U.S. Department of Energy
Office of Civilian Radioactive Waste Management

Waste Acceptance

Presented to:
Nuclear Waste Technical Review Board Panel on the Waste Management System

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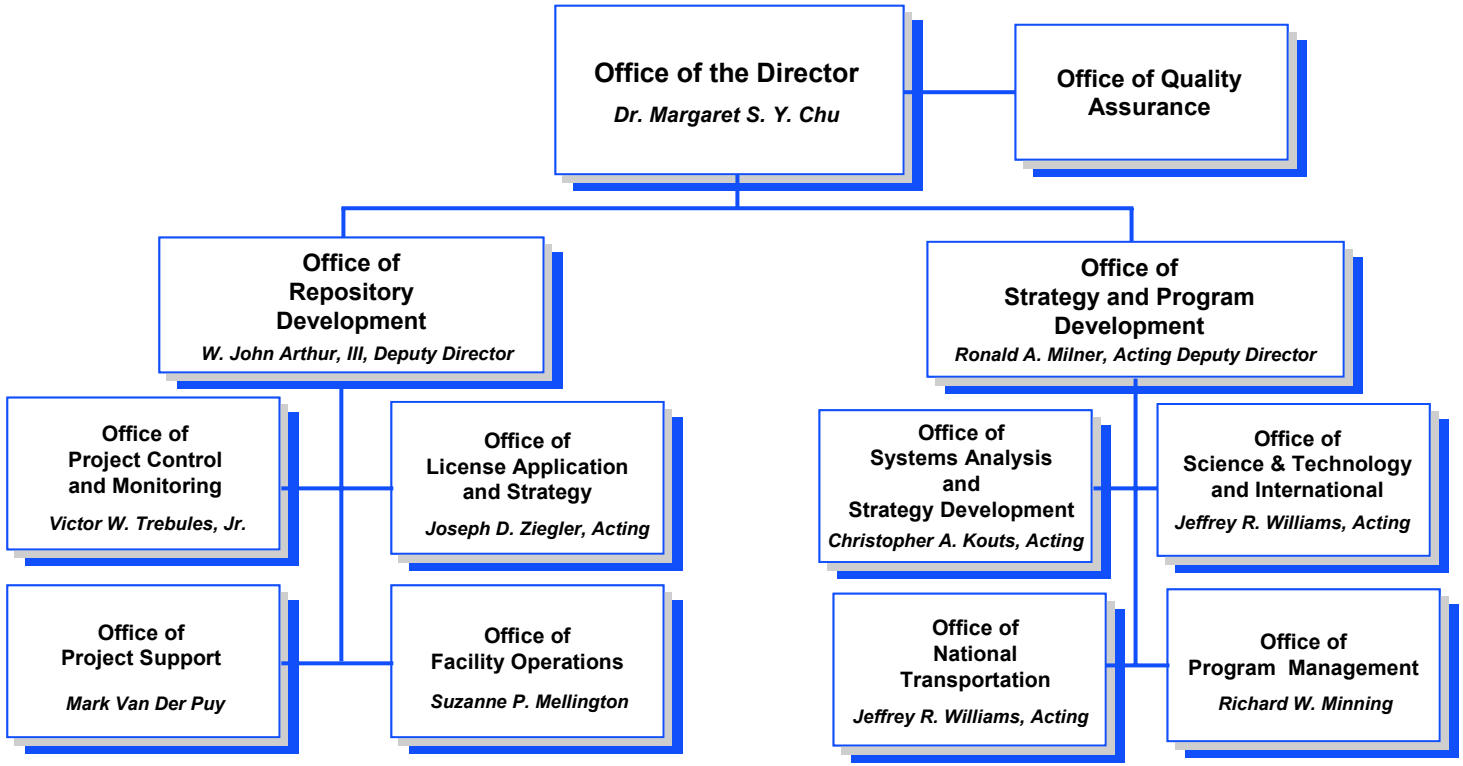
February 25, 2003
Las Vegas, Nevada

Presentation Topics

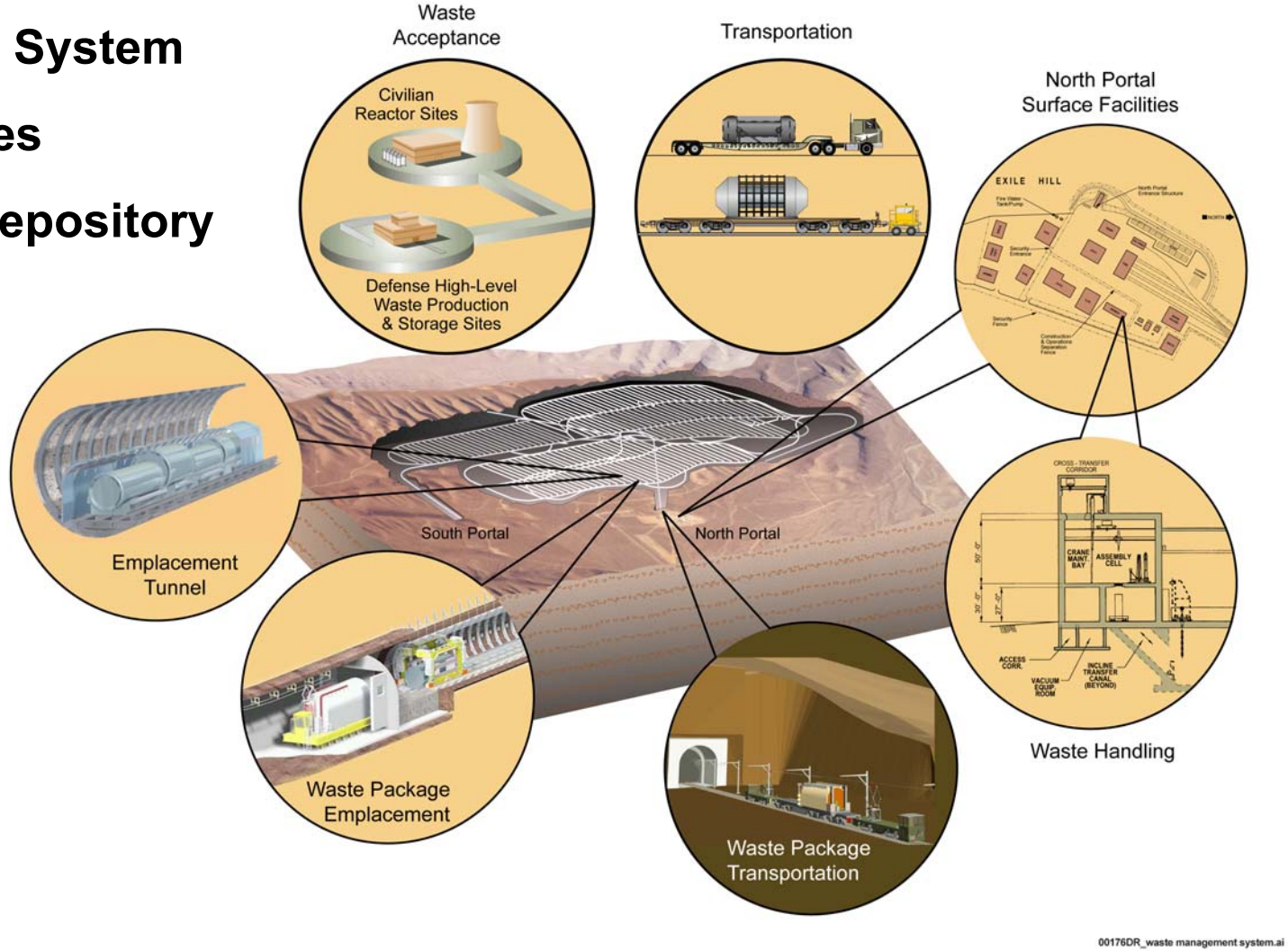
- Organization within Office of Civilian Radioactive Waste Management and System Architecture
- Standard Contract — Purchaser and DOE Responsibilities
- Schedules for various sources and ages of waste
- Condition of waste (dry vs wet storage, damaged fuel, bare or in canister)
- At-reactor cask loading
- Differences between DOE Spent Nuclear Fuel (SNF) / High-Level Waste (HLW) and Commercial SNF

Office of Civilian Radioactive Waste Management



System Architecture

- **Waste Acceptance**
- **Transportation System**
- **Surface facilities**
- **Underground repository**



Standard Contract

- Required by the NWPA
- Currently 68 contracts covering nuclear power plants with 38 utility purchasers
- Currently 8 contracts with 7 non-utility purchasers
- Contract defines:
  - Allocation methodology
  - Waste acceptance criteria
  - Scheduling and waste acceptance procedures
  - Roles and responsibilities of the parties
  - Fee structure

Standard Contract - Purchaser Responsibilities

- **Pay fees**
- **Provide data on actual and projected discharges**
- **Schedule deliveries**
  - **Purchasers with allocations submit Delivery Commitment Schedules (DCS) identifying location and range of spent fuel 63 months before delivery**
    - **Purchasers may adjust quantities (+/-20%) and delivery schedule (+/-2 mos) until submission of final delivery schedules (approved DCS only)**
    - **Purchasers may exchange approved DCSs up to six-months prior to delivery, subject to DOE approval**
  - **Purchasers with approved DCSs submit Final Delivery Schedules (FDS) 12 months prior to delivery**

Standard Contract - Purchaser Responsibilities

- Provide detailed description of SNF 60 days prior to delivery (Appendix F)
  - FDS subject to DOE approval, but Appendix F is not subject to DOE approval
  - Purchasers select specific SNF to be delivered. SNF earning allocation is not necessarily the SNF to be offered for delivery
- Propose type of cask (in tons) and shipping mode during DCS and FDS process
- Package SNF for transportation
- Transfer title to delivered SNF to DOE

Standard Contract - DOE Responsibilities

- **DOE Issues Annual Capacity Report (ACR) and Acceptance Priority Ranking (APR)**
  - **Allocations earned by purchasers based on "Oldest Fuel First" (OFF) Principle**
- **Provide NRC-certified casks suitable for use at Purchaser's site**
  - **Procedures for cask handling and loading**
  - **Training for Purchaser's personnel**
  - **Technical information, special tools, equipment**
  - **Sufficient documentation on equipment supplied**

Standard Contract - DOE Responsibilities (continued)

- **Accept Title to SNF/HLW**
  - **All bare spent fuel (regardless of type and condition) is acceptable**
    - **"Standard Fuel" is greater than 5 years old and meets dimensional limits and condition requirements**
    - **DOE's obligation extends to "other than standard" SNF, but subject to delivery and handling procedure confirmation**
    - **Multi-element canisters not covered by contract**
- **Transport from Purchaser facility to DOE facility**
- **Disposal of SNF and HLW**

Estimated Schedule for Acceptance of Commercial Nuclear Materials

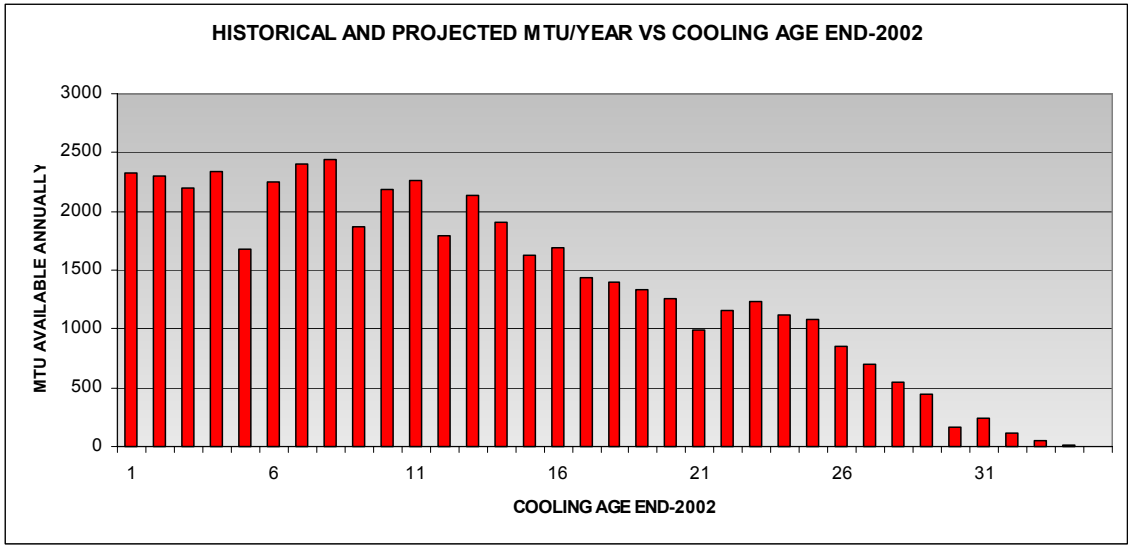
Waste Type	Commercial SNF
Total Projected Quantities (planning purposes only)	Estimated 63,000 MTHM
Projected Acceptance Schedule	**2010-End of Emplacement** Accept Commercial SNF at the following estimated annual rates* (MTHM/year): • 400 in 2010 • 600 in 2011 • 1,200 in 2012 • 2,000 in 2013 • 3,000 in 2014 through the end of emplacement

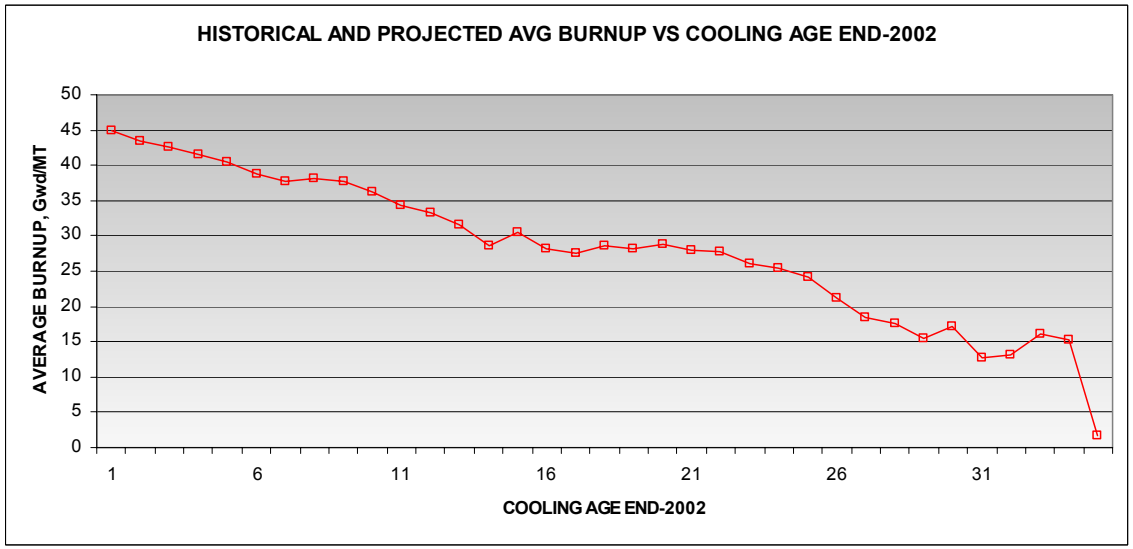
* The rates in this schedule are targets only and do not create any binding legal obligation on the Department of Energy.

Projected U.S. Commercial SNF

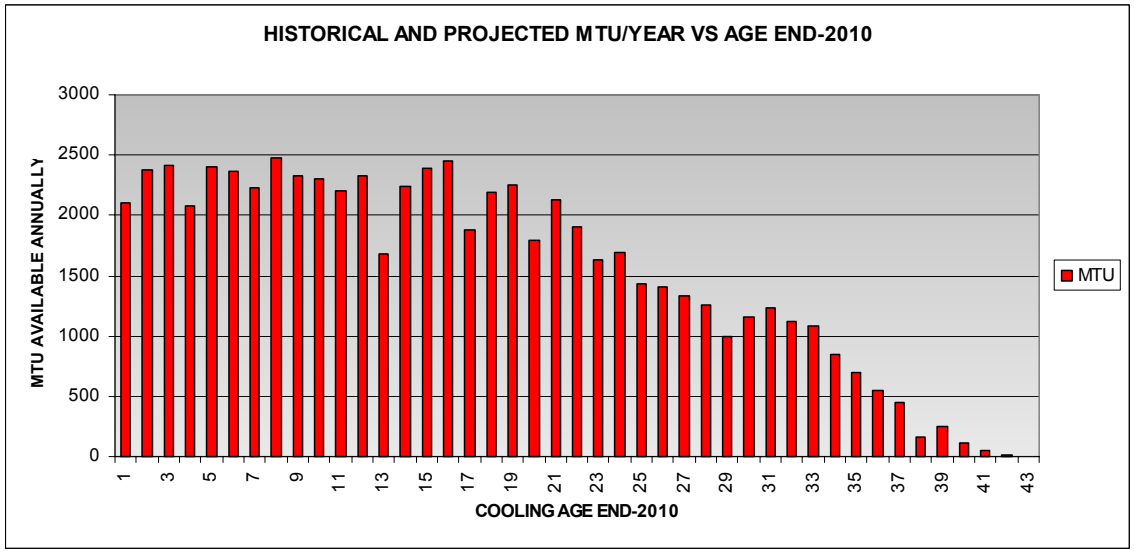
- **End-2002:**
  - **72 commercial reactor sites with SNF onsite**
    - **104 operating reactors**
    - **14 shutdown reactors**
  - **≈ 47,000 MTU - Projected inventory of Commercial Spent Nuclear Fuel (CSNF)**
  - **≈ 43,000 MTU are projected to be in pool storage**
  - **≈ 4,000 MTU are projected to be in dry storage**
  - **≈ 2,000 MTU/year - Projected generation rate**
- **End-2010:**
  - **≈ 64,000 MTU - Projected inventory of CSNF**
  - **≈ 53,000 MTU are projected to be in pool storage**
  - **≈ 11,000 MTU are projected to be in dry storage**

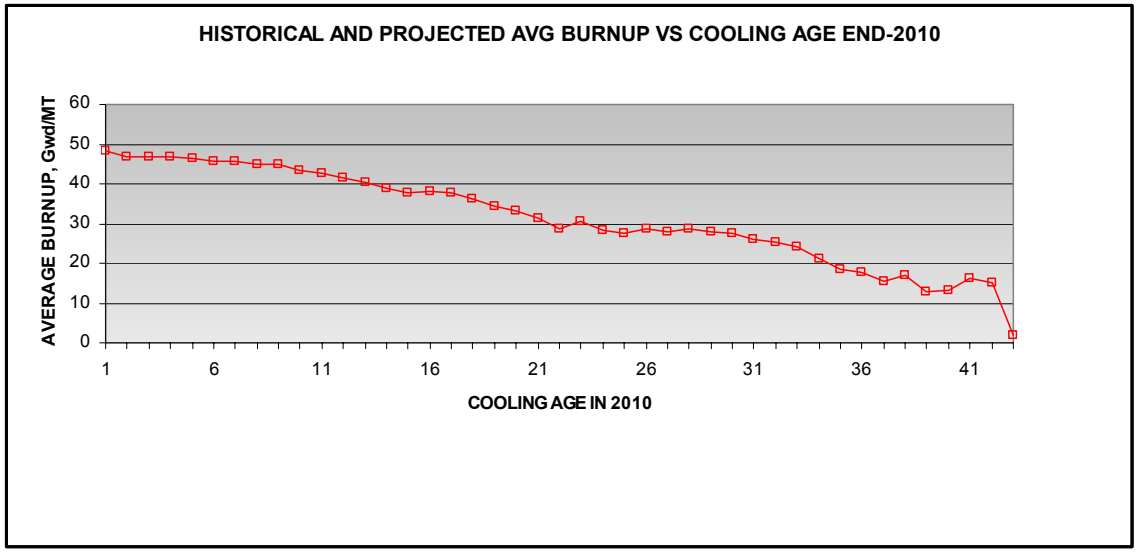
Historical and Projected Ages of Commercial SNF End-2002





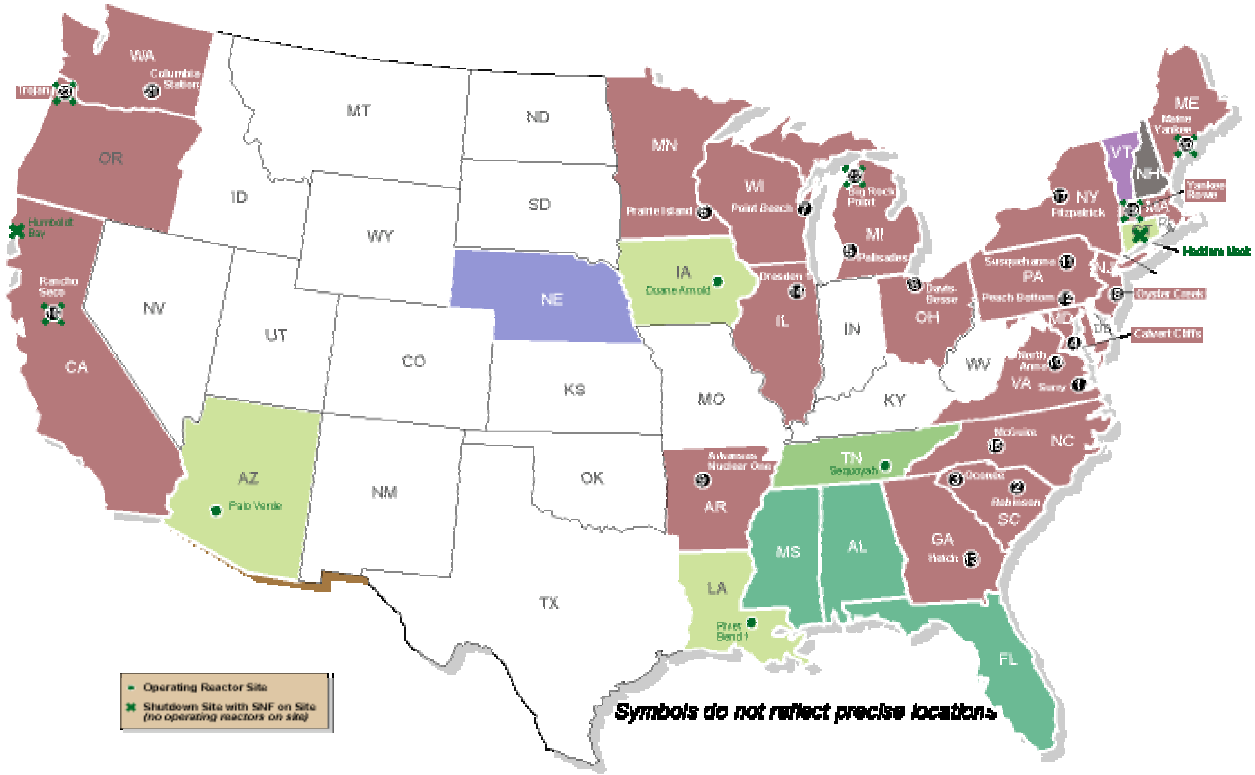
Historical and Projected Ages of Commercial SNF End-2010





Current & Projected Commercial Reactor Dry Storage

- **Currently, 23 ISFSI's in 19 states storing ≈ 4,000 MTU of SNF**
- **By 2010, 45 ISFSI's in 29 states storing ≈ 11,000 MTU of SNF**



Current Dry Storage

Dry Storage Facilities	Start Year	Numbers of Casks Loaded	Cumulative Dry Storage (MTU)*
Surry, VA	1986	45	524
Robinson, SC	1986	8	24
Oconee, SC	1990	73	632
Calvert Cliffs, MD	1992	36	335
Palisades, MI	1993	18	177
Prairie Island, MN	1993	17	248
Point Beach, WI	1995	15	136
Davis Besse, OH	1996	3	34
Arkansas Nuclear One, AR	1997	23	244
North Anna, VA	1998	15	222
Susquehanna, PA	1999	25	230
Peach Bottom, PA	2000	15	181
Hatch, GA	2000	12	147
Dresden, IL	2000	18	195
McGuire, NC	2001	5	72
Rancho Seco, CA	2001	21	228
FitzPatrick, NY	2002	3	37
Oyster Creek, NJ	2002	4	43
Yankee Rowe, MA	2002	10	62
Maine Yankee, ME	2002	11	100
Columbia, WA	2002	5	58
Big Rock Point, MI	2002	2	19
Trojan, OR	2002	1	11
Totals in Dry Storage		**385**	**4,169**

*From utility- and vendor-reported cask loadings

Projected Dry Storage 2003-2017

Year	New States	Cumulative Dry Storage Needs (MTU)
2003	AZ, CT, LA, IA	5,200
2004	TN	5,900
2005	AL, MS, FL	6,500
2006		7,500
2007	NE	8,400
2008		9,400
2009	VT	10,500
2010		11,400
2011	NH	12,500
2017		24,900

Includes fully planned on-site dry storage facilities and projected additional storage needs.

Damaged Spent Nuclear Fuel

- **Standard Contract does not contain specific guidance on how to characterize failed fuel**
- **Defined in NRC's Interim Staff Guidance - 1 (ISG-1, Rev 1)**
  - **Known or suspected clad defects having the potential of releasing particulates into a transport or storage cask**
  - **Damaged so as to compromise handling or fit into rack or basket locations, displaced or missing structurals, missing fuel rods not replaced by dummies, or degraded as to withstanding normal or accident conditions of storage or transport**
- **General Remedy: Placement in a Damaged Fuel Can**
  - **Mesh screen confines gross fuel particles, facilitates water removal**
  - **Confines damaged SNF in known volume, facilitating analysis/handling**
- **Quantities* are relatively small:**
  - **About 1% of historic discharges are estimated to require canisters**
  - **Historical rod failure rates have gone down from 0.07% to 0.02% and are progressing toward 0.01%. Only a fraction of these would be "Damaged"**
  - **Estimated future canisterings are well under 1% of future SNF discharges**

* *2002 Design Basis Waste Input Report, Appendix G*

At-Reactor Cask Loading

- DOE will provide NRC-certified casks suitable for use at Purchaser's site
- Cask loading will be performed by Purchasers
- DOE has no plans for dry transfer at Purchaser sites
- DOE has designed a Dry Transfer System which may be available for use should the need arise
  - Dry Transfer System Topical Safety Analysis Report (TSAR) submitted to NRC in 1996
  - NRC issued Assessment Report in 12/02
  - Transmittal of TSAR Revision 1 delivered to NRC on 1/23/03

Estimated Schedule for Acceptance of Government-Managed Nuclear Materials

Waste Type	Government-Managed Nuclear Materials		
	DOE SNF		HLW
Total Projected Quantities (planning purposes only)	2,333 MTHM		4,667 MTHM
Projected Acceptance Schedule	DOE SNF (3,721 Canisters)	NAVAL SNF (300 Canisters)	DOE HLW (8,315 Canisters)
	2010-End of Emplacement	**2010-2014**	**2010-End of Emplacement**
	• Receipt of government-managed SNF starting in 2010 • Receipt of entire DOE inventory from Idaho National Engineering and Environmental Laboratory by 2035 • Annual receipt quantities are to be negotiated by RW and EM consistent with the Memorandum of Agreement (1999)	Acceptance of naval SNF is planned to start in 2010 at the following annual receipt rates: • 3 canisters in 2010 • 3 canisters in 2011 • 6 canisters in 2012 • 6 canisters in 2013 • 12 canisters in 2014 **2015 - 2035** Acceptance quantities for naval SNF will be established between EM and the Navy to ensure removal of naval SNF from Idaho before 2035	• Receipt of HLW starting in 2010 • Annual receipt quantities are to be negotiated by RW and EM consistent with the Memorandum of Agreement (1999)

* The rates in this schedule are targets only and do not create any binding legal obligation on the Department of Energy.

DOE Owned and Managed Waste

- **Current baseline is for DOE SNF in sealed, Stainless Steal (SS) canisters (co-disposal waste package)**
- **Navy SNF in multi-purpose canisters (MPCs)**
- **Formerly commercial SNF not in canisters (≈ 70 MTU)**
- **DOE High-Level Radioactive Waste**
  - The product of SNF reprocessing vitrified in borosilicate glass and enclosed in a sealed SS canister

Differences Between DOE SNF & HLW and Commercial SNF

Material Comparison

Characteristic	DOE	Commercial
Varieties	SNF: Greater Than 250 including domestic research reactors, foreign research reactors, reactors for weapons material production, and reactors for medical and research isotope production. HLW: Borosilicate glass in SS canisters	Two: PWR & BWR
Decay Heat Output	DOE SNF: Generally Low HLW: 7 – 465 w/canister, average over all EM sites 1500 w/canister, worst case	PWR: 1000 w/ass'y (ave) BWR: 340 w/ass'y (ave) (both 5 yrs. post discharge)
Burnup (average, MWd/MTHM)	DOE SNF: Generally Low	*Historical* PWR: 41,200 MWd/MTHM (ave) BWR: 33,600 MWd/MTHM (ave)) *Current* PWR: 50,000 MWd/MTHM (ave) BWR: 45,000 MWd/MTHM (ave) *Future* (enrichments up to 5.5% may be possible) PWR: 57,000 MWd/MTHM (ave) BWR: 62,000 MWd/MTHM (ave)
Initial Enrichment (U^{235} w/o)	DOE SNF LEU (1.25 %) to HEU (>90 %)	*Historical* PWR: 3.75 % (ave) BWR: 3.03 % (ave) *Current* 4.0-4.5% *Future* Enrichments up to 5.5 % may be possible.
Chemical Makeup Fuel Cladding	U Metal, Uranium oxides Zircaloy-2, Zircaloy-4, 304-SS, 316-SS, Al, Graphite, etc.	Uranium Dioxide Pellets Zirconium Alloys, 304-SS

System Architecture

- **Waste Acceptance**
- **Transportation System**
- **Surface facilities**
- **Underground repository**