

Transportation Issues for Centralized v. Distributed Recycle Facilities

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Primary Considerations

- Transportation from reactors to recycle and transportation to disposal will be needed
- Storage at recycle facilities will be needed – need not be dry surface storage
 - Duration of storage at most 20 years
 - Transfers to and from storage are usually wet transfers.
- On-site transportation is not regulated in the same way as off-site transportation



Storage

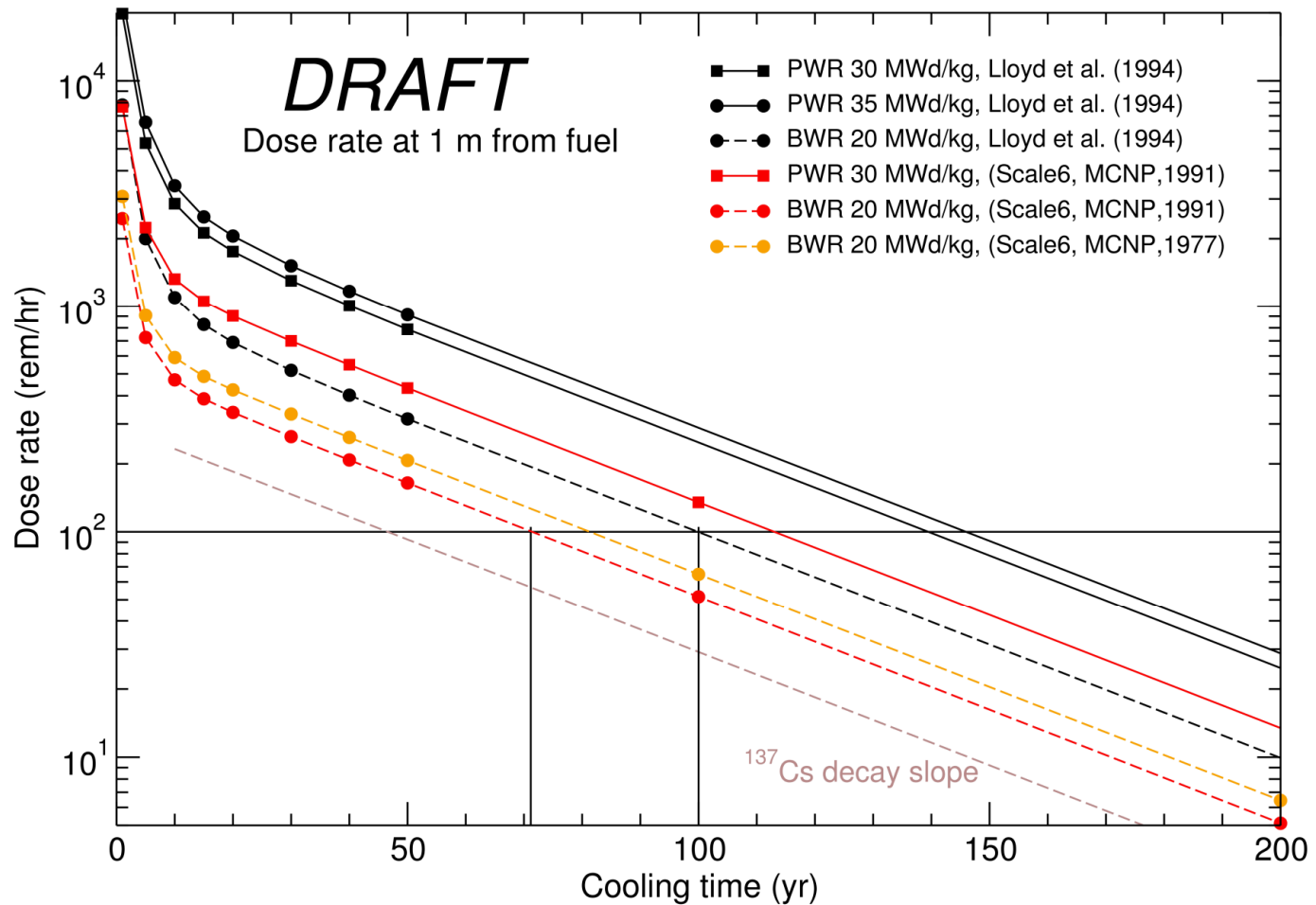
- Current storage regulations: 10 CFR Part 72
 - Both pool and dry storage
 - Current criticality limits for LWR fuel
 - Heat dissipation requirements
 - Usually external radiation monitoring only
 - Storage licensed for up to 60 years
 - NRC is considering 80 years
 - Current UFD program looking at >100 years



Storage Security

- Current security regulations: 10 CFR Part 73
 - Security at recycle facilities probably similar to reactor security
 - Self-protection considerations
 - Security categories of recycled material
 - RAMQC

Storage Security –Self Protection





Storage Security -- Categories

Material	Category I	Category II	Category III
Pu	5 kg $\geq$ gm containing U-235 + 2.5 (gm Pu + gm U-233)	>500 gm <i>or</i> 1 kg = gm containing U-235 + 2(gm Pu + gm U-233)	15 gm <i>or</i> 15 gm = gm containing U-235 + gm Pu + gm U-233
U-235	5 kg $\geq$ gm containing U-235 + 2.5 (gm Pu + gm U-233)	1 kg < U-235 < Category I; U-235 enrichment $\geq 20\%$ <i>or</i> 1 kg = gm containing U-235 + 2(gm Pu + gm U-233) <i>or</i> ≥ 10 kg U-235; 10% < U-235 enrichment < 20%	>15 gm of $\geq 20\%$ enriched <i>or</i> 1 kg < U-235 < 10 kg; 10% < U-235 enrichment < 20% <i>or</i> ≥ 10 kg U-235 < 10% enriched
U-233	5 kg $\geq$ gm containing U-235 + 2.5 (gm Pu + gm U-233)	>500gm <i>or</i> 1 kg = gm containing U-235 + 2(gm Pu + gm U-233)	



Storage Security --RAMQC

Radioactive Material	Category 1 (Ci)	Category 2 (Ci)
Am-241	1,600	16
Am-241/Be	1,600	16
Cf-252	540	5.4
Cm-244	1,400	14
Co-60	810	8.1
Cs-137	2,700	27
Gd-153	27,000	270
Ir-192	2,200	22
Pu-238	1,600	16
Pu-239/Be	1,600	16
Pm-147	1,100,000	11,000
Ra-226	1,100	11
Se-75	5,400	54
Sr90/Y90	27,000	270
Tn-170	540,000	5,400
Yb-160	8,100	81



On-site Transportation

- On-site implies not on public rights of way
- NRC regulated under 10 CFR Part 50
 - Occupational ALARA
 - External dose rate not limited
 - Containers need not meet 10 CFR 71.73
 - Out-of-certification casks
- DOE Order
- Examples from prior work
 - Hanford
 - SRS
 - INL



Transportation on Public Rights-of Way

- NRC regulated: 10 CFR Part 71
 - Limit to external dose rate: 10 mrem/hour at 2 meters
 - Surface temperature limit
 - Criticality limit
 - Burnup credit for actinides but not for fission products



Transportation on Public Rights-of Way

- Fuel shipments
 - Both UOX and MOX fuel would be shipped on public rights-of way to and from reactors
 - Intact fresh and used UOX fuel: certified casks available
 - Intact fresh and used MOX fuel: some certified casks available
 - Damaged fuel: limited certified casks
 - Separated materials: limited cask availability for small quantities
 - ABR fuels: some derated casks; new cask designs needed

Transportation on Public Rights-of Way: Separated Materials



*Model 9975 packagings
on a pallet and cutaway
showing the internals*

9975 package for
transporting U/Pu
oxides and other
actinide oxides.

Transportation on Public Rights-of Way

- Highway v. Rail
 - Flexibility
 - Need for rail access
 - Casks per shipment
 - Assemblies per cask
 - Volume of separated materials per cask





Observations

- Recycle facilities will need storage (
- Transportation to and from reactors and disposal will be on public rights of way
- Transportation between co-located facilities is on-site, regulated by DOE orders (Federal facilities) or 10 CFR Part 50 (commercial facilities)
- Certified casks exist for UOX and MOX fuels and limited amounts of separated materials
- Cask designs needed for ABR fuel and separated materials