

# INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

## Part I: Background Information

Title: <b>System Plan 9: Baseline Case</b>	Information Category: <input type="checkbox"/> Abstract <input type="checkbox"/> Journal Article <input type="checkbox"/> Summary <input type="checkbox"/> Internet <input checked="" type="checkbox"/> Visual Aid <input type="checkbox"/> Software <input type="checkbox"/> Full Paper <input type="checkbox"/> Report <input type="checkbox"/> Other _____
Publish to OSTI? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Yes    NA <input type="checkbox"/> <input checked="" type="checkbox"/>
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Document Number: TOC-PRES-21-2225 -VA Rev. 0	Date: April 2021
Author: Reaksecker, Sean D	

## Part II: External/Public Presentation Information

Conference Name: FFRDC Meeting	
Sponsoring Organization(s): Office of River Protection	
Date of Conference: 05/03/2021	Conference Location: Virtual
Will Material be Handed Out? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Will Information be Published? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <span style="float: right;"><i>(If Yes, attach copy of Conference format instructions/guidance.)</i></span>

## Part III: WRPS Document Originator Checklist

Description	Yes	N/A	Print/Sign/Date
Information Product meets requirements in TFC-BSM-AD-C-01?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Document Release Criteria in TFC-ENG-DESIGN-C-25 completed? (Attach checklist)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If product contains pictures, safety review completed?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

## Part IV: WRPS Internal Review

Function	Organization	Date	Print Name/Signature/Date
Subject Matter Expert	WRPS		Reaksecker, Sean D Approved via att. IDMS data file.
Responsible Manager	WRPS		Sams, Rebecca J Approved via att. IDMS data file.
Other:			

## Part V: IRM Clearance Services Review

Description	Yes	No	Print Name/Signature
Document Contains Classified Information?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If Answer is "Yes," ADC Approval Required  _____ Print Name/Signature/Date
Document Contains Information Restricted by DOE Operational Security Guidelines?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Reviewer Signature:  _____ Print Name/Signature/Date
Document is Subject to Release Restrictions? <i>If the answer is "Yes," please mark category at right and describe limitation or responsible organization below:</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Document contains: <input type="checkbox"/> Applied Technology <input type="checkbox"/> Protected CRADA <input type="checkbox"/> Personal/Private <input type="checkbox"/> Export Controlled <input type="checkbox"/> Proprietary <input type="checkbox"/> Procurement – Sensitive <input type="checkbox"/> Patentable Info. <input type="checkbox"/> OUO <input type="checkbox"/> Predecisional Info. <input type="checkbox"/> UCNi <input type="checkbox"/> Restricted by Operational Security Guidelines <input type="checkbox"/> Other (Specify) _____
Additional Comments from Information Clearance Specialist Review?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Information Clearance Specialist Approval  <div style="border: 1px solid green; padding: 2px; display: inline-block; color: green; font-weight: bold;">APPROVED</div> <small>By Julia Raymer at 8:26 am, Aug 18, 2021</small> _____ Print Name/Signature/Date

**When IRM Clearance Review is Complete – Return to WRPS Originator for Final Signature Routing (Part VI)**

## INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

### Part VI: Final Review and Approvals

Description	Approved for Release		Print Name/Signature
	Yes	N/A	
WRPS External Affairs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Approved via att. IDMS data file.
WRPS Office of Chief Counsel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Approved via att. IDMS data file.
DOE – ORP Public Affairs/Communications	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Approved via att. IDMS data file.
Other: ORP SME & OCC	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Approved via att. IDMS data file.
Other:	<input type="checkbox"/>	<input type="checkbox"/>	

Comments Required for WRPS-Indicate Purpose of Document:

This presentation describes the results of the River Protection Project System Plan 9 Baseline Case, which has been publicly released in ORP-11242, Rev. 9.

APPROVED

By Julia Raymer at 8:31 am, Aug 18, 2021

Approved for Public Release;  
Further Dissemination Unlimited

#### Information Release Station

Was/Is Information Product Approved for Release?  Yes  No

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Date Information Product Stamped/Marked for Release: 8/18/2021

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  username="h3310581" disposition="Cleared" authentication="true" />
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## Raymer, Julia R

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**From:** Harrison, Sarah E  
**Sent:** Wednesday, June 23, 2021 1:32 PM  
**To:** Porcaro, Elaine N  
**Cc:** Raymer, Julia R  
**Subject:** RE: Help with IDMS

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Perfect, thanks so much Elaine!

Thank you,

### Sarah Harrison

HMIS Information Clearance

North Wind Solutions | Cell › 602-571-2375



---

**From:** Porcaro, Elaine N <elaine\_n\_porcaro@orp.doe.gov>  
**Sent:** Wednesday, June 23, 2021 1:27 PM  
**To:** Harrison, Sarah E <sarah\_e\_harrison@rl.gov>  
**Subject:** RE: Help with IDMS

So sorry for the delay and thanks so much...yes, confirming I'm alright clearing both of these slide presentations for public release.

Thanks,  
Elaine

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**From:** Harrison, Sarah E <[sarah\\_e\\_harrison@rl.gov](mailto:sarah_e_harrison@rl.gov)>  
**Sent:** Tuesday, June 22, 2021 8:31 AM  
**To:** Porcaro, Elaine N <[elaine\\_n\\_porcaro@orp.doe.gov](mailto:elaine_n_porcaro@orp.doe.gov)>  
**Subject:** RE: Help with IDMS

No worries, we can use this email to approve your step in IDMS.

Just to confirm, you are approving the below presentations for public release?

TOC-PRES-21-2226-VA Rev0 - *HLW Analysis of Alternatives*

TOC-PRES-21-2225-VA-00 - *System Plan 9: Baseline Case*

Thank you,

### Sarah Harrison

HMIS Information Clearance

# System Plan 9: Baseline Case

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy  
Office of River Protection under Contract DE-AC27-08RV14800



**P.O. Box 850**  
**Richland, Washington 99352**

## System Plan 9: Baseline Case

S. D. Reaksecker  
Washington River Protection Solutions

Date Published  
April 2021

To be Presented at  
FFRDC Meeting

Office of River Protection  
Virtual

05/03/2021

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy  
Office of River Protection under Contract DE-AC27-08RV14800



**P.O. Box 850**  
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**APPROVED**  
*By Julia Raymer at 8:29 am, Aug 18, 2021*

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Release Approval

Date

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# THE HANFORD SITE

## System Plan 9 Baseline Case

Alec Schubick, Rebecca Sams, Sean Reaksecker

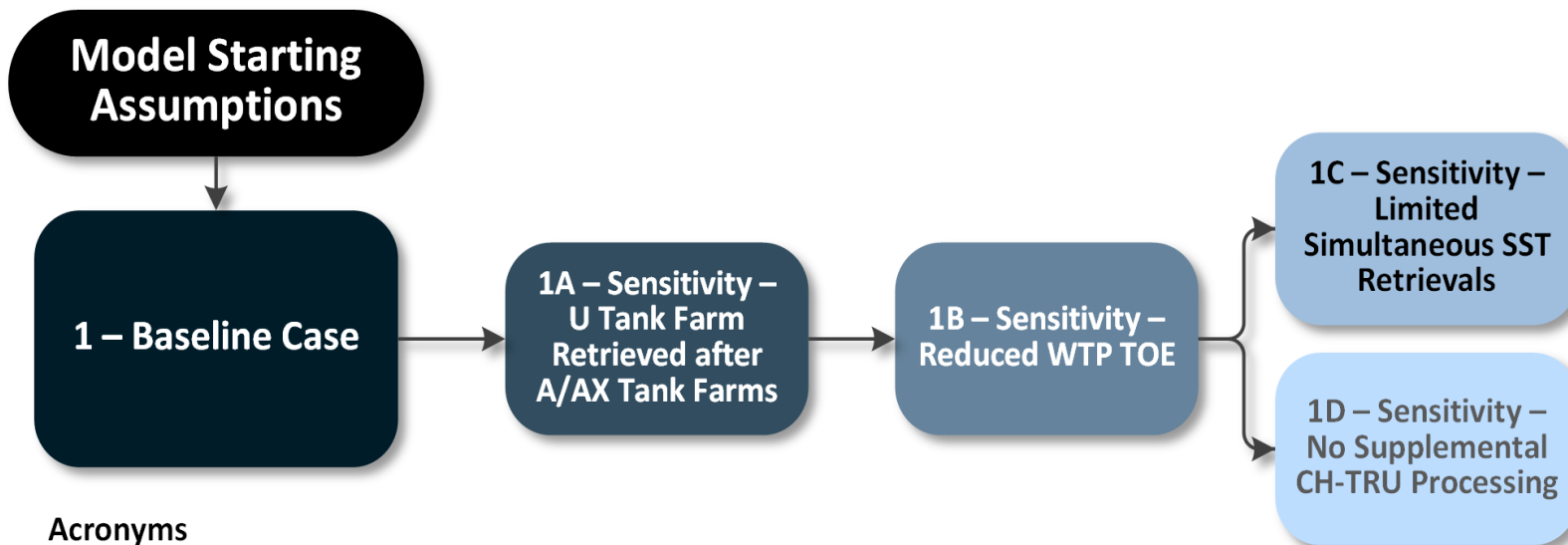
Mission Integration Analysis

Washington River Protection Solutions, LLC

*May 2021*



- Objective: To evaluate the River Protection Project (RPP) mission as it is currently planned/thought to proceed and derive estimated retrieval and treatment completion dates.

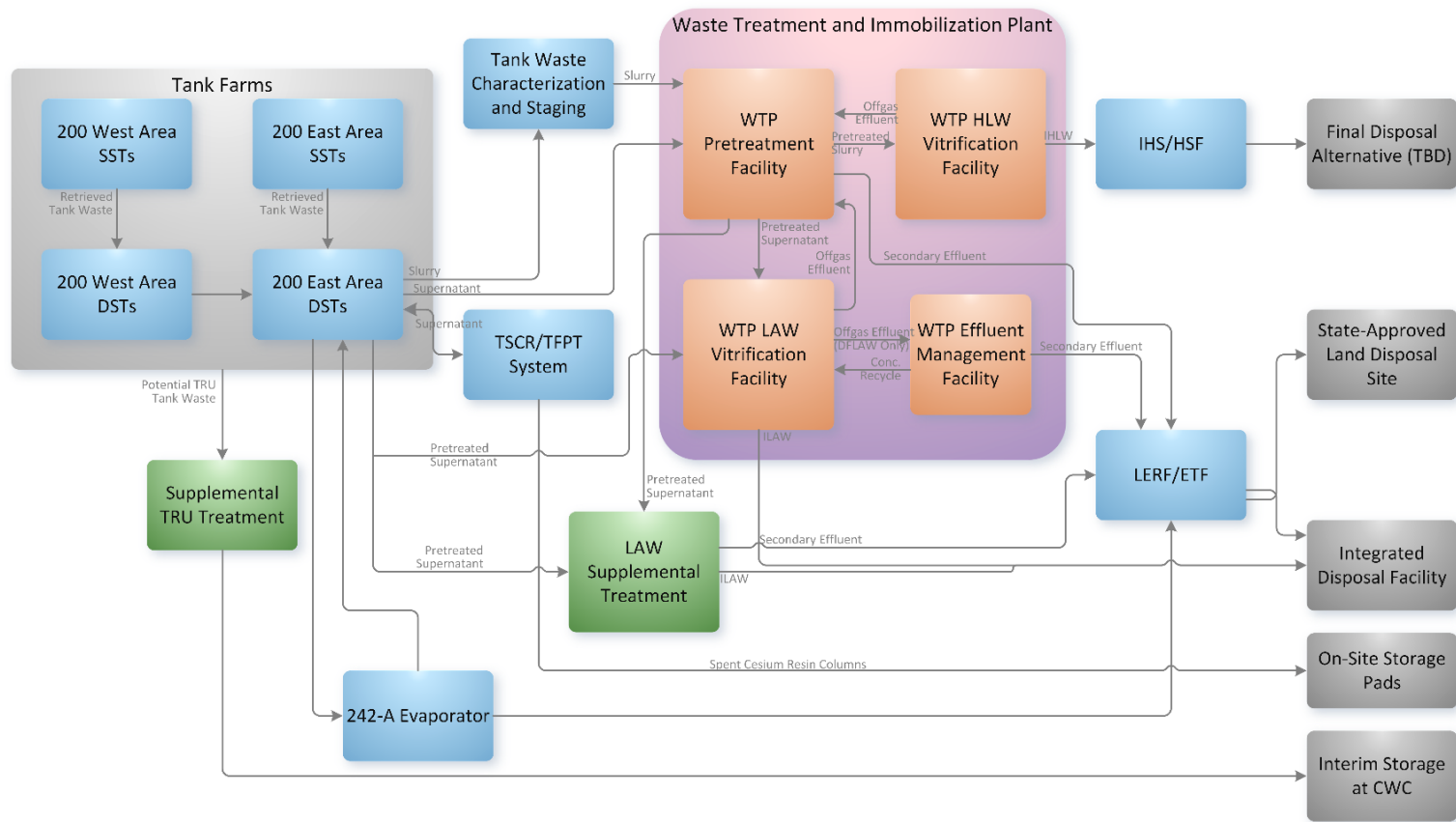


**Acronyms**

CH-TRU = contact-handled transuranic.  
 SST = single-shell tank.

TOE = total operating efficiency.  
 WTP = Waste Treatment and Immobilization Plant.

SP9\_Scenario\_1\_Run\_Map\_R1.png



**Legend**

- Tank Farms
- WTP
- Supp. Treatment
- Other

**Acronyms**

- |     |                             |      |   |
|-----|-----------------------------|------|---|
| CWC | Central Waste Complex       | LERF | Liquid Effluent Retention Facility                    |
| DST | double-shell tank           | MT   | metric ton  |
| ETF | Effluent Treatment Facility | SST  | single-shell tank                                     |
| HLW | high-level waste            | TSCR | tank side cesium removal                              |
| HSF | Hanford Shipping Facility   | TFPT | Tank Farm pretreatment                                |
| IHS | Interim Hanford Storage     | TBD  | to be determined                                      |
| LAW | low-activity waste          | TRU  | transuranic   |
|     |                             | WTP  | Hanford Tank Waste Treatment and Immobilization Plant |

For illustrative purposes only: The flowsheet presented here has been simplified for presentation purposes.

SP8\_S1SF5\_2017-07-18\_R1

System	Key Assumptions	System	Key Assumptions								
SST Retrievals	<ul style="list-style-type: none"> <li>Use A/AX per most recent Multi-Year Operating Plan (MYOP), Rev. 8</li> <li>Other Single-Shell Tanks (SSTs) per SS-1647, Rev. 7</li> <li>Start S/SX Tank Farms after A/AX</li> <li>One retrieval at a time per area, increasing to two when needed (to maintain adequate feed to the Waste Treatment Plant (WTP))</li> <li>2-month delay between SST retrievals</li> <li>Waste Receiving Facilities (WRFs) – 6 x 150-kgal tanks available 6 months before needed</li> </ul>	DST Operations	<ul style="list-style-type: none"> <li>1.265 Mgal of emergency space</li> <li>Direct-Feed Low-Activity Waste (DFLAW) Tanks AP-105, AP-106, AP-107, AP-108</li> <li>Near-term transfers (and retrievals) consistent with the MYOP, Rev. 8</li> <li>Group A, AN-104, SY-103 mitigations after A/AX retrievals</li> <li>Increase solids limit in SY-102 and SY-103 to 200 inches when S/SX Tank Farm retrievals begin</li> <li>DST heel retrieval durations 128 days (based on AY-102)</li> <li>DST retrievals limited to 2 simultaneous maximum per farm and shall not exceed 4 simultaneous maximum including SST retrievals</li> </ul>								
242-A Evaporator	<ul style="list-style-type: none"> <li>Maximum of 6 campaigns per year</li> <li>90-day sampling time per campaign</li> </ul>	TWCS Capability	<ul style="list-style-type: none"> <li>Operational 06/30/2032</li> <li>Stage, mix, and sample waste to meet WTP PT Facility Waste Acceptance Criteria (WAC) (190-day sampling time)</li> <li>6 x 500-kgal tanks</li> </ul>								
DFLAW	<ul style="list-style-type: none"> <li>Tank-Side Cesium Removal (TSCR) operational on 02/01/2023</li> <li>Feed from Tank AP-107, treated waste to Tank AP-106</li> <li>100 kgal space reserved in Tank AP-102 for emergency returns</li> <li>Non-elutable resin, increased capacity after 5 years</li> <li>Continues operating after WTP Pretreatment (PT) Facility start-up to augment feed to Low-Activity Waste (LAW) supplemental treatment, as needed</li> </ul>	WTP EMF	<ul style="list-style-type: none"> <li>100% recycle of concentrate to LAW feed</li> <li>Dynamic batching to minimize variability in glass loading</li> <li>Caustic scrubber bypass directly to Liquid Effluent Retention Facility (LERF)/Effluent Treatment Facility (ETF)</li> <li>Only operates during DFLAW</li> </ul>								
WTP PT	<ul style="list-style-type: none"> <li>Operational by 12/31/2033</li> <li>Integrated WTP total operating efficiency (TOE) 70%</li> <li>Feeds from Tank Waste Characterization and Staging (TWCS) capability (High-Level Waste (HLW)) and Double-Shell Tanks (DSTs) (LAW)</li> <li>Feeds WTP LAW and HLW Vitrification Facilities and LAW supplemental treatment</li> <li>Handles recycle of secondary liquid waste from LAW and HLW</li> </ul>	WTP HLW	<ul style="list-style-type: none"> <li>Operational on 12/31/2033</li> <li>2016 Glass Model</li> <li>Ramp-up (70% TOE)                             <table border="1" style="margin-left: 20px;"> <tr> <td>12/31/2033</td> <td>3.0 Metric Tons of Glass (MTG)/day</td> </tr> <tr> <td>12/31/2034</td> <td>4.0 MTG/day</td> </tr> <tr> <td>09/30/2036</td> <td>4.2 MTG/day</td> </tr> <tr> <td>12/31/2038</td> <td>5.25 MTG/day (2<sup>nd</sup> generation melters)</td> </tr> </table> </li> </ul>	12/31/2033	3.0 Metric Tons of Glass (MTG)/day	12/31/2034	4.0 MTG/day	09/30/2036	4.2 MTG/day	12/31/2038	5.25 MTG/day (2 <sup>nd</sup> generation melters)
12/31/2033	3.0 Metric Tons of Glass (MTG)/day										
12/31/2034	4.0 MTG/day										
09/30/2036	4.2 MTG/day										
12/31/2038	5.25 MTG/day (2 <sup>nd</sup> generation melters)										
WTP LAW	<ul style="list-style-type: none"> <li>Operational on 12/31/2023</li> <li>2016 Glass Model</li> <li>Ramp-up (70% TOE)                             <table border="1" style="margin-left: 20px;"> <tr> <td>12/31/2023</td> <td>9.0 MTG/day</td> </tr> <tr> <td>07/31/2024</td> <td>18.0 MTG/day</td> </tr> <tr> <td>07/31/2025</td> <td>21.0 MTG/day</td> </tr> </table> </li> </ul>	12/31/2023	9.0 MTG/day	07/31/2024	18.0 MTG/day	07/31/2025	21.0 MTG/day	LAWST	<ul style="list-style-type: none"> <li>Operational 12/31/2034, so as not to limit HLW throughput</li> <li>4-melter-equivalent capacity (42 MTG/day) (initial estimate will be sized so LAW treatment does not limit the mission)</li> <li>Assumed to be a vitrification facility for cost purposes</li> </ul>		
12/31/2023	9.0 MTG/day										
07/31/2024	18.0 MTG/day										
07/31/2025	21.0 MTG/day										
LERF/ETF	<ul style="list-style-type: none"> <li>Fed continuously (cannot cause upstream delays)</li> <li>Secondary solid waste (as powder, treated brine, and cast stone) to Integrated Disposal Facility (IDF)</li> </ul>	CH-TRU	<ul style="list-style-type: none"> <li>Contact Handled Transuranic Waste (CH-TRU) treatment operational after full WTP operations (exact date to be determined)</li> </ul>								

- Meets near-term Amended Consent Decree dates (B-1, B-2, B-3\*).
- 242-A Evaporator required to concentrate waste and create enough DST space to keep up with retrieval volumes.
- Mission duration is mainly driven by WTP pretreatment.
- LAW Supplemental Treatment (LAWST) sized at 4 melter equivalents, or capacity of 42 MTG/day (60 MTG/day\*70%).
- Additional 242-A Evaporator, SST, and DST restrictions added ~3 years to the mission and 5 years to SST retrievals compared to System Plan 8 (SP8).
- HLW could operate with a single melter without resulting in delays to the mission.

\*B-1: C-102, C-105, C-111 complete by 03/31/2024.

B-2: Complete retrievals of the 9 SSTs from A and AX Tank Farms by 09/30/2026.

B-3: Complete 5 tanks from B-1 and B-2 by 06/30/2021.

- All SSTs retrieved by 2061.\*
  - 5 years longer than SP8.
- All waste treated by 2066.\*
  - 3 years longer than SP8.
- 7,300 immobilized high-level waste (IHLW) canisters.
  - 500 reduction from SP8.
- 89,000 immobilized low-activity waste (ILAW) containers.
  - 5,000 reduction from SP8.

\*Assumes unconstrained funding.

Metric	SP8 Baseline Case	SP9 Scenario 1: Baseline Case
Next 9 SSTs Retrievals (B-2)	05/2022	06/2026
Complete All SST Retrievals	2056	2061
DST Completion	2062	2065
Treat All Tank Waste	2063	2066
IHLW Glass Canisters	7,800	7,300
IHLW Glass Waste Oxide Loading	44%	44%
WTP ILAW Glass Containers	52,000	52,000
LAWST ILAW Glass Containers	42,000	37,000
LAWST Grout Volume (yd <sup>3</sup> )	420,000	400,000
ILAW Glass Sodium Oxide Loading	22%	22%
Sodium to ILAW Glass (MT)	84,000	79,000
Potential TRU Tank Waste (Drums)	8,400	8,800

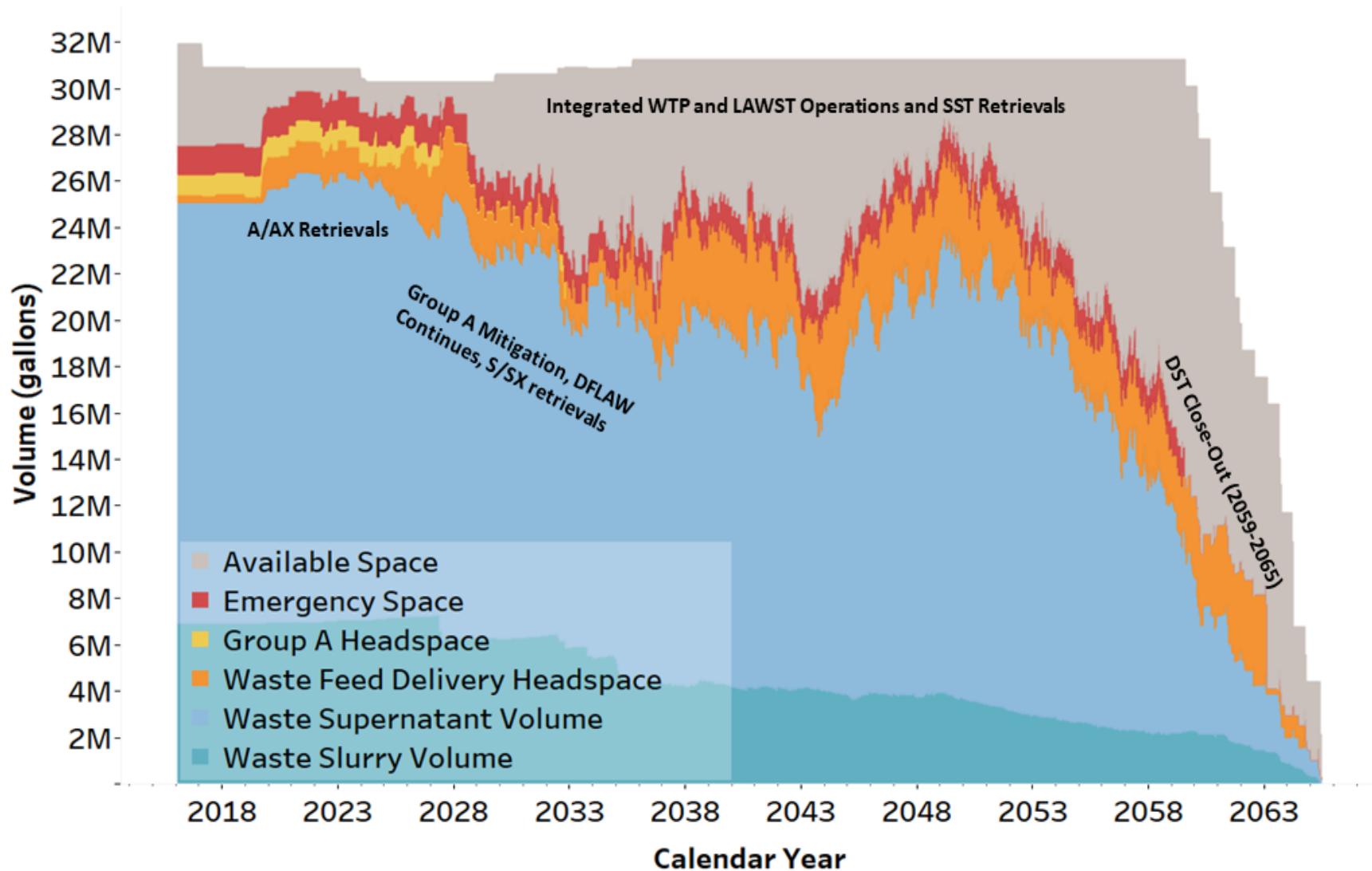
- The random uncertainty or “noise” associated with the model was evaluated for the System Plan 9 (SP9) Baseline, using 100 model runs.

Metric	SP9 Scenario 1: Baseline Case	Minimum	Mean	Maximum	Range
Complete All SST Retrievals	2061.3 (21 <sup>st</sup> percentile)	2060.5	2061.7	2063.5	3.0 years
Treat All Tank Waste	2066.3 (7 <sup>th</sup> percentile)	2065.9	2067.0	2069.0	3.1 years
IHLW Glass Canisters	7,300 (90 <sup>th</sup> percentile)	7,000	7,200	7,400	400 canisters
Total ILAW Glass Containers	88,900 (26 <sup>th</sup> percentile)	88,400	89,100	89,600	1,100 containers

- With the exception of the IHLW canister count, the final run for Scenario 1 is optimistic, but overall variability is low.
- This informs the interpretation of sensitivities and alternatives— if a run completes in 2069, we can’t say that is a significant change (though we also can’t exclude the possibility).

- Cross-site transfer line needed prior to beginning S/SX retrievals (2028).
- B-Complex Waste Receiving Facility (WRF) needed prior to beginning B/BX/BY retrievals (2035).
- T-Complex WRF needed prior to beginning T/TX/TY retrievals (2044).
- One SST retrieval per area until 2045 and then 2 per area.

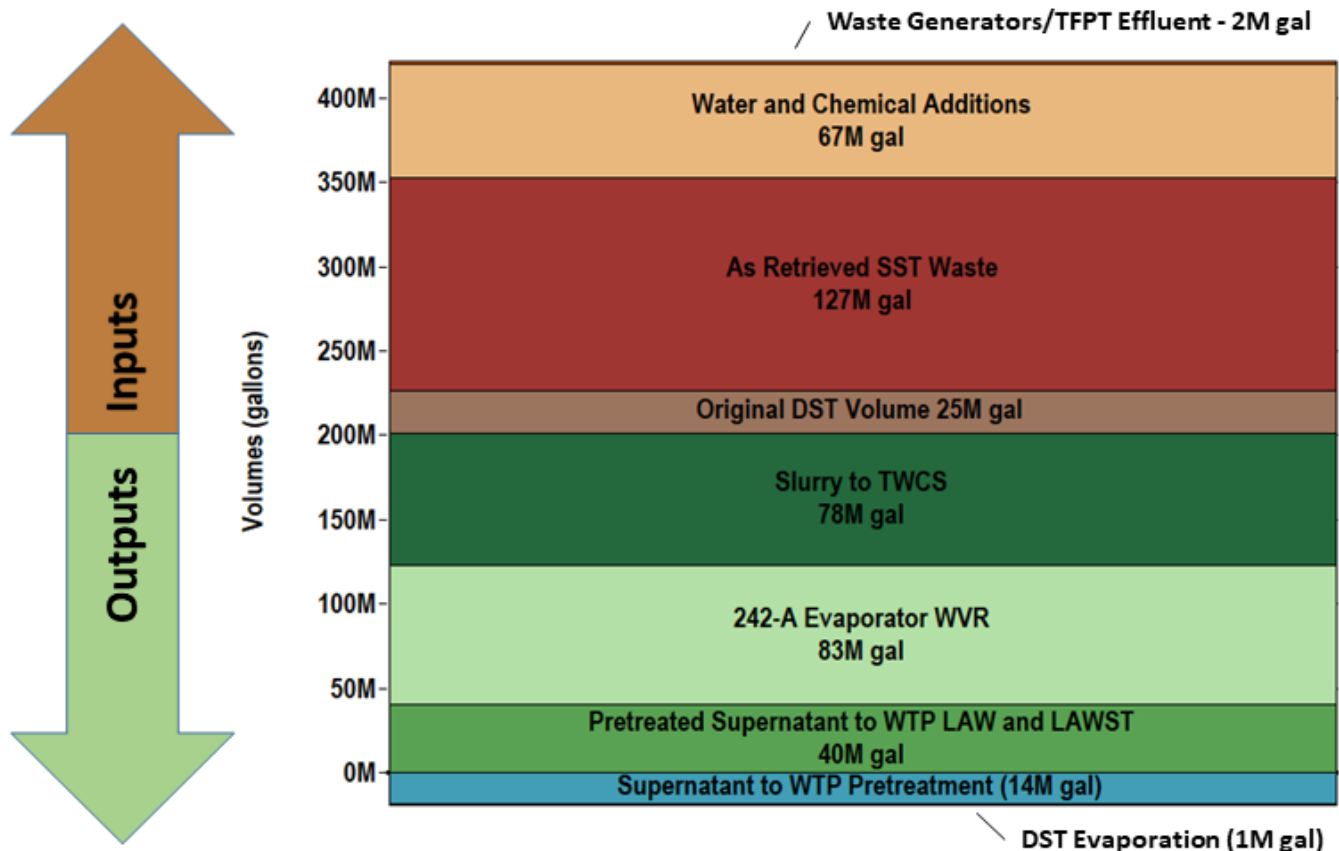






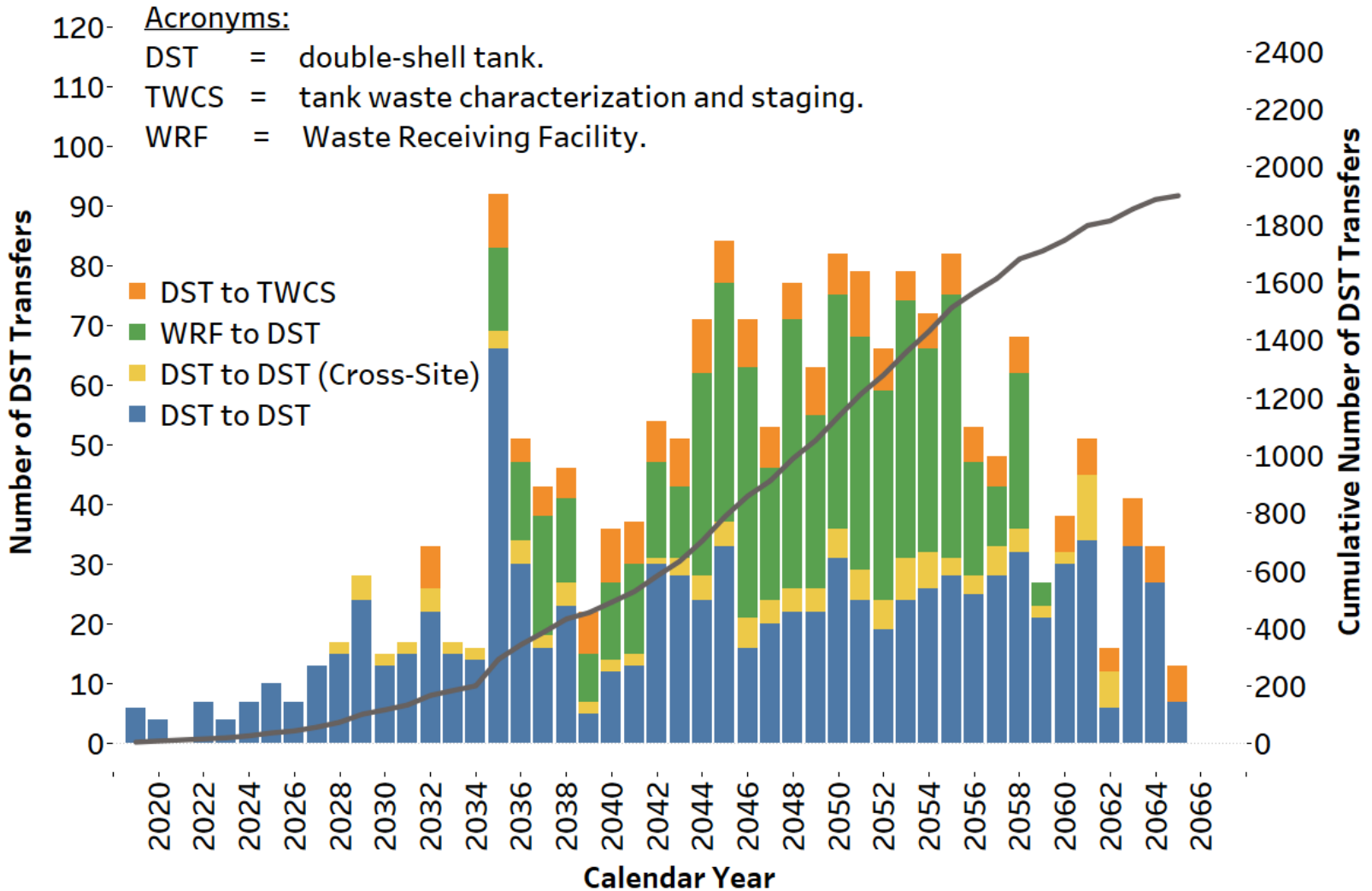
# DST Inputs & Outputs

- 242-A evaporation and treatment are necessary to balance inputs and outputs to/from the DSTs.

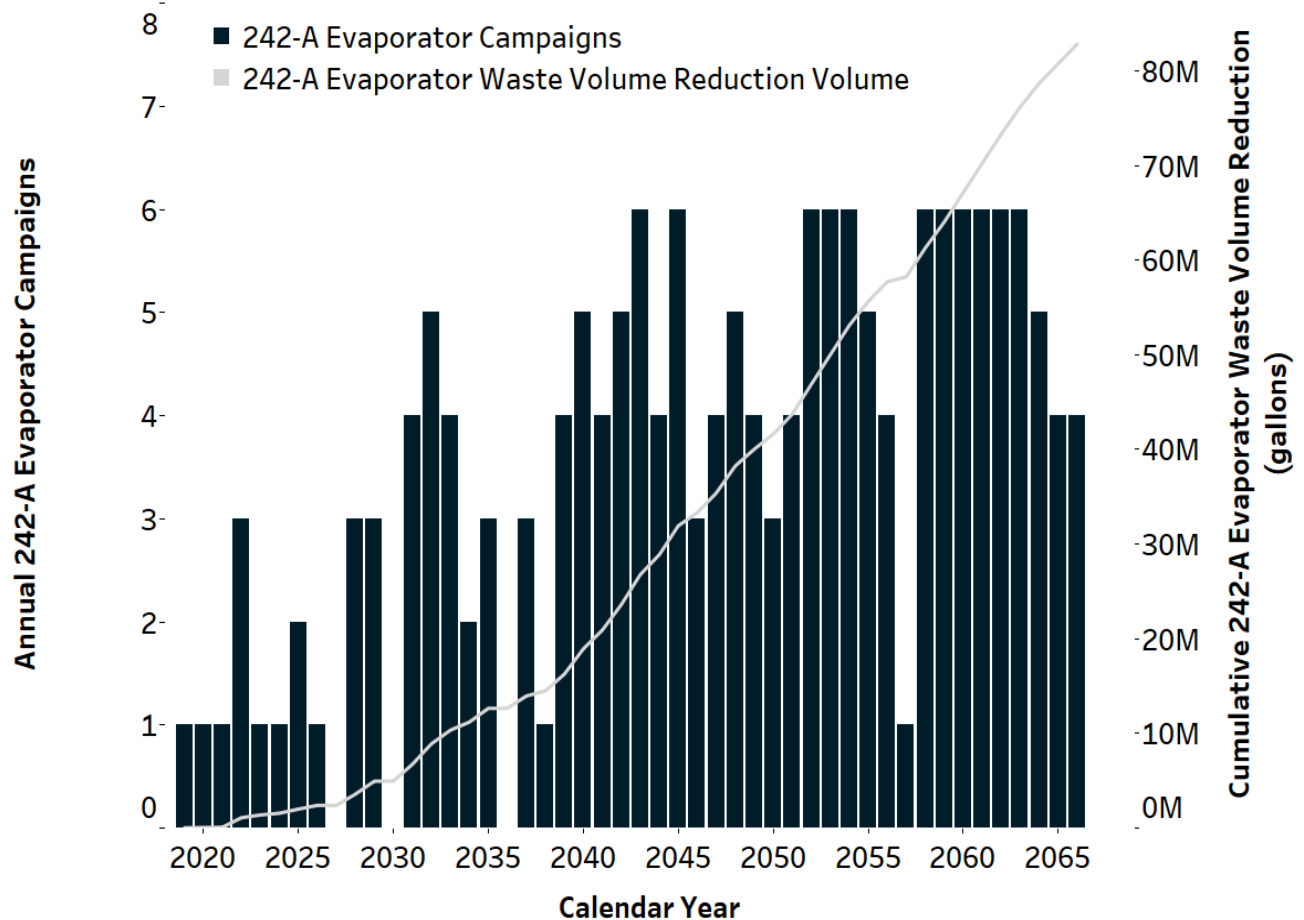


**Acronyms**

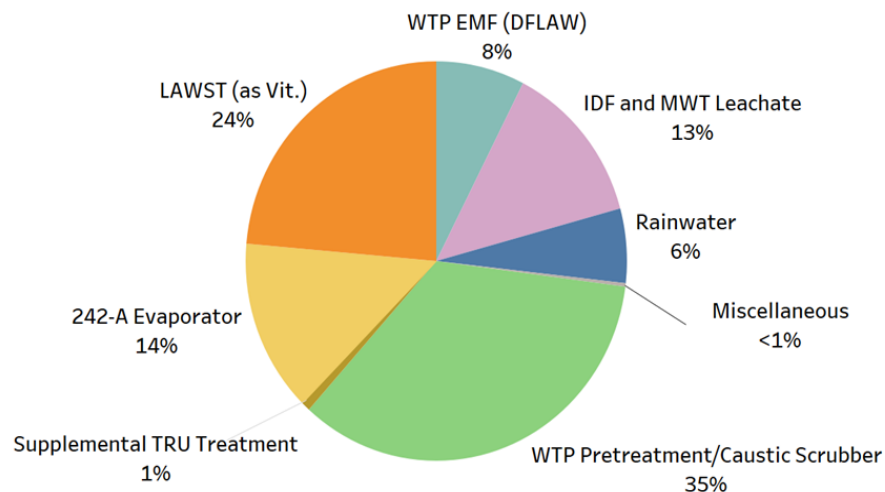
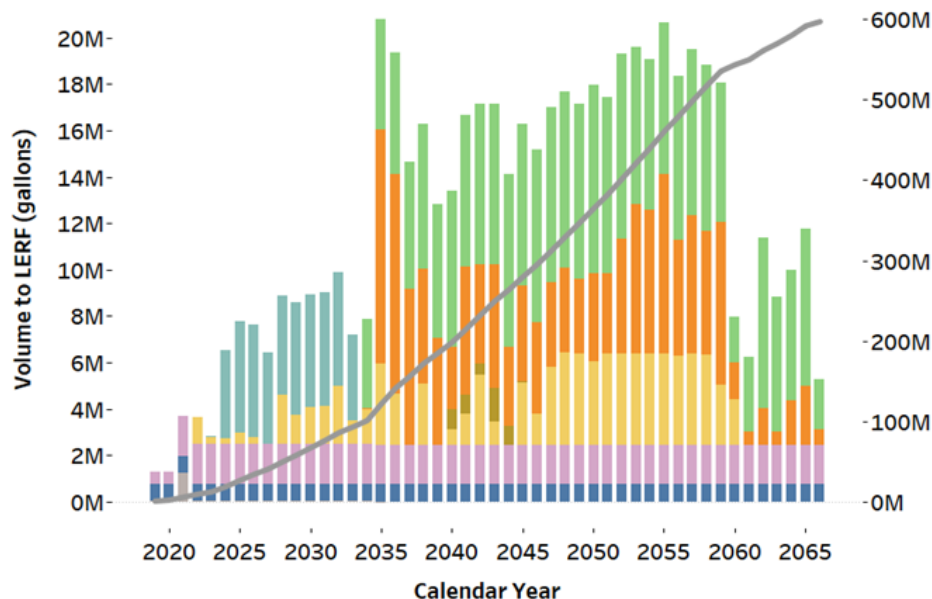
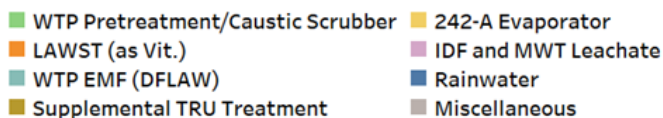
TFPT Tank Farm Pretreatment  
 WVR Waste Volume Reduction



- 242-A Evaporator is in high demand throughout the mission, concentrating dilute waste from SST retrievals and returns from TSCR.
- Limited to 6 campaigns per year compared to SP8 which had a maximum of 17 in a single year.
- Less aggressive operation compared with SP8 which had ~206 Mgal of feed compared to 123 Mgal in SP9.



- The Effluent Treatment Facility (ETF) processes ~600 Mgal of effluent over the mission.
- LAWST and WTP PT contribute the largest percentage.

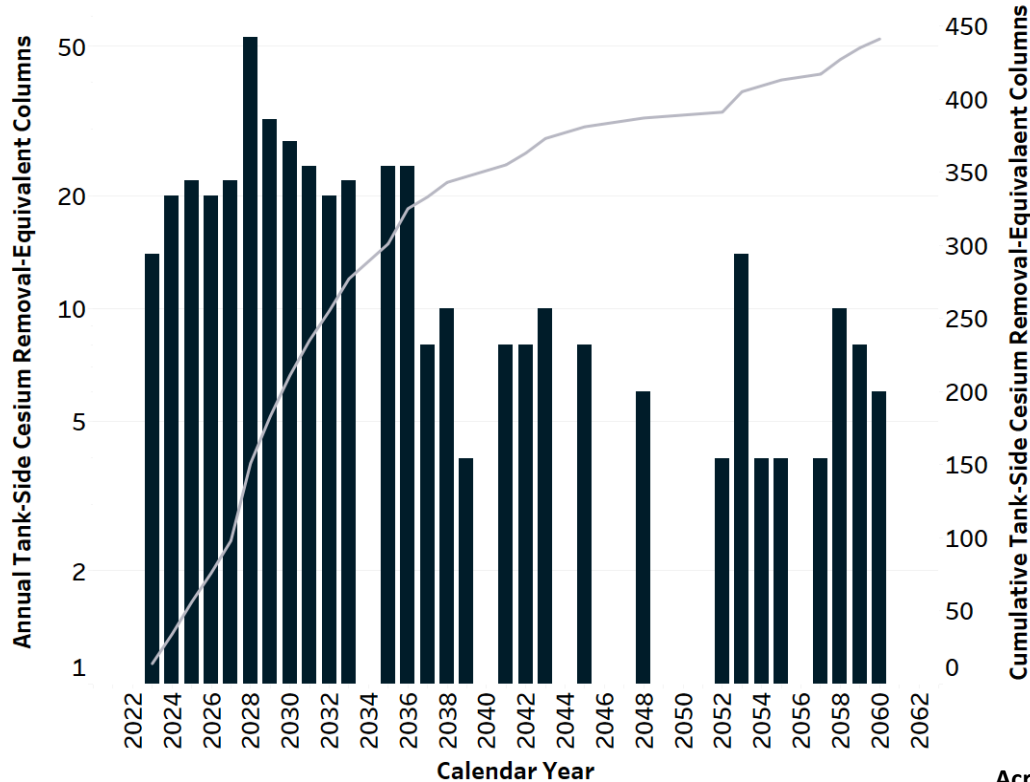


- 3.7 Mal/year currently.
- Increases to ~8 Mgal/year during Direct-Feed Low-Activity Waste (DFLAW).
- Increases to ~17 Mgal/year during full WTP/LAWST operations.

**Acronyms**

EMF	Effluent Treatment Facility
IDF	Integrated Disposal Facility
LAWST	LAW Supplemental Treatment
LERF	Liquid Effluent Retention Facility
MWT	Mixed Waste Trench
TRU	Transuranic

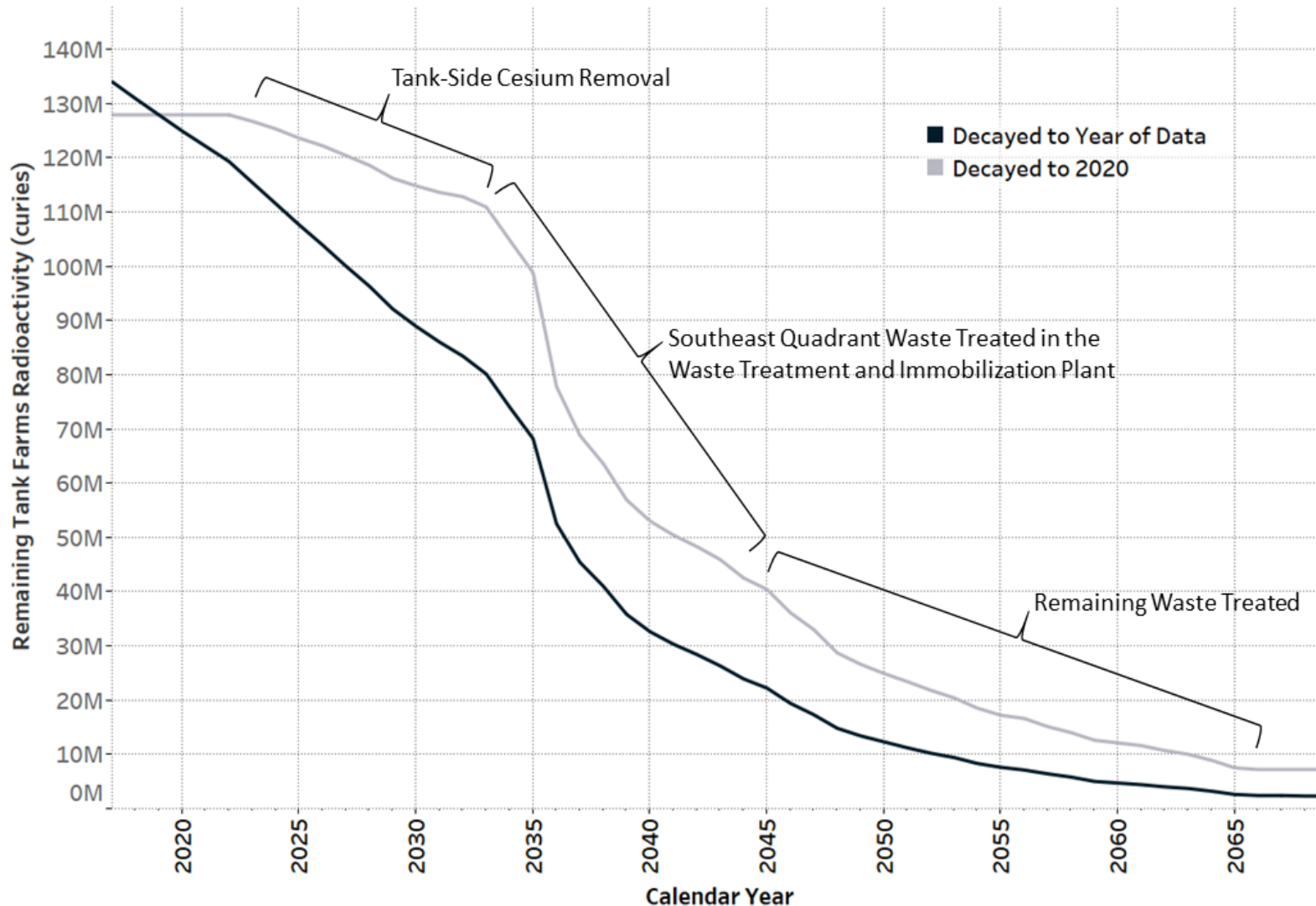
- 277 columns are projected to be used during 10 years of DFLAW.
- 441 columns are used for the full mission.

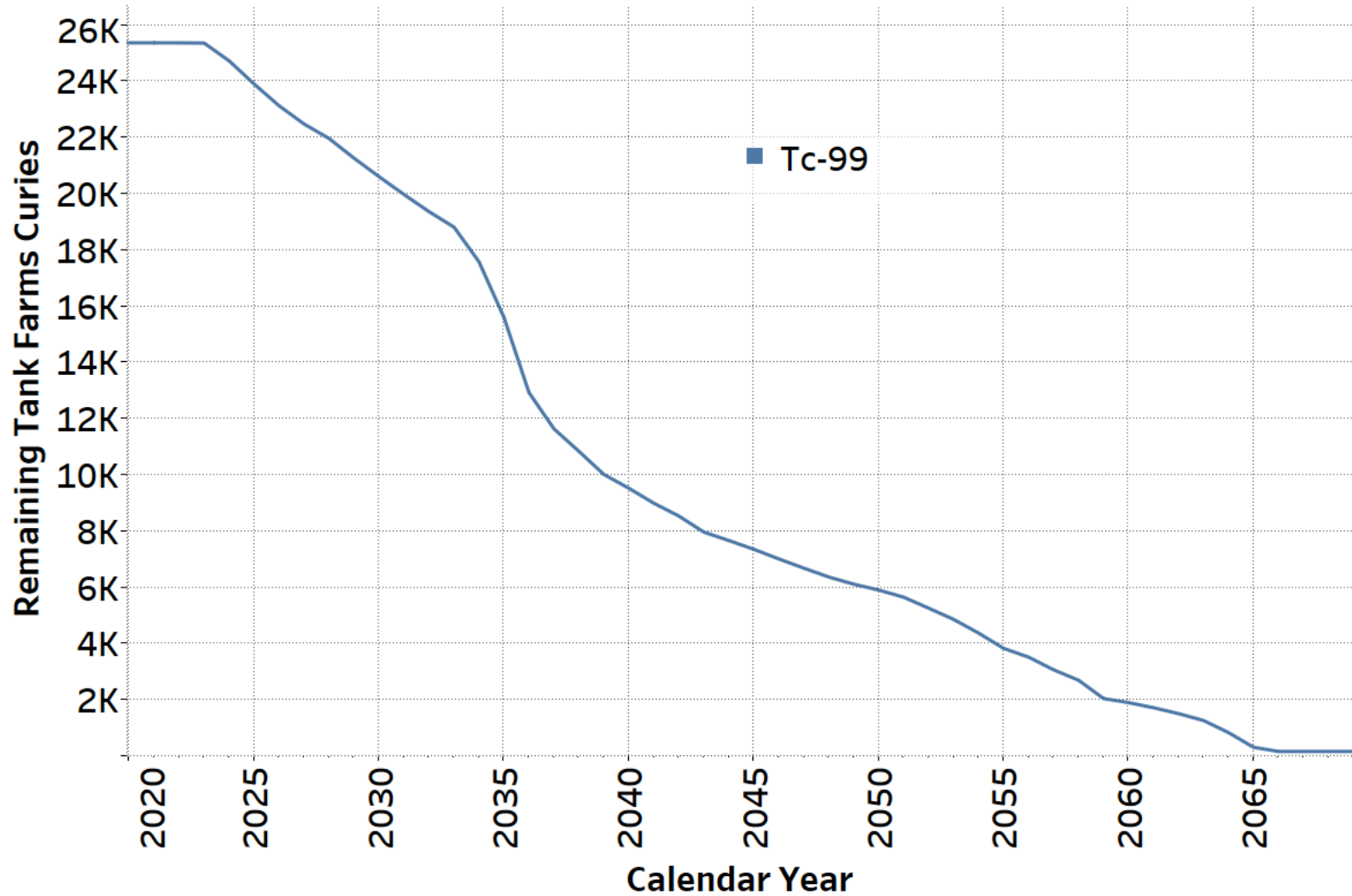


**Acronyms**

DFLAW	Direct-Feed Low-Activity Waste
IX	Ion Exchange
TFPT	Tank Farm Pretreatment
TSCR	Tank-Side Cesium Removal

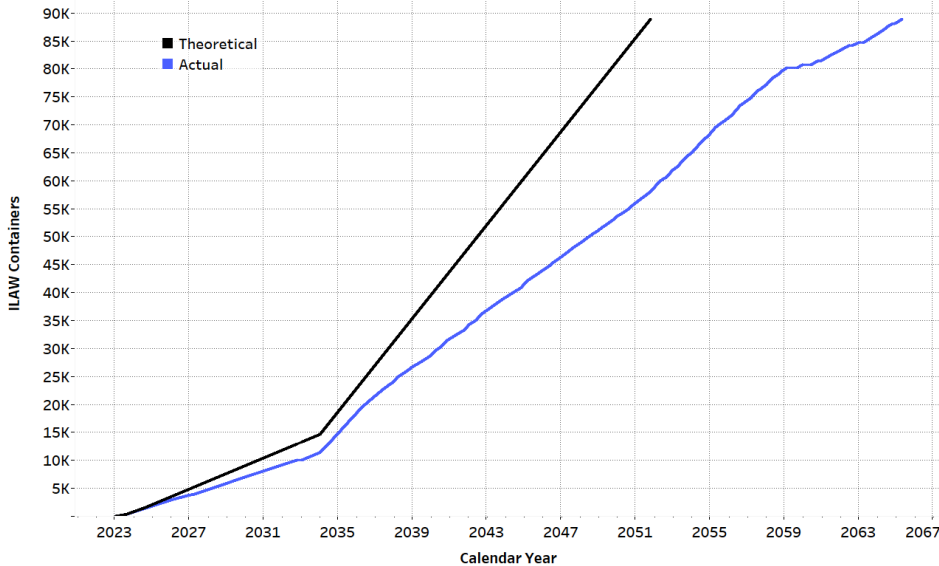
# Tank Farms Risk Reduction – Total Curies



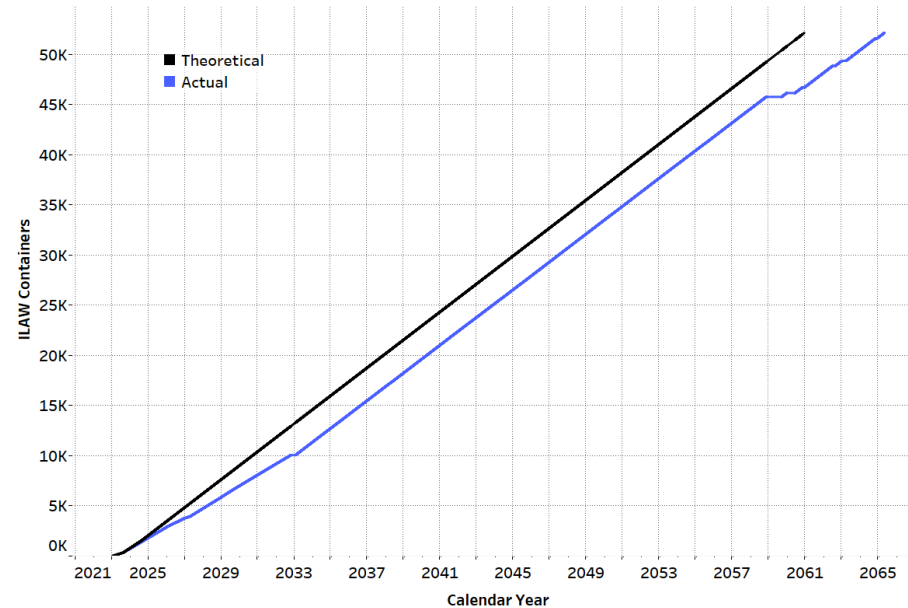


- Total of 88,900 containers with an average of 21% Na<sub>2</sub>O loading.
- LAWST makes up ~41% of the total ILAW (4 LAWST melters at 70%).
- ILAW production limited by dilute feed during DFLAW .
- DST retrieval constraints impact LAW feed after 2059.

**Combined LAWST & WTP LAW  
(63 MTG/day)**

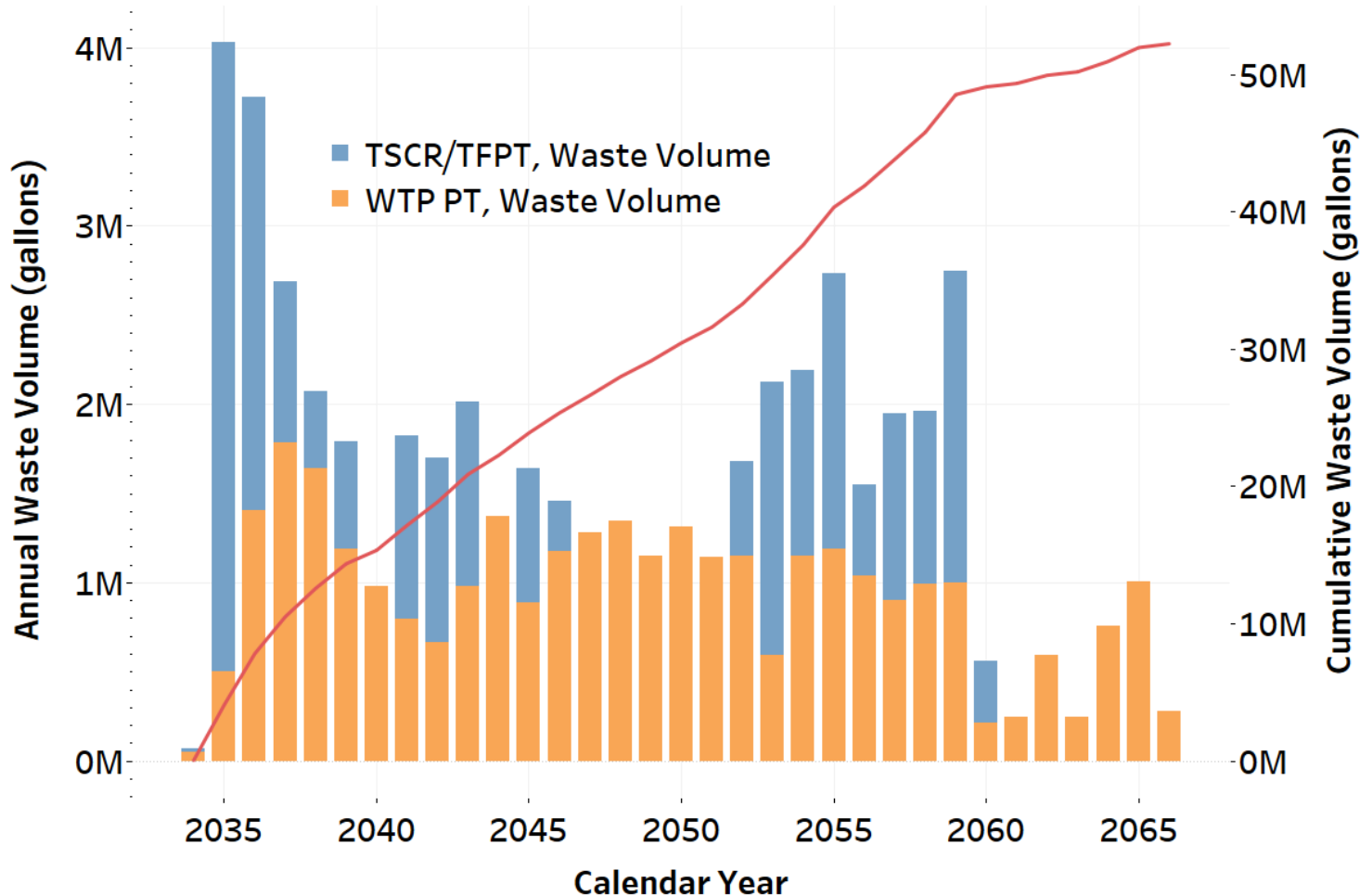


**WTP LAW Only  
(21 MTG/day)**

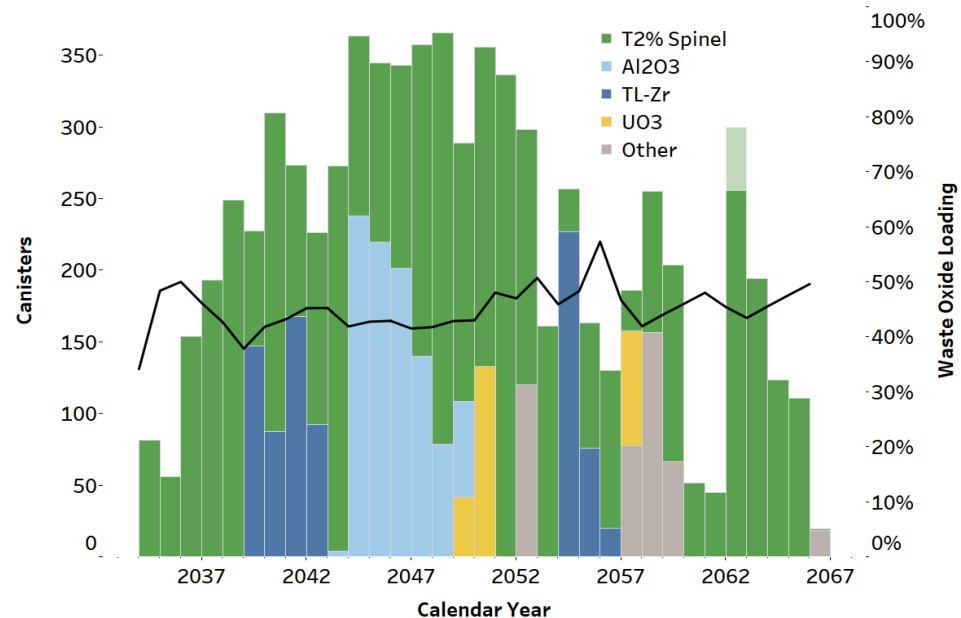
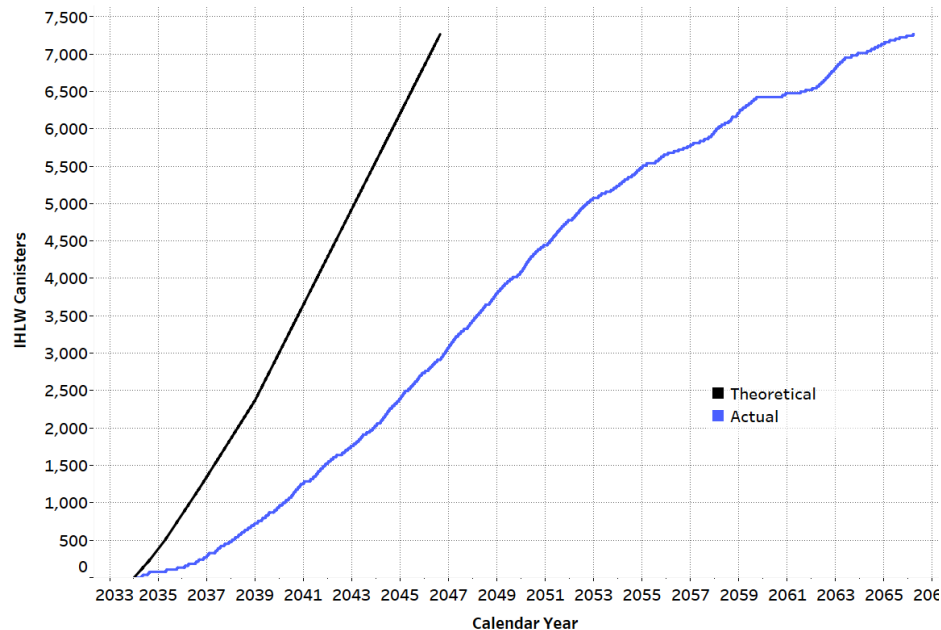




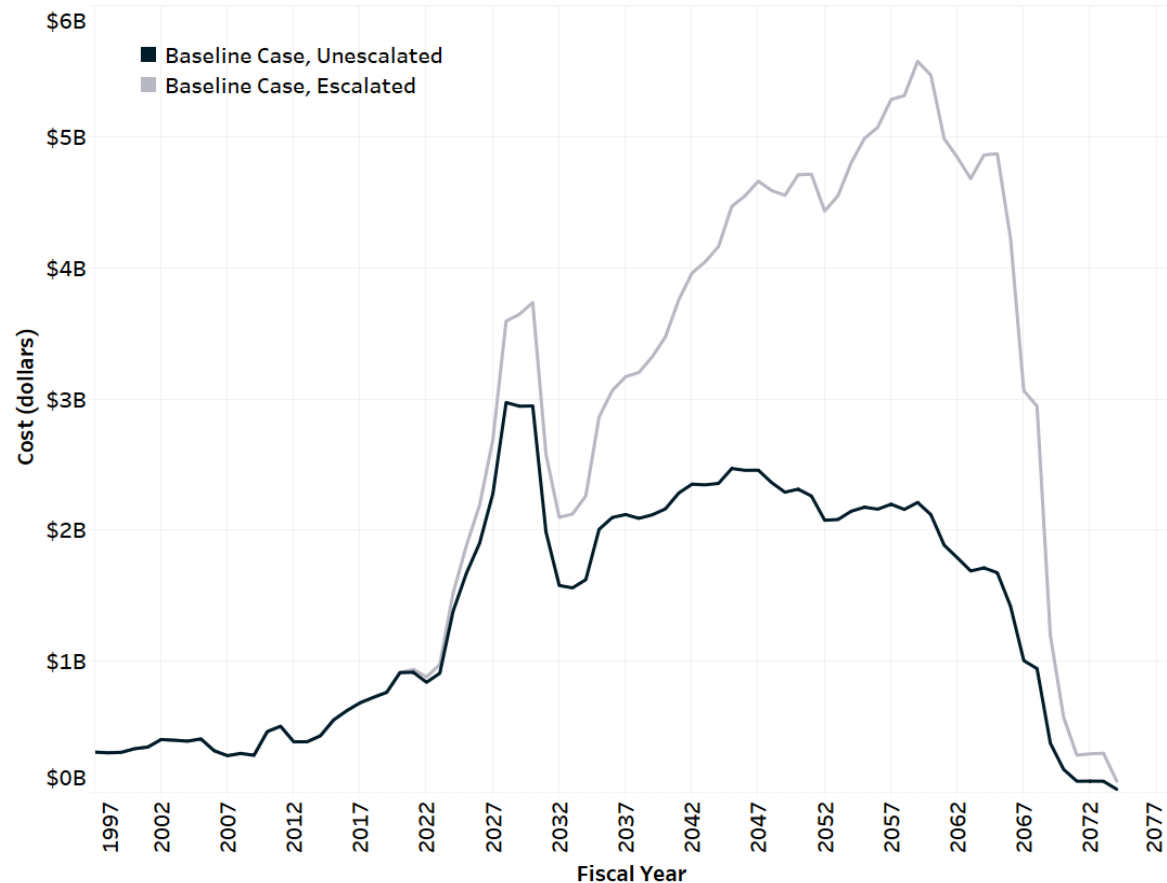
- LAWST processes 52 Mgal of supernatant waste



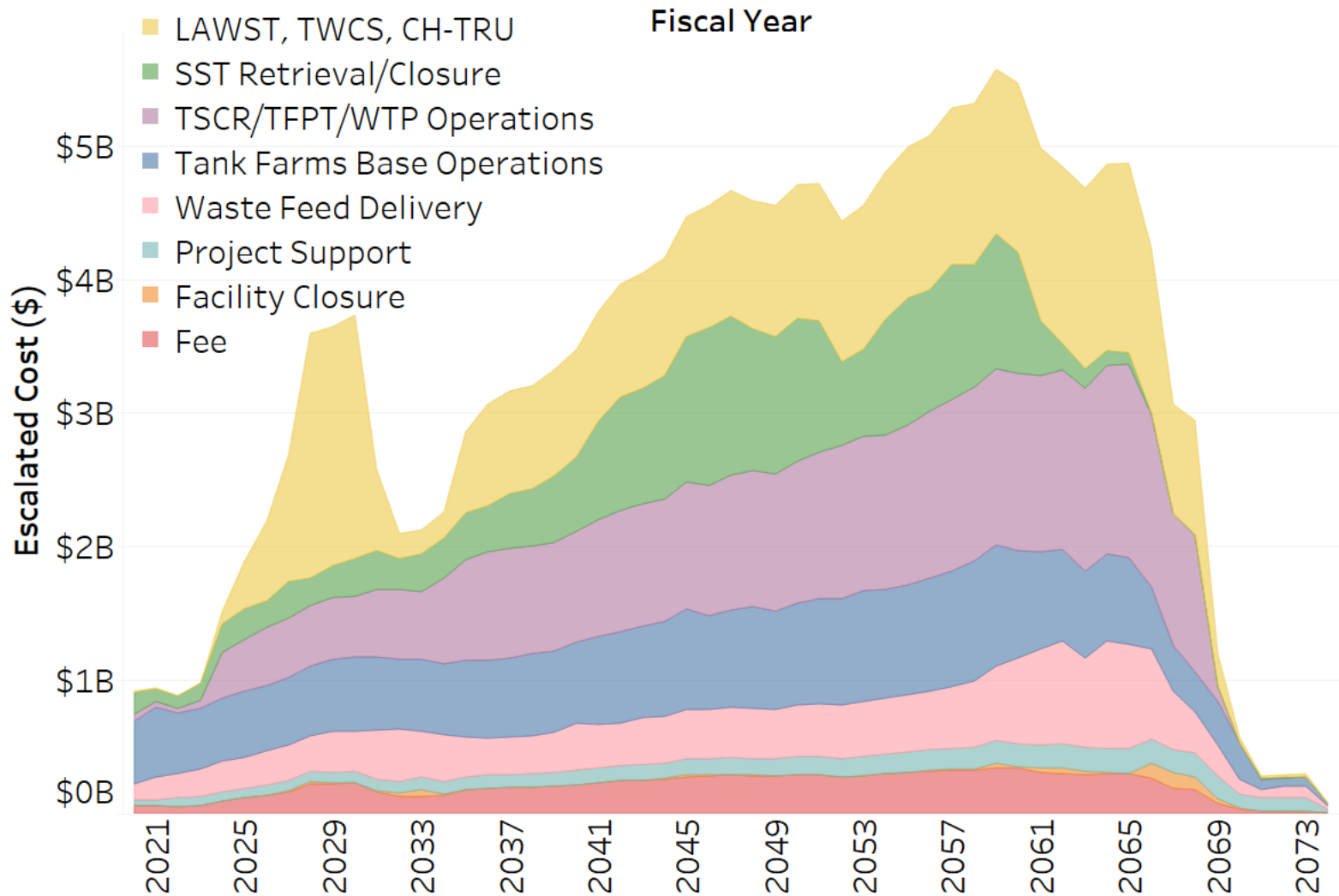
- Total of 7,300 IHLW canisters with an average 44% WOL.
- Average production achieved was 2.0 metrics tons of glass (MTG)/day versus theoretical 5.25 MTG/day (average over the years 2038-2059).
- May be feasible to operate HLW vitrification with a single melter.
- IHLW production is primarily limited by the PT throughput.



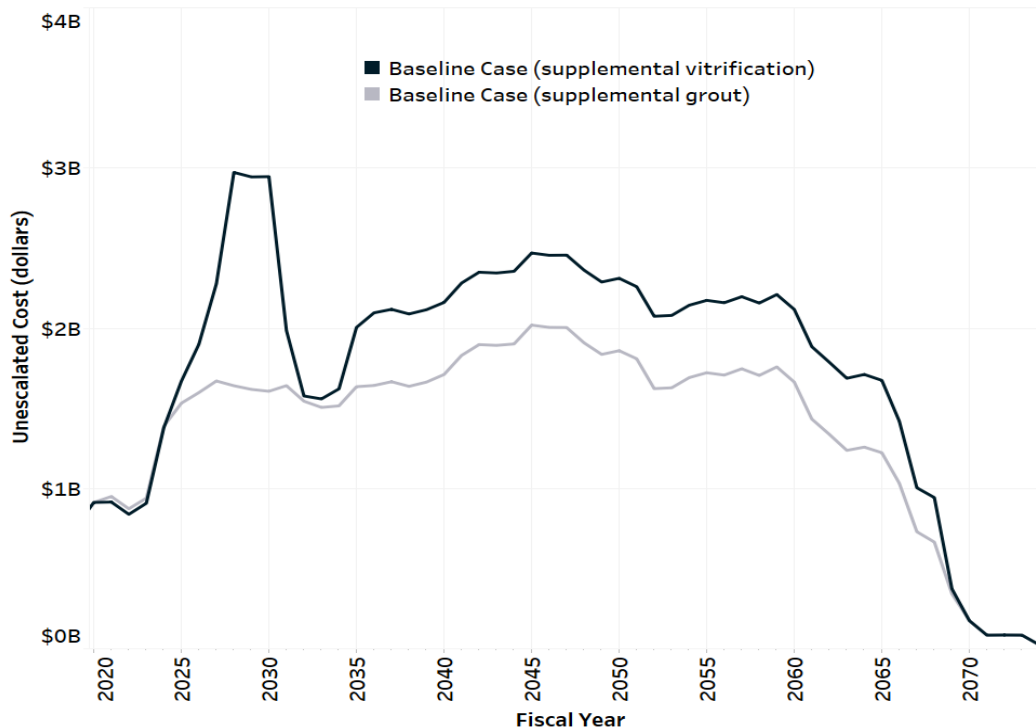
- The total lifecycle cost is \$107B (\$192B escalated).
- Does not include:
  - WTP Construction
  - HLW/TRU Disposal
  - DOE-RL/Plateau Cleanup



# Lifecycle Cost Breakdown



- \$20B reduction to lifecycle cost estimated when LAWST facility is grout.
  - \$600M construction vs. \$6B, eliminates peak near 2030.
  - Additional reductions in operations costs.



- More realistic assumptions regarding the 242-A Evaporator and SST/DST retrievals increased the mission length compared to SP8.
  - 5 year extension to SST retrievals.
  - 7 year extension to 242-A Evaporator operations.
  - 3 year extension to waste/secondary effluent treatment.
- HLW Pretreatment is the rate-determining step.
  - HLW Vitrification unable to achieve assumed throughput.
  - LAWST is sized large enough to prevent LAW treatment from being rate-limiting (4 melter equivalents).
  - LAWST is needed soon after HLW treatment startup to prevent delays/bottlenecks from LAW treatment
- Increased mission duration results in increased lifecycle cost vs. SP8.
  - Utilizing grout for LAWST can substantially reduce the lifecycle cost.