INTRODUCTION TO REPROCESSING

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FCWMD NUCLEAR FUEL CYCLE WEBINAR

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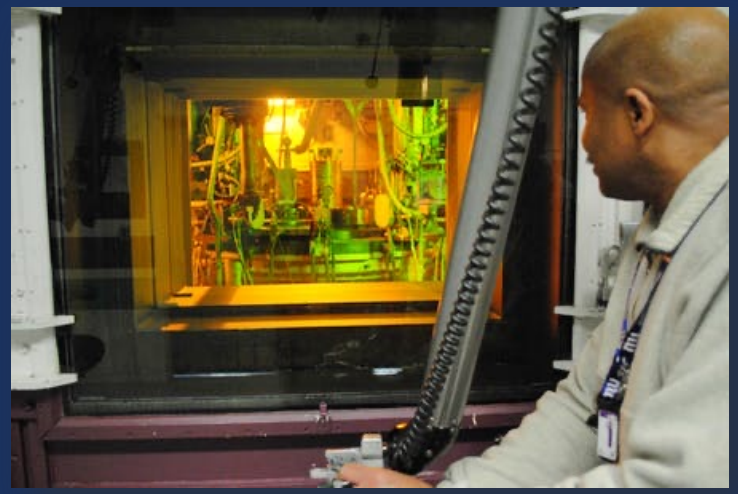

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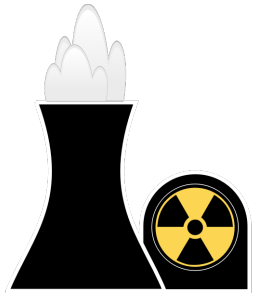
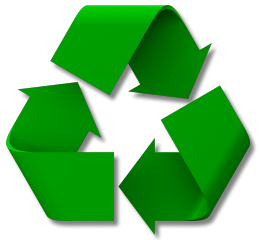
WHAT IS REPROCESSING?

*Reprocessing is the **recovery** of **valuable** actinides (typically U & Pu) from used nuclear fuel to **recycle** into new fuel*

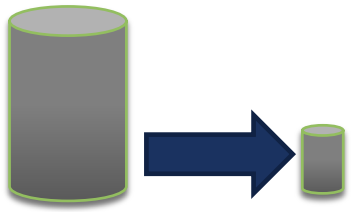
Potential Benefits of Reprocessing:



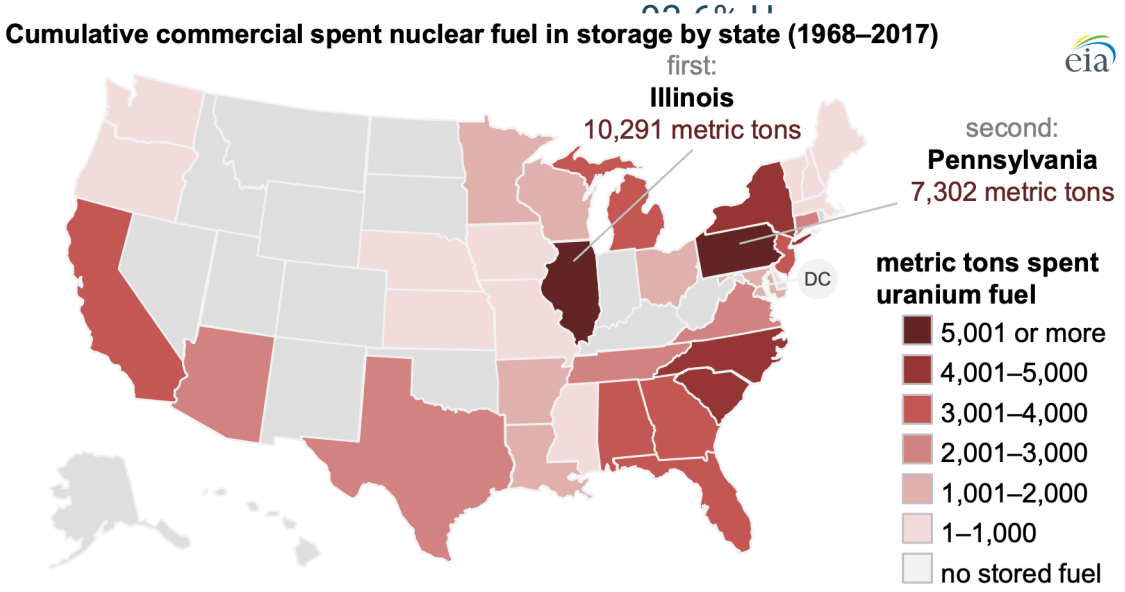
Provide LWR, CANDU, or **advanced reactor** fuel



Improve fuel utilization



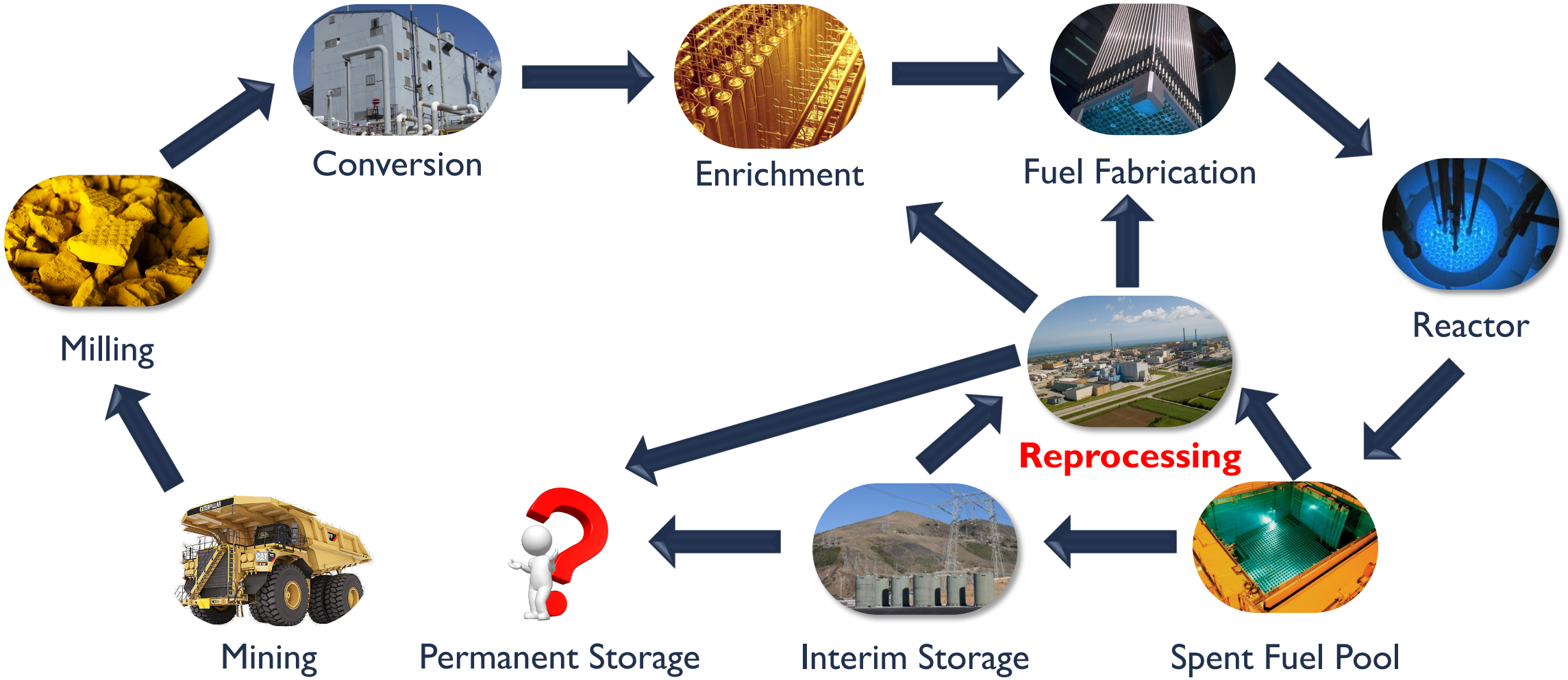
Reduce disposal impact



https://www.eia.gov/todayinenergy/detail.php?id=47796

~86,000 MT commercial UNF in the U.S.

REPROCESSING CLOSES THE NUCLEAR FUEL CYCLE



WHERE IS REPROCESSING DONE TODAY?

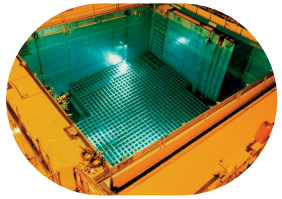
La Hague Reprocessing Facility, France
~1700 MT UNF/yr
(largest in the world)

Rokkasho Reprocessing Facility, Japan
800 MT UNF/yr
(not yet operating)

There is no industry-led reprocessing of commercial UNF in the U.S. today, but ***we've done it before***

West Valley Reprocessing Facility, NY, USA, 1966-1972

KEY REPROCESSING UNIT OPERATIONS



Spent Fuel Pool

Fuel Assemblies

Disassembly and Chopping

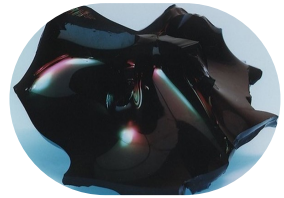
Chopped Assemblies

Dissolution

Dissolved UNF

Extraction & Partitioning of U and Pu

FP + TRU Solution



Vitrification

Impure U Nitrate

Impure Pu Nitrate

Uranium Purification and Conversion

Clean UO_3 to Storage

Storage

Plutonium Purification and Conversion

Clean PuO_2 to Fuel Fabrication with fresh UO_2

TYPES OF REPROCESSING TECHNOLOGIES

Aqueous Reprocessing

The THORP facility at Sellafield, UK, reprocessed UNF via aqueous reprocessing until 2018

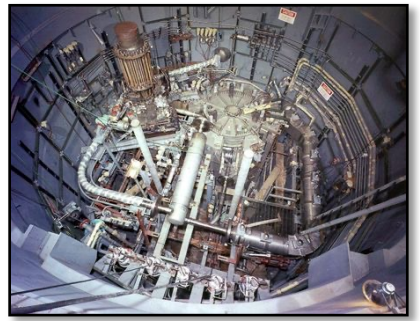
- **Low-temperature** process
- Uses solvent extraction to recover actinides
- Most suitable for oxide fuels
- Currently used worldwide to reprocess LWR fuel (PUREX)

Pyroprocessing

Batch process being conducted in hot cell at INL

- **High-temperature** process
- Uses electrochemical separations in molten salt to recover metallic actinides
- Suitable for many fuel types
- Currently used to reprocess metallic EBR-II fast reactor fuel

Fluoride Volatility



Fluoride volatility was used to reprocess MSRE fuel

- **High-temperature** process
- Exploits volatility of high-oxidation-state fluorides to recover actinide fluorides
- Suitable for many fuel types
- Not significantly used today