The Nuclear Fuel Cycle

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Uranium Milling



- Ore is crushed
- Uranium is separated



• U₃O₈ "yellow cake" produced



Uranium Conversion (to UF₆ gas)

- Impurities removed
- Uranium combined with fluorine
- UF₆ gas produced

 Gaseous form facilitates enrichment





U Enrichment

- Natural U is > 99% ²³⁸U and only ~ 0.7% ²³⁵U
- Separation of ²³⁵UF₆ and ²³⁸UF₆ based on (very small) mass difference
 Uranium enriched





Centrifugation

■UF₆ enriched from 0.7% ²³⁵U to 3%-5% ²³⁵U





Fuel Fabrication

Enriched UF₆ gas converted to uranium oxide (UO₂) solid



Uranium Oxide Ceramic Fuel Pellets



Fuel rods filled with ceramic pellets are grouped into fuel assemblies



Fuel Fabrication



A pressurized water reactor fuel assembly



Reactors



Diablo Canyon nuclear power plant in the U.S.





- Cause new fissions to occur
- •Be absorbed to form unstable, radioactive nuclide



Fuel Consumption in the Reactor

- Fuel is in reactor for 4 6 years
- U consumed, fission products and transuranics (mostly Pu) produced







- Used fuel first stored in pool at least 5 years
 - \circ Cooling and shielding
- Older fuel can move to dry casks
 - o Air cools
 - $\circ\,$ Steel and concrete shields





Fuel recycle/reprocessing







Geologic Repository



- The choice of countries worldwide
- U.S. has studied Yucca Mt., Nevada as potential location



The End . . .