



**Joint Convention on the Safety of  
Spent Fuel Management and the  
Safety of Radioactive Waste  
Management**

# **U.S. Program for the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management**

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United States of America**

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# U. S. Delegation

- **Patty Bubar, head of delegation (U.S. Department of Energy);**
- **Janet Gorn, alternate head of delegation (U.S. Department of State);**
- **Margaret Federline, senior technical expert (U.S. Nuclear Regulatory Commission);**
- **Jeff Williams, senior technical expert; (U.S. Department of Energy);**
- **Mary E. Clark, senior technical expert (U.S. Environmental Protection Agency);**
- **John Greeves (CG1 coordinator);**
- **Other technical experts: Steven Baggett, Giorgio Gnugnoli, Frank Marcinowski, Bill Reamer, Leroy Stewart, Douglas Tonkay;**
- **Legal counsel Anita Capoferri.**

# INTRODUCTION

- **The U.S. safety program maintains robust oversight of large and mature nuclear program.**
- **Existing legislative and regulatory infrastructure to promote safety.**
- **Extensive experience with safe management of spent nuclear fuel (SNF) and radioactive waste (RW).**

# **INTRODUCTION (cont.)**

- **U.S. Preparation of the Joint Convention National Report provided:**
  - **Integrated and comprehensive view of the U.S. National Program**
  - **Confirmation that the U.S. has a high-quality and successful program**

# **Significance of the Joint Convention on Spent Fuel and Radioactive Waste Management**

- **Important to the United States of America.**
- **Complements other international conventions.**
- **Broad support from cognizant U. S. Federal agencies**

# Content of U.S. Presentation

- Policies, Practices and Scope ►
- Inventories and Lists
- Legal and Regulatory Program
- Selected Safety Topics
- Conclusions
- Observations on the U.S. National Report

# Scope of the U.S. National Report

- U.S. has reported its inventories of spent fuel and radioactive waste stored, managed and disposed, as stipulated in the scope of the Joint Convention.
- As provided in the Joint Convention, the U.S. has not reported information with security or safeguards implications within the context of its own defense.
- The U.S. does not consider operating reactor facilities within the scope of the Joint Convention.
  - To provide a complete picture for spent nuclear fuel management, the U.S. National Report does provide totals for the spent fuel stored in reactor facilities.

# **Policies, Practices and Scope**

**National Policy is safe permanent geologic disposal of spent fuel and high-level waste radioactive waste and surface or subsurface disposal of low-level radioactive waste to ensure long-term containment and isolation from the environment.**

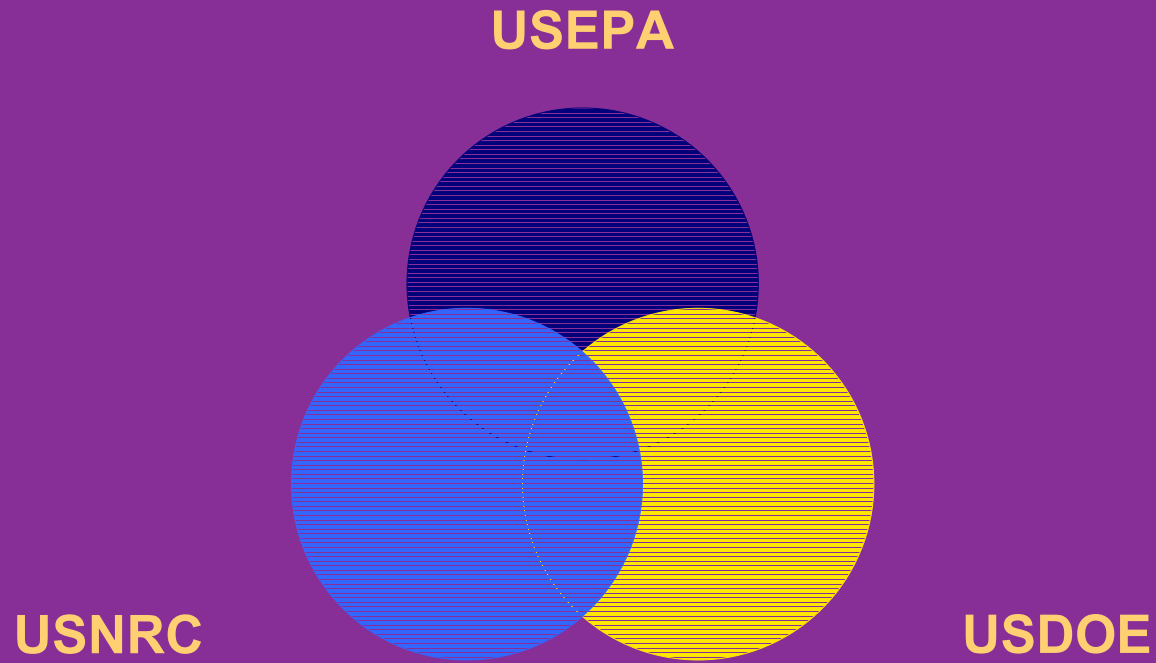
# **Policies, Practices and Scope**

- **Policies in the U.S. are established by National Law.**
- **Atomic Energy Act of 1954 set the framework for regulating “peaceful” uses of nuclear materials and power in a safe manner.**
- **Laws and subsequent regulations have been evolving since that time.**

# Atomic Energy Act of 1954

- Established commercial and governmental sectors in nuclear applications, which were both regulated by the USAEC.
- Energy Reorganization Act of 1974 split regulatory and promotional, which created:
  - An independent regulator, USNRC.
  - A nuclear science and technology developer with defense applications, USDOE.
- U.S. Environmental Protection Agency (USEPA) was created in 1970 and sets applicable standards.

# Roles & Responsibilities of U.S. Agencies

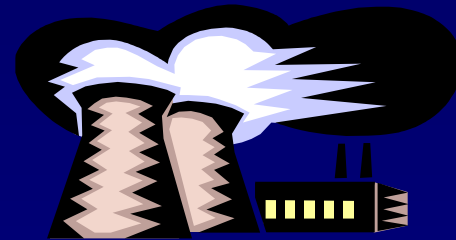


# Spent Fuel and Waste Types



## Government/DOE

- Spent Fuel
- High-level waste (HLW)
- Transuranic (TRU) waste
- Low-level waste (LLW)
- Tailings



## Commercial/NRC

- Spent Fuel
- High-level waste (HLW)
- Low-level waste (LLW)
- Tailings

# Available Disposal Options

- **Currently acceptable Disposal Options**
  - **Deep Geologic Disposal**
  - **Near-Surface Disposal**
    - **Engineered Facilities for LLW**
- **Past practices**
  - **Legacy sites - both commercial and defense**
  - **Part of national cleanup program**

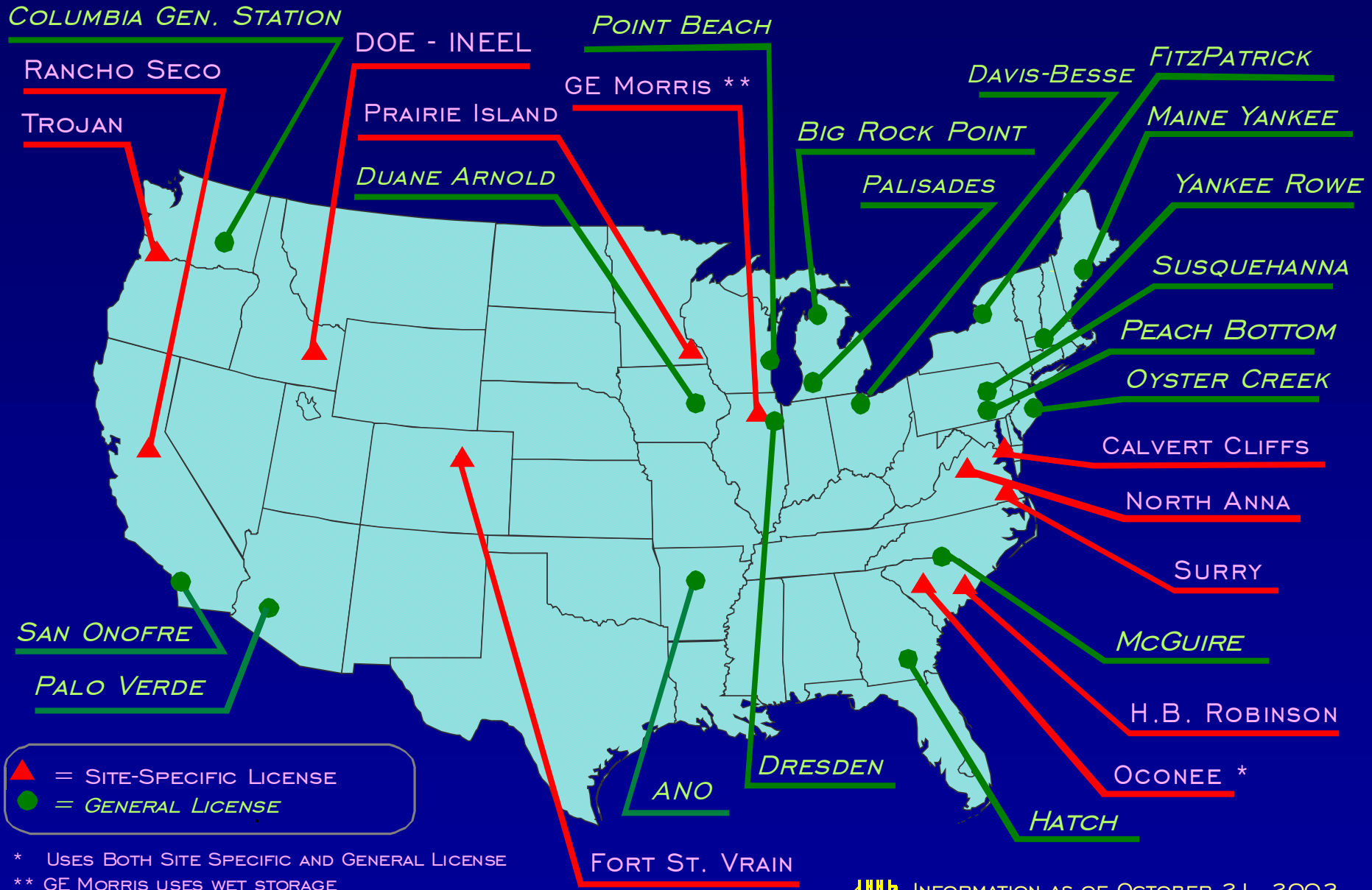
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# Stored Spent Fuel Inventory (MTHM)

<b>Commercial Facilities</b>	<b>4848</b>
<b>Government Installations</b>	<b>2474</b>
<b>At Reactor Storage</b>	<b>~37662</b>
<b>Total</b>	<b>44984</b>

# OPERATING SPENT FUEL STORAGE SITES (ISFSI)



INFORMATION AS OF OCTOBER 21, 2003

# Palisades ISFSI



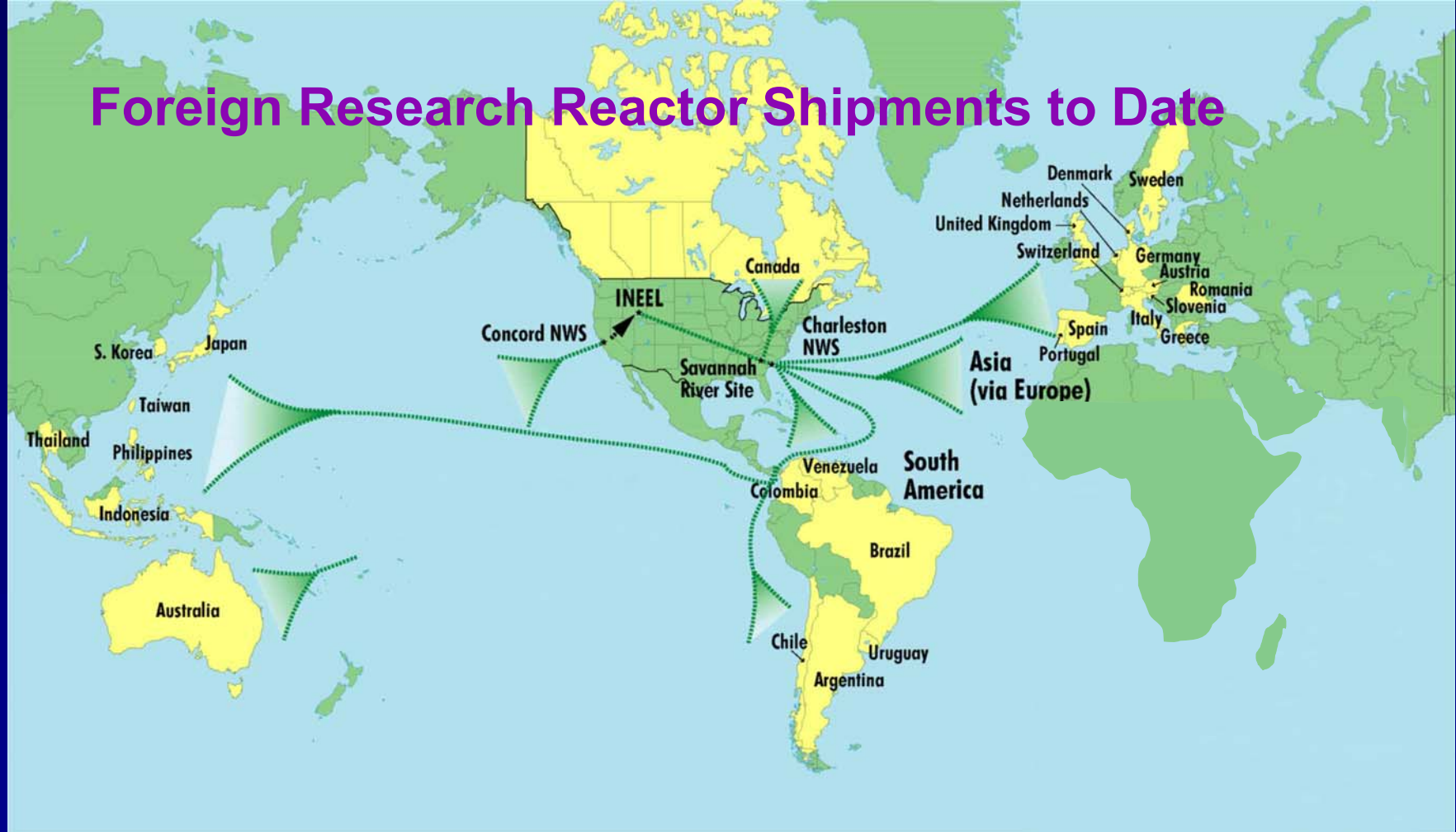
# Calvert Cliffs ISFSI



# Spent Fuel Cask Unloading at Savannah River Site Receiving Basin for Offsite Fuel (Foreign Research Reactor Shipments)



# Foreign Research Reactor Shipments to Date



## 4 shipments to INEEL

- 1 South Korea
- 2 Romania, Slovenia, Italy & Germany
- 3 United Kingdom
- 4 Germany

## 21 shipments to SRS

- 1 Sweden, Switzerland, Germany, Colombia, & Chile
- 2 Canada
- 3 Germany, Switzerland, Spain, & Italy
- 4 Japan, Sweden, Germany & Spain
- 5 Denmark, Italy, Germany, Sweden & Greece
- 6 Australia
- 7 Venezuela, Uruguay, Japan, Sweden & Spain
- 8 Germany, Denmark, & Sweden
- 9 Thailand, Philippines, Indonesia, & Taiwan
- 10 Portugal and Denmark
- 11 Japan (via Europe)
- 12 Brazil & Venezuela
- 13 Canada
- 14 Italy & Germany
- 15 Japan
- 16 Chile & Argentina
- 17 Austria, Germany, & Netherlands
- 18 Germany, Sweden, & Japan
- 19 Denmark
- 20 Denmark, Germany, & Sweden
- 21 Japan

# Stored Radioactive Waste

Inventory of Stored Radioactive Waste	
GOVERNMENT	Volume m <sup>3</sup>
HLW	354,000
TRU	111,000
LLW	204,000
COMMERCIAL	Volume m <sup>3</sup>
HLW	230

# Inventory of Disposed Waste

Inventory of Disposed Radioactive Waste		
GOVERNMENT	QUANTITY	UNITS
TRU	9,300	M <sup>3</sup>
LLW	2,260,000	M <sup>3</sup>
TAILINGS	5,970,000	M <sup>3</sup>
COMMERCIAL	QUANTITY	UNITS
LLW (Class A,B,C)	1,730,000	M <sup>3</sup>
TAILINGS	163,000,000	Metric Tons

# Radioactive Waste Management Facilities

<i>Summary of Radioactive Waste Management Facilities</i>		
Sector	Type	Number
Government	Storage/Treatment Facilities	54
Government	LLW (includes “Mixed” LLW ) Disposal Facilities	16
Government	TRU Waste Disposal Facility (WIPP)	1
Government	Closed Greater Confinement Disposal	1
Government	Operating Mill Tailings/Past Practice	1
Government	Closed Mill Tailings/Past Practice	2
Government/Commercial	Proposed Yucca Mountain Geologic Repository	1
Commercial	Commercial Treatment/Processing	44
Commercial	Operating LLW Disposal Facilities	3
Commercial	Closed LLW Disposal Facilities	4
Government/Commercial	Mill Tailings	21
Commercial	Mill Tailings	36

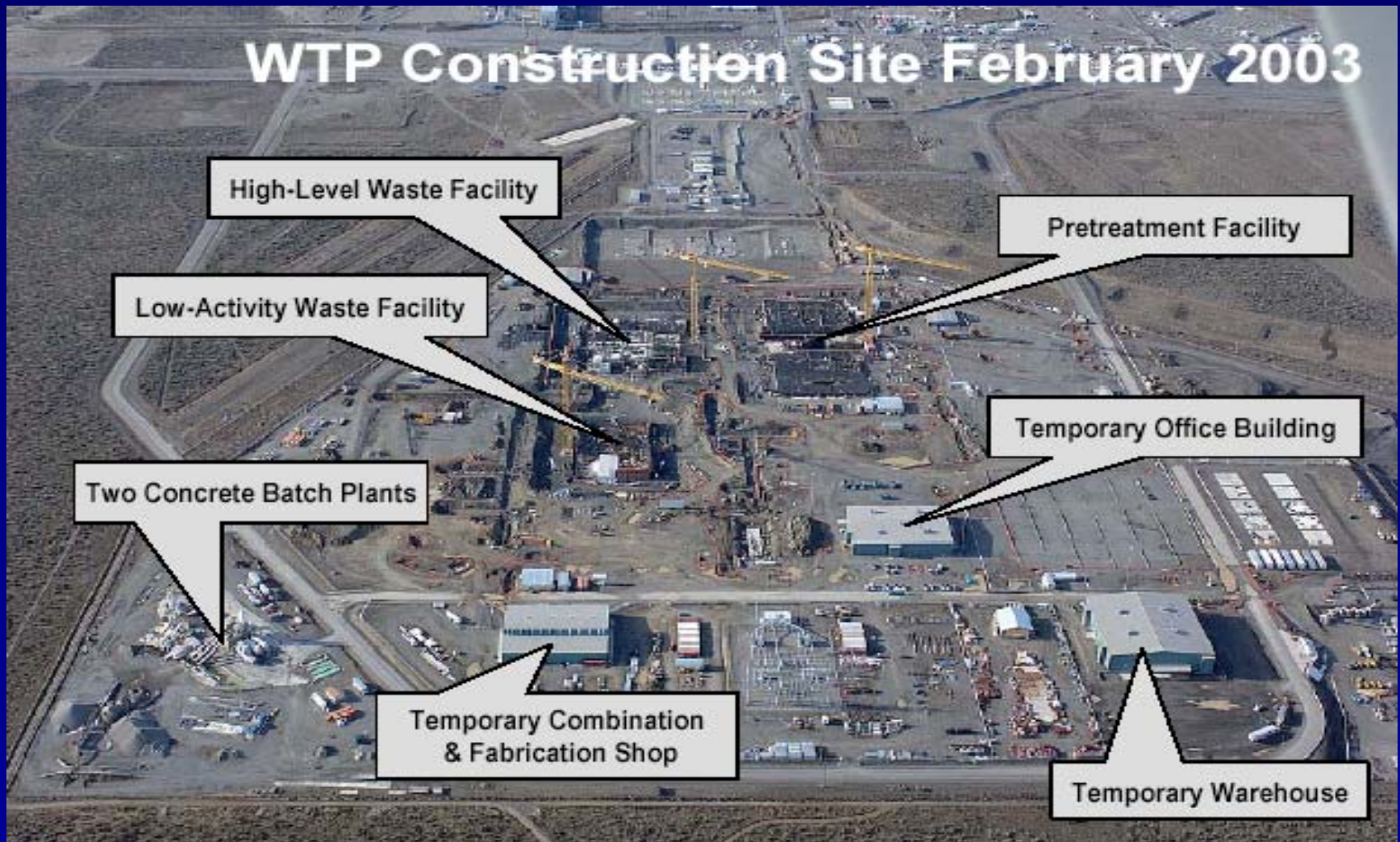
# HLW Processing Facilities

DWPF at Savannah River - in operation



# HLW Processing Facilities

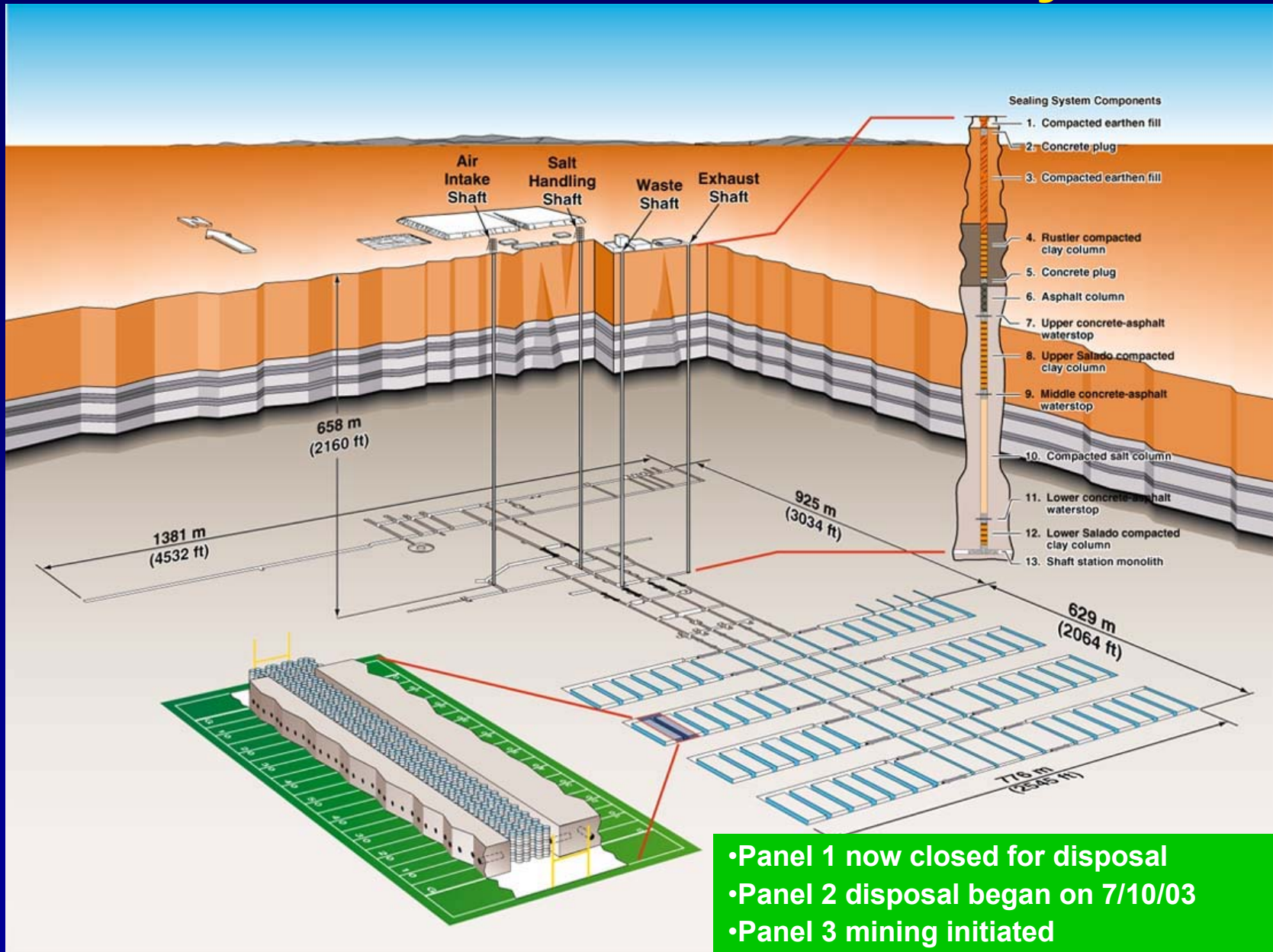
WTP at Hanford - under construction



# WIPP & TRUPACT II loading



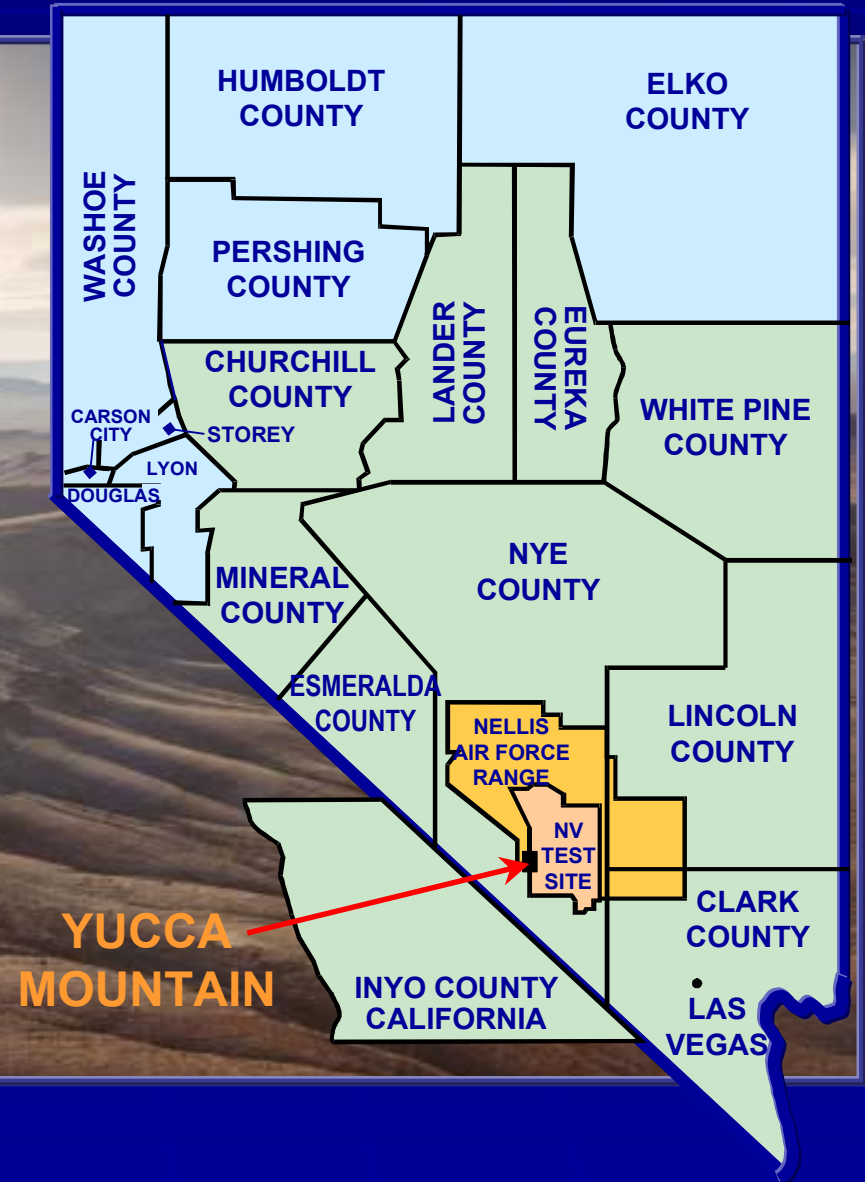
# Waste Isolation Pilot Plant Layout



- Panel 1 now closed for disposal
- Panel 2 disposal began on 7/10/03
- Panel 3 mining initiated
- Permit modification in review for panels 4-8

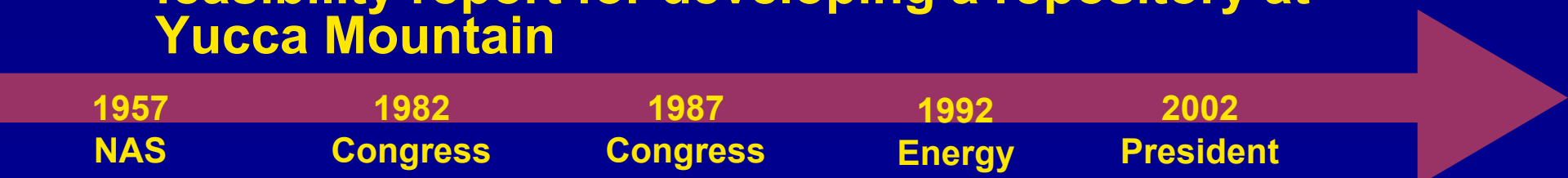
# Location of Yucca Mountain

- Yucca Mountain is 100 miles northwest of Las Vegas in Nye County.
- It is located on the western boundary of the Nevada Test Site, a DOE facility.



# U.S. Congress Created a Legal Obligation to Dispose of Nuclear Waste

- 1982 - Enactment of Nuclear Waste Policy Act (NWPA) for the disposition of high-level radioactive waste and commercial spent nuclear fuel
- 1987 - NWPA as amended eliminated all sites but Yucca Mountain to be characterized for a potential repository
- 1997 - U.S. Congress directed USDOE to provide a feasibility report for developing a repository at Yucca Mountain

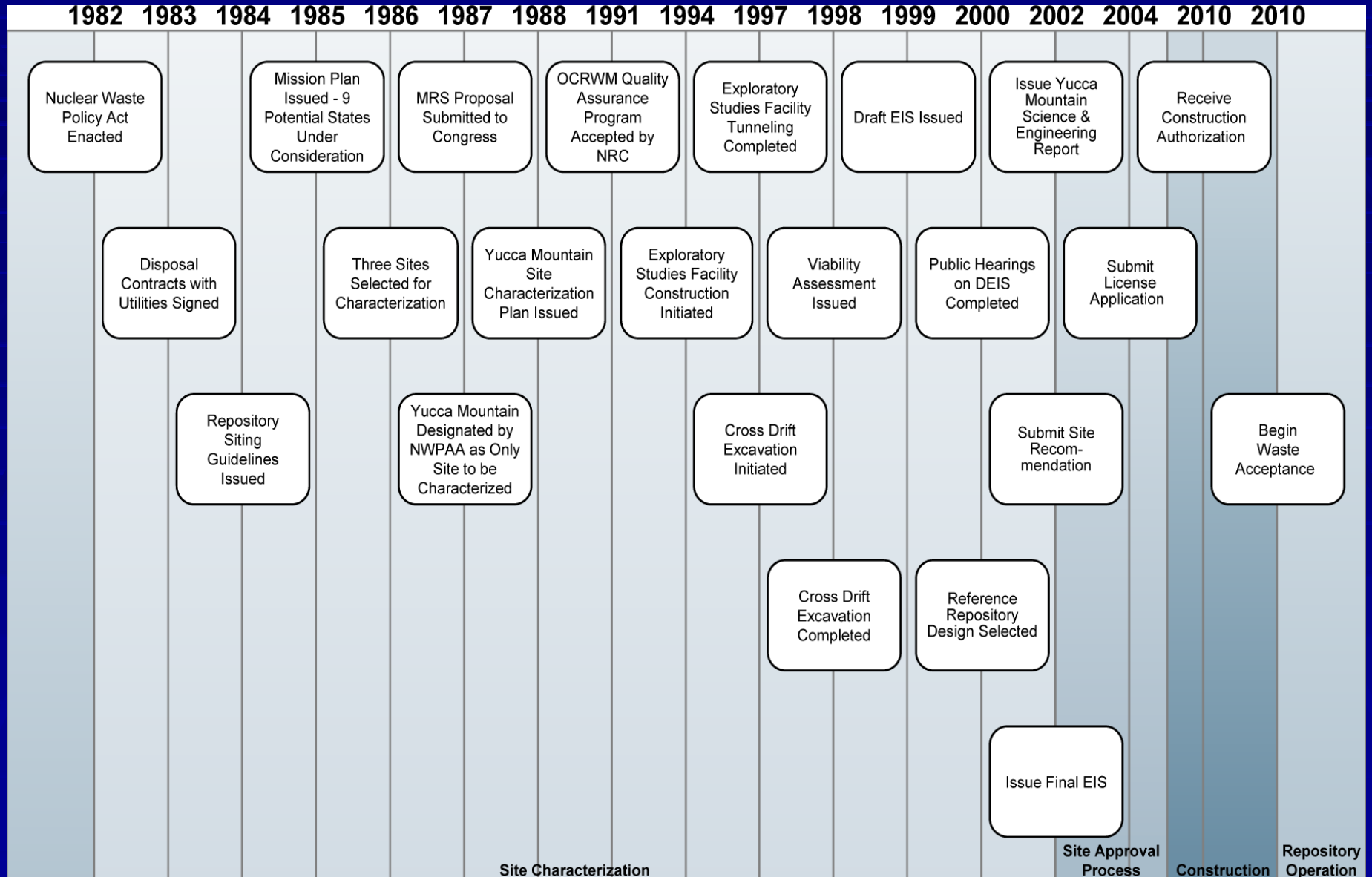
A large, dark blue arrow pointing to the right, serving as a timeline background for the bottom section of the slide.

1957	1982	1987	1992	2002
NAS supported deep geologic disposal	Congress passes Nuclear Waste Policy Act	Congress selects Yucca Mountain for study	Energy Policy Act sets EPA standard process	President recommends, Congress approves Yucca Mountain

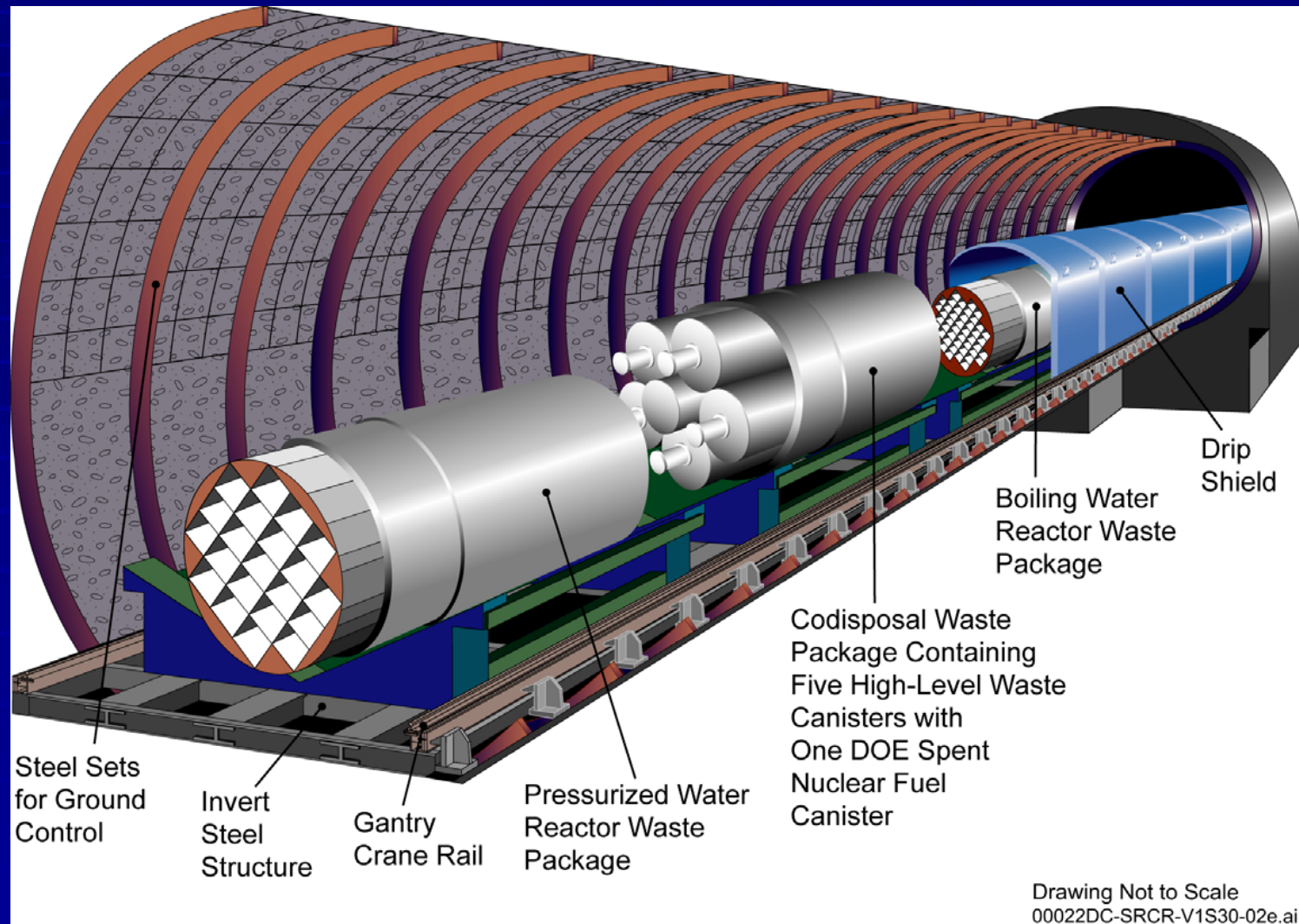
# **Yucca Mountain Pre-licensing Activities**

- **Rigorous scientific program**
- **Extensive societal process**
- **State and local oversight**
- **President and U.S. Congress involvement**

# Yucca Mountain Program Timeline



# Conceptual View of Disposal Room



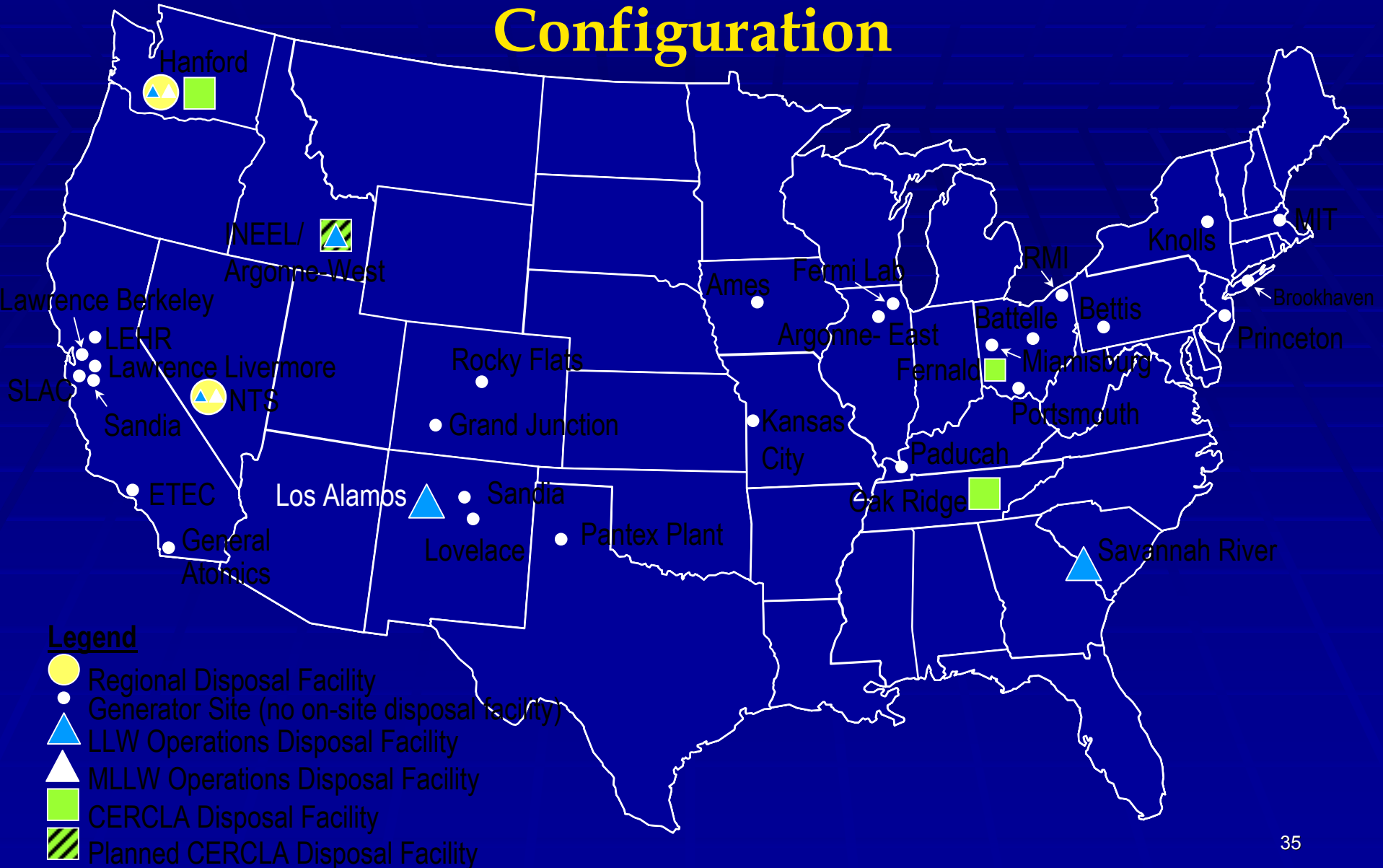
# Yucca Mountain Tunnel



# Geologic Repository Capacity

- **Yucca Mountain (SNF and HLW)**
  - 70,000 MTHM limit,
  - ~7,000 MTHM planned for defense HLW.
- **USDOE to provide a report to the U.S. Congress on need for a second SNF/HLW repository between 2007 and 2010.**
- **WIPP (defense TRU waste)**
  - 175, 600 cubic meters.

# USDOE LLW and MLLW Disposal Configuration



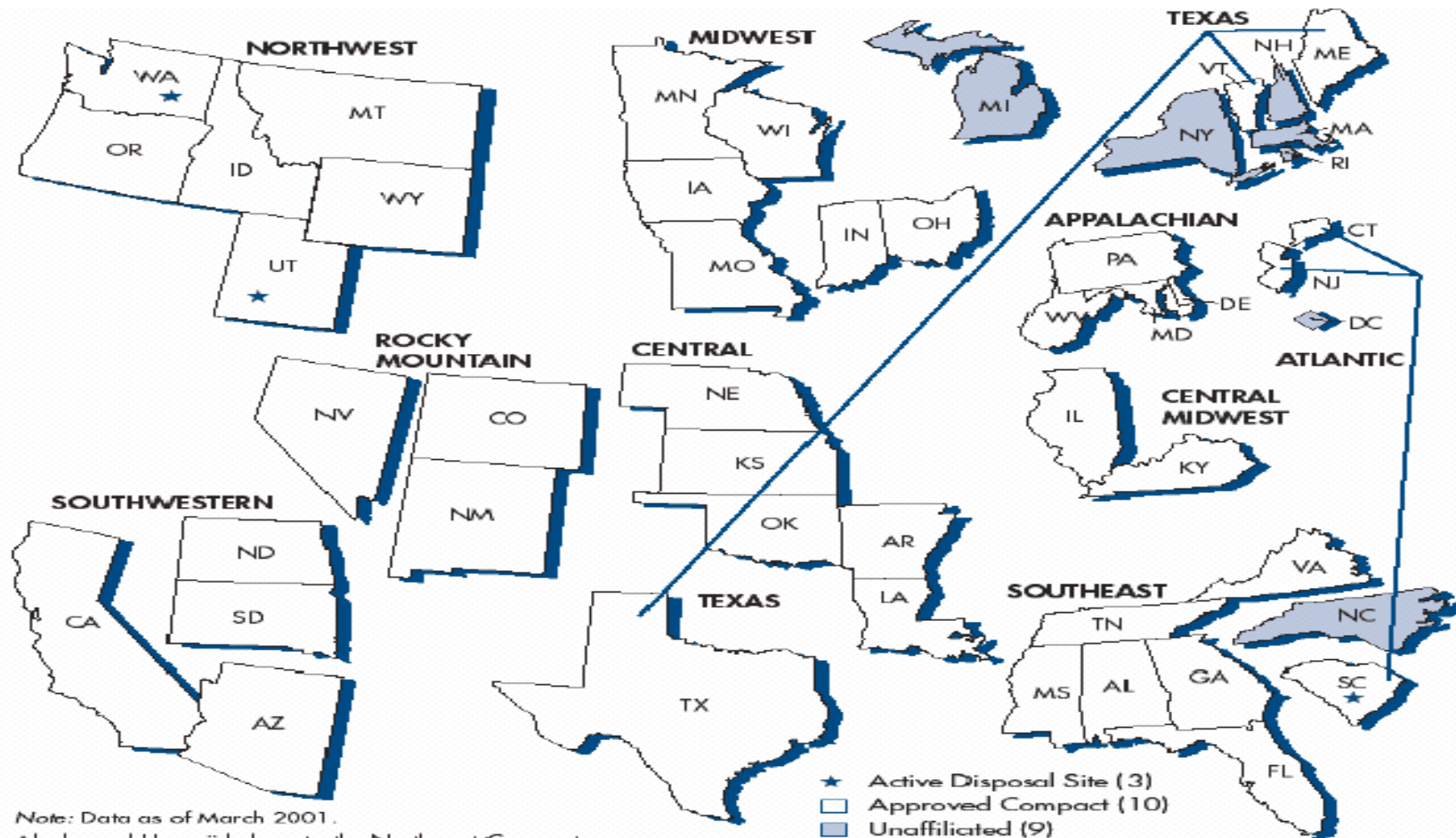
# USDOE Idaho LLW site



# USNRC Agreement State Program

- Interaction with States through the Agreement State Program
- 33 Agreement States regulate over 16,000 specific material licenses and more than 100,000 general licenses
- Program reviews of NRC regions and Agreement State programs (IMPEP)

# U.S. LLW Compacts



Note: Data as of March 2001.

Alaska and Hawaii belong to the Northwest Compact.  
Puerto Rico is unaffiliated.

There are three active, licensed low-level waste disposal facilities located in Agreement States.

Barnwell, located in Barnwell, South Carolina. Currently, Barnwell accepts waste from all U.S. generators except those in Rocky Mountain and Northwest compacts. Beginning in 2008, Barnwell will only accept waste from the Atlantic Compact states (Connecticut, New Jersey, and South Carolina). Barnwell is licensed by the State of South Carolina to receive wastes in Classes A-C.

Hanford, located in Hanford, Washington. Hanford accepts waste from the Northwest and Rocky Mountain compacts. Hanford is licensed by the State of Washington to receive wastes in Classes A-C.

Envirocare, located in Clive, Utah. Envirocare accepts waste from all regions of the United States. Envirocare is licensed by the State of Utah for Class a waste only.

Source: Nuclear Regulatory Commission

# Existing Commercial Radioactive Waste Disposal Facilities

- **Envirocare of Utah (A LLW/ MLLW & mill tailings)**
  - Licensing request for class B & C waste on hold at Envirocare's request.
- **Duratek/Chem-Nuclear, Barnwell SC (A, B, & C LLW)**
  - Currently accepts waste from all states/compacts,
  - After June 30,2008 Atlantic compact waste (3 states) only .
- **U.S. Ecology, Richland WA (A, B, and C LLW)**
  - Acceptance from Northwest Compact (8 states) and some waste from other compacts under certain conditions, e.g., Rocky Mountain Compact (3 states).

# Low Level Waste Disposal Sites

**Barnwell**



**Envirocare**

# Decommissioning of Nuclear Facilities

- **The US has extensive experience in D&D of nuclear facilities**
- **US Report details of decommissioned facilities by program area**
- **D&D of nuclear power plants has provided lessons learned**

## ***Summary of Decommissioning Activities.***

<b>Sector</b>	<b>Type</b>	<b>Number</b>
<b>Government</b>	<b>USDOE Nuclear/Radioactive Facilities for which Decommissioning is Ongoing or Pending</b>	<b>1186</b>
<b>Government/ Commercial</b>	<b>Formerly Utilized Sites Remedial Action Program (FUSRAP)</b>	<b>26</b>
<b>Government/ Commercial</b>	<b>Decommissioning Materials Sites</b>	<b>41</b>
<b>Commercial</b>	<b>Nuclear Power Plants</b>	<b>23</b>
<b>Commercial</b>	<b>Other Non-Power Reactor Facilities</b>	<b>15</b>

## Decommissioning of plutonium production reactor at Hanford (D-Reactor)



# West Valley Demonstration Project Nuclear Wastes



First LLW rail shipment from WVDP in 2000



Drums of cemented LLW stored at WVDP in special shielded aboveground facility-  
handling is fully remote



LLW in storage at WVDP



HLW underground storage tanks under  
construction in 1960s

# INEEL Entombment Process



# Control and Accountability for Sealed Sources

- Approximately 150,000 general licensees in U.S. with about 45,000 under USNRC jurisdiction
- These licensees possess about 1.5-1.8 million devices.
- On occasion radioactive material has been inadvertently been included into scrap metal intended for recycling
- USNRC has approved a regulation to implement a registration program for generally licensed devices

# USDOE Offsite Source Recovery Project



**A down-hole Am/Be source failure at a drill site in Texas in 1995 resulted in significant environmental contamination and the need for emergency recovery of the source.**

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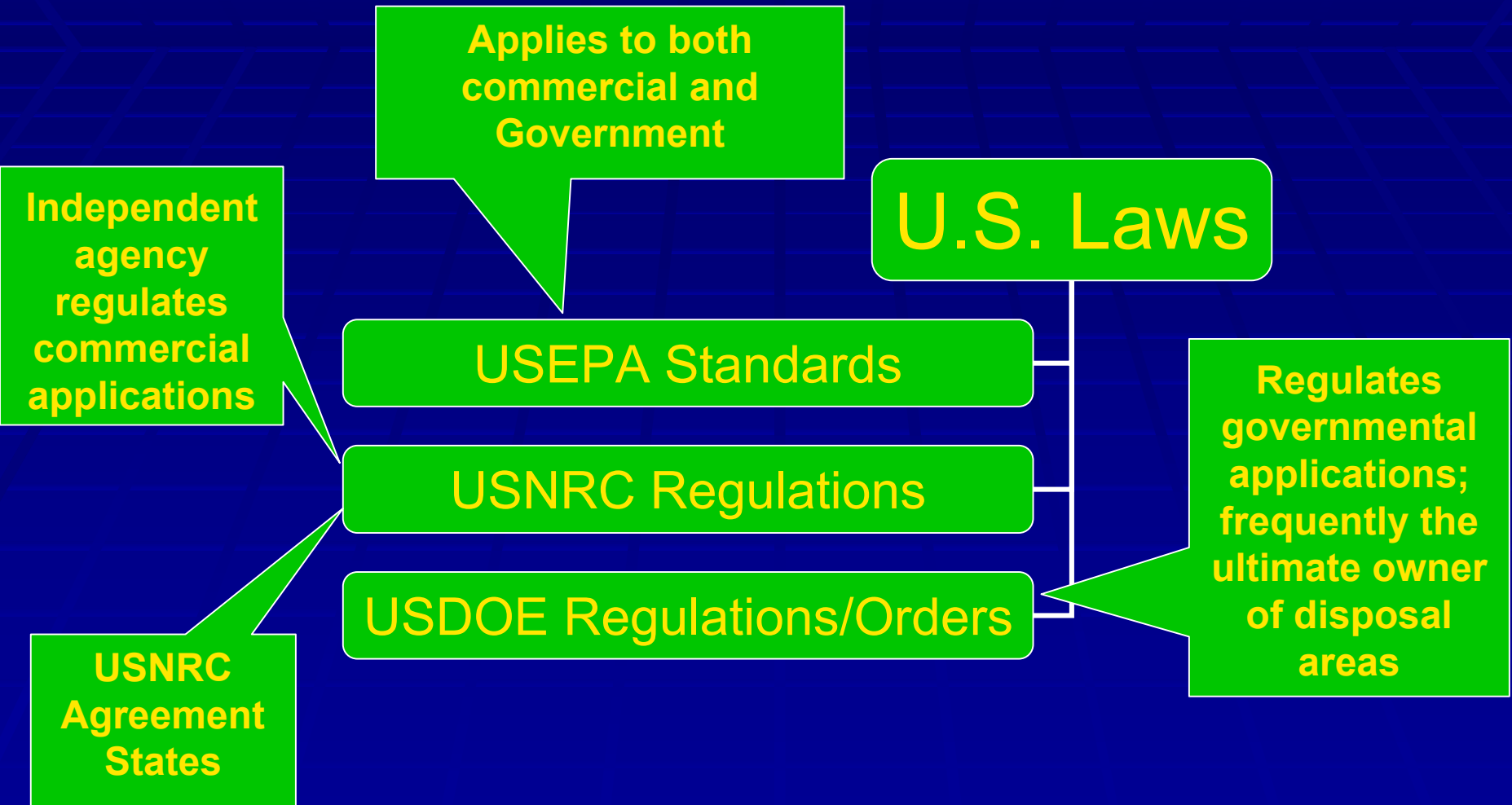
# KEY U.S. LAWS on RADIOACTIVE WASTE MANAGEMENT

- **Atomic Energy Act (AEA)** 1954
- **National Environmental Policy Act (NEPA)** 1969
- **Energy Reorganization Act** 1974
- **Uranium Mill Tailings and Radiation Control Act (UMTRCA)** 1978
- **Low-Level Radioactive Waste Policy Act** 1980
- **Low-Level Radioactive Waste Policy Amendments Act** 1985
- **Nuclear Waste Policy Act (NWPA)** 1982
- **Nuclear Waste Policy Amendments Act (NWPAA)** 1987
- **Waste Isolation Pilot Plant Land Withdrawal Act** 1992
- **Energy Policy Act** 1992

# Evolution of Law - Nuclear Waste Policy Act (Example)

- NWPA of 1982
  - Defined relationship of Federal & State governments on HLW
  - Established schedule for siting, construction & operation
  - Created Nuclear Waste Fund
- NWPAA of 1987
  - Created Nuclear Waste Technical Review Board
  - Established Nuclear Waste Negotiator
  - Directed DOE to study only Yucca Mountain site
  - Established requirement to report on need for second repository
  - Established role of NRC
- EnPA of 1992
  - Directed National Academy of Sciences to evaluate YM standard's bases
  - Directed USEPA to establish new health & safety standards for YM
  - Directed USNRC to conform technical requirements to EPA standards

# Legal & Regulatory Program



# Overview of Regulatory Process

- **Developing regulations and guidance for applicants and licensees,**
- **Licensing or authorizing applicants to use nuclear materials or operate nuclear facilities**
  - **Commercial licensees generally fall into two main categories: nuclear reactor operators and materials' licensees.**
- **Inspecting operations and facilities to enforce safety requirements,**
- **Evaluating operational experience at existing facilities with authorized activities, and**
- **Conducting research and obtaining independent reviews to support regulatory decisions.**

# U.S. Department of Energy Safety Policy

- Integrated Safety Management (ISM)
  - All work is done in a manner that protects workers and others and does not harm the environment
  - Safety is part of the job – not a stand-alone program
- Complementing ISM are:
  - A USDOE independent oversight program reporting directly to the Secretary of Energy
  - Enforcement activities (Price-Anderson Act)
  - Oversight by the U.S. Defense Nuclear Facilities Safety Board

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# Radiation Protection Standards

- Public dose limits - total effective dose equivalent (TEDE) to individual 1.0 mSv/a.
- Occupational limit - more limiting of: (1) TEDE = 0.05 Sv; or (2) deep-dose equivalent + the CDE to any individual organ or tissue other than the lens of the eye being equal to 0.5 Sv.
- ALARA plays a large role in U.S. regulatory program.

# Radiation Protection Program

- For specific activities, usually a fraction of the general public protection values are used to account for multiple sources, etc... (e.g., decommissioning constraints are 0.25 mSv/a).
- USNRC Agreement States are required to use compatible limits, but may be more stringent.
- In cleanup of legacy sites, USEPA permittees can enter into compliance agreements for cleanup levels.
- Compliance is usually achieved by means of monitoring and inspections.

# Control of the Disposition of Solid Materials

- International community refers to this as “clearance.”
- No uniform, national standard exists.
- Case-by-case decision making.
- USNRC is currently in the process of rulemaking.

# Financial Mechanisms

- Regulations require decommissioning funding
- Materials licensees must provide funds or guaranteed access to funds for full amount of decommissioning before license is issued
- Reactor licensee may use sinking fund to accumulate funds over life of plant
- Funds must be outside licensee control
- Decommissioning under restricted release conditions and uranium mills must provide funds for long-term surveillance and control of the site after license termination

# Financial Mechanism for Yucca Mountain

- The cost for the YM repository is shared between government and industry.
  - Fund based on a collection of a fee of \$0.001 per kilowatt-hour of nuclear-generated electricity from utilities.
  - U.S. Congress contributes to this fund and allocates funding for disposal of defense-related HLW
- The goal is to ensure that the programs are implemented.

# Transboundary Interface

- All exports and imports of “radioactive waste” out of or into the U.S. require specific NRC export/import licenses
- Consultations with Foreign Governments required as part of review and approval
- Disused Radioactive Sources excluded from regulatory definition of “Radioactive Waste”

# Example - Emergency Preparedness

- The Federal Radiological Emergency Response Plan (FRERP) identifies the USNRC as the lead Federal Agency for emergencies involving the shipments of licensed radiological materials.
- USEPA has the lead when an emergency involves radiological material not licensed or owned by a Federal agency or an Agreement State.
- With the recent heightened alerts involving terrorism, Federal response to nuclear terrorism is being revised.

# **Planned Activities to Improve Safety**

- **Spent Fuel and HLW Disposal**
- **Commercial LLW Disposal**
- **Disused Sealed Sources**
- **Accelerated Cleanup of Former Nuclear Weapons Complex**

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# Conclusions

- **The U.S. has a large and mature nuclear program.**
- **Existing legislative and regulatory infrastructure to promote safety.**
- **Extensive experience in the management of spent nuclear fuel (SNF) and radioactive waste (RW)**

# Conclusions

- **Preparation of the Joint Convention National Report provided:**
  - **Integrated and comprehensive view of the U.S. National Program**
  - **Confirmation that the U.S. has a high-quality and successful program**

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# Topics Raised in the Review of the U.S. National Report

- **US activities regarding exposure limits and release from regulatory control of slightly radioactive material**
- **ALARA principle & how it is implemented in licensee activities, regulator involvement, dedicated reviews, etc....**
- **Reconcile retrievability provisions being designed into Yucca Mountain with permanent disposal (and at the same time address Monitored Retrievable Storage).**
- **Clarify Yucca Mountain waste acceptance in terms of capacity, breakdown of defense and commercial waste, criteria for defense waste, and point of acceptance.**
- **US position with respect to spent fuel in reactor pools and exclusion from scope in reporting their inventories as waste under Joint Convention.**

# Topics Raised in the Review of the U.S. National Report

- **US perspective on environmental discharge limits and soil cleanup limits; basis thereof.**
- **How is the US harmonizing regulations with ICRP-60.**
- **US interactions with neighboring countries and the international community on emergency preparedness.**
- **Comparison of safety requirements for NPPs versus those applied to spent fuel and waste management facilities.**
- **Explanation of the safety performance period beyond 10,000 years.**
- **Explanation of the role of the public, stakeholders and States in the siting process; how is input taken into account and is considered by USNRC, USEPA, and USDOE.**

# **Topics Raised in the Review of the U.S. National Report**

- **Continuity of control for operations provided from waste production to disposal with entities in the commercial sector.**
- **U.S. approach for verification of governments of other countries receiving radioactive waste; confirmation that the destination has administrative and technical capacity and regulatory structure in place (e.g., ethical considerations).**
- **The “polluter pays” principle applied to the U.S. regulation of sites and activities; e.g., the Off-Site Sealed Source Recovery Program.**
- **Explanation of effective independence between regulatory and operations parts of USDOE ensured.**