National Academies of Science – Supplemental LAW Options

April 2022: two-week review impressions

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Oregon Involvement in This Study

TinyURL.com/OR-LAW0	Opening Remarks on Phase 1 Study
TinyURL.com/OR-LAW1	Phase 1 Study Technical Comments (2019)
TinyURL.com/OR-LAW2	Phase 2 Kickoff Presentation (07/21)
TinyURL.com/OR-LAW3	Phase 2 Kickoff Spoken Remarks (07/21)
TinyURL.com/OR-LAW4	FFRDC Outline Discussion PPT (10/21)
TinyURL.com/OR-LAW5	FFRDC Report Outline Video (10/21)

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Some Oregon Questions and Issues

- Key radionuclide retention in grout
- Nitrate/Nitrite budget for IDF
- Organics treatment uncertainties
- Cross Site Transfer line

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FFRDC Preferred Alternative(s)

"Start with offsite grout disposal, keep working the grout science, buy some risk budget, and save onsite grout performance for another day."

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Alternative Risk Management (What's the fallback?)

Grout 6 (offsite first, onsite later)

Grout 4B (all offsite)

FBSR? Vit 2? (dare to dream)

Build an evaporator

We have an extra evaporator

We learn by 2027 which path we are on.

Some Other Oregon Questions and Issues

- Grout & “Mission Acceleration” -> Sludge Management?
- Integration with Analysis of Alternatives and Holistic Negotiations
- Vitrification Alt 2: The “Faster Horse Hypothesis”
- Nitrate/Nitrite: where do we leave it for later?
- Offsite transportation analysis clarifications
- Cross Site Transfer line assumptions and risks
- Regulatory and community acceptance

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Sludge management under Grout 4B/6

significantly impact the completion date for waste treatment. As the LAW supplemental treatment dates are a function of facility cost, higher facility costs imply a later starting date (and larger range thereof), more HLW vitrification years at lower capacity, and a longer total mission duration with concordantly higher cost. Conversely, if LAW supplemental treatment can be facilitated without large projects, earlier than 2035 start dates would allow use of available DST space for feed preparation (LAW and HLW) and to support retrievals.[2]

FFRDC Volume II, p. F-4.

- The FFRDC report does not contain supporting system modeling to evaluate the effect of early SLAW on sludge levels in DSTs.
- Oregon concerns:
    - DST sludge levels get too high and create "Group A" tanks or halt SST retrievals
        - Affects time/cost savings value proposition of the preferred alternative?
    - Sludge could be left in SSTs during saltcake>grout retrieval and ultimately left in place.

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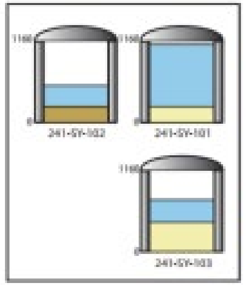
SY Farm remaining sludge capacity: **1280 kgal**
(Jeff's calc for 200" sludge height limit)

Sludge in S/SX/U: **2418 kgal**

SY-Tank Farm- Constructed 1974-1976
3 @ 1,160 Kgal Tank Capacity, Double-Shell

Tank	Sludge (Kgal)	Saltcake (Kgal)	Supernatant (Kgal)
241-SY-101	0	223	884
241-SY-102	220	0	304
241-SY-103	0	414	321

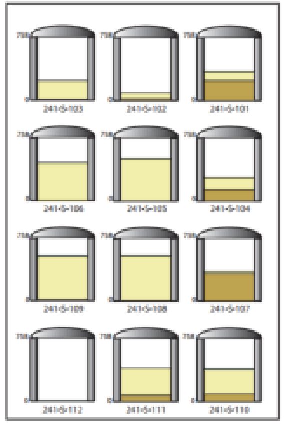


*Source: **HNF-EP-0182 REV 410** - WASTE TANK SUMMARY REPORT FOR MONTH ENDING FEBRUARY 28, 2022*

Figure 1-4. 200-West Tank Waste Contents

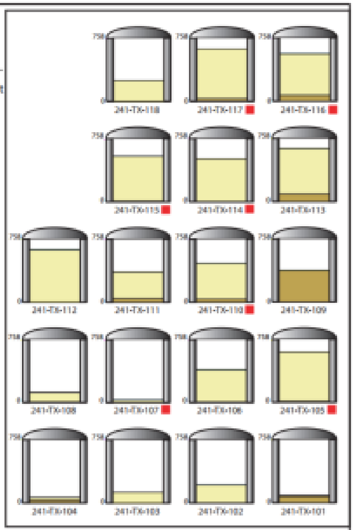
S-Tank Farm- Constructed 1950-1951
12 @ 758 Kgal Tank Capacity, Single-Shell

Tank	Sludge (Kgal)	Saltcake (Kgal)	Supernatant (Kgal)
241-S-101	235	115	0
241-S-102	22	69	2
241-S-103	9	220	1
241-S-104	132	149	1
241-S-105	2	506	0
241-S-106	0	451	0
241-S-107	328	30	0
241-S-108	5	537	0
241-S-109	13	520	0
241-S-110	91	296	0
241-S-111	72	329	0
241-S-112	2.5	0	0



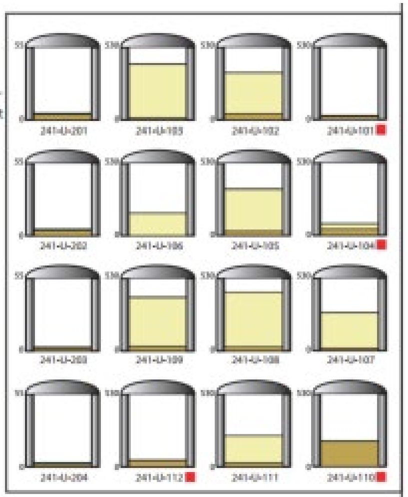
TX-Tank Farm- Constructed 1947-1948
18 @ 758 Kgal Tank Capacity, Single-Shell

Tank	Sludge (Kgal)	Saltcake (Kgal)	Supernatant (Kgal)
241-TX-101	73	9	5
241-TX-102	2	211	0
241-TX-103	0	126	2
241-TX-104	33	30	3
241-TX-105	11	589	0
241-TX-106	5	386	0
241-TX-107	0	27	0
241-TX-108	6	110	1
241-TX-109	375	0	0
241-TX-110	37	425	0
241-TX-111	43	317	0
241-TX-112	0	627	0
241-TX-113	88	546	0
241-TX-114	4	510	0
241-TX-115	8	536	0
241-TX-116	66	499	0
241-TX-117	29	597	0
241-TX-118	0	250	0



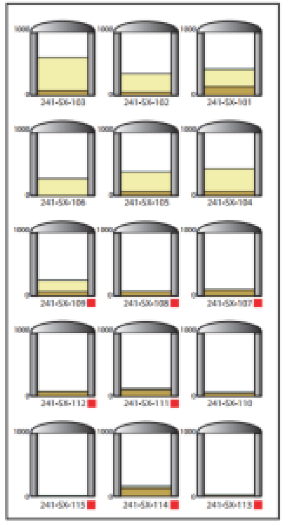
U-Tank Farm- Constructed 1943-1944
12 @ 530 Kgal Tank Capacity, Single-Shell
4 @ 55 Kgal Tank Capacity, Single-Shell

Tank	Sludge (Kgal)	Saltcake (Kgal)	Supernatant (Kgal)
241-U-101	21	0	9
241-U-102	43	299	2
241-U-103	13	392	1
241-U-104	45	39	0
241-U-105	32	305	4
241-U-106	0	163	2
241-U-107	16	260	0
241-U-108	29	399	0
241-U-109	32	357	1
241-U-110	183	0	0
241-U-111	26	199	0
241-U-112	44	0	4
241-U-201	4	0	1
241-U-202	4	0	1
241-U-203	2	0	1
241-U-204	2	0	1



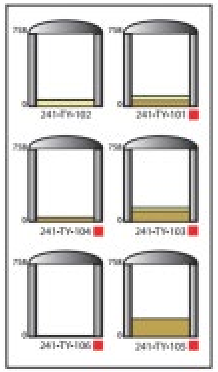
SX-Tank Farm- Constructed 1953-1955
15 @ 1,000 Kgal Tank Capacity, Single-Shell

Tank	Sludge (Kgal)	Saltcake (Kgal)	Supernatant (Kgal)
241-SX-101	141	275	0
241-SX-102	55	287	0
241-SX-103	80	519	0
241-SX-104	69	360	0
241-SX-105	65	311	0
241-SX-106	0	267	1
241-SX-107	96	0	0
241-SX-108	72	0	0
241-SX-109	66	175	0
241-SX-110	49	9	0
241-SX-111	97	20	0
241-SX-112	71	0	0
241-SX-113	19	0	0
241-SX-114	127	31	0
241-SX-115	4	0	0



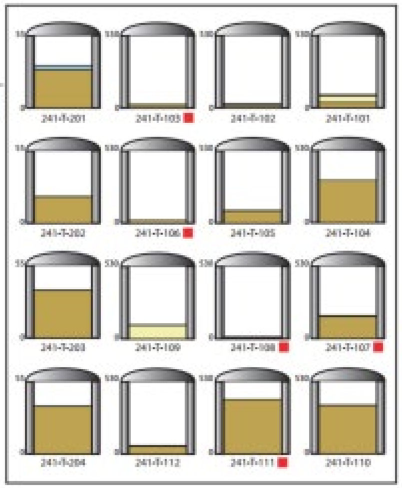
TY-Tank Farm- Constructed 1951-1952
6 @ 758 Kgal Tank Capacity, Single-Shell

Tank	Sludge (Kgal)	Saltcake (Kgal)	Supernatant (Kgal)
241-TY-101	59	47	0
241-TY-102	0	61	9
241-TY-103	108	40	0
241-TY-104	39	0	4
241-TY-105	187	0	0
241-TY-106	13	0	0



T-Tank Farm- Constructed 1943-1944
12 @ 530 Kgal Tank Capacity, Single-Shell
4 @ 55 Kgal Tank Capacity, Single-Shell

Tank	Sludge (Kgal)	Saltcake (Kgal)	Supernatant (Kgal)
241-T-101	37	49	7
241-T-102	19	0	11
241-T-103	23	0	3
241-T-104	310	0	0
241-T-105	89	0	1
241-T-106	21	0	0
241-T-107	160	0	7
241-T-108	7	8	0
241-T-109	0	98	1
241-T-110	351	0	2
241-T-111	397	0	0
241-T-112	55	0	7
241-T-201	29	0	3
241-T-202	20	0	0
241-T-203	36	0	0
241-T-204	36	0	0



SST Retrieval Gantt Chart – Comparative Dates to Consolidate Waste into Double Shell Tanks

Vitrification alternative includes offsite grout?

Table 3.3-3. Technetium-99 Disposition – Alternatives 4B and Delayed Low-Activity Waste Supplemental Vitrification

Disposal	Waste Type	Treatment	Alternative 4B Ci Tc	Delayed Vitrification Ci Tc
Offsite	LAW	West TSCR	6,500	7,500
Offsite	LAW	East TSCRs	10,500	N/A
Onsite	LAW	LAW vitrification	6,800	11,900
Onsite	LAW	Supplemental LAW vitrification	N/A	4,400
Offsite	HLW	HLW vitrification	1,250	1,250
		Total	**25,050**	**25,050**

Notes: Tank farm inventory **25,000 Ci**
Expected loss 1%
HLW nominal content 5% (1,250 Ci)

HLW = high-level waste.
IDF = Integrated Disposal Facility.
LAW = low-activity waste.
Tc = technetium.
TSCR = tank-side cesium removal.

Summary Technetium Disposition

Off-site Grout 4B		Delayed LAW Supplemental Vitrification
18,250	Total offsite (Ci)	8,750
6,800	Total on-site IDF (Ci)	16,300

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Grout 4B vs. Delayed LAW vit

- How does grouting LAW result in fewer HLW canisters?
- Would new DSTs produce the same result?
- What if more DSTs fail?
- Show me the sludge!

Table F-12. Mission Performance and Cost Metrics – Alternative 4B and Delayed Low-Activity Waste Supplemental Vitrification

	Alternative 4B Early Start Offsite Grout	Delayed LAW Supplemental Vitrification (2050)
Treat all tank waste (calendar year)	2066	2075
HLW canisters produced	9,300	12,000
Maximum TSCR pretreatment required	5	8
Completions SST retrievals	2057	2070
Unescalated cost	$79B	$110B
Total escalated lifecycle cost	$145B	$240B

HLW = high-level waste.
LAW = low-activity waste.
SST = single-shell tank.
TSCR = tank-side cesium removal.

Several key parameters are worth noting. A primary result is the reduction of mission completion from 2075 (Delayed Vitrification) to 2066 (Grout 4B). This is accomplished due solely to the DST space generated by LAW supplemental treatment being used for HLW feed preparation, resulting in a 20% reduction in HLW canisters. At the same time, additional space generated by LAW supplemental treatment is sufficient to allow SST retrievals to complete 13 years earlier (2057 versus 2070). These

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Nitrate/Nitrite

Statement in FFRDC Volume II:

scale is not mature. An assessment of NO_3/NO_2 release from a supplemental LAW grout inventory in the IDF showed that existing leach testing results are close to meeting maximum contaminant levels (MCL) in groundwater for nitrate release in the IDF based on existing drinking water compliance standards. Note that laboratory tests are a bounding conservative case due to the saturated nature of the tests (PNNL-28992, *Performance Metric for Cementitious Waste Form Inventory Release in the Integrated Disposal Facility*, Figure 4-3). Numerous laboratory studies and field demonstrations have used the

Disclaimer in PNNL-28992:

In summary, the performance metrics will allow rapid assessment of future grout leach data to select optimized formulations for maturation and eventual deployment to facilitate the Hanford mission. It should be noted that these simulations only consider the contribution from the SLAW inventory and not any contribution to the overall release rate from the primary LAW inventory. As a result, the R values that achieve the target concentrations would be an underestimation of the full LAW inventory release. The performance metric is not intended for use in regulatory decision-making.

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Figure 4-3 in PNNL-28992

Note: PNNL-28992 does not include a metric for nitrite.

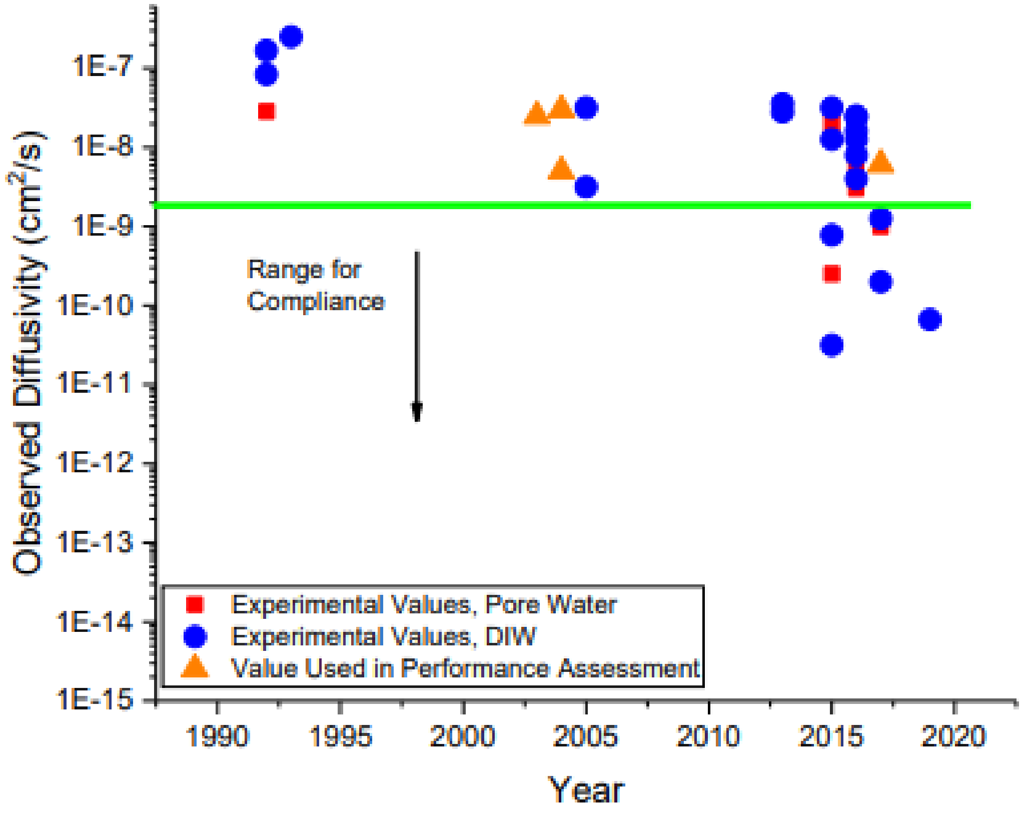

Figure 4-3. Comparison of previously reported observed diffusivity values for NO_3^- measured in deionized water (blue), simulated porewater (red), and those used in previous PAs and RAs (orange) with the performance metric for NO_3^- (green line).

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Offsite Transportation of LAW

- Analysis seems to jump between liquid vs. solid transport.
- 615 railcars total in 42 years?
- Relative non-rad transportation risk of the Oregon route (to Clive) is significantly less than non-Oregon route (WCS).
- Significant risk difference if liquid or solid?
- Transport to an offsite rail spur?
- Oregon is willing to work with DOE on safe LAW transportation options and accident response planning.

Figure D-11. Rail Routes from Hanford (Perma-Fix) to Waste Control Specialists (Texas) and Clive (Utah)

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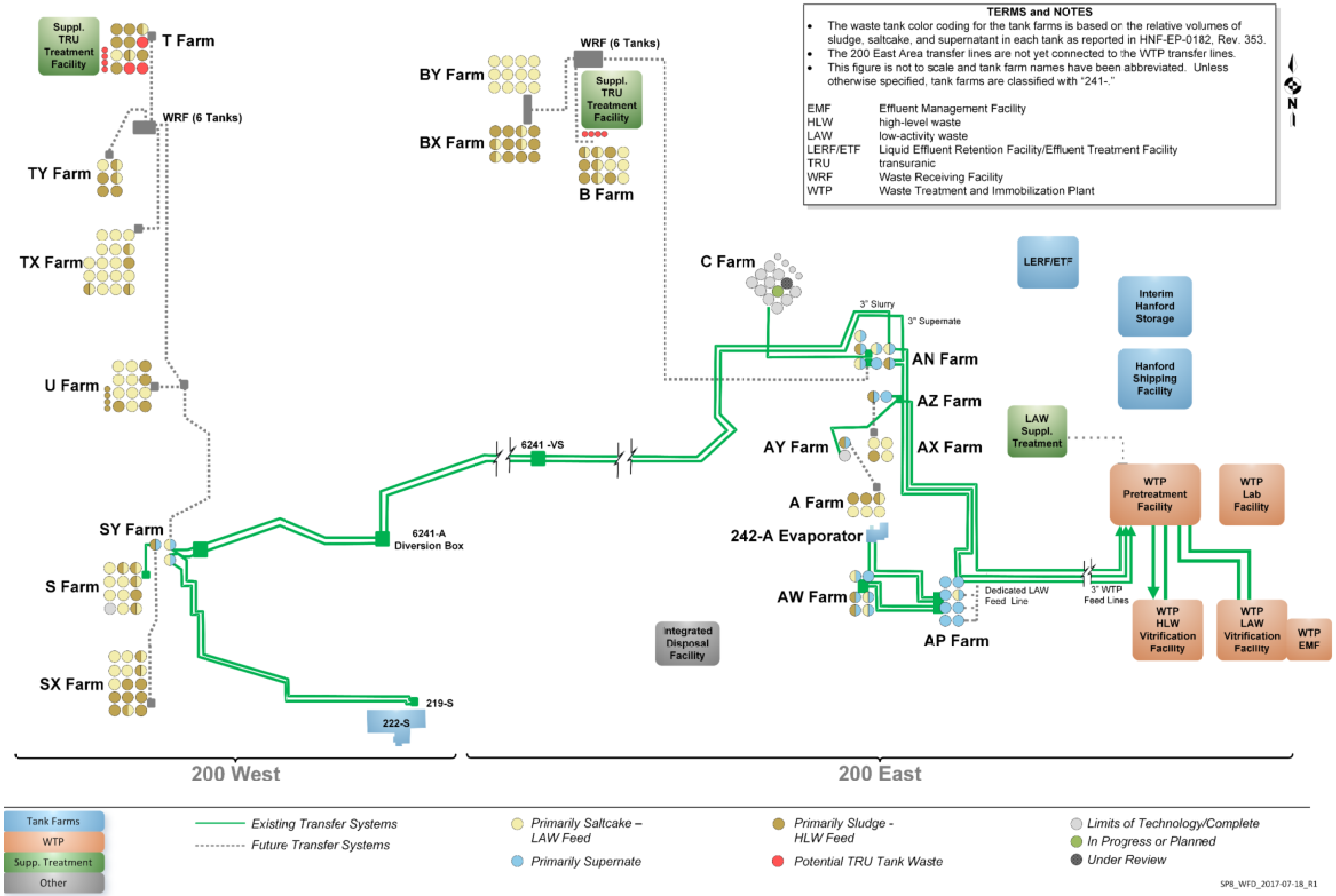
"Geography Matters"

Figure 3-8. Simplified Representation of the Hanford Waste Feed Delivery System.



Source: System Plan 8

Regulatory and Community Acceptance

- *We are not beyond convincing, but we must be convinced.*
- *Oregon Hanford Cleanup Board may also provide feedback on waste disposal and transportation issues.*
- *VLAW WIR is still in NRC's court.*
- *Risk-based is ok, but the how matters as much as the what.*
- *"If you're concerned, I'm concerned."*
- *What happens next will happen at the speed of trust.*

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