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SEP 2 5 2019

19-MIO-0020

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Ms. Smith:

REQUEST FOR CONCURRENCE ON SELECTED SCENARIOS FOR THE RIVER PROTECTION PROJECT SYSTEM PLAN, REVISION 9

The U.S. Department of Energy (DOE), Office of River Protection requests your concurrence on the jointly developed attachment as partial fulfillment of milestone M-062-40, of the Tri-Party Agreement. The milestone requests that "One year prior to the issuance of the System Plan, DOE and Ecology will each select the scenarios (including underlying common and scenario specific assumptions) that will be analyzed in the System Plan, with DOE and Ecology each having the right to select a minimum of three scenarios each."

With no substantive changes since the last System Plan, the results of the Scenario 6 compliant case, are still valid and will not be repeated in revision 9.

If you have any questions, please contact me or your staff may contact Kaylin Burnett, Mission Planning and Analysis, Mission Integration Office, at (509) 372-0622.

Brian T. Vance
Manager

MIO:KWB

Attachment

cc w/attach:
J. Lyons, Ecology
D. McDonald, Ecology
TPA Administrative Record

ATTACHMENT

19-MIO-0020

SELECTED SCENARIOS FOR THE RIVER PROTECTION PROJECT SYSTEM PLAN, REVISION 9

48 pages (including cover page)

EXECUTIVE SUMMARY

PARTIAL COMPLETION OF HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER (TRI-PARTY AGREEMENT) INTERIM MILESTONE M-62-040

The U.S. Department of Energy (DOE), Office of River Protection (ORP) and Washington State Department of Ecology (Ecology) are submitting the attached, *Selected Scenarios for the River Protection Project System Plan, Revision 9,* in fulfillment of the criteria established by milestone M-62-040. "One year prior to the issuance of the System Plan, DOE and Ecology will each select the scenarios (including underlying common and scenario specific assumptions) that will be analyzed in the System Plan, with DOE and Ecology each having the right to select a minimum of three scenarios each."

The attached plan is a result of joint efforts by members of both ORP and Ecology to provide a broad set of scenarios to inform future decision makers regarding the potential outcomes for the waste currently stored at Hanford. In addition to the Base Case, five other scenarios were proposed and are described in the attached plan.

ORP and Ecology expect continued open dialogue as scenarios are modeled to increase a common understanding of the mission.

Brian T. Vance, Manager
Office of River Protection

Alexandra K. Smith
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Washington State Department of Ecology

RPP-RPT-61707
Rev. 0

Selected Scenarios for the River Protection Project System Plan, Revision 9

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Washington River Protection Solutions, LLC

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TERMS

CH-TRU	contact-handled transuranic[1]
CWC	Central Waste Complex
DFHLW	direct-feed high-level waste
DFLAW	direct-feed low-activity waste
DOE	U.S. Department of Energy
DST	double-shell tank
Ecology	Washington State Department of Ecology
EMF	Effluent Management Facility
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration and Disposal Facility
ETF	Effluent Treatment Facility
GFM	glass formulation model
HLW	high-level waste
HSF	Hanford Shipping Facility
IDF	Integrated Disposal Facility
IHS	Interim Hanford Storage
kgal	kilo gallons
LAW	low-activity waste
LERF	Liquid Effluent Retention Facility
M	molar
Mgal	million gallons
MTG	metric tons of glass
MYOP	Multi-Year Operating Plan (WRPS-1801991, "WRPS Multi-Year Operating Plan, Revision 7, FY 2019 – FY 2024")[2]
NEPA	National Environmental Policy Act
ORP	Office of River Protection
PT	Pretreatment (Facility)
RPP	River Protection Project
SALDS	State-Approved Land Disposal Site
SP6	System Plan, Revision 6 (ORP-11242, Rev. 6, *River Protection Project System Plan*)
SP7	System Plan, Revision 7 (ORP-11242, Rev. 7)
SP8	System Plan, Revision 8 (ORP-11242, Rev. 8)

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[1] As defined in the Waste Isolation Pilot Plant *Land Withdrawal Act* [Public Law (P.L.) 102-579], as amended by P.L. 104-201.

[2] Revision 8 of the MYOP is in process, and once released, will be used in the modeling of the scenarios in ORP-11242 (System Plan, Revision 9).

SP9	System Plan, Revision 9 (ORP-11242, Rev. 9)
SST	single-shell tank
TBD	to be determined
TFPT	tank farm pretreatment
TOE	total operating efficiency
TPA	Tri-Party Agreement
TSCR	tank-side cesium removal
TWCS	tank waste characterization and staging
WAC	waste acceptance criteria
WRF	Waste Receiving Facility
WRPS	Washington River Protection Solutions, LLC
WTP	Hanford Waste Treatment and Immobilization Plant

1.0 INTRODUCTION

The *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989), also known as the Tri-Party Agreement (TPA), is a comprehensive cleanup and compliance agreement between the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology). It defines commitments and milestones for cleanup of the Hanford Nuclear Site, in Southeast Washington State.

Milestone M-062-40 of the TPA requires submission of a System Plan to Ecology describing the disposition of all tank waste managed by DOE Office of River Protection (ORP). The milestone requires that every three years (beginning October 31, 2010), the plan is updated to document any further optimization of retrieval and waste treatment capabilities to, in the case of SST retrievals, complete such retrievals as quickly as is technically feasible (but not later than the date established in Milestone M-045-70), and, in the case of tank waste treatment, complete such treatment as quickly as is technically feasible (but not later than the date established in Milestone M-062-00), both with and without consideration of (i) whether such further optimization would be excessively difficult or expensive within the context of such activities, and, (ii) any impact on the overall cleanup mission. Each System Plan includes analyses of scenarios selected by DOE and Ecology. The purpose of this paper is to document the scenarios selected for inclusion in ORP-11242, *River Protection Project System Plan*, Rev. 9, hereinafter referred to as SP9.

1.1 SCOPE

Milestone M-062-40 describes the requirements for the System Plan, including content requirements and due dates. One year prior to the issuance of the System Plan, DOE and Ecology each select the scenarios (including underlying common and scenario-specific assumptions) that will be analyzed in the System Plan, with DOE and Ecology each having the right to select a minimum of three scenarios each.

The objective of the System Plan process is to promote mutual understanding between Ecology and DOE of the issues, risks, and uncertainties surrounding the River Protection Project (RPP) mission in order to lay the foundation for future TPA negotiations. Over several months, personnel from Ecology, DOE, and Washington River Protection Solutions, LLC (WRPS), met on a regular basis to develop the scenarios to be presented in SP9. The strategy employed in this revision includes:

- Establishing a Baseline Case that reflects the best estimate of how the mission is thought to proceed given current conditions, constraints, and assumptions (Scenario 1).
- Defining alternative scenarios that address known risks and uncertainties to compare to the Baseline Case and understand the impacts to the mission (Scenario 5).
- Defining alternative scenarios that analyze initiatives to reduce risk, accelerate retrieval/treatment completion, or improve mission cost/performance over the Baseline Case (Scenarios 2, 3, and 4).

Five scenarios (see Table 1) and their basic assumptions were developed, reviewed, and finalized. Additionally, several sensitivity cases were identified, which seek to understand the impacts of changes to specific assumptions within the primary five scenarios. DOE selected Scenario 1, and all other scenarios and sensitivity cases were selected by Ecology.

Table 1. Primary Scenarios for System Plan, Revision 9.

Scenario #	Selected By	Scenario Name
Scenario 1*	DOE	Baseline Case
Scenario 2*	Ecology	Treatment-Favored Direct-Feed Low-Activity Waste/Direct-Feed High-Level Waste with Early Characterization in Double-Shell Tanks[3]
Scenario 3*	Ecology	Treatment-Favored Direct-Feed Low-Activity Waste/Direct-Feed High-Level Waste with "Independent" High-Level Waste Sampling and Pretreatment Facility[3]
Scenario 4*	Ecology	Retrieval-Favored Direct-Feed Low-Activity Waste/Direct-Feed High-Level Waste with Early Characterization in Double-Shell Tanks and Add New Double-Shell Tanks[4]
Scenario 5	Ecology	Periodic Double-Shell Tank Failures

* Indicates that an additional sensitivity case(s) has been selected which includes a minor analysis of a variation to the primary case.

Note: Some of the activities described herein may be subject to and/or undergo an analysis required by the *National Environmental Policy Act* (42 U.S.C. § 4321, et seq; NEPA). Additionally, some of the technologies described herein may be subject to and/or undergo analysis under DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. They are included within this document for planning purposes only, not for decisional purposes, which would be conducted following any applicable NEPA and/or DOE O 413.3B processes.

1.2 TERMINOLOGY

Several concepts have been defined below to clarify the intent of the system planning process that will facilitate understanding the relationships between the selected scenarios. The following terminology and guidelines are being adopted for the purposes of SP9.

- **Scenario/Case** – A scenario/case is defined as a set of assumptions and/or success criteria intended to be used in the system planning process. Technical assumptions and/or success criteria are defined and used as input parameters for modeling or performing calculations. In the event a case does not meet the success criteria or other stated objectives, the reasons will be identified and documented, as appropriate.
- **Sensitivity Scenario/Case** – A sensitivity scenario/case is a secondary scenario/case (based off a primary scenario/case) in which limited model parameter(s) or sequence of events are altered in order to identify the impact of those changes relative to the primary scenario/case. Examples include increasing or decreasing expected Hanford Tank Waste Treatment and Immobilization Plant (WTP) melter capacities or changing a glass formulation model (GFM).

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[3] "Treatment favored" means priority is given to treating waste over retrieving waste.

[4] "Retrieval favored" means priority is given to retrieving waste over treating waste.

A description of the objective and case-specific key assumptions for each scenario are presented in Section 2.0.

1.3 HIERARCHY OF ASSUMPTIONS

The assumptions used in the system planning effort form a hierarchy, from upper-level assumptions regarding the purpose and intent of a case, down to detailed modeling assumptions and programming techniques. The top tier of this hierarchy is established by this paper and is intended to satisfy the M-062-40 milestone for selecting the scenarios including the objective and key assumptions for each scenario. These two elements are:

- **Selected Scenarios** – This element includes the name and objective/purpose of each scenario as established and agreed to in this document.
- **Key Assumptions** – This element includes the underlying common (Baseline Case assumptions) and scenario-specific assumptions needed to define and distinguish each case in sufficient detail to begin to prepare detailed assumptions in the next steps following the agreement to the selected scenarios.

The next elements (to follow the "Selected Scenarios" process) are part of routine System Planning and Modeling efforts and are comprised of:

- **Detailed Modeling Assumptions** – Detailed base modeling assumptions are documented in the most current model/software requirements document. The scenario-specific assumptions will be developed using the most current Mission Analysis and Planning process and procedures. Additional detail is provided in Section 5.0, Methodology. This process provides adequate communication between the customer, subject matter expert, and the modeler to develop the detailed modeling assumptions needed to model or perform necessary calculations for each scenario.
- **Programming Techniques** – Programming techniques involve minor manipulations of the detailed elements of the model software necessary to ensure the model is able to meet the key and detailed modeling assumptions defined for each scenario.

1.4 BRIEF SYSTEM DESCRIPTIONS

The key assumptions presented in this document are organized into categories based on the aspect of the model to which they pertain. The assumptions defining each scenario are organized in a table by category. The categories are the same for each scenario (see the assumption tables in Section 2.0 and the scenario comparison table in Attachment A) and consist of the following:

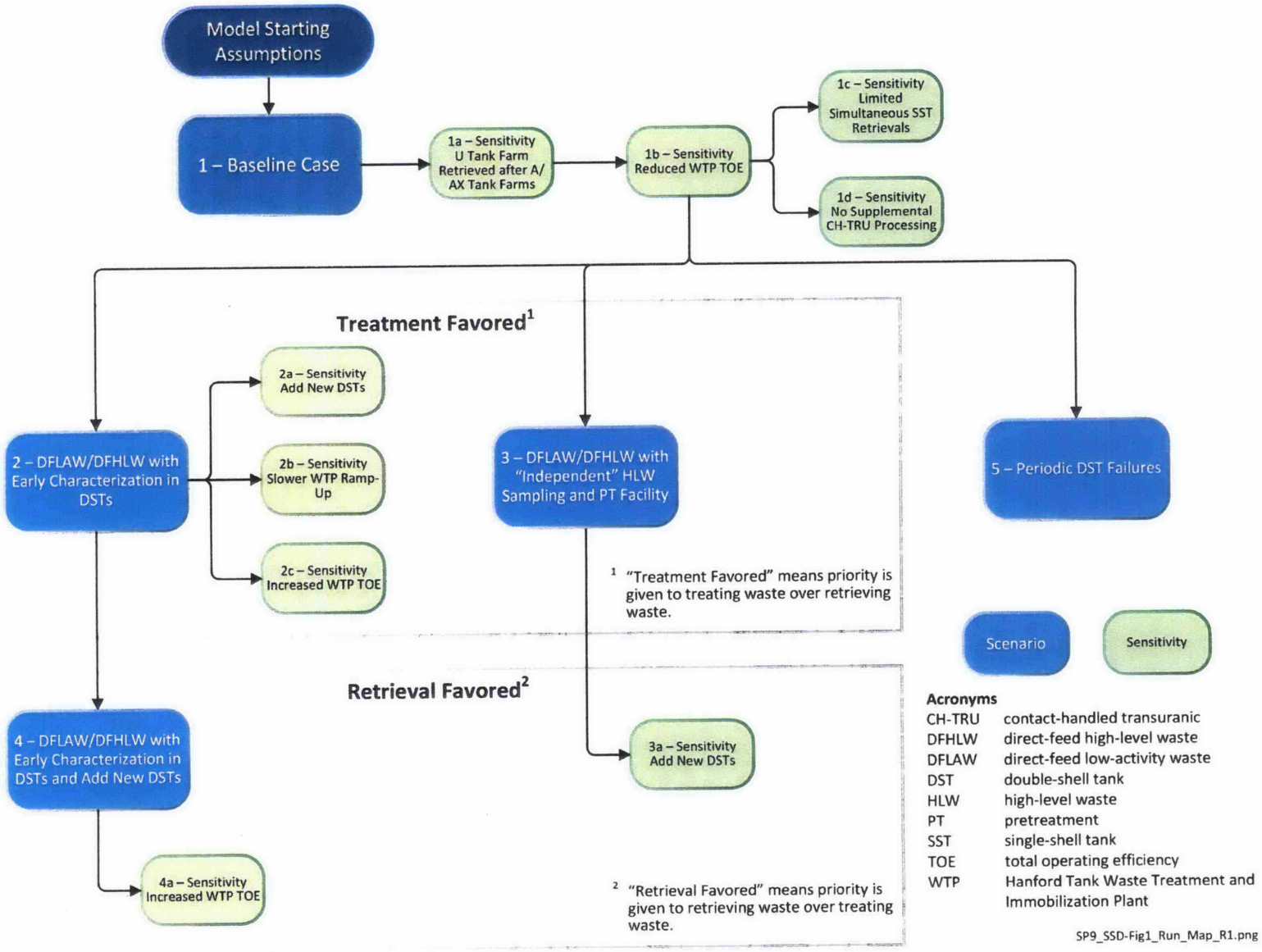
- **SST Retrievals** – Assumptions related to retrieving single-shell tanks (SST).
- **DST Operations** – Assumptions pertaining to the operation and configuration of double-shell tanks (DSTs), including identifying functionality performed by DSTs and mitigating actions associated with DSTs.
- **242-A Evaporator** – Assumptions related to operating the 242-A Evaporator.
- **DFLAW** – Assumptions related to direct-feed low-activity waste (DFLAW) operations and associated facilities and capabilities.

- **WTP PT** – Assumptions pertaining to the start-up and operation of the WTP Pretreatment (PT) Facility.
- **WTP HLW** – Assumptions pertaining to the start-up and operation of the WTP High-Level Waste (HLW) Vitrification Facility.
- **WTP LAW** – Assumptions pertaining to the start-up and operation of the WTP Low-Activity Waste (LAW) Vitrification Facility.
- **CH-TRU** – Assumptions pertaining to the start-up and operation of a supplemental contact-handled transuranic (CH-TRU) waste processing facility that would receive waste from SSTs containing potential CH-TRU waste.
- **LERF/ETF** – Assumptions pertaining to routing effluents and associated operations performed by the Liquid Effluent Retention Facility (LERF)/Effluent Treatment Facility (ETF).
- **EMF** – Assumptions regarding the start-up and operation of the Effluent Management Facility (EMF) during DFLAW operations.
- **WRF** – Assumptions pertaining to the start-up and configuration of the Waste Receiving Facilities (WRF). The WRFs are future planned facilities that will assist in receiving waste retrieved from B- and T-Complex SSTs and sending it to DSTs.
- **TWCS Capability** – Assumptions pertaining to the start-up and operation of the tank waste characterization and staging (TWCS) capability. This capability is planned to stage HLW for feed to the WTP.
- **LAW Supplemental Treatment** – Assumptions regarding the start-up and operation of LAW supplemental treatment.
- **GFM** – Identification of the GFMs used to predict the resulting LAW and HLW glass loading and compositions based on waste feed delivered to the WTP.

2.0 SCENARIOS/CASES

The scenarios selected and defined for SP9 are summarized in this section. Figure 1 shows how each scenario/sensitivity case is related from the perspective of assumptions. In SP9, the analysis of sensitivity cases will focus on the impacts of their assumption changes on their parent scenarios, while the analysis of scenarios will include a comprehensive comparison to the Baseline Case. Additionally, cost analyses will not be performed for sensitivity cases, but will be provided for scenarios. The assumptions for each scenario and related sensitivity cases are provided in the following subsections. Attachment A provides a side-by-side comparison of the assumptions for each scenario.

Figure 1. The Relationships of System Plan, Revision 9, Scenarios.



2.1 SCENARIO 1 – BASELINE CASE

Objective: Evaluate the mission using current baseline plans and assumptions. See Figure 2 following the assumption list for a simplified flowsheet of the scenario.

System	Draft "Baseline Case" Key Assumptions
SST Retrievals	• Use A/AX Tank Farm Project and Multi-Year Operating Plan (MYOP)-based[5] schedule for early retrieval start dates and minimum retrieval durations • Retrieval volumes, chemical additions, and minimum durations consistent with RPP-PLAN-40145, *Single-Shell Tank Waste Retrieval Plan*, and associated spreadsheet SS-1647, Rev. 7, with the exception of A/AX Tank Farm • Start S/SX Tank Farms as the next retrievals after A/AX Tank Farms with the goal of continuity of SST retrievals • One retrieval at a time per area (200-East and 200-West), increasing to two simultaneous retrievals per area when needed (to maintain adequate feed to WTP) • 2-month delay between SST retrievals • Supernatant and slurry cross-site transfer lines available to support S/SX Tank Farm retrievals
DST Operations	• 1.265 Mgal of emergency space • Condition supernatant waste for DFLAW feed (Tanks AP-105, AP-106, AP-107) • Receive plant wash from DFLAW feed prep (Tank AP-108), approximately 10 kgal per campaign • Near-term transfers (and retrievals) shall be consistent with the MYOP process assumptions • Perform Group A mitigation of Tank SY-103 after A/AX Tank Farm retrievals and before beginning S/SX Tank Farm retrievals, and Tank AN-104 before accumulating retrieved solids in SY Tank Farm • Increase solids limit of Tanks SY-102 and SY-103 to 200 in when S/SX Tank Farm retrievals begin • DST heel retrieval durations based on Tank AY-102 (124 days), DST heel/final • DST retrievals limited to 2 simultaneous maximum per farm and shall not exceed 4 simultaneous maximum including SST retrievals
242-A Evaporator	• Support SST retrievals • 180-day continuous operational limit • Maximum of 6 campaigns per year • 90-day sampling time per campaign

DFLAW	The following assumptions support completion of LAW Hot Commissioning and Achieve Initial Plant Operations for the WTP as defined in the Amended Consent Decree[6], "Initial Plant Operations under this Decree is defined as, over a rolling period of at least 3 months leading to the milestone date [12/31/2036], operating the WTP to produce…low-activity waste glass at an average rate of at least 21 MTG/day."
	• **Tank-side cesium removal (TSCR) operational on 02/01/2023, operations consistent with 60% design basis**
	  o Feed from Tank AP-107, treated waste to Tank AP-106
	  o Non-elutable resin (crystalline silicotitanate)
	  o 5-year service life, after which an increased capacity will come online for the balance of DFLAW
	  o Continues operating after WTP PT Facility start-up to augment feed to LAW supplemental treatment, as needed
	• Shall have sufficient capacity to maintain WTP LAW Vitrification Facility production rates during DFLAW

WTP PT	The following assumptions support completion of the PT Facility Hot Commissioning and Achieve Initial Plant Operations for the WTP as defined in the Amended Consent Decree, "Initial Plant Operations under

[5] WRPS-1801991, "WRPS Multi-Year Operating Plan, Revision 7, FY 2019 – FY 2024," (referred to as the MYOP). Revision 8 of the MYOP is in process, and once released, will be used in the modeling of the scenarios in SP9.

[6] The "Consent Decree" collectively refers to the Consent Decree in Case No. 2:08-CV-05085-FVS (E.D. WA October 25, 2010), the Amended Consent Decree, Case No. 2:08-CV-05085-RMP (March 11, 2016), the Second Amended Consent Decree, Case No. 2:08-CV-05085-RMP (April 12, 2016), and the Third Amended Consent Decree, Case No. 2:08-CV-5085-RMP (October 12, 2018).

System	Draft "Baseline Case" Key Assumptions

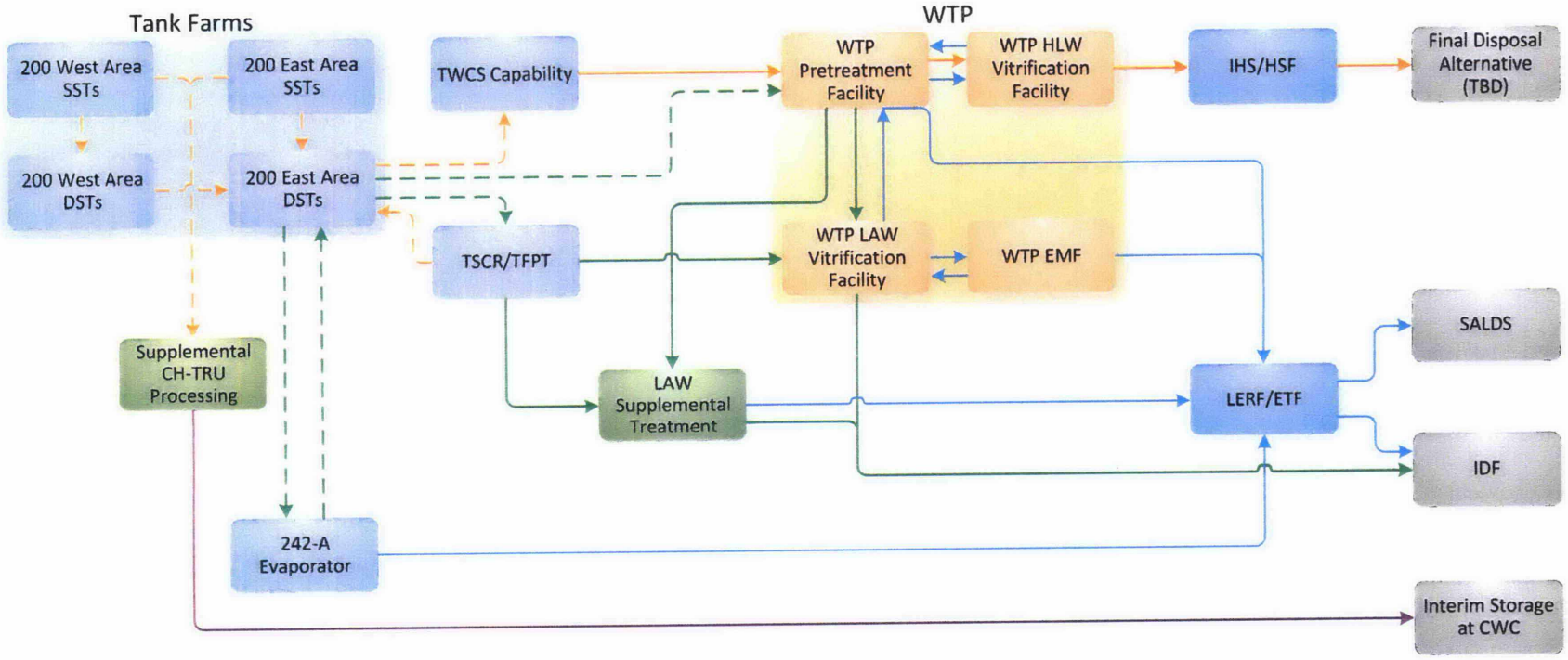
	this Decree is defined as, over a rolling period of at least 3 months leading to the milestone date [12/31/2036], operating the WTP to produce high-level waste glass at an average rate of at least 4.2 Metric Tons of Glass (MTG)/day, and low-activity waste glass at an average rate of at least 21 MTG/day."
	• **Operational by 12/31/2033**
	  o 70% total operating efficiency (TOE)
	  o Feeds from TWCS capability (HLW) and DSTs (LAW)
	  o Feeds WTP LAW and HLW Vitrification Facilities and LAW supplemental treatment
	  o Handles recycle of secondary liquid waste from LAW and HLW

WTP HLW	The following assumptions support completion of HLW Construction Substantially Complete, HLW Hot Commissioning Complete, and Achieve Initial Plant Operations for the WTP as defined in the Amended Consent Decree, "Initial Plant Operations under this Decree is defined as, over a rolling period of at least 3 months leading to the milestone date [12/31/2036], operating the WTP to produce high-level waste glass at an average rate of at least 4.2 Metric Tons of Glass (MTG)/day..."
	• **Construction substantially complete by 12/31/2030**
	• **Operational on 12/31/2033**
	• Ramp-up (70% TOE)
	  12/31/**2033** 3.0 MTG/day
	  12/31/**2034** 4.0 MTG/day
	  09/30/**2036** 4.2 MTG/day
	  12/31/**2038** 5.25 MTG/day (2nd generation melters)

WTP LAW	The following assumptions support completion of LAW Hot Commissioning and Achieve Initial Plant Operations for the WTP as defined in the Amended Consent Decree, "Initial Plant Operations under this Decree is defined as, over a rolling period of at least 3 months leading to the milestone date [12/31/2036], operating the WTP to produce…low-activity waste glass at an average rate of at least 21 MTG/day."
	• **Operational on 12/31/2023**
	• Ramp-up (hot commissioning will not specifically be modeled) (70% TOE)
	  12/31/**2023** 9.0 MTG/day
	  07/31/**2024** 18.0 MTG/day
	  07/31/**2025** 21.0 MTG/day

CH-TRU	• CH-TRU operational after full WTP operations. Exact date to be determined based on budget constraint analysis, since budget is the only constraint that affects the start date.
LERF/ETF	• Upgrades to treat variable secondary liquid wastes (242-A Evaporator condensate, Integrated Disposal Facility [IDF] leachate, Environmental Restoration and Disposal Facility [ERDF] leachate, EMF/WTP condensates, and caustic scrubber) • Fed continuously (cannot cause upstream delays) • Secondary solid waste (as powder, treated brine, and cast stone) to IDF
EMF	• 100% recycle of concentrate to LAW feed (100 kgal space reserved in Tank AP-102 for emergency returns) • Dynamic batching to minimize variability in glass loading • Caustic scrubber by-pass directly to LERF/ETF • Only operates during DFLAW
WRFs	• WRFs available 6 months before needed. Exact date to be determined by modeling, based on DST space available to start retrievals in B and T Complexes. • Six 150-kgal tanks
TWCS Capability	• **Operational 06/30/2032** (18 months prior to completion of HLW hot commissioning) • Stage, mix, and sample waste to meet WTP PT Facility waste acceptance criteria (WAC) (190-day sampling time) • Six 500-kgal tanks
LAW Supplemental Treatment	• **Operational 12/31/2034**, so as not to limit HLW throughput (based on System Plan, Rev. 8 [SP8] analysis) • 4-melter-equivalent capacity (42 MTG/day) (initial estimate will be sized so LAW treatment does not limit the mission) • Assumed to be a vitrification facility for cost purposes
GFM	• DOE 2016 LAW Glass Model (PNNL-25835, *2016 Update of Hanford Glass Property Models and Constraints for Use in Estimating the Glass Mass to be Produced at Hanford by Implementing Current Enhanced Glass Formulation Efforts*) • DOE 2016 HLW Glass Model (PNNL-25835)

Figure 2. Scenario 1 Simplified Flowsheet.



Legend

Streams

- Supernate
- Slurry
- Treated LAW/ILAW
- Treated HLW/IHLW
- Secondary Effluent/Offgas
- CH-TRU (Potential)

Systems

- Tank Farms
- WTP
- Supp. Treatment
- Other

Acronyms

CH-TRU	contact-handled transuranic
CWC	Central Waste Complex
DST	double-shell tank
EMF	Effluent Management Facility
ETF	Effluent Treatment Facility
HLW	high-level waste
HSF	Hanford Shipping Facility
IDF	Integrated Disposal Facility
IHS	Interim Hanford Storage
LAW	low-activity waste
LERF	Liquid Effluent Retention Facility
SALDS	state-approved land disposal site
SST	single-shell tank
TBD	to be determined
TSCR	tank-side cesium removal
TFPT	tank farm pretreatment
TWCS	tank waste characterization and staging
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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

SP9_SSD-Fig2_BaselineCase_R1.png

2.2 SCENARIO 1A – BASELINE CASE SENSITIVITY – U TANK FARM RETRIEVED AFTER A/AX TANK FARMS

Objective: Determine the impact to the Baseline Case (specifically, DFLAW feed) when U Tank Farm is retrieved after A/AX Tank Farms instead of S/SX Tank Farms.

System	Scenario 1a Key Assumptions (where Different from Scenario 1)
SST Retrievals	• Start U Tank Farm as the next retrievals after A/AX Tank Farms with the goal of continuity of SST retrievals • Supernatant and slurry cross-site transfer lines available to support U Tank Farm retrievals

2.3 SCENARIO 1B – BASELINE CASE SENSITIVITY – REDUCED WASTE TREATMENT AND IMMOBILIZATION PLANT TOTAL OPERATING EFFICIENCY

Objective: Determine the impact to the Baseline Case of reducing the WTP TOE from 70% to 50%. Scenario 1b builds off Scenario 1a.

System	Scenario 1b Key Assumptions(where Different from Scenario 1)
SST Retrievals	• Start U Tank Farm as the next retrievals after A/AX Tank Farms with the goal of continuity of SST retrievals • Supernatant and slurry cross-site transfer lines available to support U Tank Farm retrievals
WTP PT	• Reduce TOE to 50%
WTP HLW	• Ramp-up (50% TOE) 12/31/**2033** 1.8 MTG/day 12/31/**2034** 2.3 MTG/day 09/30/**2036** 3.0 MTG/day 12/31/**2038** 3.75 MTG/day (2nd generation melters)
WTP LAW	• Ramp-up (hot commissioning will not specifically be modeled) (50% TOE) 12/31/**2023** 9.0 MTG/day 07/31/**2024** 11.0 MTG/day 07/31/**2025** 15.0 MTG/day
LAW Supplemental Treatment	• Same number of melters as Scenario 1, but capacity reduced to 50% TOE

2.4 SCENARIO 1c – BASELINE CASE SENSITIVITY – LIMITED SIMULTANEOUS SINGLE-SHELL TANK RETRIEVALS

Objective: Determine the impact to the Baseline Case of limiting SST retrievals to one at a time per area (200-East and 200-West) (maximum of two simultaneous retrievals) for the full mission. Scenario 1c builds off Scenario 1b.

System	Scenario 1c Key Assumptions(where Different from Scenario 1)
SST Retrievals	• Start U Tank Farm as the next retrievals after A/AX Tank Farms with the goal of continuity of SST retrievals • Supernatant and slurry cross-site transfer lines available to support U Tank Farm retrievals • 1 retrieval at time per area (200-East and 200-West) for the full mission
DST Operations	• DST retrievals limited to 1 at a time per farm and 2 at a time total
WTP PT	• Reduce TOE to 50%
WTP HLW	• Ramp-up (50% TOE) 12/31/**2033** 1.8 MTG/day 12/31/**2034** 2.3 MTG/day 09/30/**2036** 3.0 MTG/day 12/31/**2038** 3.75 MTG/day (2nd generation melters)
WTP LAW	• Ramp-up (hot commissioning will not specifically be modeled) (50% TOE) 12/31/**2023** 9.0 MTG/day 07/31/**2024** 11.0 MTG/day 07/31/**2025** 15.0 MTG/day
LAW Supplemental Treatment	• Same number of melters as Scenario 1, but capacity reduced to 50% TOE

2.5 SCENARIO 1D – BASELINE CASE SENSITIVITY – NO SUPPLEMENTAL CONTACT-HANDLED TRANSURANIC WASTE PROCESSING

Objective: Determine the impact to the Baseline Case of eliminating supplemental CH-TRU waste processing. Scenario 1d builds off Scenario 1b.

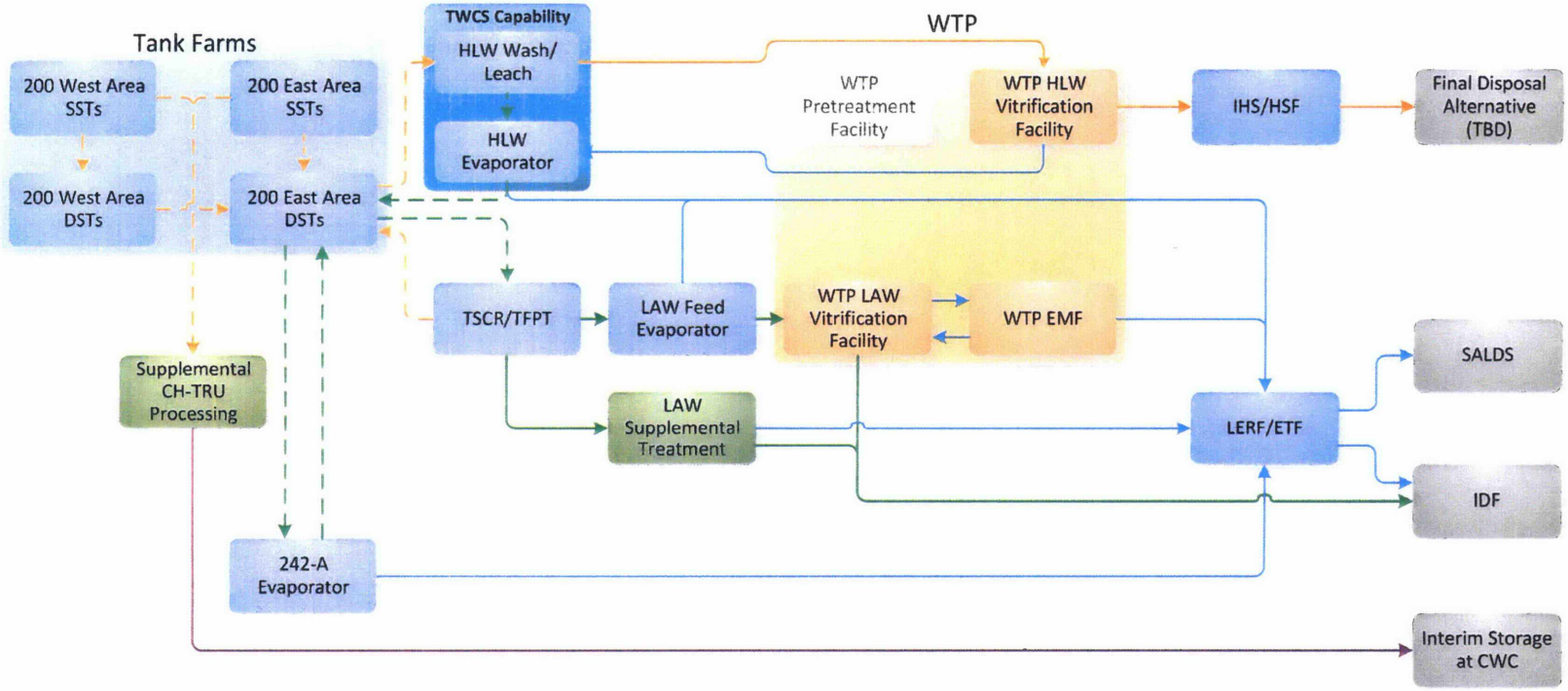
System	Scenario 1d Key Assumptions (where Different from Scenario 1)
SST Retrievals	• Start U Tank Farm as the next retrievals after A/AX Tank Farms with the goal of continuity of SST retrievals • Supernatant and slurry cross-site transfer lines available to support U Tank Farm retrievals
WTP PT	• Reduce TOE to 50%
WTP HLW	• Ramp-up (50% TOE) 12/31/**2033** 1.8 MTG/day 12/31/**2034** 2.3 MTG/day 09/30/**2036** 3.0 MTG/day 12/31/**2038** 3.75 MTG/day (2nd generation melters)
WTP LAW	• Ramp-up (hot commissioning will not specifically be modeled) (50% TOE) 12/31/**2023** 9.0 MTG/day 07/31/**2024** 11.0 MTG/day 07/31/**2025** 15.0 MTG/day
CH-TRU	• No supplemental CH-TRU waste processing
LAW Supplemental Treatment	• Same number of melters as Scenario 1, but capacity reduced to 50% TOE

2.6 SCENARIO 2 – TREATMENT-FAVORED DIRECT-FEED LOW-ACTIVITY WASTE/DIRECT-FEED HIGH-LEVEL WASTE WITH EARLY CHARACTERIZATION IN DOUBLE-SHELL TANKS

Objective: Evaluate the lifecycle impacts and requirements of using existing DSTs for sampling/characterization and other equipment for pretreatment of waste destined for HLW melters, to include leaching, sampling, and washing. See Figure 3 following the assumption list for a simplified flowsheet of the scenario. Scenario 2 builds off Scenario 1b.

System	Scenario 2 Key Assumptions(where Different from Scenario 1)
SST Retrievals	• Start U Tank Farm as the next retrievals after A/AX Tank Farms with the goal of continuity of SST retrievals • Supernatant and slurry cross-site transfer lines available to support U Tank Farm retrievals
DST Operations	• Perform sampling and staging (210-day qualification time) of HLW feed in the DSTs • Allocate additional DSTs as feed qualification tanks, as needed, to support additional TSCR units and, as needed, to support direct-feed high-level waste (DFHLW) feed continuity
242-A Evaporator	• Same as Scenario 1
DFLAW	• TSCR/tank farm pretreatment (TFPT) operates for the full mission • Define the needed pretreatment capacity (as equivalent number of TSCR units) to maintain sufficient LAW feed to the WTP LAW Vitrification Facility and LAW supplemental treatment • Assume each TSCR unit is replaced after 5 years (for cost purposes) • Reduce the minimum sodium concentration in TSCR/TFPT feed to maintain salts in solution (primarily B- and T-Complex SST waste) • A new LAW feed evaporator will come online once the TSCR/TFPT feed sodium concentration is reduced in order to concentrate pretreated LAW feed for improved melter throughput
WTP PT	• The WTP PT Facility will not be modeled in this scenario
WTP HLW	• Fed directly from the TWCS capability • Ramp-up (50% TOE) 12/31/**2033** 1.8 MTG/day 12/31/**2034** 2.3 MTG/day 09/30/**2036** 3.0 MTG/day 12/31/**2038** 3.75 MTG/day (2nd generation melters)
WTP LAW	• Ramp-up (hot commissioning will not specifically be modeled) (50% TOE) 12/31/**2023** 9.0 MTG/day 07/31/**2024** 11.0 MTG/day 07/31/**2025** 15.0 MTG/day
CH-TRU	• Same as Scenario 1
LERF/ETF	• Same as Scenario 1
EMF	• Operates for the full mission
WRFs	• Same as Scenario 1
TWCS Capability	• Wash feed to nominal 1M sodium, perform gibbsite leaching • Receive HLW offgas effluent • Includes an evaporator to concentrate HLW by-product streams and return to tank farms • Consists of two 120-kgal primary staging tanks, two 40-kgal sludge receipt and adjustment tanks, and two 27-kgal condensate receipt tanks
LAW Supplemental Treatment	• Same number of melters as Scenario 1, but capacity reduced to 50% TOE • Concentrate incoming feed when less than 5.5M sodium
GFM	• Same as Scenario 1

Figure 3. Scenario 2 Simplified Flowsheet.



Legend

Streams

- Supernate
- Slurry
- Treated LAW/ILAW
- Treated HLW/IHLW
- Secondary Effluent/Offgas
- CH-TRU (Potential)

Systems

- Tank Farms
- WTP
- Supp. Treatment
- Other

Not Used

Acronyms

CH-TRU	contact-handled transuranic
CWC	Central Waste Complex
DST	double-shell tank
EMF	Effluent Management Facility
ETF	Effluent Treatment Facility
HLW	high-level waste
HSF	Hanford Shipping Facility
IDF	Integrated Disposal Facility
IHS	Interim Hanford Storage
LAW	low-activity waste
LERF	Liquid Effluent Retention Facility
SALDS	state-approved land disposal site
SST	single-shell tank
TBD	to be determined
TSCR	tank-side cesium removal
TFPT	tank farm pretreatment
TWCS	tank waste characterization and staging
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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

SP9_SSD-Fig3_Scenario_2_R1.png

2.7 SCENARIO 2A – SCENARIO 2 SENSITIVITY – ADD NEW DOUBLE-SHELL TANKS

Objective: Evaluate whether adding new DSTs to Scenario 2 improves the ability to maintain feed to the WTP.

System	Scenario 2a Key Assumptions (where Different from Scenario 2)
DST Operations	• Additional 4 to 8 new DSTs in 200-West Area or 200-East Area (as determined by need) to maintain/improve WTP operations and optimize waste feed delivery • New DSTs shall be available by 12/31/2030

2.8 SCENARIO 2B – SCENARIO 2 SENSITIVITY – SLOWER WASTE TREATMENT AND IMMOBILIZATION PLANT RAMP-UP

Objective: Evaluate the impact to Scenario 2 of the slower WTP ramp-up.

System	Scenario 2b Key Assumptions(where Different from Scenario 2)
WTP HLW	• 15-year ramp-up (50% TOE) 12/31/**2033** 1.8 MTG/day 12/31/**2038** 2.4 MTG/day 12/31/**2043** 3.0 MTG/day 12/31/**2048** 3.75 MTG/day (2nd generation melters)
WTP LAW	• 10-year ramp-up for LAW (50% TOE) 12/31/**2023** 9.0 MTG/day 12/31/**2028** 12.0 MTG/day 12/31/**2033** 15.0 MTG/day

2.9 SCENARIO 2C – SCENARIO 2 SENSITIVITY – INCREASED WASTE TREATMENT AND IMMOBILIZATION PLANT TOTAL OPERATING EFFICIENCY

Objective: Determine the WTP throughput needed to achieve the Baseline Case treatment completion date, using the flowsheet from Scenario 2.

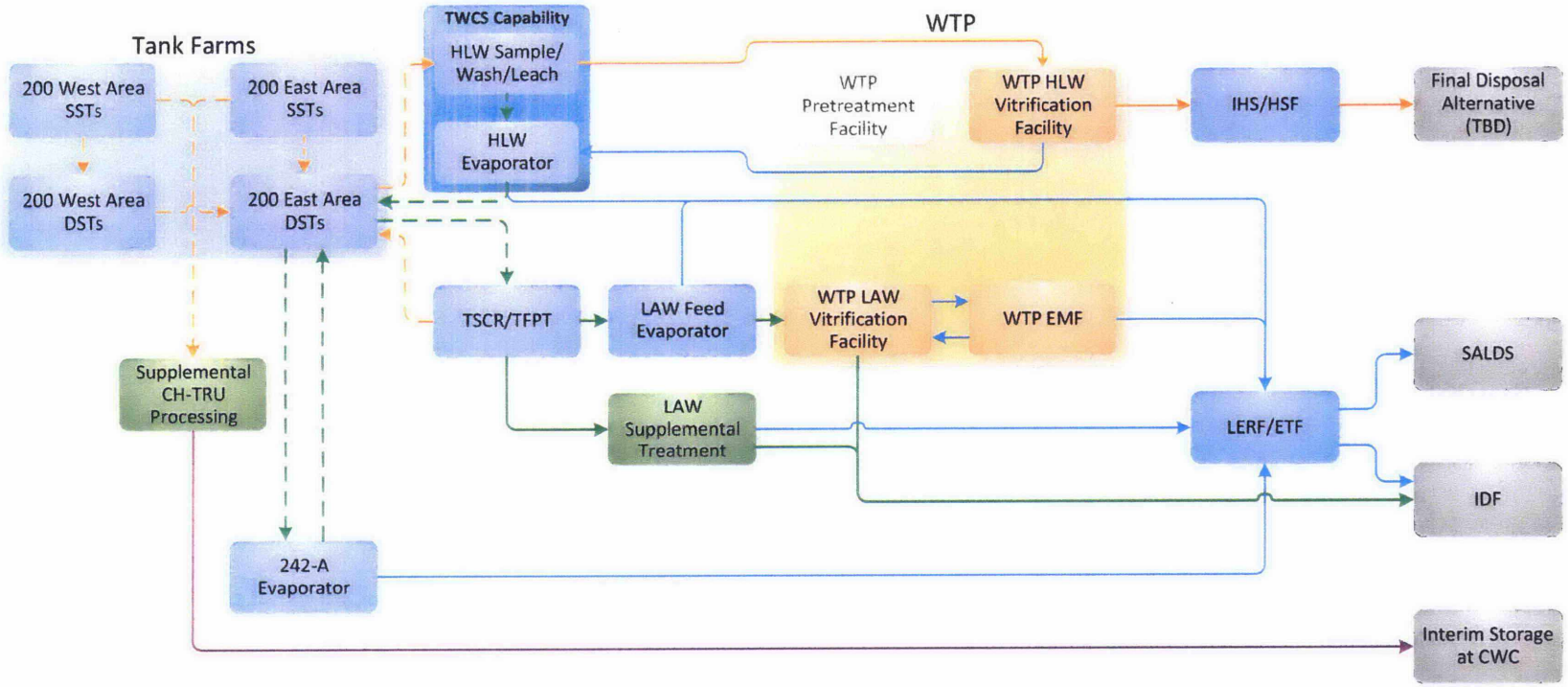
System	Scenario 2c Key Assumptions(where Different from Scenario 2)
DFLAW	• Increase number of TSCR units, as needed, to support increased WTP throughput
WTP HLW	• Increase TOE to achieve Scenario 1's (Baseline Case) treatment completion date
WTP LAW	• Increase TOE to achieve Scenario 1's (Baseline Case) treatment completion date

2.10 SCENARIO 3 – TREATMENT-FAVORED DIRECT-FEED LOW-ACTIVITY WASTE/DIRECT-FEED HIGH-LEVEL WASTE WITH "INDEPENDENT" HIGH-LEVEL WASTE SAMPLING AND PRETREATMENT FACILITY

Objective: Evaluate the lifecycle impacts and requirements of using a new HLW feed preparation facility for sampling and pretreatment of waste destined for HLW melters, to include leaching, sampling, and washing. See Figure 4 following the assumption list for a simplified flowsheet of the scenario. Scenario 3 builds off Scenario 1b.

System	Scenario 3 Key Assumptions (where Different from Scenario 1)
SST Retrievals	• Start U Tank Farm as the next retrievals after A/AX Tank Farms with the goal of continuity of SST retrievals • Supernatant and slurry cross-site transfer lines available to support U Tank Farm retrievals
DST Operations	• Allocate additional DSTs as feed qualification tanks, as needed, to support additional TSCR units and, as needed, to support DFHLW feed continuity
242-A Evaporator	• Same as Scenario 1
DFLAW	• TSCR/TFPT operates for the full mission • Define the needed pretreatment capacity (as equivalent number of TSCR units) to maintain sufficient LAW feed to the WTP LAW Vitrification Facility and LAW supplemental treatment • Assume each TSCR unit is replaced after 5 years (for cost purposes) • Reduce the minimum sodium concentration in TSCR/TFPT feed to maintain salts in solution (primarily B- and T-Complex SST waste) • A new LAW feed evaporator will come online once the TSCR/TFPT feed sodium concentration is reduced in order to concentrate pretreated LAW feed for improved melter throughput
WTP PT	• The WTP PT Facility will not be modeled in this scenario
WTP HLW	• Feeds directly from the TWCS capability • Ramp-up (50% TOE) 12/31/**2033** 1.8 MTG/day 12/31/**2034** 2.3 MTG/day 09/30/**2036** 3.0 MTG/day 12/31/**2038** 3.75 MTG/day (2nd generation melters)
WTP LAW	• Ramp-up (hot commissioning will not specifically be modeled) (50% TOE) 12/31/**2023** 9.0 MTG/day 07/31/**2024** 11.0 MTG/day 07/31/**2025** 15.0 MTG/day
CH-TRU	• Same as Scenario 1
LERF/ETF	• Same as Scenario 1
EMF	• Operates for the full mission
WRFs	• Same as Scenario 1
TWCS Capability	• Stage, mix, and sample waste to meet HLW WAC (190-day sampling time) • Wash feed to nominal 1M sodium, perform gibbsite leaching • Receive HLW offgas effluent • Includes an evaporator to concentrate HLW by-product streams and return to tank farms • Six 250-kgal tanks
LAW Supplemental Treatment	• Same number of melters as Scenario 1, but capacity reduced to 50% TOE • Concentrate incoming feed when less than 5.5M sodium
GFM	• Same as Scenario 1

Figure 4. Scenario 3 Simplified Flowsheet.



Legend

Streams

- Supernate
- Slurry
- Treated LAW/ILAW
- Treated HLW/IHLW
- Secondary Effluent/Offgas
- CH-TRU (Potential)

Systems

- Tank Farms
- WTP
- Supp. Treatment
- Other
- Not Used

Acronyms

CH-TRU	contact-handled transuranic
CWC	Central Waste Complex
DST	double-shell tank
EMF	Effluent Management Facility
ETF	Effluent Treatment Facility
HLW	high-level waste
HSF	Hanford Shipping Facility
IDF	Integrated Disposal Facility
IHS	Interim Hanford Storage
LAW	low-activity waste
LERF	Liquid Effluent Retention Facility
SALDS	state-approved land disposal site
SST	single-shell tank
TBD	to be determined
TSCR	tank-side cesium removal
TFPT	tank farm pretreatment
TWCS	tank waste characterization and staging
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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

SP9_SSD-Fig4_Scenario_3_R1.png

2.11 SCENARIO 3A – SCENARIO 3 SENSITIVITY – ADD NEW DOUBLE-SHELL TANKS

Objective: Determine the quantity and location of new DSTs to allow SST retrievals to complete at the same time as the Baseline Case, using the Scenario 3 flowsheet.

System	Scenario 3a Key Assumptions (where Different from Scenario 3)
SST Retrievals	• Target SST retrieval completion at the same time as Scenario 1 (Baseline Case) • Delays within and between sequential SST retrievals shall not exceed 3 years
DST Operations	• Add new DSTs in 200-East Area and 200-West Area (as determined by need) to allow SST retrievals to complete at the same time as Scenario 1 (Baseline Case) • The first new DSTs shall be available by 12/31/2030

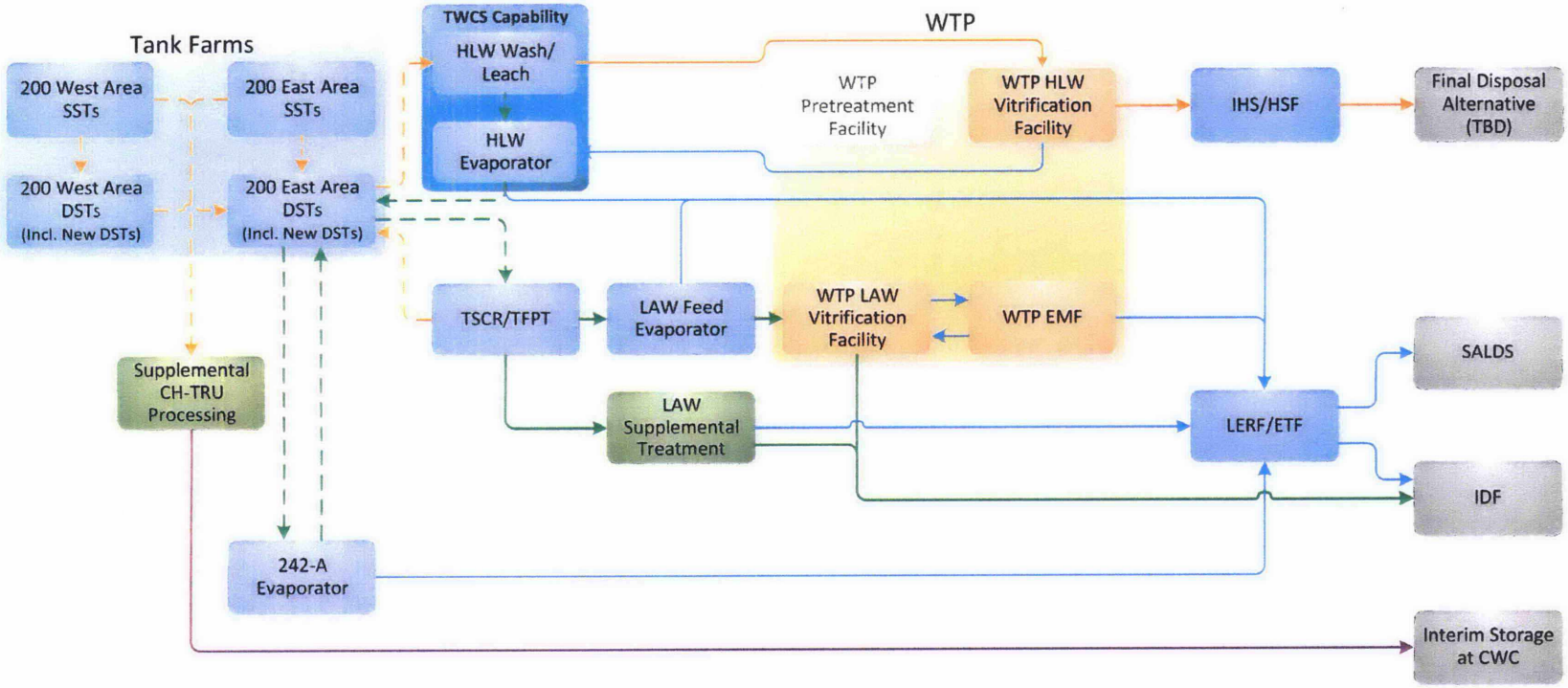
2.12 SCENARIO 4 – RETRIEVAL-FAVORED DIRECT-FEED LOW-ACTIVITY WASTE/DIRECT-FEED HIGH-LEVEL WASTE WITH EARLY CHARACTERIZATION IN DOUBLE-SHELL TANKS AND ADD NEW DOUBLE-SHELL TANKS

Objective: Evaluate the lifecycle impacts and requirements of favoring retrievals, using existing DSTs for sampling/characterization and other equipment for pretreatment of waste destined for HLW melters, to include leaching, sampling, and washing. In this scenario, new DSTs are utilized to maintain SST retrievals consistent with the Baseline Case despite a slowdown in treatment throughput. See Figure 5 following the assumption list for a simplified flowsheet of the scenario. Scenario 4 builds off Scenario 2.

System	Scenario 4 Key Assumptions (where Different from Scenario 1)
SST Retrievals	• Start U Tank Farm as the next retrievals after A/AX Tank Farms with the goal of continuity of SST retrievals • Supernatant and slurry cross-site transfer lines available to support U Tank Farm retrievals • Target retrieval completion at the same time as the Scenario 1 (Baseline Case) • Delays within and between sequential SST retrievals shall not exceed 3 years
DST Operations	• Perform sampling and staging (210-day qualification time) of HLW feed in the DSTs • Allocate additional DSTs as feed qualification tanks, as needed, to support additional TSCR units and, as needed, to support DFHLW feed continuity • New DSTs in 200-East Area and 200-West Area (as determined by need) to allow SST retrievals to complete at the same time as Scenario 1 (Baseline Case) • The first new DSTs shall be available by 12/31/2030
242-A Evaporator	• Same as Scenario 1
DFLAW	• TSCR/TFPT operates for the full mission • Define the needed pretreatment capacity (as equivalent number of TSCR units) to maintain sufficient LAW feed to the WTP LAW Vitrification Facility and LAW supplemental treatment • Assume each TSCR unit is replaced after 5 years (for cost purposes) • Reduce the minimum sodium concentration in TSCR/TFPT feed to maintain salts in solution (primarily B- and T-Complex SST waste) • A new LAW feed evaporator will come online once the TSCR/TFPT feed sodium concentration is reduced in order to concentrate pretreated LAW feed for improved melter throughput
WTP PT	• The WTP PT Facility will not be modeled in this scenario
WTP HLW	• Feeds directly from the TWCS capability • Ramp-up (50% TOE) 12/31/**2033** 1.8 MTG/day 12/31/**2034** 2.3 MTG/day 09/30/**2036** 3.0 MTG/day 12/31/**2038** 3.75 MTG/day (2nd generation melters)
WTP LAW	• Ramp-up (hot commissioning will not specifically be modeled) (50% TOE) 12/31/**2023** 9.0 MTG/day 07/31/**2024** 11.0 MTG/day 07/31/**2025** 15.0 MTG/day
CH-TRU	• Same as Scenario 1
LERF/ETF	• Same as Scenario 1
EMF	• Operates for the full mission
WRFs	• Same as Scenario 1
TWCS Capability	• Wash feed to nominal 1M sodium, perform gibbsite leaching • Receive HLW offgas effluent • Includes an evaporator to concentrate HLW by-product streams and return to tank farms • Consists of two 120-kgal primary staging tanks, two 40-kgal sludge receipt and adjustment tanks, and two 27-kgal condensate receipt tanks

System	Scenario 4 Key Assumptions (where Different from Scenario 1)
LAW Supplemental Treatment	• Same number of melters as Scenario 1, but capacity reduced to 50% TOE • Concentrate incoming feed when less than 5.5M sodium
GFM	• Same as Scenario 1

Figure 5. Scenario 4 Simplified Flowsheet.



Legend

Streams

- Supernate
- Slurry
- Treated LAW/ILAW
- Treated HLW/IHLW
- Secondary Effluent/Offgas
- CH-TRU (Potential)

Systems

- Tank Farms
- WTP
- Supp. Treatment
- Other

Not Used

Acronyms

CH-TRU	contact-handled transuranic
CWC	Central Waste Complex
DST	double-shell tank
EMF	Effluent Management Facility
ETF	Effluent Treatment Facility
HLW	high-level waste
HSF	Hanford Shipping Facility
IDF	Integrated Disposal Facility
IHS	Interim Hanford Storage
LAW	low-activity waste
LERF	Liquid Effluent Retention Facility
SALDS	state-approved land disposal site
SST	single-shell tank
TBD	to be determined
TSCR	tank-side cesium removal
TFPT	tank farm pretreatment
TWCS	tank waste characterization and staging
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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

SP9_SSD-Fig5_Scenario_4_R1.png

2.13 SCENARIO 4A – SCENARIO 4 SENSITIVITY – INCREASED WASTE TREATMENT AND IMMOBILIZATION PLANT TOTAL OPERATING EFFICIENCY

Objective: Determine the WTP throughput needed to complete waste treatment 7 years after SST retrievals complete in Scenario 4.

System	Scenario 4a Key Assumptions (where Different from Scenario 4)
WTP HLW	• Increase full-mission average TOE (after ramp-up), as needed, to finish treatment 7 years after the end of SST retrievals
WTP LAW	• Increase full-mission average TOE (after ramp-up), as needed, to finish treatment 7 years after the end of SST retrievals

2.14 SCENARIO 5 – PERIODIC DOUBLE-SHELL TANK FAILURES

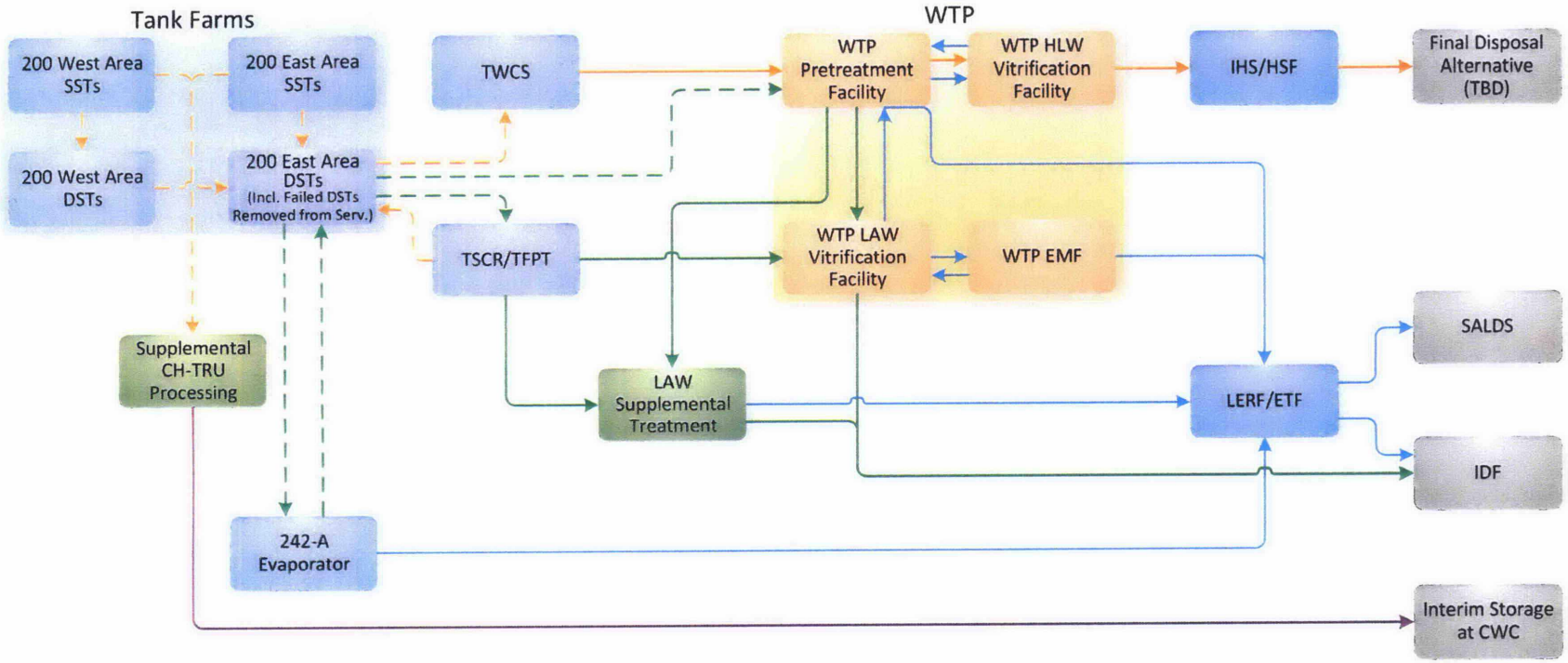
Objective: Evaluate the lifecycle impacts and requirements of a sequence of DST failures, one every 5 years in sequence as follows (failure of first tank in 2025):

- AY-101
- AZ-101
- AZ-102
- AN-107
- AW-105.

See Figure 6 following the assumption list for a simplified flowsheet of the scenario. Scenario 5 builds off Scenario 1b.

System	Scenario 5 Key Assumptions (where Different from Scenario 1)
SST Retrievals	• Start U Tank Farm as the next retrievals after A/AX Tank Farms with the goal of continuity of SST retrievals • Supernatant and slurry cross-site transfer lines available to support U Tank Farm retrievals
DST Operations	• Starting in 2025, and every 5 years thereafter, a DST is declared leaking (in the following order): o AY-101 o AZ-101 o AZ-102 o AN-107 o AW-105 • When a DST is declared leaking, pumping must begin within 120 days • Preference should be given to mitigate leaking tanks over maintaining feed to the treatment facilities • Emergency space may be used to mitigate leaking tanks, but SST retrievals must be stopped until emergency space is recovered • Once a leaking DST is mitigated, it will be removed from service for the balance of the mission
242-A Evaporator	• Same as Scenario 1
DFLAW	• Same as Scenario 1
WTP PT	• Reduce TOE to 50%
WTP HLW	• Ramp-up (50% TOE) 12/31/**2033** 1.8 MTG/day 12/31/**2034** 2.3 MTG/day 09/30/**2036** 3.0 MTG/day 12/31/**2038** 3.75 MTG/day (2nd generation melters)
WTP LAW	• Ramp-up (hot commissioning will not specifically be modeled) (50% TOE) 12/31/**2023** 9.0 MTG/day 07/31/**2024** 11.0 MTG/day 07/31/**2025** 15.0 MTG/day
CH-TRU	• Same as Scenario 1
LERF/ETF	• Same as Scenario 1
EMF	• Same as Scenario 1
WRFs	• Same as Scenario 1
TWCS Capability	• Same as Scenario 1
LAW Supplemental Treatment	• Same number of melters as Scenario 1, but capacity reduced to 50% TOE
GFM	• Same as Scenario 1

Figure 6. Scenario 5 Simplified Flowsheet.



Legend

Streams

- Supernate
- Slurry
- Treated LAW/ILAW
- Treated HLW/IHLW
- Secondary Effluent/Offgas
- CH-TRU (Potential)

Systems

- Tank Farms
- WTP
- Supp. Treatment
- Other

Acronyms

CH-TRU	contact-handled transuranic
CWC	Central Waste Complex
DST	double-shell tank
EMF	Effluent Management Facility
ETF	Effluent Treatment Facility
HLW	high-level waste
HSF	Hanford Shipping Facility
IDF	Integrated Disposal Facility
IHS	Interim Hanford Storage
LAW	low-activity waste
LERF	Liquid Effluent Retention Facility
SALDS	state-approved land disposal site
SST	single-shell tank
TBD	to be determined
TSCR	tank-side cesium removal
TFPT	tank farm pretreatment
TWCS	tank waste characterization and staging
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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

SP9_SSD-Fig6_Scenario_5_R1.png

3.0 SUCCESS CRITERIA

Many TPA milestones were modified and added during the negotiations that occurred from 2007 to 2009 and became effective under a series of TPA change control forms in conjunction with the Consent Decree in *State of Washington v. DOE*, Case No. 08-5085-FVS, as entered in federal court on October 25, 2010. To date, the Consent Decree has been amended three times. (See Amended Consent Decree [March 11, 2016], Second Amended Consent Decree [April 12, 2016], Case No. 2:08-CV-5085-RMP, and the Third Amended Consent Decree [October 12, 2018], Case No. 2:08-CV-5085-RMP.)

Since the milestone dates in M-062-00 and other related TPA milestones were predicated on the milestones established in the 2010 Consent Decree, and those dates have been extended by the Court, DOE has determined that many of the existing interim milestones in M-062-00 and other series are at risk or cannot be met. The TPA milestones affected by the modified milestones in the 2016 Amended Consent Decree need to be adjusted accordingly.

DOE and Ecology have engaged in developing scenarios to be addressed in SP9, which is due to be issued in accordance with TPA Milestone M-062-40 by October 31, 2020. Many milestones used for success criteria in Rev. 6 and Rev. 7 of ORP-11242 (SP6 and SP7) are either postponed or in the process of renegotiation. The achievability of these milestones was evaluated in Rev. 8 of ORP-11242 (SP8) and determined to be infeasible given technical and budgetary constraints. Therefore, these milestones will not be used to constrain scenarios in SP9. Both agencies will continue to amend the TPA using the processes and procedures outlined in the TPA. The analysis of these scenarios in SP9 will provide information useful for reevaluating, changing, or establishing new TPA milestones.

This revision of the System Plan will meet requirements of the TPA outlined for the document as described in Sections 4.0 and 5.0. As in SP8, the Amended Consent Decree dates are identified in the various SP9 scenarios, notably Scenario 1 – Baseline Case, which is intended to be compliant with the 2016 Amended Consent Decree. Following renegotiations of milestones, the schedule-based success criteria will likely be evaluated in future revisions of the System Plan developed for Milestone M-062-40.

4.0 CONTINGENCY PLANNING AND SENSITIVITY ANALYSIS

The M-062-40 milestone requires that the System Plan consider contingency measures to address certain risks as well as include sensitivity analyses of selected key assumptions. While the language of the milestone does not require that the contingency planning be based on cases or their sensitivity analyses, a number of the cases selected for SP9 were defined with contingency planning in mind (refer to Table 2). Of the scenarios, four cases support contingency planning and four include sensitivity analyses.

Additionally, the risk management process used by the DOE Office of River Protection (ORP) includes contingency planning and incorporates key issues and uncertainties for discussion in each System Plan. The results from these cases might identify new issues and uncertainties that may affect the risks and/or mitigating actions addressed in ORP's risk management process.

Table 2. Relationship to Contingency Planning and Sensitivity Analysis.

Scenario	Supports Contingency Planning		Supports Sensitivity Analysis
	Analyze Risks/ Uncertainties	Analyze Initiatives to Reduce Risk or Improve Mission	
Scenario 1 – Baseline Case			✓
Scenario 2 – Treatment-Favored DFLAW/DFHLW with Early Characterization in DSTs		✓	✓
Scenario 3 – Treatment-Favored DFLAW/DFHLW with "Independent" HLW Sampling and PT Facility		✓	✓
Scenario 4 – Retrieval-Favored DFLAW/DFHLW with Early Characterization in DSTs and Add New DSTs		✓	✓
Scenario 5 – Periodic DST Failures	✓		

5.0 METHODOLOGY

The primary purpose of the System Plan is to describe to Ecology the disposition of all tank waste managed by ORP, including the retrieval of all tanks not addressed specifically by the Consent Decree, and the completion of the treatment mission. In addition, information on optimizations, technologies, and capabilities are updated every 3 years with and without consideration of difficulties, expenses, and impact on the overall cleanup mission. Regarding scenario evaluation, the System Plan will present for each scenario:

1. A system description for each system utilized in the planning
2. A planning basis
3. Descriptions of key issues, assumptions, and vulnerabilities and how they could be addressed
4. A sensitivity analysis of key assumption(s), if applicable
5. Estimated cost and schedule impacts (excluding sensitivity cases)
6. The identification of new equipment, technology, or actions that would be needed for each scenario
7. The identification of issues, techniques, or technologies that need further evaluation in order to accelerate retrievals and treatment
8. The impacts on closure activities.

Each System Plan is based upon a detailed set of key assumptions and success criteria, as previously defined. The primary set of assumptions defined for SP9 include those defined in the Baseline Case. Scenarios were developed from this foundation, and general assumptions, or distinguishing features, are identified for each scenario in Section 2.0.

During a series of meetings (Table 3) with Ecology, ORP, and WRPS, five scenarios were defined. From Scenario 1 (the Baseline Case), four sensitivity scenarios will assess the impacts of changing key assumptions, such as SST retrieval sequences and treatment operating efficiencies. The Baseline Case sensitivity scenarios build off each other (Scenario 1b starts from Scenario 1a, and Scenarios 1c and 1d start from Scenario 1b). Scenario 1b forms the starting point for Scenarios 2, 3, and 5. Scenario 4 is developed from Scenario 2.

None of the scenarios selected for SP9 include cost or budget constraints. Instead, the System Plan will identify the estimated funding levels that would be required to execute the scenarios, and the risks associated with those funding levels in the context of historical/expected funding.

For each scenario, an objective/purpose, key assumptions (as compared to the Baseline Case), and any sensitivity analyses to be performed were identified and documented herein. Once this document is released, the assumptions are then further detailed by the Mission Integration & Analysis group of WRPS with a subject matter expert and modeler in a Model Scenario Request form and, subsequently, incorporated into the model. The model results are analyzed and presented in the final version of SP9.

Table 3. Meeting Record.

Date	Attendees	Comments
March 21, 2019	Kaylin Burnett, ORP Steve Pfaff, ORP Jeff Lyon, Ecology Dan McDonald, Ecology John Fleming, WRPS Sean Reaksecker, WRPS Rebecca Sams, WRPS Matt Shoaf, WRPS Samantha Tilanus, WRPS	The purpose of the meeting was to discuss schedule, expectations, and other kick-off items.
March 26, 2019	Kaylin Burnett, ORP Rana Evans, ORP Steve Pfaff, ORP Jay Decker, Ecology Jeff Lyon, Ecology Dan McDonald, Ecology John Fleming, WRPS Sean Reaksecker, WRPS Rebecca Sams, WRPS Alec Schubick, WRPS Matt Shoaf, WRPS Samantha Tilanus, WRPS	The purpose of the meeting was to provide model/tool updates and the scenario definition approach.
April 9, 2019	Kaylin Burnett, ORP Rana Evans, ORP Jay Decker, Ecology Jeff Lyon, Ecology Dan McDonald, Ecology Paul Certa, WRPS John Fleming, WRPS Rob Mauws, WRPS Annamaria Praga, WRPS Sean Reaksecker, WRPS Rebecca Sams, WRPS Alec Schubick, WRPS Matt Shoaf, WRPS Samantha Tilanus, WRPS	The purpose of the meeting was to provide flowsheet updates and recent modeling results.
April 23, 2019	Kaylin Burnett, ORP Rana Evans, ORP Jim Alzheimer, Ecology Jay Decker, Ecology Dan McDonald, Ecology John Fleming, WRPS Sean Reaksecker, WRPS	The purpose of this meeting was to start developing a potential Baseline Case.

Table 3. Meeting Record.

Date	Attendees	Comments
	Rebecca Sams, WRPS Matt Shoaf, WRPS	
May 7, 2019	Kaylin Burnett, ORP Rana Evans, ORP Jim Alzheimer, Ecology John Fleming, WRPS Ted Hohl, WRPS Russell Jasper, WRPS Annamaria Praga, WRPS Sean Reaksecker, WRPS Rebecca Sams, WRPS Alec Schubick, WRPS Matt Shoaf, WRPS Samantha Tilanus, WRPS	The purpose of the meeting was to start discussing alternate scenarios.
May 21, 2019	Kaylin Burnett, ORP Rana Evans, ORP Jim Alzheimer, Ecology Jay Decker, Ecology Dan McDonald, Ecology Jeremy Belsher, WRPS John Fleming, WRPS Sean Reaksecker, WRPS Matt Shoaf, WRPS Samantha Tilanus, WRPS	The purpose of this meeting was to review alternative scenarios (Ecology's) and/or the Model Starting Assumptions.
June 4, 2019	Kaylin Burnett, ORP Dan McDonald, Ecology Jeremy Belsher, WRPS Linda Bergmann, WRPS John Fleming, WRPS Sean Reaksecker, WRPS Rebecca Sams, WRPS Matt Shoaf, WRPS Samantha Tilanus, WRPS	The purpose of the meeting was to review Ecology's alternative scenarios and/or the Model Starting Assumptions.
July 2, 2019	Kaylin Burnett, ORP Nathan Denney, ORP Rana Evans, ORP W. Don Seaborg, ORP Vanessa Turner, ORP Jay Decker, Ecology Jeff Lyon, Ecology Dan McDonald, Ecology Sean Reaksecker, WRPS	The purpose of this meeting was to review Ecology's alternative scenarios in the Selected Scenario Document and approve the first five meeting minutes.

Table 3. Meeting Record.

Date	Attendees	Comments
	Rebecca Sams, WRPS Matt Shoaf, WRPS Samantha Tilanus, WRPS Dave Reinemann, BNI	
July 15, 2019	Kaylin Burnett, ORP Jim Alzheimer, Ecology Dan McDonald, Ecology Matt Shoaf, WRPS John Fleming, WRPS Sean Reaksecker, WRPS Rebecca Sams, WRPS Dave Reinemann, BNI	The purpose of this meeting was to review the updates to Ecology's alternative scenarios in the Selected Scenario Document.
July 30, 2019	Kaylin Burnett, ORP Steve Pfaff, ORP W. Don Seaborg, ORP Jay Decker, Ecology Jeff Lyon, Ecology Dan McDonald, Ecology John Fleming, WRPS Sean Reaksecker, WRPS Rebecca Sams, WRPS Matt Shoaf, WRPS Samantha Tilanus, WRPS Dave Reinemann, BNI	The purpose of this meeting was to review the Model Starting Assumptions.
August 12, 2019	Kaylin Burnett, ORP Nathan Denney, ORP Rana Evans, ORP Steve Pfaff, ORP Jim Alzheimer, Ecology Jeff Lyon, Ecology Dan McDonald, Ecology Sean Reaksecker, WRPS Alec Schubick, WRPS Samantha Tilanus, WRPS Dave Reinemann, BNI	The purpose of this meeting was to continue reviewing the Model Starting Assumptions.

6.0 REFERENCES

Amended Consent Decree, 2016, *State of Washington v. DOE*, Case No. 2:08-CV-5085-RMP (March 11), Eastern District of Washington.

Consent Decree, 2010, *State of Washington v. DOE*, Case No. 08-5085-FVS (October 25), Eastern District of Washington.

DOE O 413.3B, 2010, *Program and Project Management for the Acquisition of Capital Assets*, U. S. Department of Energy, Washington, D.C.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order – Tri-Party Agreement*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

National Environmental Policy Act of 1969, 42 U.S.C. § 4321, et seq.

ORP-11242, 2011, *River Protection Project System Plan*, Rev. 6, U.S. Department of Energy, Office River Protection, Richland, Washington.

ORP-11242, 2014, *River Protection Project System Plan*, Rev. 7, U.S. Department of Energy, Office River Protection, Richland, Washington.

ORP-11242, 2017, *River Protection Project System Plan*, Rev. 8, U.S. Department of Energy, Office River Protection, Richland, Washington.

PNNL-25835, 2016, *2016 Update of Hanford Glass Property Models and Constraints for Use in Estimating the Glass Mass to be Produced at Hanford by Implementing Current Enhanced Glass Formulation Efforts*, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

RPP-PLAN-40145, 2016, *Single-Shell Tank Waste Retrieval Plan*, Rev. 6, Washington River Protection Solutions, LLC, Richland, Washington. (See associated spreadsheet SS-1647.)

Second Amended Consent Decree, 2016, *State of Washington v. DOE*, Case No. 2:08-CV-5085-RMP (April 12), Eastern District of Washington.

Third Amended Consent Decree, 2018, *State of Washington v. DOE*, Case No. 2:08-CV-5085-RMP (October 12), Eastern District of Washington.

Waste Isolation Pilot Plant *Land Withdrawal Act*, Public Law (P.L.) 102 579, as amended by P.L. 104 201.

WRPS-1801991, 2018, "WRPS Multi-Year Operating Plan, Revision 7, FY 2019 – FY 2024," (email to Distribution), from K. H. Subramanian, Washington River Protection Solutions, LLC, Richland, Washington, June 27.

ATTACHMENT A – SCENARIO COMPARISON