



Reprocessing And Recycling: Environmental Protection

**U.S. Nuclear Regulatory Commission
Reprocessing Workshop
October 19th and 20th,
Albuquerque, NM**



Several Aspects To Environmental Protection

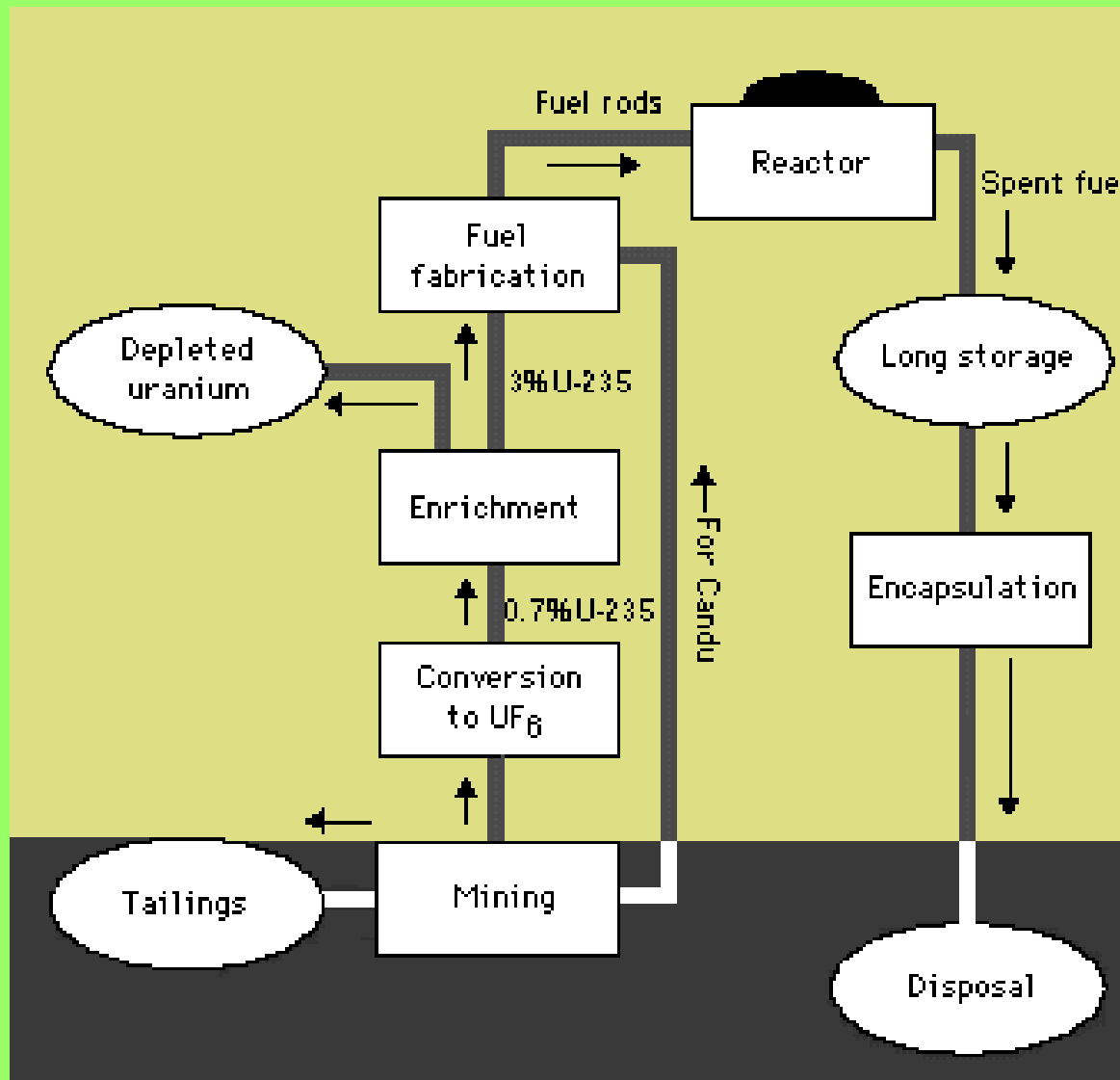
- Staff planning an Environmental Topical Report (ETR) to assist regulatory basis development
- NEPA Requirements
 - EIS required for a major Federal action
 - Subsequent R&R rulemaking likely constitutes a major Federal action
- Effluents/Emissions (current focus)
- Other aspects
 - For example, confinement/containment, filters/types

ETR

Environmental Topical Report

- Will likely discuss:
 - Purpose and need for proposed rulemaking action
 - Technology/history of R&R
 - Description of potential facilities and interactions with the environment
 - Discussion of construction, operations, and postulated accidents
 - Decommissioning
- Comparisons between open and closed nuclear fuel cycles

U.S. Currently Uses An “Open” Fuel Cycle

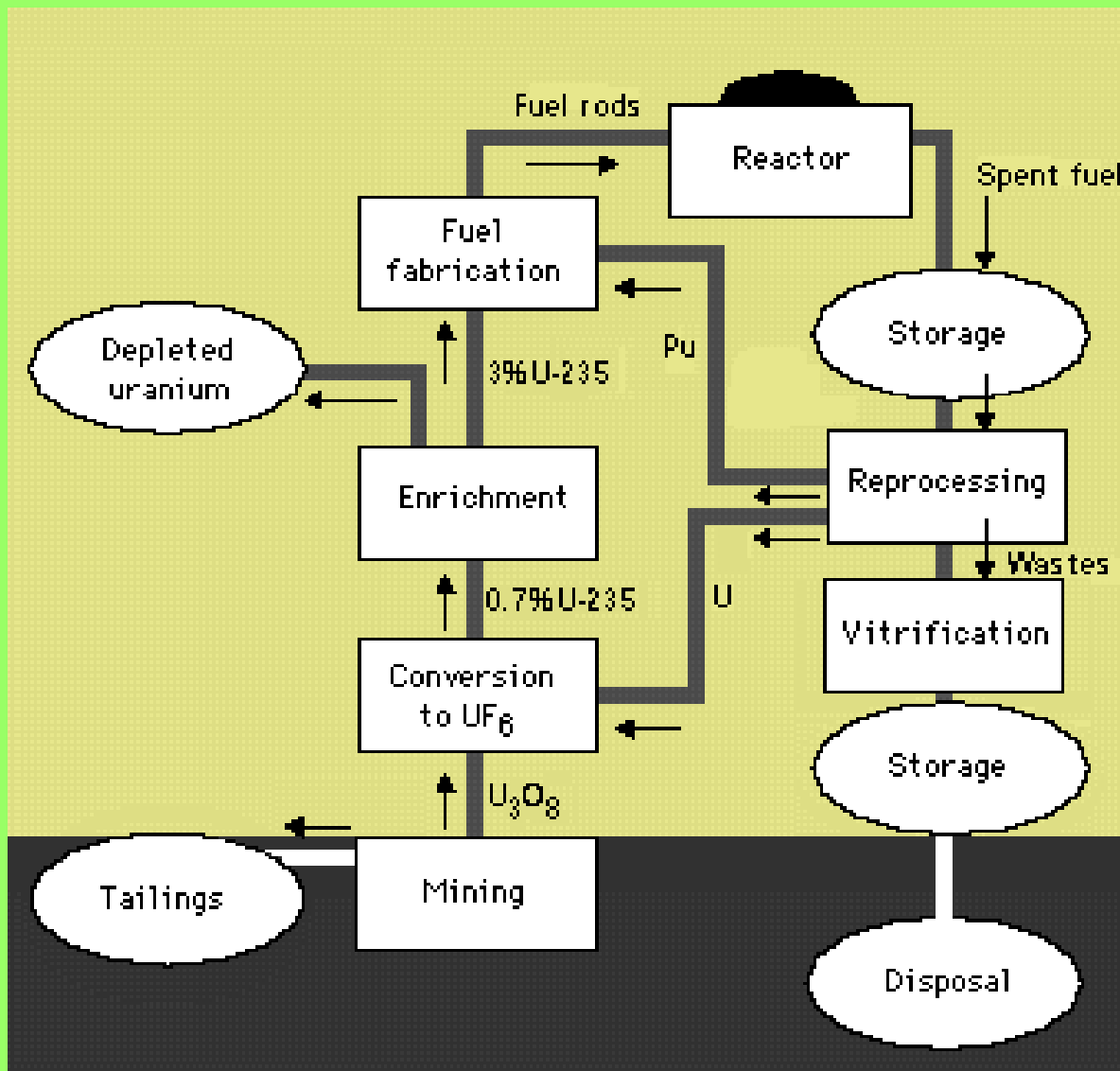


No Recycle –
SNF Directly To
Disposal

Current SNF
Discharges Range
2,000-2,500 MTHM
Annually

Use 2,500 MTHM
Per Year As Basis

Example Of A Closed Nuclear Fuel Cycle



Reprocess SNF

Recycle –
MOX to LWRs

Repository Disposal –
HLW

Current SNF
Discharges Range
2,000-2,500 MTHM
Annually

Hypothetical R&R Facility



Potential Unit Operations Include:

- SNF receipt and storage
- Shearing, may include disassembly and voloxidation (if planned)
- Dissolution
- Separations
- Purification/recovery of products
- Manufacture of recycled fuel/materials/products
- Management of byproducts
- Storage of products (fresh MOX) and any byproducts (potentially reprocessed uranium, certain fission products [Xe, Pt series])
- Waste management – treatment and storage
- Shipping/Transportation (to customers/other sites, disposal)
- Support facilities – maintenance, chemical storage, recovery/recycle (e.g., solvents, acids)

Effluents And Emissions

- Limits established by the EPA in 40 CFR 190
 - NRC regulates to the EPA limit via Part 20
- Dose Limits relatively low
 - Based upon individual health impact
 - 25/75/25 mrem/yr whole body/thyroid/other organs
 - 1 chest x-ray is about 10 mrem
 - moving to Denver from Washington DC is about 200 mrem/yr
 - Easily met by modern, commercial reprocessing facilities
- Quantity (radioactive – curie) limits more difficult to ascertain and meet
 - Based upon collective exposure of populations
 - Very small doses to very large populations
 - This “microdoses to megapopulations” may overstate the impacts

EPA 40 CFR 190 Limits Apply To Entire Fuel Cycle And Power Reactors

**Essentially all of the releases would
 come from reprocessing operations**

Annual Dose Equivalent Limit, mrem/yr		Isotope	Limit	Potential Emission
Whole body dose	25	Kr-85	50,000 Ci/Gwe-yr	300,000
Thyroid	75	I-129	5 milliCi/Gwe-yr	1,000
Any other organ	25	Pu-239 and other alpha-emitting TRU	0.5 milliCi/Gwe-yr	< 0.5 (met)

Basis For EPA Quantity (curie) Limits

- Population (Collective) dose
- 1,000 GWe nuclear power (10 times actual value)
- 25 1,500 MTIHM/yr reprocessing plants (actual value is zero)
- Relatively short cooling times before reprocessing (1-5 years; current practice is 4-5 years)
- Land-locked site (current practice is coast-based)

Analysis

- Some emission control technologies add potential hazards (e.g., voloxidation, krypton and tritium capture)
 - Do benefits outweigh the risks?
- Use of old SNF reduces Kr and T significantly
 - Significant quantity of SNF > 30 years after discharge
 - Reduces Kr and T by circa 90%
 - Loses fuel value of Pu-241 and increases Am-241 (recycle/disposal)
- Iodine limit based upon many assumptions, some of which may not be valid today

Any Specific Requirements For Environmental Protection?

- Technologies
 - Confinement/containment
 - Filtration – sand, HEPA, metal
- Performance-based
 - Minimum decontamination factors
- ALARA

Potential Questions For Discussion

- What should be the content and level of detail of the ETR?
- What should be the basis (e.g., throughput, technology) for the hypothetical facility? 1,000 MTIHM/yr? Purex, COEX, NUEX, Pyro?
- Where would information/data/analyses on the hypothetical facility come from?
- What are the current practices and limits for overseas facilities and would they be relevant for the U.S.?
- How would reprocessing facilities comply with EPA's 40 CFR 190 limits?
- What available technologies would be needed to meet the 40 CFR 190 limits?
- How would the ALARA concept apply to R&R emissions?
- Should the NRC develop criteria similar to Part 50 Appendix I for R&R facilities?
- Are there impacts from siting attributes (e.g., coast vs desert, humid vs arid)?
- Should there be SNF burnup, aging, performance, or other requirements?