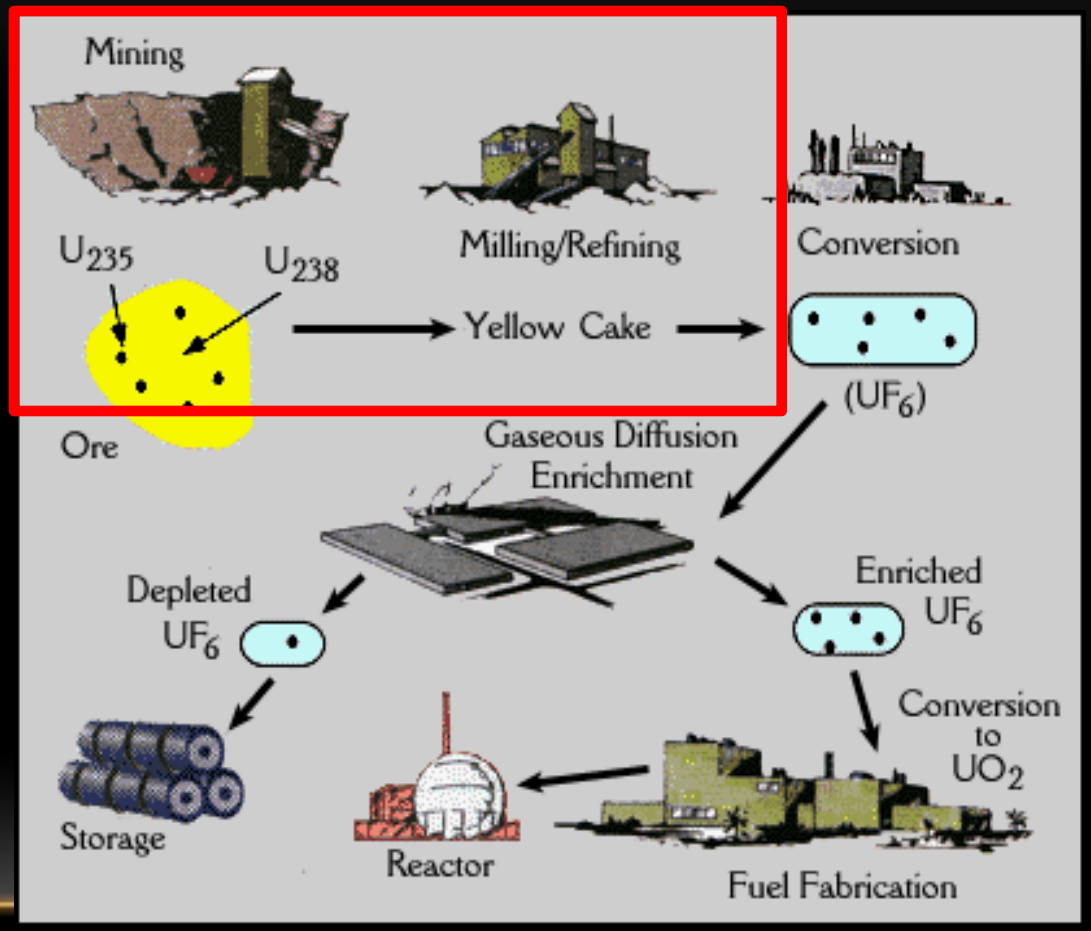


URANIUM

- Naturally occurring
- Extracted from rock – mines ~20 countries
- Enriched in Uranium-235 isotope & formed into pellets

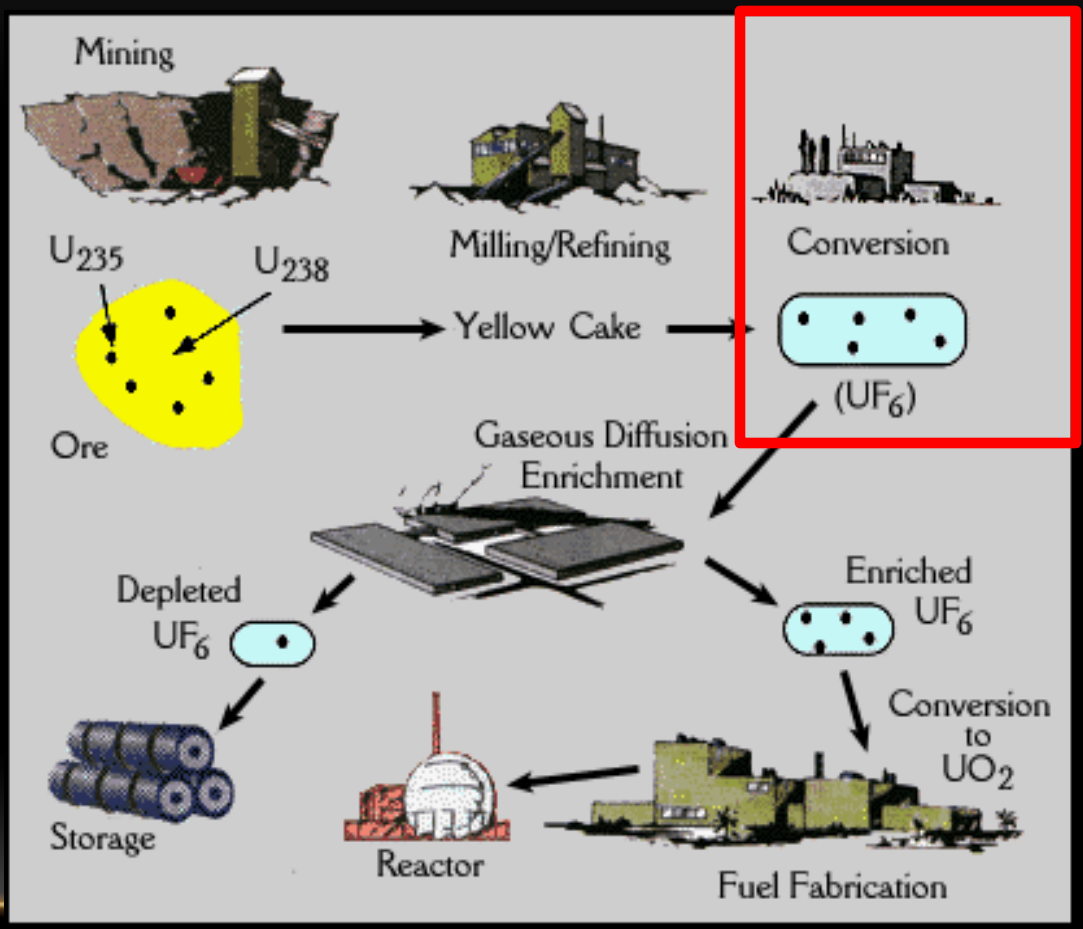
URANIUM ENRICHMENT PROCESS

- 1. Mining
- 2. Ore goes through mill
  - Crushed ground in water into slurry slurry leached with H_2SO_4 to dissolve uranium oxides (UO_2)
- 3. Liquid filtered & separated by ion exchange precipitates filtered & dried sealed in drum (“yellow cake”)



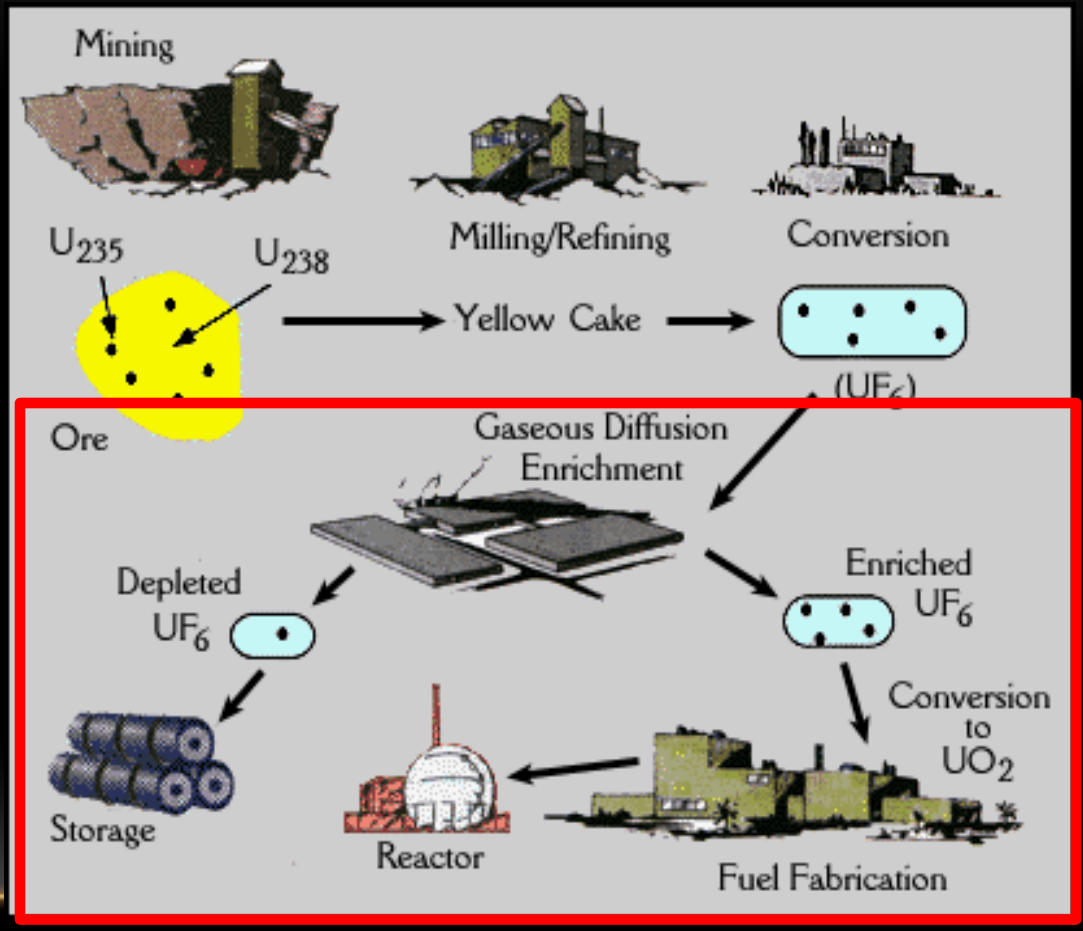
URANIUM ENRICHMENT PROCESS

- 4. “Yellow cake” is processed with fluorine to create uranium hexafluoride (UF_6)
  - Exits process as gas which is then cooled to a liquid and drained into storage and transport cylinders.
  - Then is shipped to enrichment facility

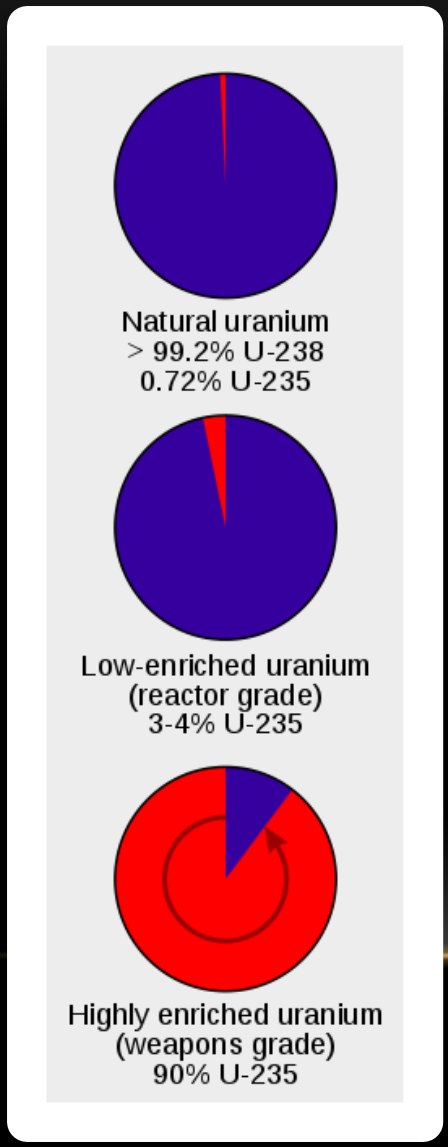


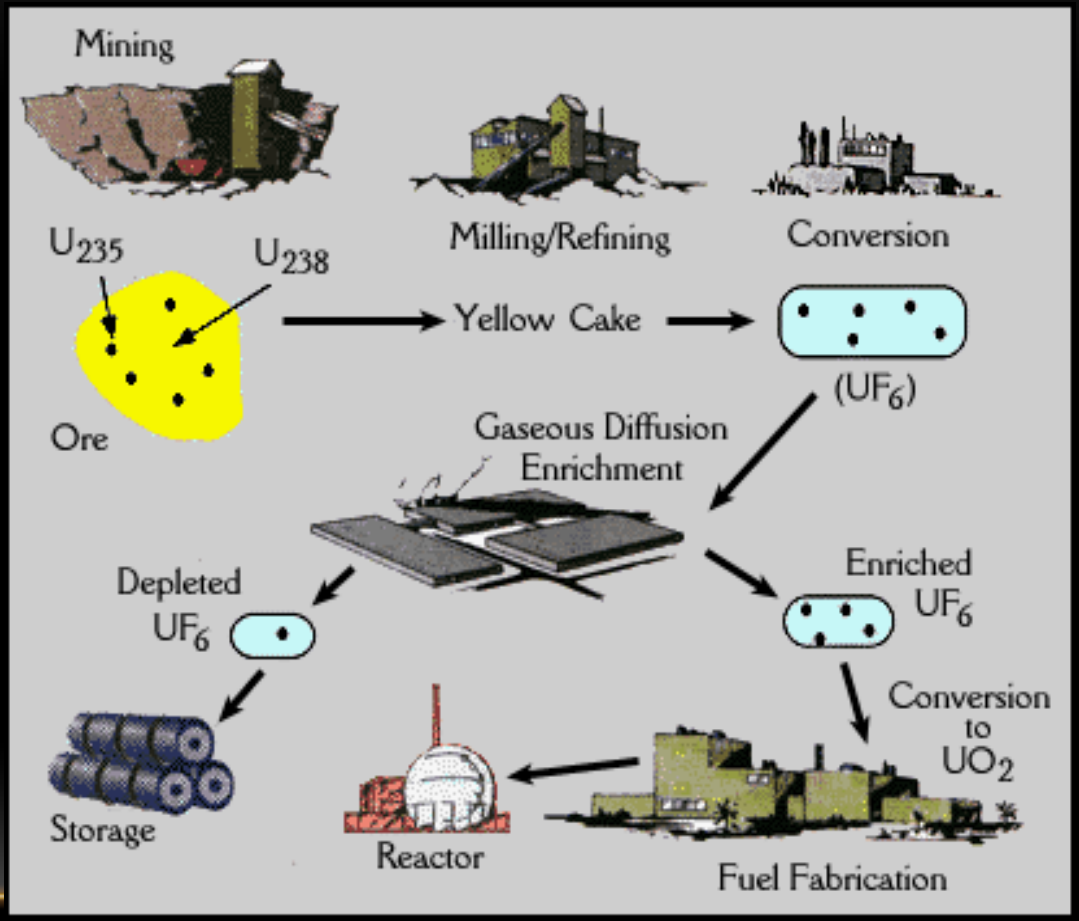
URANIUM ENRICHMENT PROCESS

- 5. Enrichment plant concentrates useful uranium-235 by separating gaseous form into 2 streams
  - One is increased (enriched) in the percentage of U-235
  - One is reduced (depleted)
- Enriched is further processed while depleted is stored
- Most is stored at locations where produced
  - Paducah, KY
  - Oak Ridge, TN (thermal diffusion)
  - Piketon, OH



URANIUM ENRICHMENT PROCESS





INSIDE A NUCLEAR POWER PLANT