SCHEDULING NOTE

Title: **BRIEFING ON GREATER-THAN-CLASS C LOW LEVEL RADIOACTIVE WASTE (PUBLIC)**

Purpose: Brief the Commission on the Current Regulatory Environment and Challenges for the Disposal of Greater Than Class-C (GTCC) Low Level Radioactive Waste

Scheduled: **August 13, 2015**
9:00 AM

Duration: Approx. 3 hours

Location: Commissioners' Conference Room, 1st fl OWFN

Participants:

Panel 1 - External Stakeholders	**40 mins.***
Janet Schlueter, Director, Fuel and Materials Safety, Nuclear Energy Institute Topic: Industry views on GTCC waste disposal	10 mins.*
Thomas Kalinowski, Vice President, DW James Consulting, LLC Topic: Low-level waste streams from nuclear power plants, including GTCC waste streams	10 mins.*
Scott Kirk, Vice President, Licensing and Regulatory Affairs, Waste Control Specialists Topic: Low-level disposal site interest in accepting all GTCC Low-Level Radioactive Waste (LLRW)	10 mins.*
Arjun Makhijani, President, Institute for Energy and Environmental Research Topic: Public interest perspective on disposing of GTCC waste	10 mins.*
Commission Q & A	**40 mins.**
Break	**5 mins.**

Panel 2 – Government **40 mins.***

Frank Marcinowski, Deputy Assistant Secretary for
Waste Management,
Office of Environmental Management,
U.S. Department of Energy (DOE)
Topic: Disposal of GTCC waste

Charles Maguire, Director, Radioactive Materials Division,
Texas Commission on Environmental Quality
Topic: Texas consideration of disposal of GTTC LLRW

Michael Weber, Deputy Executive Director for Operations

Catherine Haney, Director
Office of Nuclear Material Safety and Safeguards (NMSS)

Larry W. Camper, Director, Division of Decommissioning,
Uranium Recovery and Waste Programs, NMSS
Topics:

- Historical Perspective
- Policy Issues
- Challenges

Commission Q & A **40 mins.**

Discussion – Wrap-up **5 mins.**

*For presentation only and does not include time for Commission Q & A's

Industry Perspective on Greater Than Class C Waste (GTCC) Disposal

Janet R. Schlueter
Senior Director, Radiation and Materials Safety
USNRC Commission Meeting
August 13, 2015 • Rockville, MD

Overview

- Industry-Generated GTCC Waste is Safely and Securely Managed Today
- Industry Supports Additional Efforts to Facilitate Safe and Secure Permanent Disposal Options for GTCC and TRU Wastes
- Both Staff Options (1 and 2) Provide Potential Path Forward
- Option 2 Offers Unique Benefits and Challenges

Industry Generators of GTCC

- Industry Generates Various Forms and Minimal Volumes of GTCC Waste at Licensed Facilities Such as:
  - Nuclear Power Plants
  - Fuel Cycle Facilities (Fuel Research)
  - Sealed Sources
  - Broad Scope Medical and Research Facilities
  - Large Irradiators

GTCC is Adequately Managed

- Industry Currently Manages GTCC Wastes in a Manner that Adequately Protects Public Health and Safety and Environment

- Industry Recognizes the Need to Address Important Jurisdiction Question Raised by the State of Texas

Related Issues

- Issuance of DOE's Final Environmental Impact Study and its Preferred Approach to GTCC Waste Management

- Revision of NRC's Part 61 Waste Classification Tables and Affect on Future Categorization of GTCC Waste

Options Provided in SECY-15-0094

- Both Options 1 and 2 Would Permit Consideration of WCS Facility as Disposal Option for GTCC Wastes
  - NEI Supports Consideration of WCS Facility
- Option 2 Would Permit Texas to License and Regulate Disposal of GTCC Waste at WCS with NRC in Oversight Role

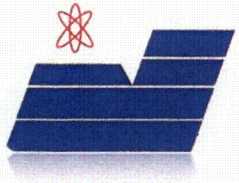
SECY Options (continued)

- Provided Statutory and Regulatory Implications are Addressed, Option 2 Provides Additional Advantages, Including:
  - Experienced Agreement State Regulator
  - Continued NRC Oversight of Texas Program via Agreement State Program
  - Most Efficient and Least Resource Intensive Regulatory Option

Summary

- Industry-Generated GTCC Waste is Safely and Securely Managed Today
- Industry Supports Additional Efforts to Facilitate Safe and Secure Permanent Disposal Options for GTCC and TRU Wastes
- Industry Suggests Public Workshop with Affected Stakeholders for Transparency

Low-Level Waste Streams from Nuclear Power Plants Including GTCC Waste Streams



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Primary Waste Streams During Operation/Decommissioning

- Process Waste Streams
  - Resins (Primarily Operations, Legacy at Decommissioning)
  - Filters (Primarily Operations, Legacy at Decommissioning)
  - DAW (Operations and Decommissioning)
  - Contaminated Items (Operations and Decommissioning)
  - Building Rubble (Decommissioning)
- Activated Metals
  - Consumable Hardware & Instrumentation (Primarily Operations, Legacy at Decommissioning)
  - Reactor Vessel and Internals (Decommissioning)

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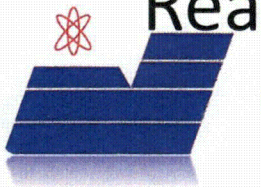
GTCC Waste Streams From Commercial Reactors

- Activated Metal Components
  - Mostly long-term core items in BWR's and fuel assembly hardware in PWR's
- Instrumentation
  - Fission chambers with Special Nuclear Material 'orphaned' from component
- Reactor Vessel Internals at Decommissioning.
  - Core region only
- Cartridge Filters
  - Reactor coolant filters from some PWR's
- Not Likely GTCC from Resins or Other Blendable Waste
- DOE Estimates of Volumes are Conservative but Reasonable



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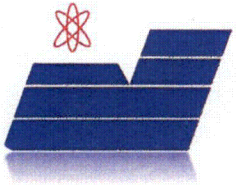
Isotopes of Concern

- Average Concentrations in Class C Hardware
  - ^{94}Nb - 0.09 Ci/m^3 (Class C fraction of 0.47) (Note: ^{94}Nb activity in stainless steel is based on inadequate data; likely overestimated)
  - ^{59}Ni – 20.4 Ci/m^3 (Class C fraction of 0.09)
  - ^{63}Ni - 3114.7 Ci/m^3 (Class C fraction of 0.44)
  - ^{14}C - 4.6 Ci/m^3 (Class C fraction of 0.06)
- Individual Components within a Factor of 2 or 10 of the Class Limit
- Significant TRU Concentrations Occur Only With Significant Fuel Defects
  - Not typical of commercial reactor waste



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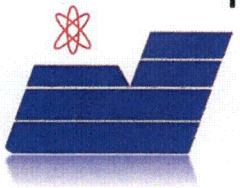
GTCC Waste Compared to Class C

- GTCC Stainless Steel from Core Regions
  - §61.55 Table 1 Fraction up to 18
  - §61.55 Table 2 Fraction up to 16
  - Not Significantly Different from LLW
- GTCC Waste from Other Metals
  - Principally specialty metals with constituent concentrations of Nb up to §61.55 Table 1 Fraction of 28
  - Small volume, mostly fuel assembly hardware
- Cartridge Filters
  - §61.55 Table 1 Fraction up to 83 (§61.55 Table 2 Class C)
  - Classification controlling radionuclides are ^{99}Tc and ^{14}C and likely to be significantly overestimated



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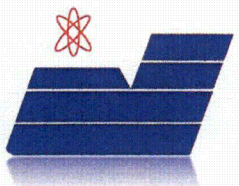
GTCC Disposal

- Most GTCC Waste from Commercial Reactors is Similar to Class C Waste
  - Same materials
  - Higher activity
- Isotopes Driving Classification are Mostly Shorter Half Life
  - ^{63}Ni $t^{1/2} \approx 100$ years (^{94}Nb overestimated)
- Disposal of Commercial GTCC Waste in a Near-Surface Facility is Feasible



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ANDREWS, TEXAS

WCS' Perspectives Regarding Greater Than Class C LLW

J. Scott Kirk, CHP,
Vice President of Licensing & Regulatory Affairs

NRC Commissioners' Briefing
13 August 2015, Rockville, Maryland

SECY-15-0094

- WCS commends the NRC, TCEQ , and DOE for making significant strides that could provide a pathway for the disposal of commercial and federally owned or generated GTCC LLW.

- Allows for the disposal of waste based on the hazards posed to public health, via a Site-Specific Analysis.

- Provides for a disposal pathway for orphaned disused sealed sources as specified in the Energy Policy Act of 2005.

- Also provides a disposal pathway for other orphaned wastes needed to cleanup certain DOE sites.

Option 2

- WCS agrees with the NRC Staff that Option 2 is preferable.
- It is consistent with historical NRC statements expressing a desire to retain the option of allowing Agreement States to regulate the disposal of GTCC LLW.
- Texas has extensive knowledge of the WCS facilities that would lead to greater regulatory efficiencies.
- Texas could request that the NRC approve a proposal to license the disposal of GTCC LLW pursuant to 10 CFR 61.55.(a)(2)(iv).
- NRC regulatory oversight is provided through the Agreement State Integrated Materials Performance Evaluation Program.

Option 2 (Cont.)

- Approach would establish clear cut Federal and State licensing pathways for disposal of GTCC LLW.
- Avoids having to construct a new cell for the disposal of commercial GTCC LLW that would be licensed by the NRC.
- A separate rulemaking is needed to ensure that waste containing certain alpha-emitting transuranic radionuclides at concentrations exceeding 100 nCi/g are not orphaned.
- Consistent with a framework more closely aligned with ensuring disposal of waste is based on risk, as opposed to its origin and statutory definition.

Petition for Rulemaking

- WCS submitted a Petition for Rulemaking that was unanimously approved by the TCEQ Commissioners on September 10, 2014.
- Petition proposed changes to Texas regulations removing the prohibitions to dispose of waste exceeding Class C limits.
- Petition served to revise Texas regulations in a manner more consistent with State and Federal Statutes and regulations.
- The Texas Radiation Control Act currently authorizes the disposal of waste that is the responsibility of the federal government in the FWF as defined in the LLWPAA of 1985.
- Federal government is responsible for the disposal of all DOE owned or generated LLW and commercial GTCC LLW.

Disposal of Federal Facility Waste

- Commercial and DOE owned or generated GTCC LLW may only be disposed of at the Federal Waste Disposal Facility (FWF).
- DOE responsible for taking title of FWF after post closure.
- Texas Statute required written agreement with DOE for disposal of waste in the FWF.

Technical Basis Establishing Class C Limits

- NRC established the Class C limits in the initial Part 61 rulemaking based on scenarios for protecting the inadvertent intruder.

- Those assumptions differ significantly from those used at WCS:

  - On-site agricultural resident scenario that relied on water for irrigation and drinking water.

  - Limited to disposal facilities located in humid environments.

  - Required disposal of Class C LLW at a depth only 5 meters below grade, or with intruder barriers designed to last at least 500 years.

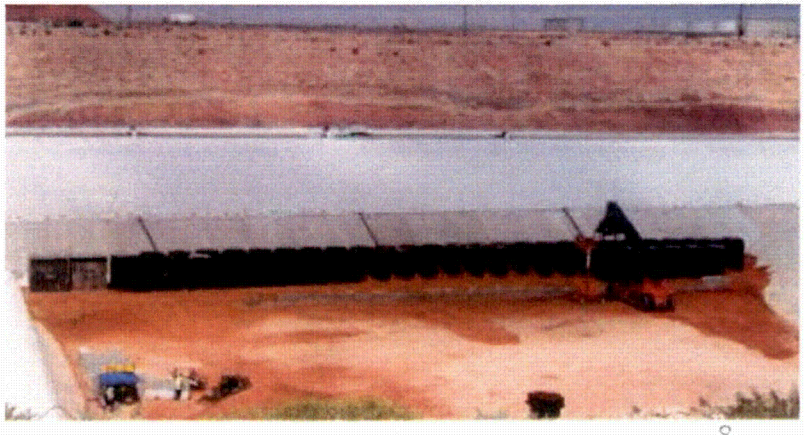
  - Waste exceeding Class C limits considered not generally suitable for near surface disposal.

Near Surface Disposal

- Wastes that was not generally suitable for near surface disposal in the 1980s could be demonstrated suitable in 2015.
  - Deeper depth of disposal
  - Multiple intrusion barriers
  - Minimal rainfall
  - High rate of evapotranspiration
  - Lack of potable water, etc.
- Historical scenarios do not reflect modern disposal practices, especially in an arid environment.

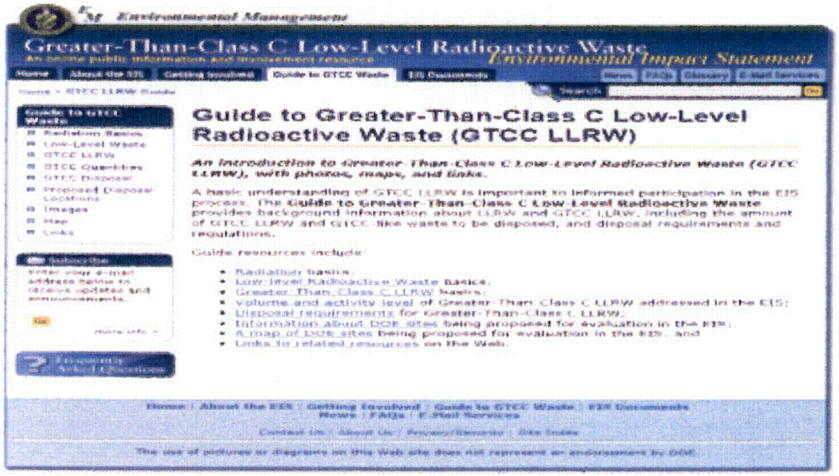
Barnwell

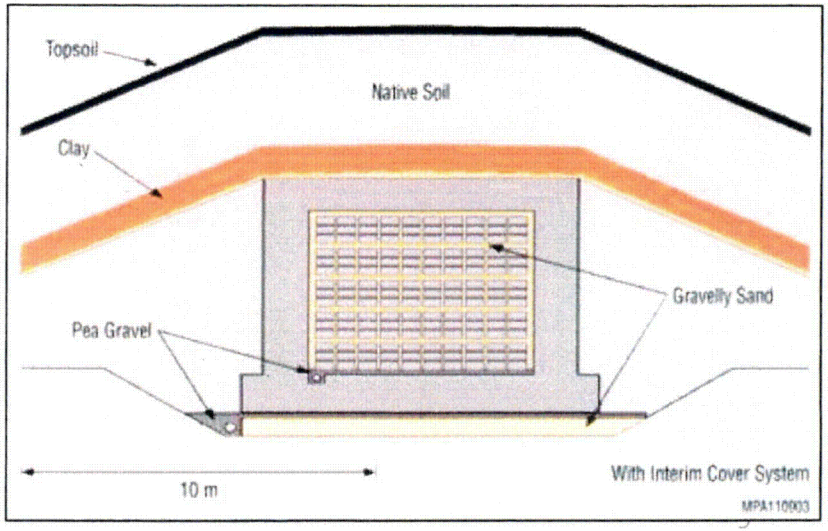
WCS



Environmental Impact Statement on GTCC LLW

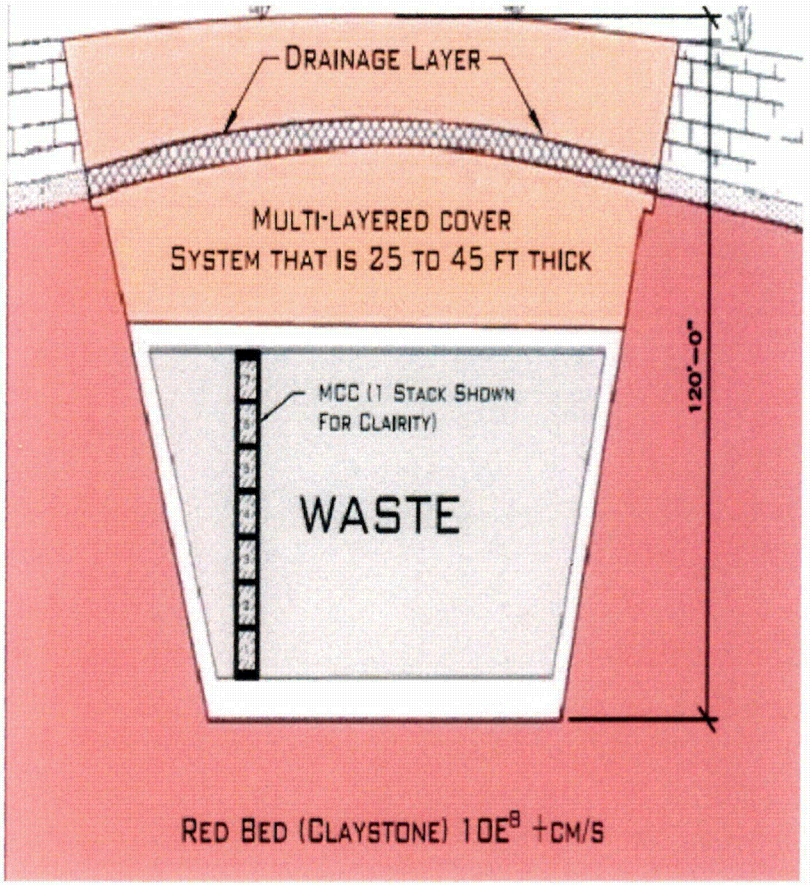
- The DOE may select a commercial entity as one of its Preferred Alternatives in its Final EIS.
- Draft EIS evaluated using an enhanced near surface disposal vault facility similar to the FWF for disposal of GTCC and GTCC-like LLW.
- Characteristics include features such as barriers, deeper depth to disposal, and enhanced waste packaging.
- DOE Final EIS expected to be issued by the end of this year.





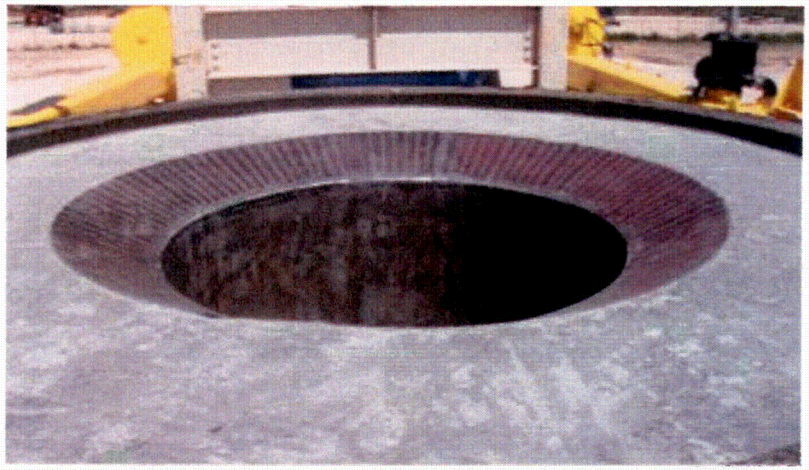
Site Characteristics and Engineering Design

- All waste is disposed of in impermeable redbed clays (Dockum Formation) that are 600-800 thick.
- Non-potable water tables located 600 – 1000 feet below grade.
- Located in an arid climate with rainfall less than 15 inches per year
- Evapotranspiration potential over 60 inches of water per year.



Modular Concrete Canisters: Enhanced Waste Packages

- Modular Concrete Canisters (MCCs) serve as an enhanced disposal package.
- High Density MCCs are currently used to substantially reduce radiation levels for disposal of Irradiated Hardware.
- MCCs weigh up to 100,000 lbs and 10 ft in height.
- Intruder resistant, reduce radiation levels and impede mobility of radionuclides.
- Stacked up to 7 high in the FWF.
- Depth of disposal deeper than 30 meters possible.



Conclusions

- WCS commends the NRC, TCEQ and DOE for their leadership in moving forward with a disposal pathway for GTCC and TRU.
- Provides a disposal pathway for orphaned disused sealed sources as envisioned in the Energy Policy Act of 2005.
- Provides a disposal pathways for other orphaned waste needed for the decommissioning of certain DOE facilities.
- Waste that was not suitable for near surface disposal in the 1980s, may be suitable for disposal an enhanced near surface disposal facility at WCS.
- WCS encourages the Commissioners to approve SECY-15-0094, Option 2.

GTCC WASTE MANAGEMENT

Arjun Makhijani, Ph.D.
President, IEER

At the Nuclear Regulatory Commission

August 13, 2015

OVERVIEW

- The current 10 CFR 61 revision proposal, to have a period of performance of 10,000 years and allow site-specific performance-based evaluation in place of conformance to waste concentration limits, is fundamentally deficient, made much worse by the potential inclusion of GTCC waste in shallow land burial, including potentially large amounts of depleted uranium.
- 10 CFR 61.55(a)(3)(iii) and (a)(4(iv) should be tightened to require that all wastes with concentrations greater than Tables 1 and 2 (column 3) SHALL *be disposed of in deep geologic burial without exception. The word "transuranic" should be removed from Table 1.*
- 10 CFR 61.55(a)(3)(iii) should be expanded to include curie and concentration limits for ALL long-lived radionuclides (half-lives >10 years). Depleted uranium and recycled uranium are like transuranic waste (or GTCC) for disposal purposes and should be governed by a requirement for repository disposal.
- The NRC proposal to revise 10 CFR 61.41 to eliminate organ doses under the guise of modernizing the science is a disingenuous deception of the public. It is nothing less than an egregious relaxation of the standards. The current dose standards should be tightened by the incorporation of drinking water rules by reference.
- My comments on the proposed LLW rule revisions are the basis of a large part of my presentation here and should be referred to as you review my remarks. They are at http://ieer.org/wp/wp-content/uploads/2013/01/IEER-Comments-on-NRC-LLW-disposal-7January2013-Docket-NRC-2011-0012-1.pdf.

PERFORMANCE PERIOD (SLIDE 1)

1. In 2009, Peter Burns, an NRC-invited geochemist, stated "I was **particularly amused** by the climatic divisions, none of which can be relied on, even perhaps at 1,000 but certainly not in 10,000 or 100,000 [years]. As an example, I am a geoscientist. **So I have this rare ability to see into the far distant past.** (Laughter.) And I know, for example, that Death Valley was filled with about 1,000 feet of water 10,000 years ago. And that tells you how much the climate can change in the arid regions."
2. The draft LLW rule has completely ignored this advice and set a performance period of 10,000 years.
3. The draft rule also ignores specifics related to the added complexity that anthropogenic climate disruption is adding to the problem of long-term performance assessment of LLW sites.
4. The proposed rule also allows radionuclides whose concentrations build even after that time to be disposed of in low-level waste facilities. No computer program or performance assessment can remedy the risks of near-surface disposal of very long-lived radionuclides.

PERFORMANCE PERIOD (SLIDE 2)

1. Shallow land burial should be confined to amounts and concentrations that would not exceed dose limits (10 CFR 61.41 with a drinking water sublimit) at 500 years (intruder barrier time) if the entire amount of waste were released into the groundwater at that time or if performance assessment indicates that doses may be exceeded during that period.
2. In the case of radionuclides with daughter products that build up, a "Gedanken" calculations of doses resulting from release of peak amounts, whenever they occur, should be done; they should be used to set curie limits, assuming a resident farmer scenario.
3. The calculations in 1 and 2 above should be used to set curie limits for long-lived radionuclides, including carbon-14, Sr-90, Cs-137, Ni-59, and Ni-63, as well as all radionuclides in Table 1 that do not fall into the GTCC category. Deep geologic disposal rules should govern GTCC.
4. After 500 years, there are no "intruders." That word applies only to persons entering prohibited areas, often with criminal intent. If barriers are not required to persist beyond that time, all people on the site are simply members of the public. Their doses should be limited to the current 10 CFR 61.41 and to the drinking water limits if by that pathway. These is no scientific or etymological basis for a regulatory idea that a person could be an "intruder" after institutional controls and barriers are presumed to be gone.
5. Using this method and with the above rule changes, the performance period should be limited to 500 years. This is the longest that is reasonable for low-level waste facilities. But without the accompanying restrictions described above on long-lived radionuclides outlined here, a short performance period would simply allow a radiological ambush of unsuspecting future generations.

GTCC WASTE CONCENTRATIONS

- Long lived waste should be defined as having half-lives >10 years. Rationale: decay time, ~10 half-lives, is greater than the required period of institutional control.
- The term "transuranic" should be removed from Table 1 in 10 CFR 61.55. This will then accommodate thorium and uranium, including depleted uranium and recycled uranium in the present rule so far as concentrations are concerned.
- As described in the previous slide, there should be curie limits in addition to concentration limits for long-lived radionuclides. This is a way to reduce uncertainties and have better assurance that future generations doses will not exceed 10 CFR 61.41 in the period beyond 500 years.
- Dilution of waste that results in a lower classification (e.g., C to A, or GTCC to C) should be prohibited.

COMMENTS RE: 10 CFR 61.41 ALSO RELEVANT FOR GTCC WASTE (SLIDE 1)

- The argument that updating the dosimetric basis of the standards requires or even implies going from organ doses and the equivalent dose to the whole body in the current rule to committed effective dose is an egregious misrepresentation of the science and the ICRP's work at best and sophistry at worst. It disguises a large relaxation of radiation protection, especially in regard to radionuclides with target organs, including all actinides and Sr-90. The ICRP has updated its organ dose methodology. My arguments are stated in detail in my comments to the EPA's ANPR for 40 CFR 190, which I incorporate here by reference. http://ieer.org/wp/wp-content/uploads/2014/08/IEER-Comments-on-EPA-ANPR-40cfr190.pdf.
- **Organ doses remain the fundamental scientific basis of internal dosimetry**. Committed effective dose is a derivative quantity that requires organ weighting factors, which have changed in odd ways in the past.
- The proposed 10 CFR 61.41(a) and (b) would result in a large relaxation of contamination limits and organ dose limits, especially with respect to waste containing transuranic radionuclides, any other actinides, including depleted uranium and other similar wastes and any other radionuclides like Sr-90 that have target organs. This includes much GTCC waste and the waste we propose be treated like GTCC (like depleted uranium).

COMMENTS RE: 10 CFR 61.41 (SLIDE 2)

- Organ weighting factors are averages over all ages and over males and females. Given that we know (BEIR VII, EPA Blue book, Table 3-12a and 3-12b), this is unacceptable for protecting individuals. 10 CFR 61 seeks to protect "any member of the public." This means the most exposed member of the public. It is rendered meaningless when organ dose weighting factors for children, males, and females are averaged.
- The ICRP has itself has explained that "Effective dose is an indicator for stochastic risk but it is *not intended for the assessment of risks of individuals*" (italics added). And 10 CFR 61 limits individual dose -- not population dose.

COMMENTS RE: 10 CFR 61.41 (SLIDE 3)

I conclude, therefore, that whole body dose can be eliminated from 10 CFR 61.41. The following paragraph can replace the existing 10 CFR 161.41. It is sound, updated science, including BEIR VII and EPA's Blue book and would protect females, children, and males :

- Concentrations and total amounts of radioactive materials which may be released to the general environment in groundwater, surface water, air, soil, plants, or animals must not result in an annual organ dose (external plus internal) to any organ exceeding 25 millirem. Annual internal organ dose is defined as the committed equivalent dose to any organ due to intakes of radionuclides in one year. All pathways are included in the estimation of dose, including the drinking water pathway. Drinking water concentrations specified in or implicit in 40 CFR 141.66 shall not be exceeded in surface water or groundwater at any point on or beyond the site boundary. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as reasonably achievable.

MEMBER OF THE PUBLIC, INTRUDER

- The term intruder should be defined to be any person who enters the site during the 100-year period of institutional control or during the 400 years after that when barriers are expected to be operational.
- During the 500-year period, all persons outside the site not acting in an official capacity are "members of the public." After 500 years all persons are members of the public and 61.41 should apply to them.
- A suitable definition of member of the public should be included: Member of the public means any individual that can receive a radiation dose in the general environment, whether she/he may or may not also be exposed to radiation as part of an occupation associated with the low-level waste facility. However, an individual is not considered a member of the public during any period in which she/he is engaged in carrying out any operation which is part of the low-level waste facility.

GTCC WASTE IMPLICATIONS

- The above general comments on 10 CFR 61.41 and on definitions of members of the public would also apply to GTCC waste.
- The EPA can be asked to issue a new rule for the ensemble of wastes, including GTCC waste, that should go into a deep geologic repository.
- The rule would resemble 40 CFR 191, though dose limits would be in terms of organ doses only, as described above.
- Given the volume of GTCC and other wastes that should be disposed of in deep geologic repository, it is desirable to evaluate a repository process separate from the spent fuel disposal process to deal with these wastes. This is for both economic and environmental reasons.

SLIDES NOT TO BE PRESENTED BUT ARE PART OF MY COMMENTS

- The slides that follow are part of my comments but I do not plan to present them. They describe the inventories of various materials that should be disposed of in a deep geologic repository. They includes both civilian and DOE waste. This is apt since DOE is responsible for GTCC waste as well as its own GTCC-like waste. There are, moreover, vast quantities of other long-lived wastes that are estimated to utterly destroy groundwater's usability over the long-term. The carbon-14 inventory of the Hanford graphite moderator blocks is one important example.
- If they are not doing so already, I recommend that the NRC and DOE coordinate their activities and proposals in regard to GTCC waste, related DOE waste as described in the following slides, the NRC LLW rule revision, and related matters to ensure that the GTCC wastes and other similar wastes (enumerated in slides below) are slated for deep geologic disposal.
- The inventories below do not constitute and an exhaustive list.

SHOULD BE DISPOSED IN DEEP GEOLOGIC DISPOSAL ALONG WITH GTCC

- Depleted uranium
- Recycled uranium
- Pre-1970 Buried TRU waste
- Hanford graphite moderator blocks
- ILAW (immobilized low-activity waste) at Hanford
- Sr-90 and Cs-137 capsules at Hanford.

DEPLETED URANIUM AS GTCC-LIKE

- Uranium is not a transuranic (TRU) element, yet it has all the physical, chemical, and radiological characteristics of TRU radionuclides.
- The specific activity of uranium oxides, the chemical form for disposal, is well above 100 nanocuries per gram.
- The specific activity increases with time

INVENTORY OF EXISTING DEPLETED URANIUM

- About 700,000 metric tons stored in steel cylinders in the form of uranium hexafluoride (UF_6) at Paducah (KY), Portsmouth (OH), and Oak Ridge (TN).
- Will become 558,000 metric tons once turned into U_3O_8.
- This is the equivalent of about 190,000 curies.

ACTUAL AND ESTIMATED PROJECTED (IN 2011) INVENTORY OF DU_3O_8

	Current/Projected	Metric tons	Cubic meters	Curies
DOE complex	Current	5.58E+05	6.72E+04	1.90E+05
LES	Projected	3.09E+05	3.72E+04	1.05E+05
Areva	Projected	3.46E+05	4.16E+04	1.17E+05
Total	Current and Projected	1.21E+06	1.46E+05	4.12E+05

RECYCLED URANIUM

- 250,000 metric tons in the DOE complex with various degrees of enrichments.
- Contains transuranic radionuclides (mainly plutonium and Np-237), fission products (mainly Tc-99), and activation products (mainly U-236).

PRE-1970 BURIED TRU WASTE

- DOE is planning to leave it in the soil.
- It is greater than class C under NRC rules and TRU under EPA rules.

	Volume m^3	Curies	nanocuries/g
Total DOE sites (including Hanford)	138,000	48,510	195
Hanford	82,800	42,651	286

REACTOR GRAPHITE WASTE AT HANFORD

- The radionuclide of concern is carbon-14. The concentration is slightly less than GTCC definition but potential groundwater contamination, if buried at Hanford, would be much greater than drinking water standard.
- The total C-14 radioactivity is 37,400 curies in the graphite reactor blocks of all 8 reactors. Total release would likely be greater than allowed for spent fuel from a deep geologic repository under 40 CFR 191 (100 curies per 1,000 metric tons of spent fuel for a total of 10,000 to 15,000 curies from all U.S. reactor spent fuel, already generated and projected from existing reactors).
- This could be released as radioactive carbon dioxide to the air or to water from shallow land burial. It is not suitable for shallow land burial. The curie amounts are too large.

IMMOBILIZED LOW ACTIVITY WASTE (ILAW) AT HANFORD

- Volume: 160,000 cubic meters
- Activity: 476,000 curies (Tank EIS, Alternative 2A)

INVENTORY OF GTCC AND OTHER WASTES THAT SHOULD BE SLATED FOR DEEP GEOLOGIC DISPOSAL

	Volume m^3	Curies
DU (DU_3O_8)	146,000	412,000
RU	13,200	250,000 (1)
TRU	138,000	48,510
ILAW	160,000	476,000
Graphite moderators	5,690	37,400
GTCC LLRW and GTCC-Like	7,710	1,790,000
Total	470,000 (rounded)	3,000,000

(1) Assuming an average activity of 1,000 nanocuries per gram

SR-90 AND CS-137 CAPSULES

- Extracted from high-level liquid waste to reduce radioactivity

	MCi in 2001	MCi in 2011	Volume m^3	MCi/m^3 in 2011
Sr-90	20	16	1.5	11
Y-90	20	16		
Cs-137	47	37	3.5	5
Ba-137m	47	37		
Total	134	106	5	not applicable