A Review of Where We are as a Nation with Nuclear Waste Management

A presentation to:
Nuclear Integration Project (NIP) Workshop:
"The Back-end: Healing the Achilles Heel of the Nuclear Renaissance?"

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Workshop Purpose and Mission:

• Define one or several technically and publicly-credible integrated nuclear waste management program options that provide for safe disposal of all wastes generated from the current and potential future energy fuel cycles, as well as other defense and civilian nuclear wastes.

• Premise: Currently, the country's nuclear waste management system is challenged to provide adequate pathways for management of defense wastes, low level wastes, spent nuclear fuel and potentially new waste streams from advanced fuel cycles.

• But effective ways to address this challenge remain elusive

• Discussions of the issue are regularly confused and inconclusive – and almost always offer incomplete approaches

•Why? One reason is that both temporal and conceptual contexts get confused.

The twin challenges to a coherent workshop:

Keeping track of what would/would not change OVER TIME - not just long-term

1. Some material flows change ineluctably – there will be new SNF; some new TRU
2. Others flows would/will change dramatically under different scenarios for new nuclear generation – for example, more new SNF/less SNF
3. The material flows to be managed would change under different nuclear
   - management proposals (best example: reprocessing); and/or
   - different classification systems for nuclear waste and nuclear materials
4. Time frames and protection approaches change if institutional arrangements change
   - changing defense/civilian responsibility – for example, among public and private sectors
   - altering storage/disposition priorities and management requirements
5. And, of course, tracking the impact of decay on whatever has to be managed and how it is to be managed

Keeping discussion of / proposals to address the integration challenge from drifting deceptively among four elements of the current discussion:

1. Existing legal requirements – law and regulation *and*
2. Policy/planning assumptions being made by implementers of law/regulation *and*
3. Technical feasibility (now/soon) of alternative approaches for NWM *and*
4. Assessments of the prognosis for changing (and/or strategies to change) both 1 & 2

We take so seriously this issue of keeping the discussion from drifting deceptively among these four conceptual elements,

that we begin the Workshop by taking time to remind
all of us of what current law and policy require

Nuclear Waste Law and Policy: Where we are now

Jane Stewart, NYU

what we have to manage – using current metrics

law and policy on
- repositories generally
- WIPP
- Yucca
- additional repositories
- reprocessing
- retrievable, interim or transitional storage

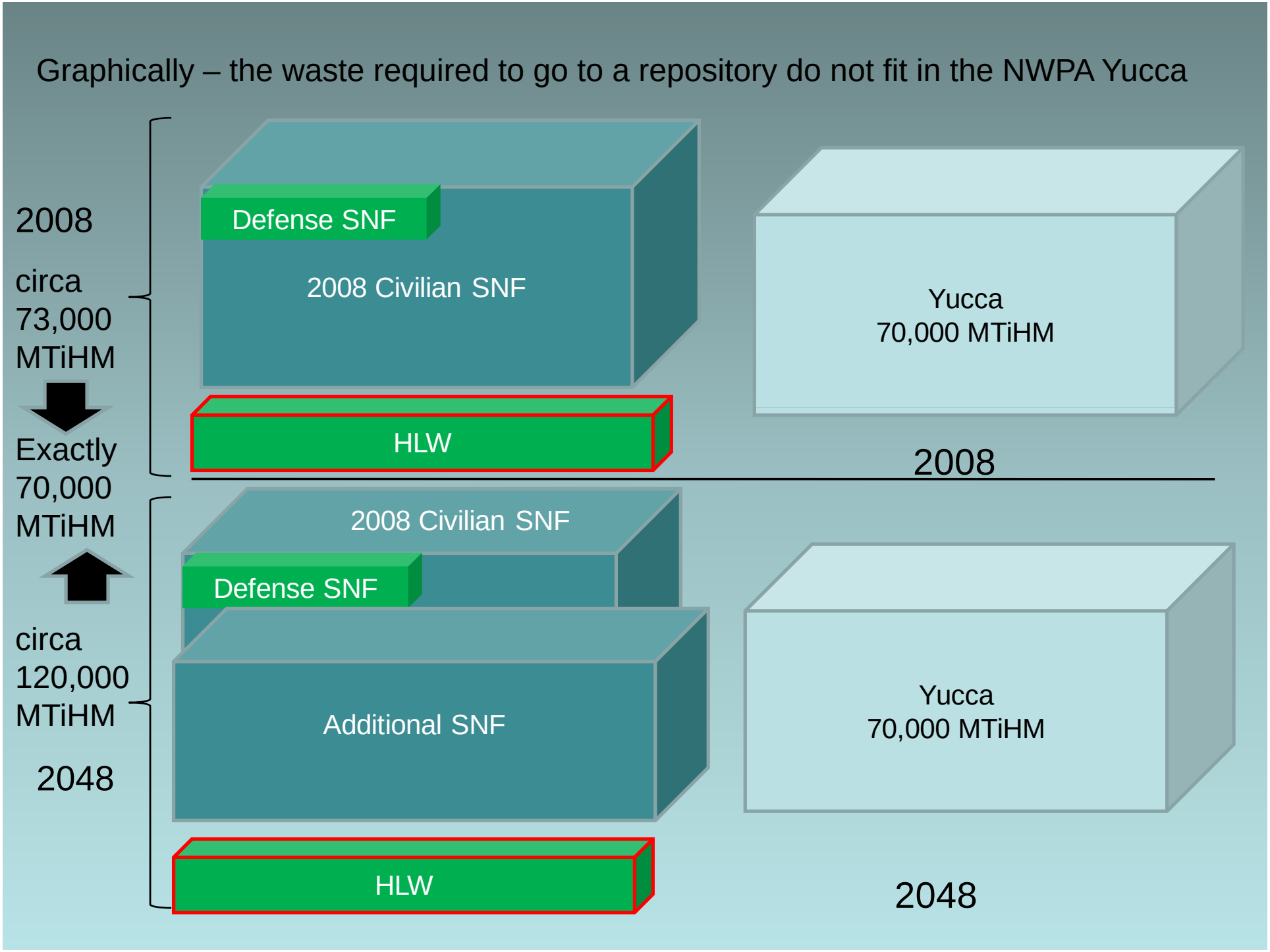
summary of pathways for HLW/SNF

What we have to manage: SNF & HLW

SNF/HLW: total of 73,000 MTiHM:

- SNF
  - defense SNF: 2,500MTiHM (at DOE sites, including SRS, INEEL, Hanford, and a Colorado site).
  - commercial SNF:
    - 58,000 now being stored at sites contiguous to 121 nuclear reactors in 39 states
    - by 2048, an additional 47,000 MTiHM will have generated, assuming the base case
- HLW: 12,505 MTiHM (22,280 canisters)
- Yucca is not authorized to take more than 70,000MTiHM. So, currently existing SNF and HLW would more than fill Yucca to capacity

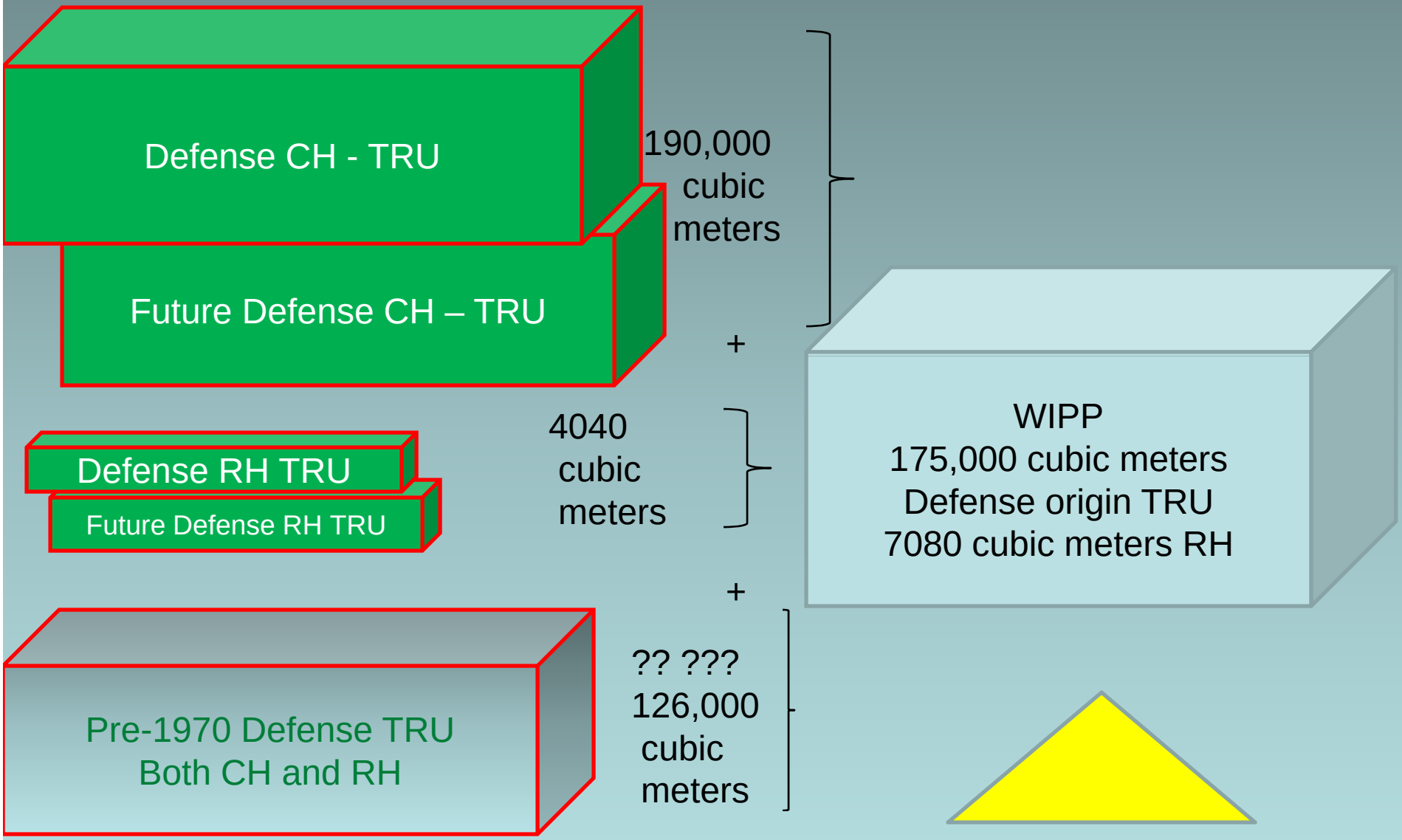
Graphically – the waste required to go to a repository do not fit in the NWPA Yucca



What we have to manage: TRU

- Currently existing TRU:
  - -Uncertainties in exact amount of TRU requiring disposition.
  - -Best estimates:
    - -CH TRU: 110,000 cubic meters currently in inventory; an estimated additional 80,000 cubic meters will be generated in future: total of 190,000+ cubic meters
    - -RH TRU: 2,800 cubic meters currently in inventory; an estimated additional 1600 cubic meters will be generated in future: total of 4,400 cubic meters
    - -an additional 126,000 cubic meters of buried TRU that was disposed as LLW prior to 1970; unclear whether this will ever need to be excavated/disposed
- WIPP is not authorized to take more than 175,500 cubic meters of total TRU, and cannot currently take more than 7,080 cubic meters of RH-TRU (plus other limits on RH TRU).

Graphically –even the TRU waste destined for WIPP does not fit



Repositories for SNF/HLW/TRU Defense and Civilian Wastes

- **Only two geologic repositories are currently authorized: WIPP (Los Medanos) site in New Mexico and Yucca Mtn. in Nevada**
- **Only WIPP has been up and running since 1999, but is limited in what it can take**
- **Yucca not expected to be open before 2017-20; facility faces numerous obstacles and potential further delays, including:**
  - Strong political opposition
  - Litigation delays (e.g.. over site-specific environmental (containment) requirements)
  - NRC licensing hurdles

.

-New Mexico issues/administers RCRA permit for WIPP

-EPA must certify/recertify compliance of facility with Part 194 environmental containment standards

Legal Requirements for WIPP

Pursuant to WIPPLWA and other relevant legal requirements:

- WIPP can receive defense-origin wastes only, and only defense TRU (both CH and RH TRU wastes)

-facility is limited to receiving:

-maximum of 175,500 cubic meters of total TRU waste

-no more than 5.1 million curies of RH-TRU (plus other limitations on RH-TRU wastes)

Again:

-and under legislatively mandated C & C agreement between DOE and N.M., total volume of RH-TRU cannot exceed 7,080 cubic meters

Note: -No statutorily mandated date by which all waste must have been received at WIPP or by which facility must close

Legal Requirements for WIPP cont'd

- Complex statutorily/court-mandated administrative/institutional structure involving DOE, EPA, and State of N.M.:

  -Under WIPPLWA, EPA is in charge of environmental issues: facility must comply with Part 194 environmental (containment) standards; EPA must certify/recertify WIPP compliance with these standards every five years (Agency did so in 1998 and 2004).

  -Pursuant to a legislatively-mandated "C&C" agreement and a stipulated settlement of litigation, between New Mexico and DOE:

    -State has a substantial say in decision-making regarding WIPP and its impacts. State has long opposed taking high-level nuclear materials and has no nuclear power plants.

    -N.M. is in charge of issuing/enforcing WIPP's RCRA permit and any change in the type of waste received at the facility triggers permit amendment requirements

Does all TRU waste have to go to WIPP?

- WIPPLWA does not per se require all defense TRU waste to go to WIPP by a date certain. And commercial TRU waste cannot go to WIPP and has no authorized disposal pathway.

- Defense TRU wastes buried as LLW prior to 1970 are subject to CERCLAl/RCRA and equivalent state cleanup requirements on a site-by-site basis; there is no across-the-board requirement in WIPPLWA that all of these wastes be excavated and sent to WIPP. However, deep geologic disposal of TRU is considered an ARAR in remedy selection; and the statutory/regulatory preference for permanent remedies tends to reinforce disposal at WIPP as the default option in remedy selection at sites where TRU is excavated.

Does all TRU waste have to go to WIPP? CON.

There are binding legal agreements between DOE and various states (e.g., site treatment plans under Federal Facilities Compliance Act and court approved settlements) that expressly require TRU wastes at certain DOE sites to go to WIPP by specified deadlines. Examples:

—e.g., at least 65,000 cubic meters (maybe even as much as 100,000-210,000 cubic meters) of TRU waste at INEEL must be shipped to WIPP "or other such facility designated by DOE" no later than Dec. 31, 2018, pursuant to a negotiated settlement agreement [*Public Service Co. v. Batt,* Civil No. 91-0035-S-EJL, D. ID. Oct. 17, 1995]

--e.g., RH-TRU sludges and RH/CH TRU solids at ORNL must be transferred to WIPP by Sept. 30, 2023, pursuant to a FFCA site treatment plan.

WIPPLWA does not provide a closure date for WIPP; however, DOE's plans contemplate an operational life of 35 years (ie, 1999-2034). DOE plans to re-evaluate whether the operational life of the facility can/should be extended sometime before the end of WIPP's operational life.

Legal Requirements for Repository for SNF/HLW (Yucca Mtn)

- NWPA was enacted in 1982 in recognition of the need to provide for permanent disposal of SNF and HLW in the U.S. and of the federal government's responsibility to do this. The 1982 law established a procedure for developing two or more geologic repositories that would permanently dispose of these wastes. 1987 amendments to the law required DOE to focus on the potential for development of a repository at the Yucca Mtn. site alone.
- Requirements under NWPA, as amended 1987:

  -DOE was directed to characterize only Yucca as a potential site for a federal geologic repository for SNF/HLW; the law set out a process for the federal government to decide whether to designate Yucca Mtn. as the site for a repository. Characterization of alternative or additional sites was precluded.

  --Under the law, Yucca is authorized to receive commercial and defense origin SNF and HLW
- Again, total capacity for the Yucca repository is capped statutorily at 70,000 MTiHM

Legal Requirements for Repository for SNF/HLW (Yucca Mtn) cont'd

- Yucca is required to meet site-specific environmental containment standards (40 CFR Part 197) promulgated by EPA
- The repository must be licensed by NRC, under NRC licensing standards that incorporate EPA's environmental containment standards.
- EPA's environmental standards for Yucca were successfully challenged and must be revised; the revised standards have not been issued yet. NRC licensing standards must accordingly be revised before the licensing process can begin (be completed?). Both sets of revised standards are likely to be challenged in court.
- NWPA does not specify a date by which the repository must cease receiving waste or close.
- NWPA imposes liability on the federal government for DOE's failure to transfer SNF at nuclear power plants to a federal repository by the 1998 deadline. Court decisions interpret this to mean that utilities' remedy for federal government's inaction is monetary damages, rather than specific performance (ie., the gov't cannot be forced to take title to the SNF).

Does all SNF/HLW have to go to Yucca?

- The purpose of NWPA was to ensure the establishment of a federal repository that would safely and permanently dispose of the nation's commercial SNF/HLW; commercial SNF was intended to be transferred to the repository by 1998.
- Pursuant to NWPA,the federal government entered into binding legal contracts with the utilities to transfer all their SNF to a federal repository by the 1998 statutory deadline; these were meant to assure that the federal government lived up to its responsibility to dispose of these wastes.
- NWPA did not rule out the possibility that SNF emplaced at the repository might be removed for reprocessing; in fact, DOE's plans/design for Yucca were required to include a period in which SNF deposited there would be retrievable.
- Numerous settlements/agreements/RODs for cleanup of HLW at the weapons complex require HLW to be removed and disposed at a federal repository

Legal Requirements for Second Repository for HLW/SNF

- Under the 1987 NWPA amendments, DOE cannot proceed with plans for a second repository unless one is expressly authorized by Congress
- DOE is required to report to Congress on the need for a second repository within the period 2007-2010 (no report as yet)

Reprocessing of SNF: Executive Orders

- A series of Presidential executive orders and declarations have largely defined U.S. policy on reprocessing.
- In 1977 President Carter, concerned about India's development of nuclear weapons from nuclear power plant technogy supplied by the U.S. and Canada, issued an executive order cutting off federal funding of commercial SNF reprocessing facilities, specifically including Barnwell. The order "defer[s] indefinitely the commercial reprocessing and recycling of plutonium produced in U.S. nuclear power programs"
- Although Barnwell was not precluded from opening, the withdrawal of federal support effectively killed commercial recycling, which was not economically viable without federal subsidies.
- The Carter executive order nonetheless left open for future consideration the reintroduction of commercial SNF reprocessing facilities, including regional ones.
- President Reagan issued an executive order in 1981 "lifting the indefinite ban that previous administrations had placed on commercial reprocessing activities in the U.S.";and removing "regulatory barriers," but did not restore federal funding
- President Bush's GNEP proposal has raised the possibility that the reprocessing of commercial SNF could be revived.
- It is important to note that (1) executive orders of one president can be overriden by orders subsequently issued by another president and (2) executive orders are essentially policy documents, not laws; must be consistent with federal law and can, of course, be overridden by legislation

Reprocessing of SNF: Law and Regulations

- The Atomic Energy Act authorized the AEC (later succeeded by NRC) to license nuclear facilities, including commercial SNF reprocessing facilities
- This authority appears to be intact today and implementing regulations (promulgated in 1970) are still on the books
- The regulations (at 10 CFR 50, Appendix F) limit a reprocessing plant's inventory of liquid HLW to that generated within the prior 5 years; liquid HLW must be solidified to comply with this limitation.
- The regulations further require all HLW generated through reprocessing to be transferred to a federal repository within 10 years of reprocessing; DOE takes title to the HLW once transferred to the facility.

Interim Storage of HLW/SNF: Federal MRS Facility

- NWPA authorizes development of one federal facility for monitored retrievable storage (MRS), NWPA provides that:
  - DOE cannot select an MRS site until a recommendation on Yucca is made to President (happened in 2002)
  - DOE cannot begin construction of the MRS until Yucca is licensed by NRC (license application not submitted yet)
  - The MRS cannot be sited in Nevada
  - Cap on amount of SNF/HLW that can be stored at the MRS:
    - Prior to opening of federal repository (Yucca): 10,000MTiHM
    - Once federal repository (Yucca) is operational: 15,000MTiHM

Interim Storage of HLW/SNF: Private facility

- NWPA does not preclude development of private facilities for interim storage of SNF/HLW.
- Private Fuel Storage has gotten the farthest in its attempt to open a private interim storage facility; it would have capacity to store 44,000MT of SNF, on Goshute tribal land in Utah. In 2006, after an 8 ½ year licensing process, PFS was granted a 20-year license by NRC, but construction was blocked by two decisions of DOI.
- The Bureau of Indian Affairs would not approve the lease of tribal lands because it was concerned that the storage facility would become a de facto repository; BLM would not approve rights of way across federal lands needed for transportation of the wastes due to potential adverse impacts on an adjacent wilderness area.
- PFS challenged DOI's decisions in court in July 2007.

Summary of legally available disposition pathways for SFN/HLW

- **Repository options** for SNF/HLW:

  -only Yucca is currently authorized (NWPA); but it isn't licensed by NRC yet; earliest predicted opening date is is 2017

  -a second repository can be recommended by DOE right now, but Congressional authorization would be required before potential sites could be characterized

  -WIPP is a lawfully operating and largely publicly accepted repository that has been taking defense nuclear waste since 2004. However, it is precluded by law from taking non-defense origin nuclear wastes and any nuclear waste other than TRU. Also, the amount of TRU it can receive is limited.

Summary of legally available disposition pathways for SFN/HLW cont'd (slide 2)

- **Interim storage** options

  -given the lack of a licensed repository for SNF and absence of licensed off-site storage facilities, onsite storage of SNF at nuclear power plants is currently the only available option. The federal government is liable for costs of non-transfer of SNF since 1998

  -private sector interim storage facilities for SNF/HLW are legally permissible, and no cap on amount that can be stored. However, long lead-time and formidable barriers to facility licensing (e.g., Goshute)

  -federal MRS:

  - -DOE can explore potential sites/select a site now
  - -but DOE cannot begin MRS construction until Yucca is licensed
  - -only one MRS is authorized under NWPA
  - -MRS cannot store more than 10,000 MTiHM

Some obvious conclusions:

The current legal structure does not address the problem;
change is inevitable – but how and how major is not clear

The existing public policy structure has yielded two very different examples (Yucca and WIPP) about how to achieve facility siting and evolving use for disposition

The existing legal structure has inconsistently allowed, then disallowed, exploration of interim storage siting and use – except that paradoxically:

- storage is both the process with which we have the most experience largely by default (and successful); *and*

- storage has frequently been explicitly and officially rejected as a policy solution because it was believed to:
  - inhibit development/progress on disposition
  - fail as to provide needed protection/meet our responsibilities

- Integrated "back end" options are needed to guide new law and policy

This review suggests :

We should never forget the power of the existing legal paradigm - and the fundamentally **different** extant views about how to change it:

1. incremental change
2. major paradigm-shifting change
3. sequential change

We should never forget the role that time plays in changing the task to be addressed (nuclear waste/materials management). The law has not changed for 20 years, decay rates have not changed; but what we now know about our ability to implement the current law & its timeline, what NW we do have and likely will have to manage, what the rest of the world is doing, and what we know about how to achieve more protective and economic WM approaches - **have all changed.**

CRESP has been exploring the implications of these factors for some time and, while what we have found does not bind this workshop, a summary of it may well help us move through these difficult issues more rapidly