National Academies of Sciences – Supplemental LAW Options

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Technical questions/comments on the FFRDC Annotated Outline Draft

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General thoughts

- Many alternatives – complex comparison
- “Decision-ready” analysis a heavy lift
- FFRDC designs out of sync with public awareness of WTP negotiations
- Sensitivity analysis warranted for operational parameter variability (e.g., more or less LAW than expected; pretreatment issues; grout compatibility issues; SST retrieval delays)
- Comparison of risks still to come?

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Vitrification Alternative

- Tc-99 and I-129 retention in glass now 98% and 96%? (per VLAW WIR)
  - 2017 IDF PA assumed only 57.5% of I-129 total inventory retained in LAW glass
  - Single pass retention now estimated 58.33%
  - *Less Tc/I in secondary waste grout means "as good as glass" is harder to meet*
  - Does Tc/I belong in low-activity waste?
- Incorporate or respond to Kruger presentation from Phase 1 study
  - Refractory removal in next gen melter = **15MT/d –> 50MT/d** production increase?
  - Increase crystal tolerance from 1% –> 1.5% = **decrease mission 20%?**
- HLW glass incorporation of crystalline silicotitanate (CST)?
  - FFRDC assumes CST used to remove Cs/Sr from all Supplemental LAW (*new*)
  - How many more HLW glass canisters are needed?
  - Cumulative cost/operational/feed effects on HLW/LAW coupled system?
- Why assume no iodine getters in secondary waste?
- TFPT waste separation efficiency effects on HLW/LAW split?

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Grout Alternatives

- Relies on “miniaturized pretreatment” (TFPT) for many operational gains
- Need a strong basis for organics pretreatment analysis
  - Low temp oxidation and low volatility LDR organics a weak link. Good that FFRDC is looking into it.
  - Wastes with failed pretreatment will be shunted to LAW vitrification facility
  - How critical is assumed pretreatment success? What proportion of un-groutable waste is the threshold for viability of the alternative?
- “Sample and Send” strategy
  - Options if offsite disposal closes? Reserve for deep disposal if orphaned?
  - Total inventory vs. per-batch decisions
- Hybrid grout/vit alternative?

Grout Alternatives

- Sensitivity analysis needed for high uncertainty in non-pertechnetate inventory/performance
- Offsite grout treatment needs more logistical fleshing out (lag storage and transport rate)
- Large vault alternative –
  - Many variables for assumed performance
  - Expect expanded discussion of Tc/I vault retention
  - Long-distance waste/grout lines for onsite monoliths?
- Future failed grout retrieval – cost/risk incorporated?

Nitrate and Nitrite in Grout

- Control via lower grout porosity?
  - What R&D to support?
- Control via IDF cap performance?
  - Depends on PA quality
  - IDF risk budget limits already assume cap performance
  - NRC technical concurrence important
- Control via vault performance?
  - Why is now different than the 90s when this plan failed?
- Other sources on the plateau? Cumulative impact?
- Defense in depth?
- Point of compliance?
- Pretreatment/removal options?
- Nitrate conversion to nitrite in reducing grouts? (from yesterday's presentation)

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Technetium/Iodine Management

- Current outline lacks much discussion of additional pretreatment
- "Standard" grout alts assert Tc/I pretreatment not required for onsite disposal –
  - Assumes getters effective for I-129 and no getters for Tc-99
  - Interaction of I-129 getter and reducing grout? (PNNL study recommended oxidized)
  - Getter mixing infrastructure?
  - Additional support/discussion of long-term grout performance defensibility not in the report structure currently.
  - NRC review of VLAW WIR – requesting grout performance support.
  - Any concerns w/r/t Cr and Tc competition in reducing grout?
  - How will uncertainty in long term grout performance be incorporated?
- New uncertainties with non-pertechnetate inventory/performance?

What about the sludge?

- Sludge takes liquid to mobilize.
- Cross-site transfer line for sludge still needed.
- Line between sludge and saltcake blurrier with Tank Farm Pretreatment (TFPT) ?
  - Solids filtration details needed
  - How is LAW/HLW split affected if TFPT can't separate saltcake/sludge as cleanly as the Pretreatment Facility?
  - Effect on DST space and sludge levels during retrievals?
  - Effect on LAW feed rate?
- Effects on sludge management if LAW is decoupled from HLW?

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Other Considerations

- Double-check cross-site transfer system assumptions
  - Needed when vitrification is the backup option to grout-incompatible LAW
  - “supernatant transfer line” mentioned on p.18?

- TRL of small-scale or at-tank pretreatment system?
  - DFLAW for liquid in DSTs is a different animal than small-scale PT of slurry waste from a retrieved SST.
  - If it was so easy, why did we ever start building the PT facility?

- Review of “Zero groundwater pathway” assertion for offsite facility?

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Other Considerations

- Comparative performance categories good organization
- "Potential new tank leaks" – full SLAW grout alternative not required to address this risk. Potentially a false choice.
  - Include a sub-alternative where interstitial liquids are retrieved early shipped offsite?
  - Significant inventory in interstitial liquid from SRS experience.
  - HAB subcommittee considering possible benefits of early interstitial liquid retrieval + Test Bed Initiative concept of at-tank treatment and offsite grout.
- Mixing in DSTs incorrectly referred as "baseline" (TWCS facility)
- When does SST retrieval rate become the limiting factor?

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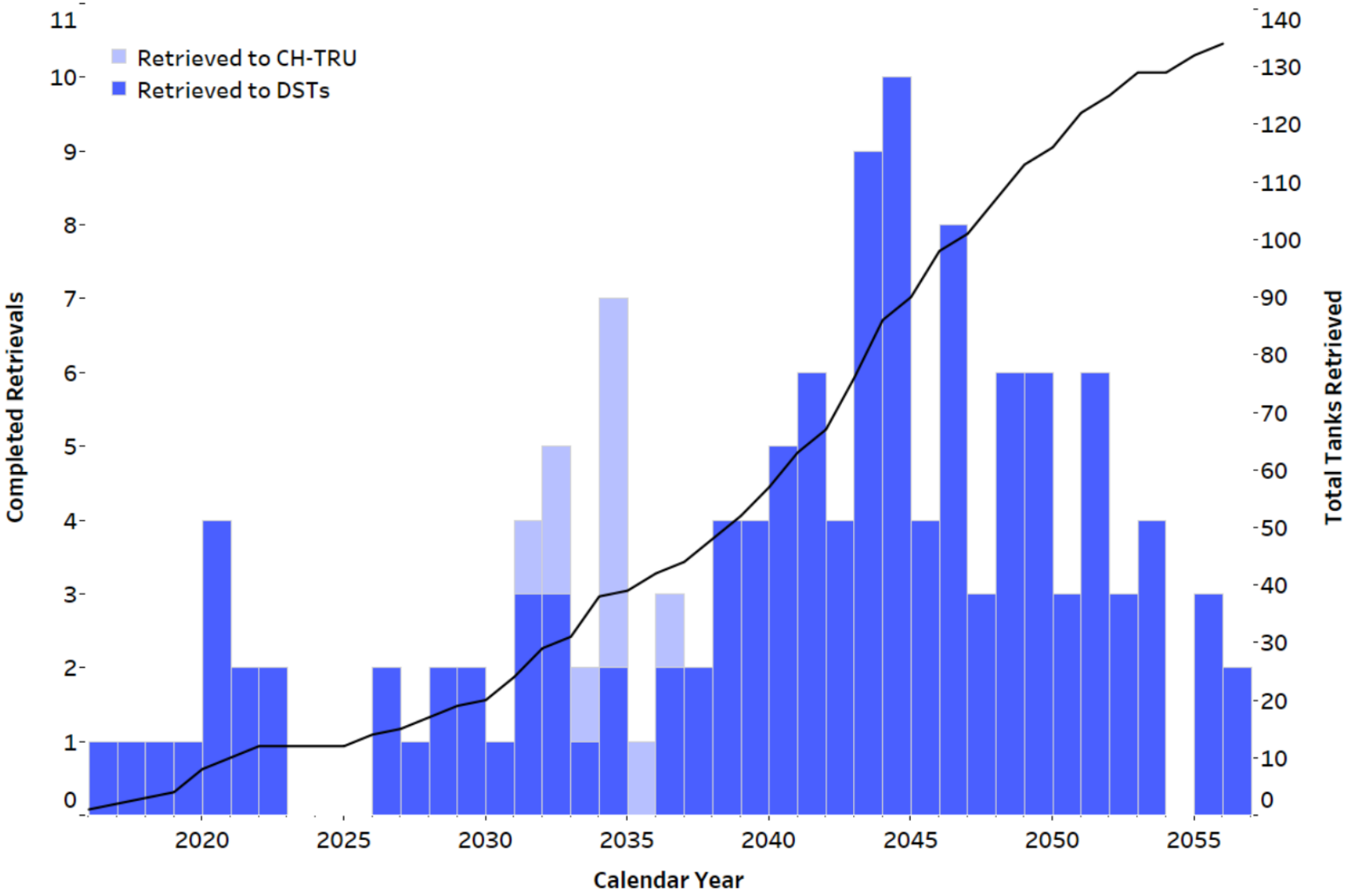
Figure 5-5. Baseline Case – Total Single-Shell Tank Retrievals Completed per Calendar Year.



Source: System Plan 8

Let’s Talk about Drinking Water Standards

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Why look into this?

- EPA final MCL rule said dosimetry methods worthy of additional study
- Grout performance estimate from Phase 1 FFRDC presentation – takes pressure off the grout performance with getters for iodine
- Low dose study advocates cite the overspending on cleanup that doesn't need to happen for protection purposes being a value proposition.

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EPA Final MCL Rule (2000)

3. RETAINING BETA PARTICLE AND PHOTON RADIOACTIVITY MCL

With today's rule, EPA is retaining the existing MCL for beta and photon emitters and the methodology for deriving concentration limits for individual beta and photon emitters that is incorporated by reference. The concentrations for these contaminants were derived from a dosimetry model used at the time the rule was originally promulgated in 1976. When these risks are calculated in accordance with the latest dosimetry models described in Federal Guidance Report 13, the risks associated with these concentrations, while varying considerably, generally fall within the Agency's current risk target range for drinking water contaminants of 10^{-4} to 10^{-6}. Accordingly, we are not changing the MCL for beta particle and photon radioactivity at this time.

We also are concerned that under the regulatory changes for the beta particle and photon radioactivity MCL proposed in 1991 [8]) the concentrations of many individual radionuclides have associated lifetime cancer morbidity (and mortality) risks that exceed the Agency's target risk range. A newly proposed MCL expressed in mrem-ede could result in a more consistent risk level within the Agency's target risk range. However, in today's final rule, we are ratifying the current standard since it is protective of public health. At the same time, we believe a near future review of the beta particle and photon radioactivity MCL and the methods for calculating individual radionuclide concentration limits is appropriate. We intend to reevaluate the MCL under the authority of section 1412(b)(9) of the SDWA to ensure that the MCL reflects the best available science. This review will be performed as expeditiously as possible (expected to be 2 to 3 years).

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Why might this be a bad idea?

- Will people trust the result if it is the main enabler of grout at Hanford? Will government credibility suffer?
- Will perceived risk/value be affected?
- Social context for risk and impact models?
- Is it consistent with Environmental Justic values of this administration and into the future?
- Is changing the standards a cumbersome process in its own right that might cost more time/money than just managing the iodine differently?
- Low dose risk is UNCERTAIN and VARIABLE by person

Essential Ingredients of this Conversation

- EPA history and perspective
- EPA periodic rule review on MCLs, including naturally occurring radionuclides
- Integrate with NASEM low dose effects study (2021)
- Social dimensions and Environmental Justice consultation
- Extensive outreach to tribes, affected communities to explain the science and solicit informed comment
- Address criticism of effective dose construct for predicting cancer probability

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Critical Organ vs. Effective Dose Equivalent

- From the EPA rule and PNNL report, core issue is which dose model is best
- Critical organ is older and simpler
  - Nearly all iodine uptake to thyroid when ingested – critical organ appropriate?
- Effective Dose used by NRC, DOE, ICRP, and the EPA FGR
- EDE is "generalized" – assigns "normalized" weighting factor to organs
  - Tissue weighting factors based on "sensitivity of organ to radiation"
  - Weighting factors reflect absolute risk or relative to other organs?
  - Thyroid "effective dose" factor is 3-5% of absorbed dose
  - Based on "Reference Person" averaged Euro-American cancer probability*
- "Committed Effective Dose" refers to internal dose over lifetime.
- Site-specific consideration of competition of I-129 with stable iodine
- Age-dependence of dose incorporated?
- Need more time and more voices to form a position

Exposure Scenarios (clarify who is protected)

- Some tribal scenarios assume 3 L/day max, not 2.
  - 4 L/day including sweat lodge use
- How many years of exposure? 26? 30? 70?
- Children vs. Adults
- Effective Dose Equivalent is not direct dose to an organ, but an apportioned dose decided by committee.
  - Informed by science, but was it informed by social science?
  - What are the environmental justice dimensions of tissue weighting factors?
- IDF Permit requirement of mitigation for exceeding 75% of “any performance standard”?

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