National Academies of Sciences – Supplemental LAW Options

Phase 2

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FFRDC General Findings of the Prior Study

- The FFRDC believes that grout can meet performance objectives for **onsite or offsite** disposal, without removing Tc-99 or I-129.
- Additional R&D is needed before implementing grout for Hanford.
- Compared against vitrification, grout is less complicated* (room temperature process).
- Compared against vitrification, grout produces less secondary waste (i.e., glass offgas effluents, which would be grouted anyway).
- Grout requires more disposal space than glass, but capacity is available.
- Grout is estimated to be significantly cheaper than glass.
- A near-term decision is needed for Supplemental LAW to guide investment, but there is inadequate funding no matter the option chosen.

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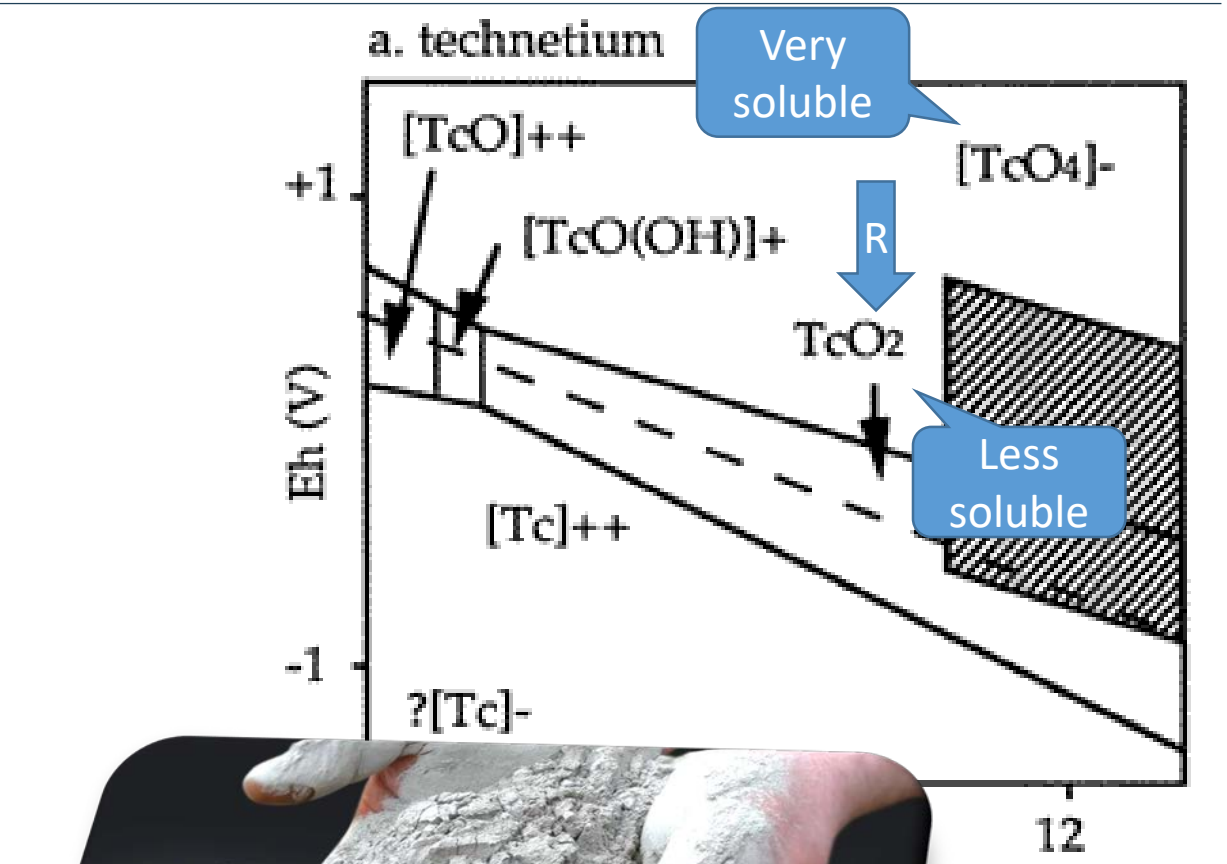
What's so special about new grout?

- Cast Stone (grout) is the same formulation now as was assumed in the 2012 Tanks EIS.
  - EIS: 8.2% Portland Cement, 44.9% fly ash, 46.9% blast furnace slag.
  - BUT! The EIS used leaching data based on grout without blast furnace slag.
- Blast furnace slag is a strong reductant.
- In its chemically reduced state, Technetium becomes insoluble and less mobile
- Reduced environments do not appear to slow down iodine.



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Sensitivity Cases

- Three sensitivity cases (waste release rate) for each waste form
  - **Low performing** – based on range from laboratory testing
  - **High performing** – based on range from laboratory testing
  - **Projected best case** – based on the highest performance from laboratory testing (includes "getters" and likely requires additional study to assure results can be consistently obtained)

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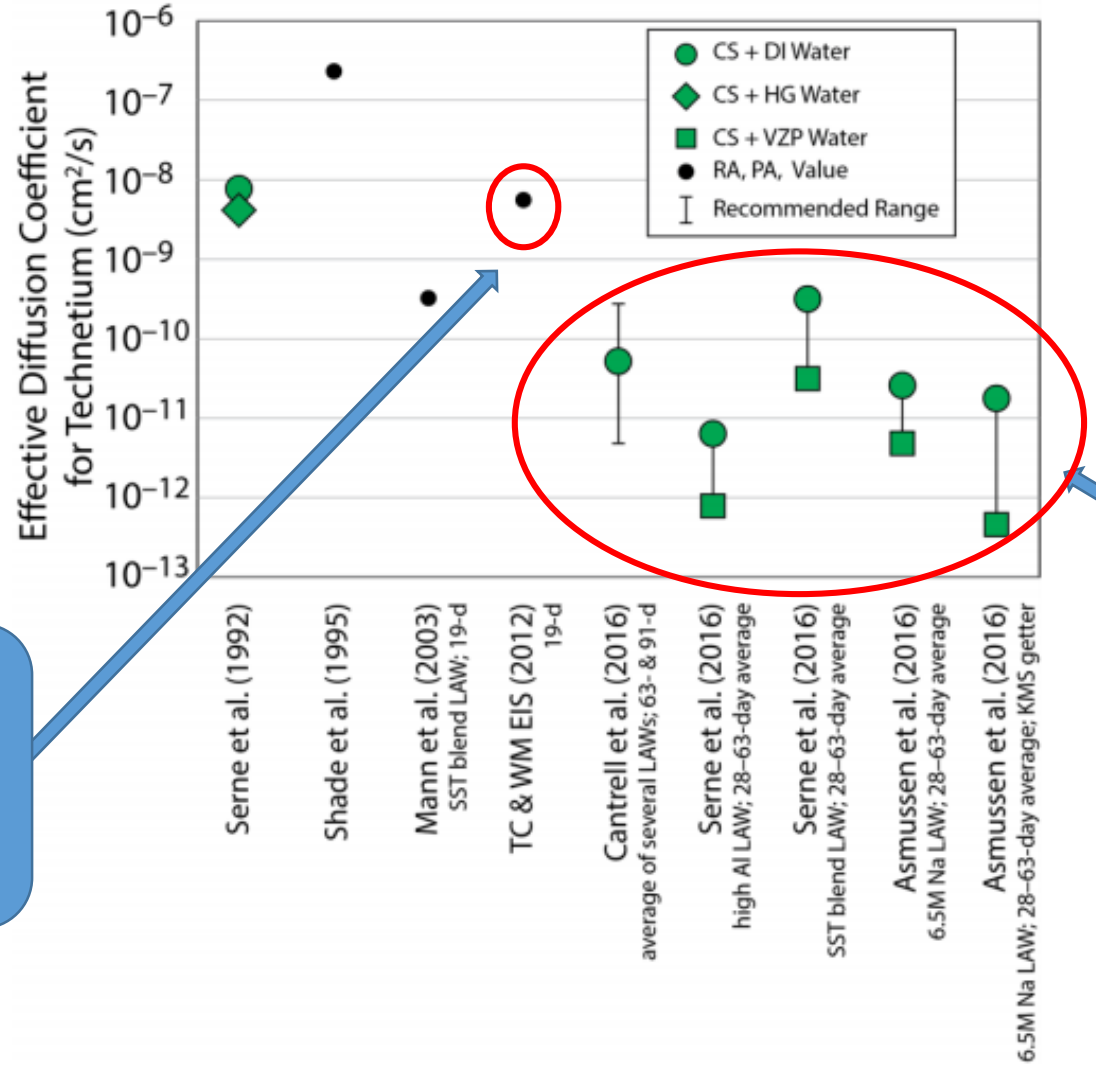
Grout performance changes



2012 Tank Closure & Waste Management EIS

Recent laboratory studies with new grout formulations

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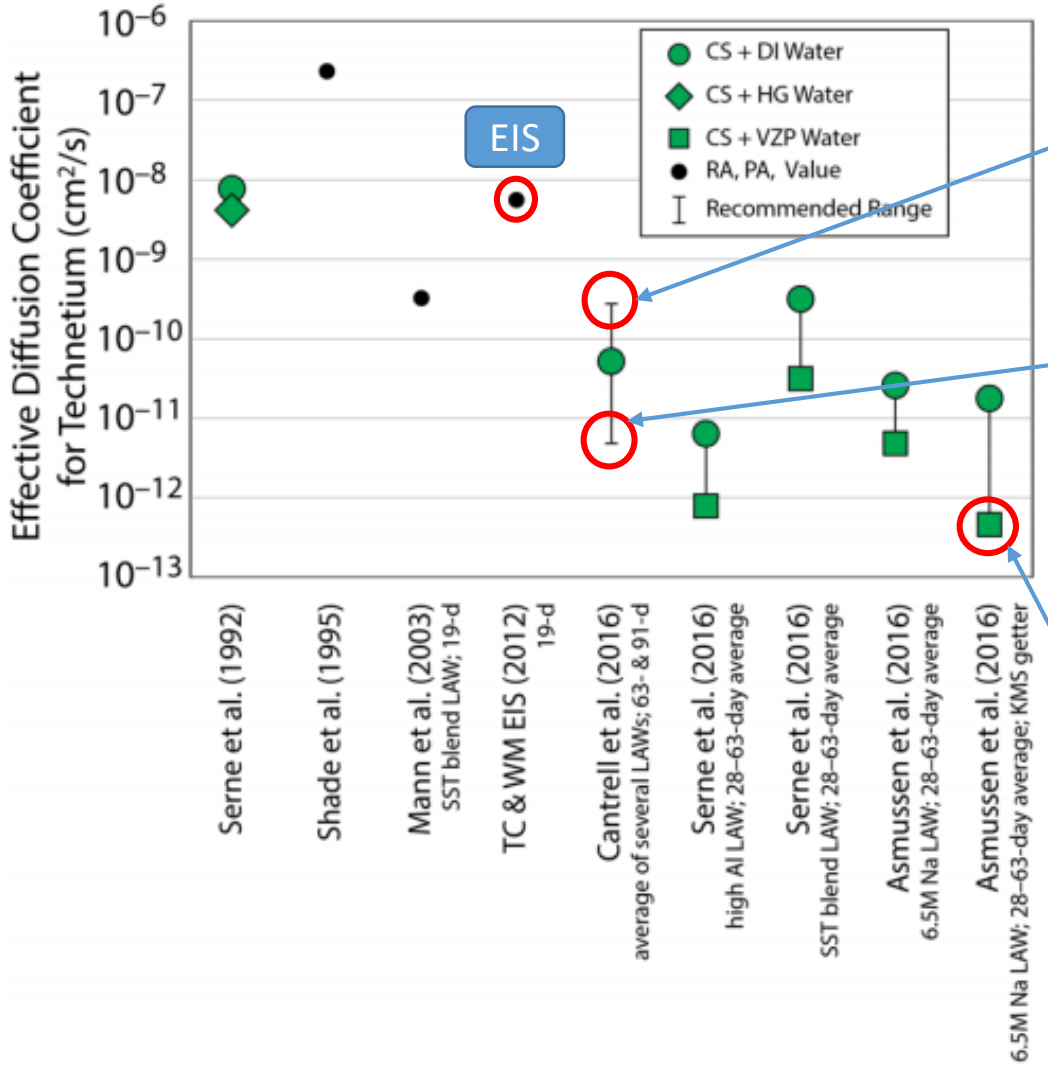
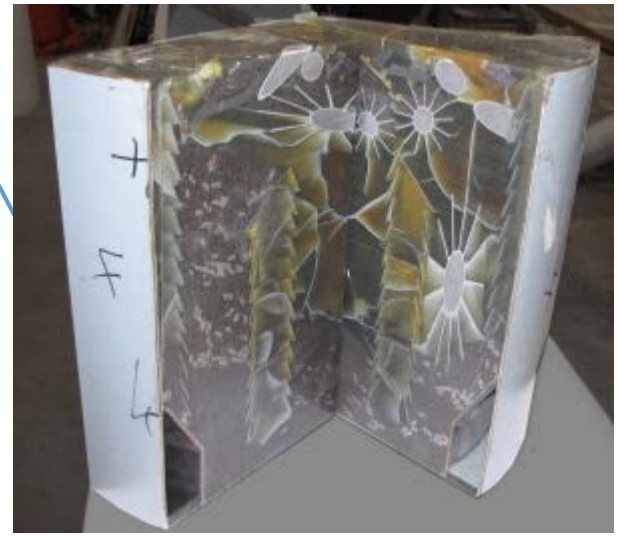
Source: NAS May 2019 meeting, FFRDC presentation

Grout performance changes



"Low" performing grout

"High" performing grout



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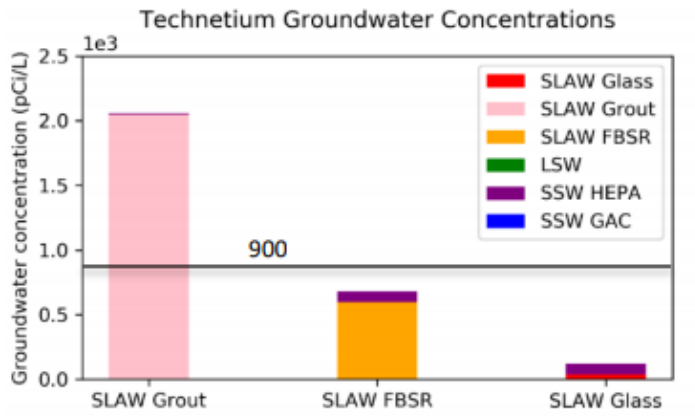
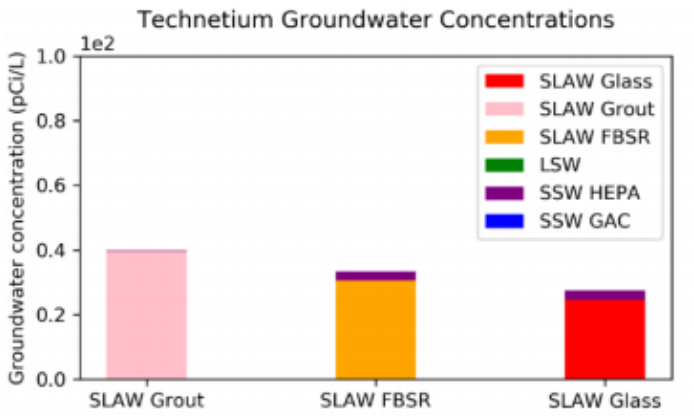
Projected Peak Groundwater Concentrations for All Cases

- **Tc-99**

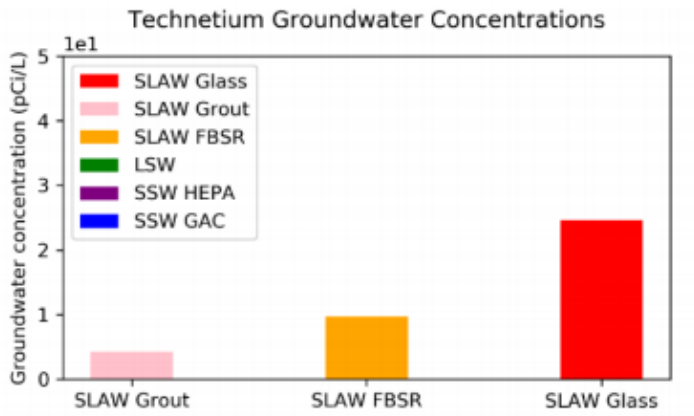
Low Performing



High Performing



Projected Best

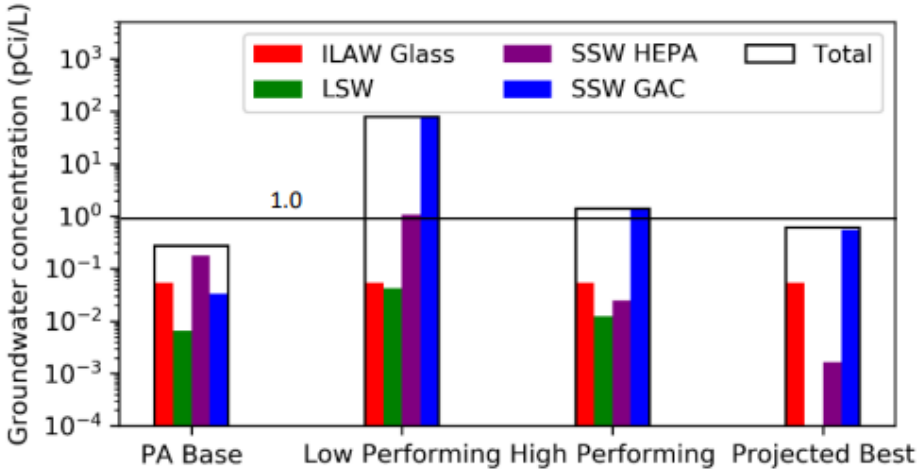


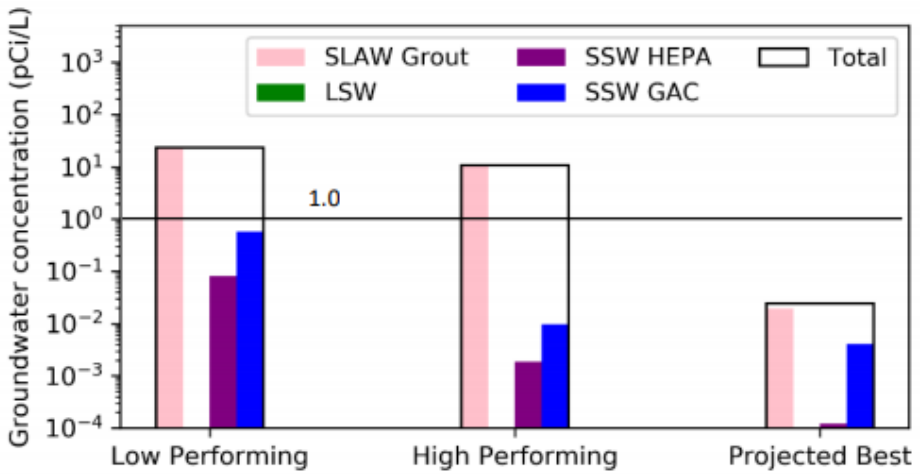
Translation:

Grout at Hanford is protective of groundwater for Tc-99 under "High Performing" and "Projected Best" case performance.

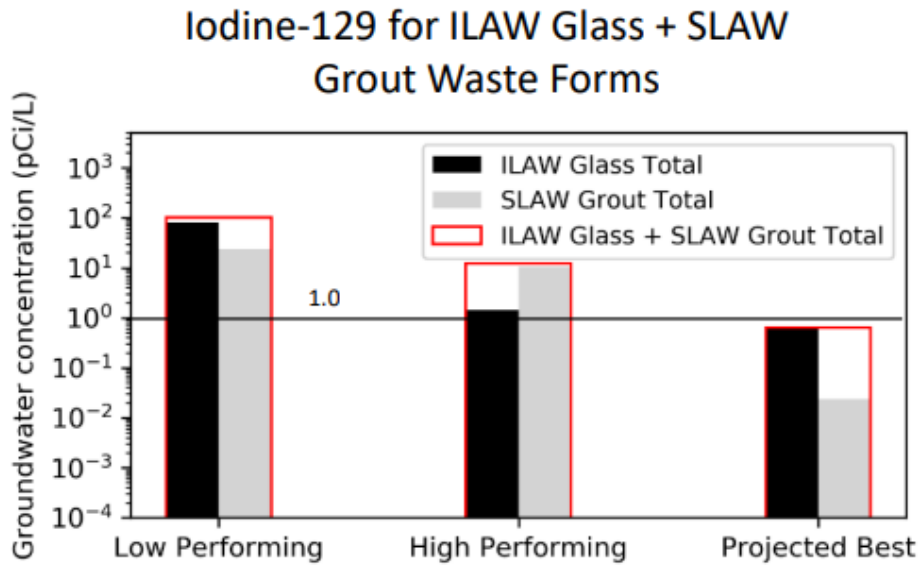
Source: NAS May 2019 meeting, FFRDC presentation

Performance Evaluation Results – Cumulative Groundwater Impacts





Translation:
Grout at Hanford is only protective of groundwater for Iodine-129 under the "Projected Best" case grout performance.



Source: NAS May 2019 meeting, FFRDC presentation

Oregon's Review of the Phase 1 NAS Hanford SLAW Options Study

https://tinyurl.com/ORSLAW2019

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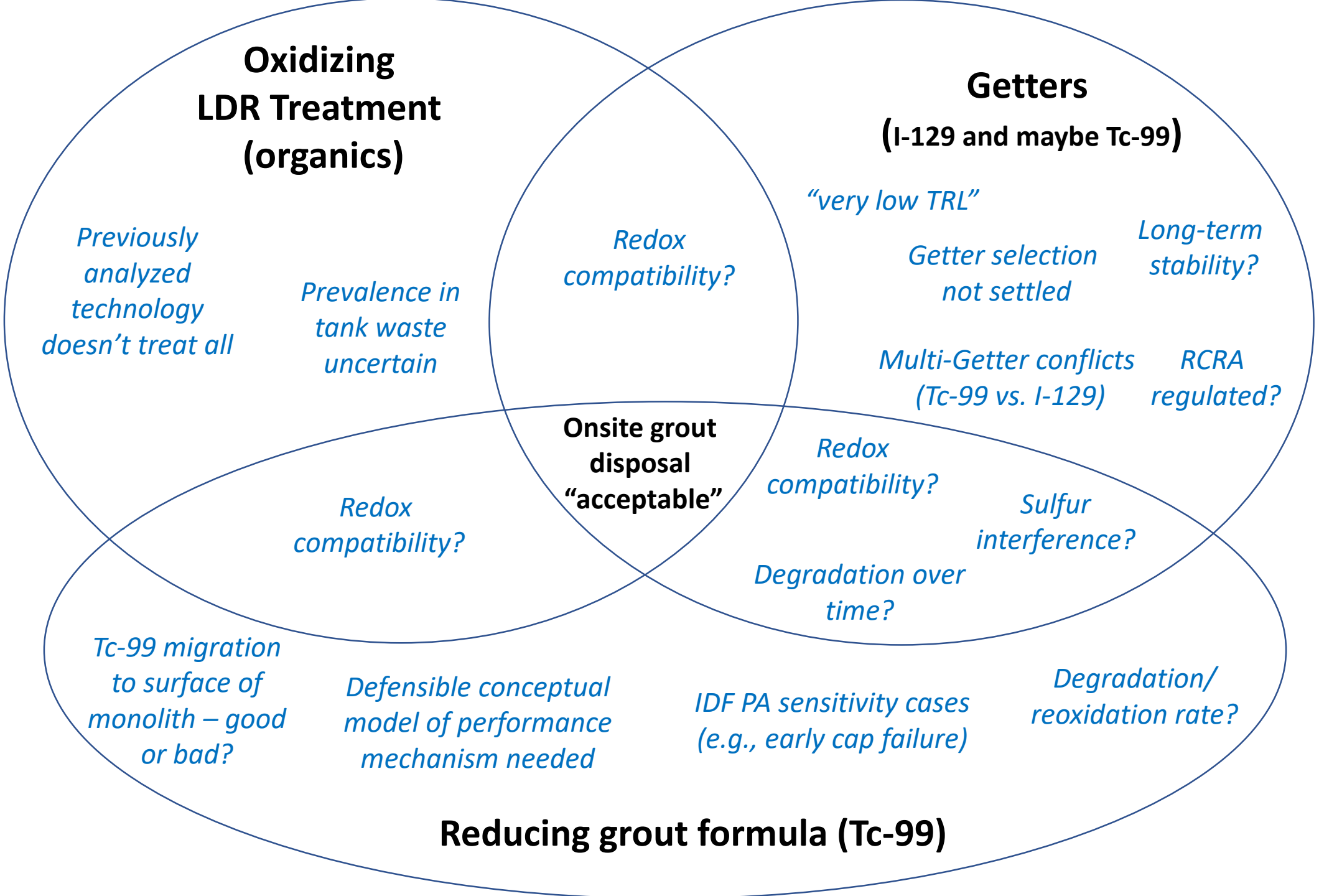
Oxidizing
LDR Treatment
(organics)
Previously analyzed technology doesn't treat all
Prevalence in tank waste uncertain
Redox compatibility?
Getters
(I-129 and maybe Tc-99)
"very low TRL"
Getter selection not settled
Long-term stability?
Multi-Getter conflicts (Tc-99 vs. I-129)
RCRA regulated?
Onsite grout disposal "acceptable"
Redox compatibility?
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Sulfur interference?
Degradation over time?
Tc-99 migration to surface of monolith – good or bad?
Defensible conceptual model of performance mechanism needed
IDF PA sensitivity cases (e.g., early cap failure)
Degradation/ reoxidation rate?
Reducing grout formula (Tc-99)

Is a No-SLAW future possible?

- DOE Glass Scientist predicted future LAW melters will be more efficient.
  - 15 metric tons/day → 50 MTD if we remove unnecessary refractory liner.
  - Increasing crystallization tolerance in glass from 1% to 1.5% would reduce the mission by 20%
  - A system model from the contractor in 2013 predicted no need for Supplemental LAW if a 3rd melter is added to the existing LAW facility.
  - A new 2020 glass formulation model predicts no need for Supplemental LAW.
  - How optimistic are we?

Put the “bad actors” in a smaller package?

- Getters vs. pretreatment – it’s all about location!
- Technology reportedly exists to separate Tc-99 and I-129, but more information needed.
- Mitigates uncertainty about getter interactions and long-term performance
- Manages uncertainty that offsite disposal may fall through after grout investments
- Potentially enables onsite disposal of more benign grouted waste form
- “As good as glass” comparability

Whither Nitrate and Nitrite?

- Assessments from 90s Hanford grout program concluded that the key obstacles for grouted waste at Hanford weren't limited to Tc-99 and I-129, but also nitrate and nitrite
- Nitrite is an "extremely hazardous waste" per WA statute.
- Prior FFRDC report *qualitatively* acknowledges value of nitrate destruction via thermal processes (vitrification or steam reforming)
- IDF Performance Assessment does not calculate nitrate/nitrite to groundwater from primary LAW (it's destroyed in vitrification!)
- No Performance Evaluation performed in prior FFRDC report for nitrate/nitrite like was performed for Tc-99 and I-129.

IDF Risk Budget Tool (2020)

- Built on the same model as the IDF Performance Assessment to allow budgeting of total inventory that may be disposed in IDF without surpassing drinking water MCLs.
- Risk Budget Tool provides estimates for “ETF Liquid Secondary Waste” as closest analogue to SLAW.

- Nitrate: **maximum disposal limit = 5.86 million kg**
  - Total NO3 in tank waste = **56 million kg**. 40% for SLAW = **20-22M kg**
  - Tool doesn’t take into account the existing nitrate plume under IDF

- Nitrite: **maximum disposal limit = 435,000 kg.**
  - BBI for nitrate – **11.8 million kg**. 40% for SLAW = **4.72 million kg**

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