S. Sta 4. ②

SEP 28 2000

ENGINEERING DATA TRANSMITTAL

0053825

1. EDT 629276

2. To: (Receiving Organization) DST Program	3. From: (Originating Organization) Retrieval System Development	4. Related EDT No.: NA
5. Proj./Prog./Dept./Div.: RPP/DST Retrieval System Dev.	6. Design Authority/Design Agent/Cog. Engr.: O.R. Rasmussen	7. Purchase Order No.: NA
8. Originator Remarks: For approval and release.		9. Equip./Component No.: NA
		10. System/Bldg./Facility: AY103,104,105 & AW101
		12. Major Assm. Dwg. No.: NA
11. Receiver Remarks:	11A. Design Baseline Document? ☐ Yes ☒ No	13. Permit/Permit Application No.: NA
		14. Required Response Date: NA

RECEIVED OCT 19 2000 EDMC

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	HNF-4669	--	0	Decision Document for the Low-Activity Waste Retrieval Strategy for Tanks 241-AN-103, 241-AN-104, 241-AN-105, and 241-AW-101	NA	1	1	-
						2		

16. KEY

Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
E, S, Q, D OR N/A (See WHC-CM-3-5, Sec. 12.7)	1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
		Design Authority				1	1	A.F. Choho	for G. [illegible]	8/31/00	
		Design Agent				1	1	[illegible]	[illegible]	8/31/00	
1	1	Cog. Eng. O.R. Rasmussen	OR Rasmussen	8-30-00							
1	1	Cog. Mgr. P.J. Certa	Paul J. Certa	8/31/00							
		QA									
		Safety									
		Env.									

HFCH0121

18.	19.	20.	21. DOE APPROVAL (if required)
OR Rasmussen O.R. Rasmussen 8-30-00 Signature of EDT Originator / Date	[illegible] JG Kristofzski 9/22/00 Authorized Representative for Receiving Organization / Date	PJ Certa 8/31/00 P.J. Certa Design Authority/ Cognizant Manager / Date	Ctrl No. _____ ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

Decision Document for the Low-Activity Waste Retrieval Strategy for Tanks 241-AN-103, 241-AN-104, 241-AN-105, and 241-AW-101

O. R. Rasmussen
CH2M HILL Hanford Group, Inc.
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-99RL14047

EDT/ECN: 629276 UC: 721
Cost Center: 6N100 Charge Code: 110350/ 6A10
B&R Code: EW3130000 Total Pages: ~~24~~ 26 ~~27-10~~ 9-28-00

Key Words: retrieval, strategy, low-activity waste, LAW, alternatives generation and analysis, AGA, Tank 241-AN-103, Tank 241-AN-104, Tank 241-AN-105, Tank 241-AW-101

Abstract:
This report documents the preferred approach (retrieval strategy) to prepare and transfer waste from low-activity waste source tanks containing soluble solids (Tanks 241-AN-103, 241-AN-104, 241-AN-105 and 241-AW-101) to the vitrification plant. Several opportunities to further refine the selected retrieval strategy were identified; these were recommended for follow-on studies.

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Printed in the United States of America. To obtain copies of this document, contact: Document Control Services, P.O. Box 950, Mailstop H6-08, Richland WA 99352, Phone (509) 372-2420; Fax (509) 376-4989.

DATE: HANFORD RELEASE ID: 2
STA: 4
SEP 28 2000

[signature] 9/28/00
Release Approval Date Release Stamp

Approved For Public Release

HNF-4669
Revision 0

Decision Document for the Low-Activity Waste Retrieval Strategy for Tanks 241-AN-103, 241-AN-104, 241-AN-105, and 241-AW-101

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

CH2MHILL
Hanford Group, Inc.
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC06-99RL14047

Approved for Public Release; Further Dissemination Unlimited

HNF-4669
Revision 0

Decision Document for the Low-Activity Waste Retrieval Strategy for Tanks 241-AN-103, 241-AN-104, 241-AN-105, and 241-AW-101

Prepared by:
O. R. Rasmussen
CH2M HILL Hanford Group, Inc.
Richland, Washington

Date Published
September 2000

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

CH2MHILL
Hanford Group, Inc.

P. O. Box 1500
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC06-99RL14047

Approved for Public Release; Further Dissemination Unlimited

LEGAL DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced from the best available copy.
Available in paper copy and microfiche.

Available electronically at
http://www.doe.gov/bridge. Available for a processing fee to the U.S. Department of Energy and its contractors, in paper, from:
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
phone: 865-576-8401
fax: 865-576-5728
email: reports@adonis.osti.gov(423) 576-8401

Available for sale to the public, in paper, from:
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Phone: 800-553-6847
fax: 703-605-6900
email: orders@ ntis.fedworld.gov
online ordering:
http://www.ntis.gov/ordering.htm

Printed in the United States of America

DECISION DOCUMENT FOR THE LOW-ACTIVITY WASTE RETRIEVAL STRATEGY FOR TANKS 241-AN-103, 241-AN-104, 241-AN-105, AND 241-AW-101

DECISION APPROVALS

Decision Maker

09/05/00

R. A. Dodd
Double-Shell Tank and Waste Feed Delivery
Operations Director

Date

DECISION SUPPORT BOARD CONCURRENCE

Your signature indicates that you agree that the description given in Section 8.0 of this document is a fair and complete representation of the recommendation and that you agree with the recommendation. Titles are those in effect at the time of your involvement (before the August 2000 reorganization).

8/31/00

G. P. Duncan, Project Definition Operations

Date

for

8/31/00

A. F. Choho, Retrieval Engineering

Date

9/17/00

R. S. Popielarczyk, Chief Engineer

Date

9/12/00

C. E. Leach, Nuclear Safety and Licensing

Date

CONTENTS

1.0 STATEMENT OF THE PROBLEM TO BE DECIDED 1

2.0 DATE OF SELECTION 1

3.0 DECISION-MAKER 1

4.0 DECISION ACTION OFFICER 1

5.0 LOW-ACTIVITY WASTE RETRIEVAL STRATEGY DECISION 1

6.0 KEY CONSIDERATIONS 2
- 6.1 ACCELERATED SCHEDULE FOR THE INITIAL RETRIEVAL OF SUPERNATANT 2
- 6.2 JUST-IN-TIME INSTALLATION OF PUMPS 2
- 6.3 DELIVERY OF LOW-ACTIVITY WASTE BATCHES 5
- 6.4 ADDITIONAL AREAS FOR STUDY AND DECISION MAKING 5

7.0 HISTORICAL PERSPECTIVE ON THE LOW-ACTIVITY WASTE STRATEGY DECISION 7

8.0 ALTERNATIVE SELECTED 8

9.0 DECISION CRITERIA 8

10.0 ASSUMPTIONS 9

11.0 ALTERNATIVES REJECTED 9

12.0 REFERENCES 10

FIGURES

Figure 1. Alternative 1 – Original (1998) Baseline. 11

Figure 2. Alternative 1b – Baseline Minus Backup Decant. 12

Figure 3. Alternative 2 – Slurry with In-Line Dissolution. 13

Figure 4. Alternative 3 – Combination. 14

Figure 5. Alternative 3b – Combination with Single Staging Tank. 15

Figure 6. Alternative 4a – Decant. 16

Figure 7. Alternative 4b – Decant with Simultaneous Water Addition (Feed and Bleed). 17

Figure 8. Alternative 4c – Decant with Staggered Pump Installation. 18

Figure 9. Alternative 5 – Sluicing. 19

TABLES

Table 1. Summary Assessment of Alternative Options for Low-Activity Waste Feed Delivery Strategy 3

Table 2. Alternatives Cross Reference to Table 1. 10

DECISION DOCUMENT FOR THE LOW-ACTIVITY WASTE RETRIEVAL STRATEGY FOR TANKS 241-AN-103, 241-AN-104, 241-AN-105, AND 241-AW-101

1.0 STATEMENT OF THE PROBLEM TO BE DECIDED

What is the preferred approach to prepare and transfer waste from low-activity waste (LAW) source tanks containing soluble solids (Tanks 241-AN-103, 241-AN-104, 241-AN-105, and 241-AW-101) to the Vitrification Plant?

2.0 DATE OF SELECTION

The date of selection will be on the date the decision-maker signs this document.

3.0 DECISION-MAKER

The decision-maker is Ryan A. Dodd, Double-Shell Tank and Waste Feed Delivery Operations Director.

4.0 DECISION ACTION OFFICER

The decision action officer is A. F. Choho, Manager, Retrieval Engineering.

5.0 LOW-ACTIVITY WASTE RETRIEVAL STRATEGY DECISION

The strategy selected to prepare and transfer waste from LAW source Tanks 241-AN-103, 241-AN-104, 241-AN-105, and 241-AW-101 is as follows.

1. Accelerate the schedule for the retrieval of supernatant and dissolution of solids from Tank 241-AN-104 or 241-AN-105 to confirm equipment and retrieval strategy designs early enough that adjustments can be made if necessary.

2. Install mixer and transfer pumps in the source tanks on a just-in-time basis. This minimizes the time this equipment is passively stored in saturated salt solutions and reduces or eliminates the potential encrustation of the equipment.

3. Install a transfer pump in the source tanks and decant the existing clarified supernatant to a staging tank using in-line water dilution. Monitor flammable gas concentrations in the vapor space of the source tanks. When gas release events occur, slow or halt decanting until the ventilation system has returned the flammable gas concentrations to nominal conditions. Increase dilution water flow if gas evolution from the solids layer is rapid enough to suspend significant amounts of solids in the supernatant phase.

4. Settle, characterize, and decant the clarified LAW from the staging tank to the Vitrification Plant.

5. Add water to the source tank, install a mixer pump, and mix the contents to dissolve the soluble salts.

6. Settle, characterize, and decant the clarified LAW supernatant from the source tank directly to the Vitrification Plant.

6.0 KEY CONSIDERATIONS

The LAW Feed Delivery Strategy decisions were based primarily on the considerations discussed below. A more extensive range of options, presented in HNF-4347, *Alternatives Generation and Analysis for Low-Activity Waste Retrieval Strategy*, was considered and evaluated by the authors of the Alternatives Generation and Analysis, the Technical Advisory Group, and the Decision Support Board. The options are summarized in Table 1.

6.1 ACCELERATED SCHEDULE FOR THE INITIAL RETRIEVAL OF SUPERNATANT

Accelerating the schedule for initial retrieval of the supernatant provides an early opportunity to observe the waste behavior during the removal of the supernatant and allows for the early installation and operation of mixer pumps to dissolve soluble solids. This early test of the process and equipment will allow time for changes, if they are needed, before continuous production starts.

6.2 JUST-IN-TIME INSTALLATION OF PUMPS

The consensus of the Decision Support Board was that just-in-time installation of pumps in saturated salt solutions presents the best opportunity for on-time feed delivery. While a just-in-time installation requires more time-critical planning and scheduling than early installation, it avoids the risk of crystal growth on impellers, ports, seals, and shafts that could lead to pump failure.

Table 1. Summary Assessment of Alternative Options for Low-Activity Waste Feed Delivery Strategy. (2 sheets)

Step		Options	Advantages	Disadvantages/Risks	Original Strategy*	AGA, Decision Board Strategy*	Recommended for Future Evaluation
1	Remove obsolete equipment and provide access for new equipment in risers and pump pits	A. Remove multifunctional instrument tree, slurry distributor, pump pit jumpers, transfer pump, and ~24 cm (10-in.) salt well screen (Tanks 241-AN-103, 241-AN-104, and 241-AN-105 only). Save ~38 cm (15-in.) video system for reuse.	Clears risers and pits for new equipment.	High radiation and exposure risk associated with removing encrusted screen and pump before salt dissolution. High cost, maintenance problems associated with removal and reuse of ~38 cm (15-in.) video camera.	X	Not evaluated	
		B. Remove multifunctional instrument tree, slurry distributor, and jumpers. Dispose of old ~38 cm (15-in.) video system (scrap). Leave existing transfer pump and salt well screen in tank.	Reduced cost and exposure by deleting pump and screen removal. Reduced cost by deleting video camera reuse. Reduced future cost and maintenance by using small portable video systems in ~10 cm (4-in.) risers. Leaves ~107 cm (42-in.) riser available for other uses. Existing pump available as potential spare pump for decanting.	Requires analysis of salt well screen for resistance to mixer pump forces. Requires drawing revisions, jumper design modifications.		Not evaluated	X
2	Install above-ground retrieval infrastructure	A. Install full Project W-211 infrastructure.	Design is complete.	High cost. Funding may not be available in time for LAW schedule.	X	Not evaluated	
		B. Install temporary utilities for low-cost retrieval equipment such as propeller mixers and submersible pumps.	Reduced cost. A low-cost LAW study has been initiated.	Engineering study and design required.		Not evaluated	X
3	Install mixer and transfer pumps in waste	A. Install two mixer pumps and one transfer pump in each tank 2 yr or more before planned use and before startup approval.	Completes project work on schedule. Equipment is in place well before needed.	Crystal growth on pump components is expected. Pumps may not be operable when needed.	X		
		B. Install pumps after startup approval, immediately before actual use. Start flush and exercise program immediately.	Pumps ensured of full operability when needed.	Requires thorough planning and preparation to ensure on-time installation and startup.		X	
4	Select initial mixer pump intake elevation	A. Place intake ~15 cm (6 in.) above tank bottom in ~4.6 m (~15 ft) of semisolid salt slurry after water lancing.	Simple pump installation.	High viscosity of salt slurry (1,000,000 cP or more) makes it non-pumpable (limit for pump is 1,000 cP). Pump operation risks pump failure from cavitation and seal damage.	X	Not evaluated	
		B. Elevate pump intake into liquid phase with jackscrew lift table that allows lowering pump as solids are dissolved.	Pump operability is assured. Lift table has been designed by Project W-211.	Higher cost and complexity for lift table.		Not evaluated	X
5	Decant ~1.89 to 2.27 ML (500 to 600 kgal) of clarified supernatant to staging tank	A. Mix convective and nonconvective phases to remove flammable gases from nonconvective phase in a slow, controlled manner. Settle solids for 50 to 120 days. Decant reclarified supernatant with in-line water dilution.	Ensures 25% of LFL will not be exceeded.	Long cycle time for LAW batch. Risk that solids will not resettle sufficiently to meet <2% insoluble solids specification in schedule time allowed, resulting in solids carryover to staging tank.	X		
		B. Mix waste to degas, then pump slurry with approximately 1:1 water dilution for in-line dissolution of soluble salt fraction.	Short LAW batch cycle time. Ensures 25% LFL will not be exceeded.	Increased risk of plugging pipeline. Carryover of all insoluble solids to two staging tanks, requiring staging tank cleanouts.			

Table 1. Summary Assessment of Alternative Options for Low-Activity Waste Feed Delivery Strategy. (2 sheets)

Step		Options	Advantages	Disadvantages/Risks	Original Strategy*	AGA, Decision Board Strategy*	Recommended for Future Evaluation
5	(Continued)	C. Mix waste to degas, then pump one-half of slurry to staging tank with 1:1 water dilution. Blend remaining slurry with water in source tank, settle, and decant.	Short LAW batch cycle time. Ensures 25% LFL will not be exceeded.	Increased risk of plugging pipeline. Insoluble solids carryover to one staging tank, requiring staging tank cleanout.			
		D. Decant existing clear supernatante with in-line water dilution, allowing nonconvective phase gases to degas naturally. Slow or halt decant when GREs occur until flammable gas concentration returns to nominal levels. Increase in-line dilution to dissolve solids injected into the liquid phase.	Short LAW batch cycle time.	Slightly elevated risk of approaching or exceeding 25% of the LFL, but flammable gas study rates risk increase as insignificant. Risk of entrained solids carryover to staging tanks because of GREs muddying up supernatant, but risk is not distinguishable from old baseline.		X	
6	Add water to source tank to dissolve soluble fraction of solids	A. Add water after initial decanting is complete.	Evaluated in flammable gas study. No risk.	For case 5.D only: May allow several GREs to occur, with solids injection into supernatant during decant. Shifting tank crust with damage to in-tank equipment.	X	X	
		B. Add water during initial decanting.	Starts crust dissolution and softening early. Likely to reduce number of GREs and solids injection into supernatant for case 5.D.	Not specifically evaluated in flammable gas study but not expected to be significant.			X
7	Mix waste with water to dissolve solids, settle insolubles, and decant supernatant	A. Mix with two mixer pumps.	Effective dissolution guaranteed.	Two pumps may be overkill with unnecessary installation and removal costs.	X	Not evaluated	
		B. Mix with one mixer pump. Install second mixer pump only if needed.	Effective dissolution virtually certain with one mixer pump.	Reduces pump installation and removal costs.		Not evaluated	X
		C. Mix waste and water by sluicing from staging tank to sluicer in source tank.	A low-cost sluicing system could be developed as part of a low-cost LAW alternative.	Recirculation loop piping is not available. Engineering study would be required to assess options for switching ~5 cm (2-in.) piping from flush/dilution to sluicing.			X
8	Sample and deliver clarified LAW solution to Vitrification Plant	A. Mix, settle, sample, and ship from two staging tanks.	Provides second solids separation stage. Guarantees LAW will be within solids specifications.	Requires significant tank space to be available.	X		
		B. Mix, settle, sample, and ship one batch from staging tank. Settle, sample, and ship second batch from source tank.	Saves tank space. Solids separation is nearly as effective as for two staging tanks.	Slightly increased risk of out-of-specification LAW because of high solids.		X	
		C. Sample and ship both batches directly from source tank.	Saves most tank space.	Significant risk of out-of-specification LAW for first batch. Difficult scheduling for initial transfer to Vitrification Plant as settling time for initial undiluted LAW cannot be predicted accurately.			
		D. Mix, sample, and ship from two staging tanks with settling solids and decanting LAW.	Prevents solids buildup in staging tank; feasible if samples show less than 2% solids	Risks shipping LAW that exceeds 2% solids specification.			

*Shaded cells indicate the low-activity waste retrieval options selected.

AGA = Draft Alternatives Generation and Analysis (HNF-4347, 2000, *Alternatives Generation and Analysis for Low-Activity Waste Retrieval Strategy*, Rev. 0, Fluor Hanford, Incorporated, Richland, Washington).
GRE = gas release events.
LAW = low-activity waste.
LFL = lower flammability limit.

6.3 DELIVERY OF LOW-ACTIVITY WASTE BATCHES

The Decision Support Board chose direct decanting of the available clarified ~1.89 to 2.27 ML (500 to 600 kgal) of supernatant from each tank for obtaining the initial LAW batches. Direct decanting was selected for the following reasons:

1. Flammable gas studies (HNF-3447, Appendix F) have shown that direct decanting can remove the gases from the solids layer with the same high level of safety as mechanical mixing. During decanting, gases are released by a reduction in hydrostatic pressure. In mechanized mixing, gases are released gradually by suspending the gas-trapping solids in the liquid phase. Decanting is expected to produce several rapid gas releases from waste pockets ("gobs") that become buoyant. While the risk of approaching 25% of the lower flammability level is slightly higher for direct decanting, the overall difference in risk is insignificant. A mixing and resettling period of 2 to 6 mo, as required in the original base case, is therefore not necessary for flammable gas control. Eliminating the mechanical de-gassing step shortens the batch cycle time and significantly improves the chances for on-time feed delivery.

2. Direct decanting is expected to carry a minimal quantity of insoluble solids to the staging tank. Direct decanting will most likely result in the injection of some solids into the liquid phase by a series of small gas release events, but in the judgment of the Decision Support Board, the volume of solids is expected to be smaller than the volume that would be carried over as a result of incomplete settling after mechanical de-gassing.

3. The first LAW batch from each tank must be transferred with in-line water dilution to a staging tank, where entrained solids are settled before LAW is decanted to the Vitrification Plant. The Decision Support Board agreed that direct decanting of the initial batch from the source tank to the Vitrification Plant would pose too great a risk of exceeding the 2% solids limit.

4. The Decision Support Board agreed that the second feed batch can reasonably be shipped to the Vitrification Plant without intermediate staging and decanting because laboratory tests show that settling rates will be greatly improved after water dissolution of the solids phase. With adequate solids separation feasible in the source tank, it will be possible to minimize tank space problems early in the program, as well as to minimize the need for cleaning intermediate storage tanks between uses.

6.4 ADDITIONAL AREAS FOR STUDY AND DECISION MAKING

The Decision Support Board, as intended, resolved the main strategy issues. With these key decisions confirmed, a number of additional follow-on studies and decisions are essential to arrive at a fully effective LAW feed delivery system.

1. It is recommended that an evaluation be performed for the option of leaving the existing transfer pump and salt well screens in place. Removal of the existing salt well screens and transfer pumps in Tanks 241-AN-103, 241-AN-104, and 241-AN-105 may produce

high radiation exposures to personnel because of the massive salt encrustations anticipated both on the inside and outside of the screens. These encrustations are likely to be extremely difficult to wash off in the present tank environment. With the existing pump and screen temporarily left in the central ~30 cm (12-in.) riser, the new transfer pump would be installed in the central ~107 cm (42-in.) riser in lieu of the permanent video camera, and in-tank observations would be made whenever necessary with portable video cameras inserted through outside ~10 cm (4-in.) risers.

2. It is recommended that early utilization of the pump lift table designed by Project W-211 be evaluated. Full insertion of the initial mixer pump in the ~305 to 457 cm (10- to 15-ft-) deep nonconvective phase is expected to pose a significant risk of pump damage from operation in an excessively viscous environment. Rather than keeping the Project W-211 jackscrew pump lift table on a build-if-needed status, an evaluation should be performed to assess the benefits of building and testing the lift table well ahead of time and of using the table to elevate the pump intake into the liquid phase BEFORE initial pump operation begins.

3. It is recommended that an evaluation be performed to assess installation of the second ~224 kW (300-hp) mixer pump on an if-needed basis. Experience with the single ~112 kW (150-hp) mixer pump in Tank 241-SY-101 suggests that a second pump is probably not necessary for dissolving salt, and significant cost savings in pump installation and removal may be attainable.

4. It is recommended that the benefits and risks of adding water to the source tanks during the initial decanting be assessed. While the flammable gas release aspects of this option have not been fully studied, potential advantages include a reduced volume of solids carryover to the staging tank by reducing the number of expected gas release events, as well as a reduced risk of equipment damage from the shifting of floating crust blocks. Early water addition may partially dissolve and soften crust sections, rendering draw down induced movement harmless to equipment.

5. A Low-Cost LAW Retrieval Scenario study that was started in fiscal year 2000 should be accelerated in fiscal year 2001 to prepare for the possibility that full funding for a permanent retrieval system will not be available in time to meet LAW delivery commitments. The Low-Cost LAW study should explore such potential cost reduction actions as the use of temporary power and utilities, and the temporary installation of low-cost transfer and mixing equipment, such as submersible pumps and propeller mixers (RPP-6421, *Evaluation of Flygt™ Propeller Mixers for Double-Shell Tank High-Level Waste Auxiliary Solids Mobilization*[1]). The study of temporary installations is justified by the very short duration of the individual LAW retrieval operations.

---

[1] Flygt is a trademark of the ITT Flygt Corporation, Svetsarvagen 12 Solna, Sweden Corporation, Sweden.

7.0 HISTORICAL PERSPECTIVE ON THE LOW-ACTIVITY WASTE STRATEGY DECISION

On May 6 and 7, 1999, Brian Peters and Olaf Rasmussen, lead authors, presented the first draft of the Alternatives Generation and Analysis for the LAW Strategy (HNF-4347) to the Decision Support Board. The members of the Decision Support Board participating in this review were as follows:

Planning and Integration	Jeffry A. Voogd (for R. D. Wojtasek)
Project Development and Implementation	Warren T. Thompson
Systems Engineering	Steven M. O'Toole
Retrieval Operations	Ryan A. Dodd
Maintenance	Thomas J. Kelley
Waste Feed Delivery Program System Implementation	Ralph W. (Bill) Root
Retrieval Engineering	Anne-Marie F. Choho
Chief Engineer	Robert S. Popielarczyk
Nuclear Safety and Licensing	Thomas C. Geer
Life-Cycle Projects	Gilles P. Chevrier
Radiological Controls	Ralph H. Lipfert
Industrial Safety	Peter L. Smith (for William T. Dixon)
Quality Assurance	John F. Bores

The Draft Alternatives Generation and Analysis (HNF-4347) evaluated various combinations of the options presented in Table 1 and proposed a preferred strategy. The Decision Support Board considered the alternatives and voted unanimously to recommend the strategy described in Section 5.0 of this decision document, pending the results of a flammable gas modeling study. The new strategy was implemented as interim guidance on June 22, 1999 (Treat, 1999, *Interim Guidance on LAW Retrieval Strategy*). At the time of the Decision Support Board meeting, Russ L. Treat, Manager, Waste Feed System Definition, was the appointed decision-maker.

On November 1, 1999, Brian Peters and Olaf Rasmussen presented the results of the flammable gas modeling study (HNF-4347, Appendix F) and Retrieval Engineering's recommendation to the Technical Advisory Group. The members of the technical advisory group for this review were as follows:

Systems Engineering	Steven M. O'Toole
Retrieval Operations	Ryan A. Dodd
Maintenance	Thomas J. Kelley
Waste Feed Delivery Program System Implementation	Ralph W. (Bill) Root
Retrieval Engineering	Anne-Marie F. Choho
Chief Engineer	Robert S. Popielarczyk

Nuclear Safety and Licensing	Carole E. Leach
Quality Assurance	John F. Bores
Waste Feed System Definition	Russ L. Treat

At the time of the Technical Advisory Group meeting, the decision-maker was Warren T. Thompson, Program Principal Engineer, Tank Waste Retrieval and Disposal. After consideration, the Technical Advisory Group voted unanimously to recommend acceptance of the Decision Support Board's recommendation providing that compared cost estimates for project work under both the baseline and recommended alternatives did not exhibit major differences. Confirmation of comparable costs was provided and documented in HNF-4347.

At the time of final approval, the decision-maker was Ryan A. Dodd, Manager of Waste Retrieval Support Operations.

8.0 ALTERNATIVE SELECTED

The alternative selected by the decision-maker is that described above in Section 5.0, as recommended by Retrieval Engineering, the Decision Support Board, and the Technical Advisory Group.

9.0 DECISION CRITERIA

The decision criteria used in the selection of the chosen alternative were based directly on the following fundamental objectives:

1. Maximize public, worker, and environmental safety by minimizing the following:
   - Accidental radiation exposure to the public
   - Chronic radiation exposure to the worker
   - Accidental radiation exposure to the worker
   - Accidental chemical exposure to the worker
   - Worker industrial hazards
2. Maximize regulatory compliance:
   - U.S. Department of Energy
   - U.S. Environmental Protection Agency
   - Washington State Department of Ecology
   - Washington State Department of Health
3. Minimize life-cycle costs:
   - Design and construction cost
   - Operations cost
   - Decontamination and decommissioning cost

4. Maximize the chances of success of the waste feed delivery mission:
   - Initial delivery of feed on time
   - Routine delivery of feed on time
   - Initial quantity of feed adequate
   - Routine quantity of feed adequate
   - Feed within specifications
   - Tri-Party Agreement milestones met (Ecology, EPA, and DOE, 1996, *Hanford Federal Facility Agreement and Consent Order*).

In addition to decision criteria, an assessment of programmatic risks was used in the selection of the recommended alternative. While the Decision Support Board ranking of priorities and relative weighting in some cases did not match the rankings developed by the Technical Advisory Group, the overall conclusion was the same. The Draft Alternatives Generation and Analysis (HNF-4347), which developed the groundwork for assessing alternatives, has been issued as a historical document.

10.0 ASSUMPTIONS

The most important assumptions used in reaching this decision were as follows.

1. As directed by the U.S. Department of Energy, LAW prepared by decanting of supernatants and dissolution of solids was assumed to comply with the Vitrification Plant permits, the Final Safety Analysis Report, and the Technical Safety Requirements. Therefore little or no feed blending will be required.

2. It was assumed that current waste characterization data (chemical and physical) are accurate.

3. It was assumed that the potential for moderate gas release events (rollovers) exists during initial decanting. Therefore installed equipment must be designed to withstand such events.

11.0 ALTERNATIVES REJECTED

Options for processing LAW are shown in Table 1. The original 1998 strategy is indicated in Table 1 along with the new Decision Support Board-approved strategy, which is shown in a parallel column. In many options, both strategies are the same. Rejected alternatives are those not shown in either column.

The final list of nine alternatives assessed in detail in the historical Draft Alternatives Generation and Analysis document (HNF-4347) is shown in Table 2 below. Each of the eight strategy steps listed corresponds to a strategy step in Table 1. The letters in each row, "A," "B," "C," or "D," correspond to one of the options listed for that step in Table 1. The nine alternatives, examined in the Draft Alternatives Generation and Analysis (HNF-4347) and by the Decision

Support Board, can be mapped to each of the columns in Table 2 with the options detailed in Table 1. Alternative 1 is the original base case strategy and Alternative 4c is the strategy recommended by the Draft Alternatives Generation and Analysis (HNF-4347) and by the Decision Support Board. The nine final alternatives are illustrated in Figures 1 though 9.

Table 2. Alternatives Cross Reference to Table 1.

Strategy Step		Alternatives and Options Selected from Table 1 in the Final Alternatives Generation and Analysis								
		Alt 1	Alt 1b	Alt 2	Alt 3	Alt 3b	Alt 4a	Alt 4b	Alt 4c	Alt 5
1	Remove obsolete equipment	A	A	A	A	A	A	A	A	A
2	Install infrastructure	A	A	A	A	A	A	A	A	A
3	Install pumps in waste	A	A	A	A	A	A	A	B	B
4	Select mixer pump intake elevation	A	A	A	A	A	A	A	A	–
5	Decant supernatant	A	A	B	C	C	D	D	D	D
6	Add water to source mix	A	A	–	A	A	B	B	A	–
7	Mix, dissolve, settle, decant	A	A	–	A	A	A	A	A	C
8	Sample and deliver LAW	A	D	A	A	B	A	A	B	A

12.0 REFERENCES

Ecology, EPA, and DOE, 1996, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., Washington State Department of Ecology, Olympia, Washington; U.S. Environmental Protection Agency, Washington, D.C.; and U.S. Department of Energy, Washington, D.C.

HNF-4347, 2000, *Alternatives Generation and Analysis for Low-Activity Waste Retrieval Strategy*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-6421, 2000, *Evaluation of Flygt™ Propeller Mixers for Double-Shell Tank High-Level Waste Auxiliary Solids Mobilization*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

Treat, R. L., 1999, *Interim Guidance on LAW Retrieval Strategy* (Interoffice Memo 73600-99-006 to A. F. Choho, June 22), Lockheed Martin Hanford, Inc., Richland, Washington.

Figure 1. Alternative 1 – Original (1998) Baseline.

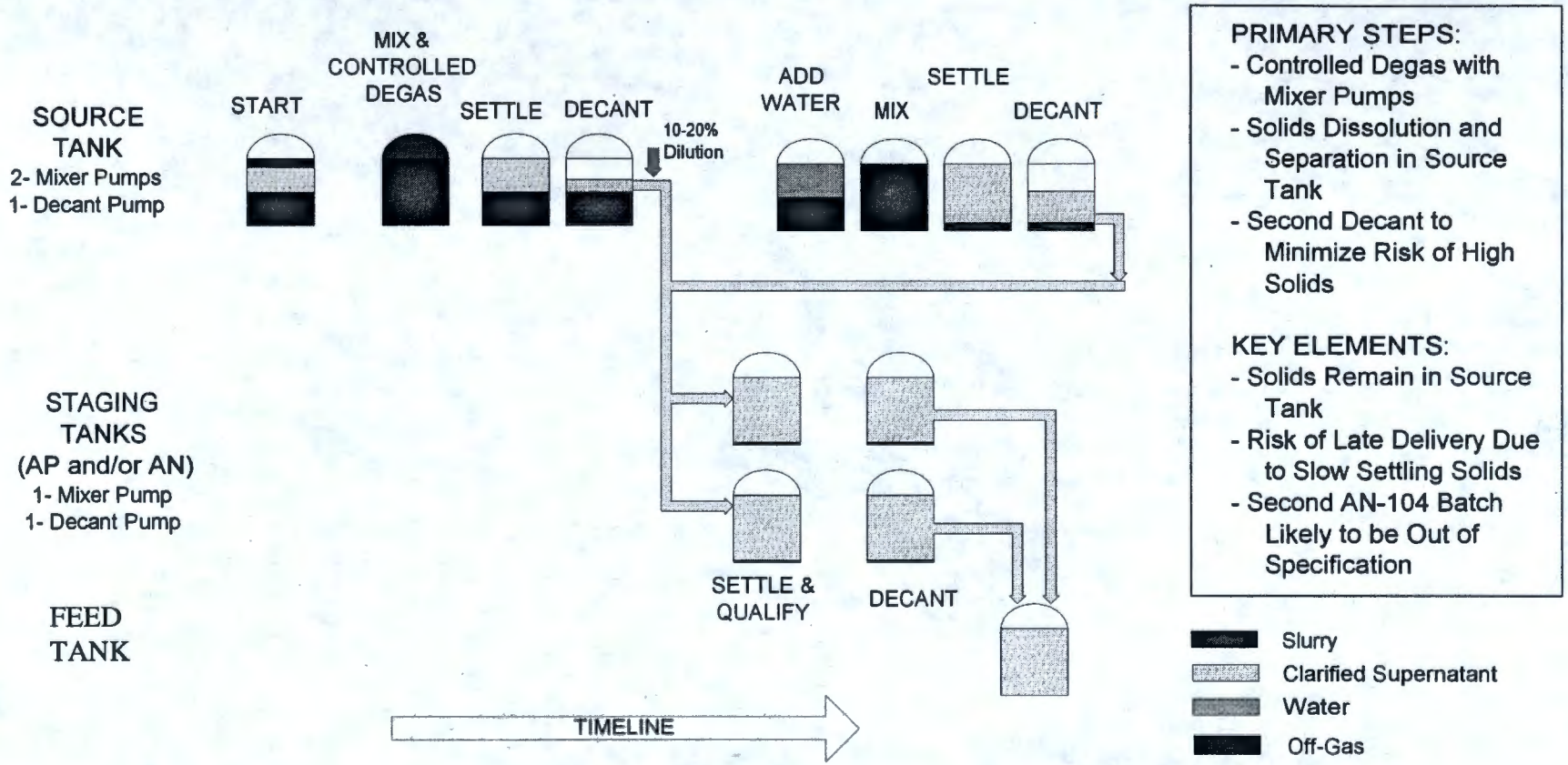


Figure 2. Alternative 1b – Baseline Minus Backup Decant.

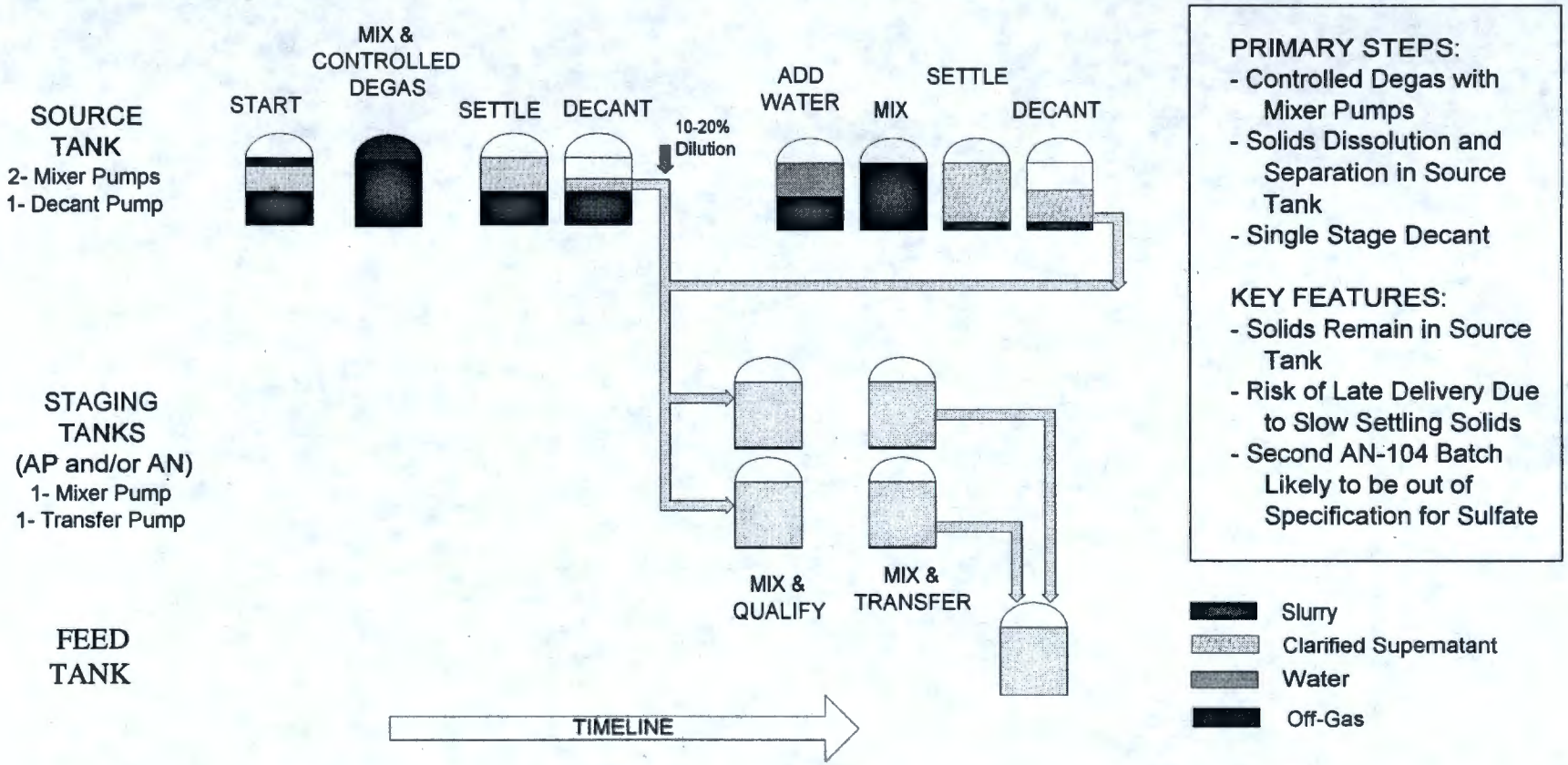


Figure 3. Alternative 2 – Slurry with In-Line Dissolution.

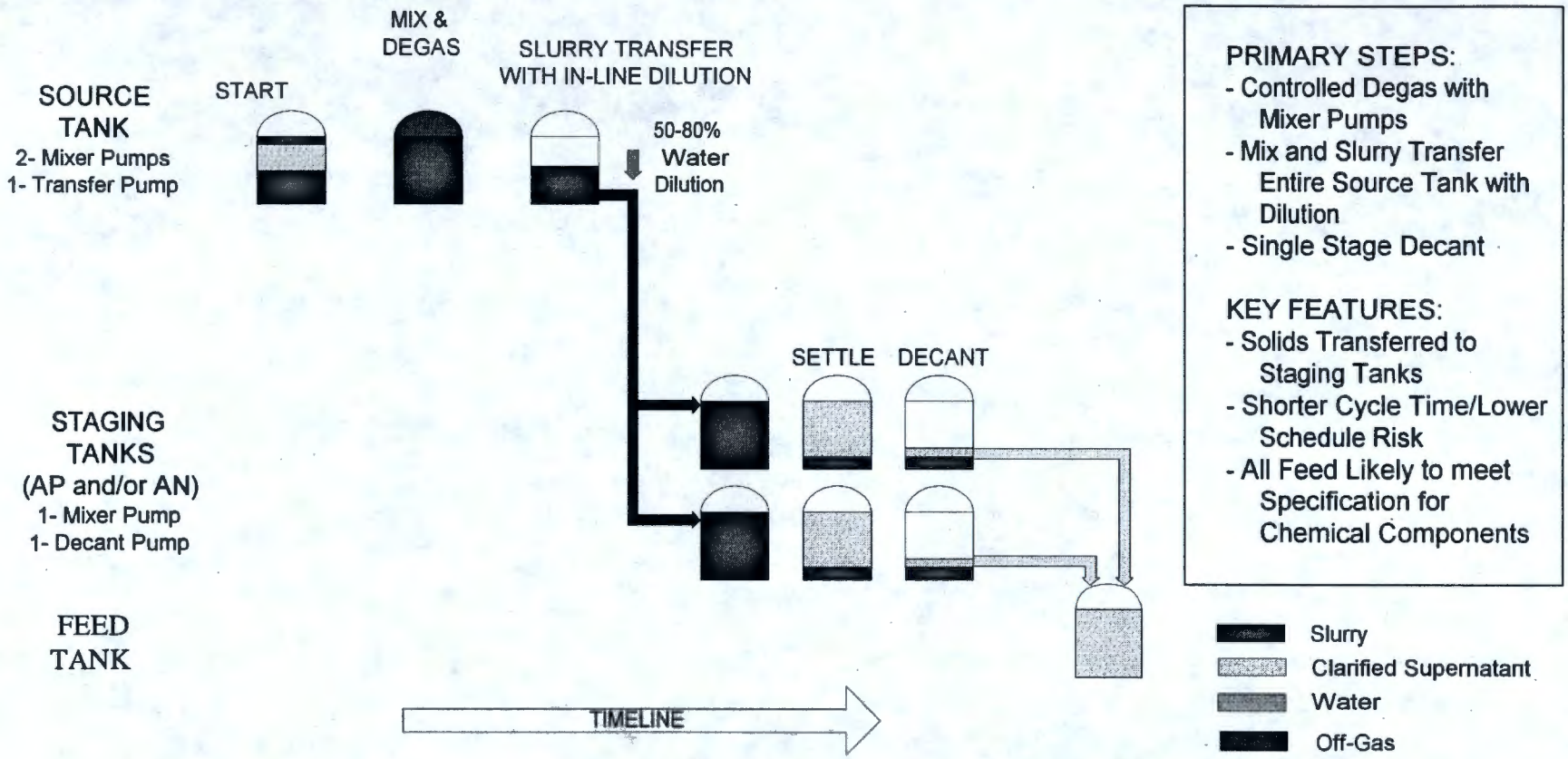


Figure 4. Alternative 3 – Combination.

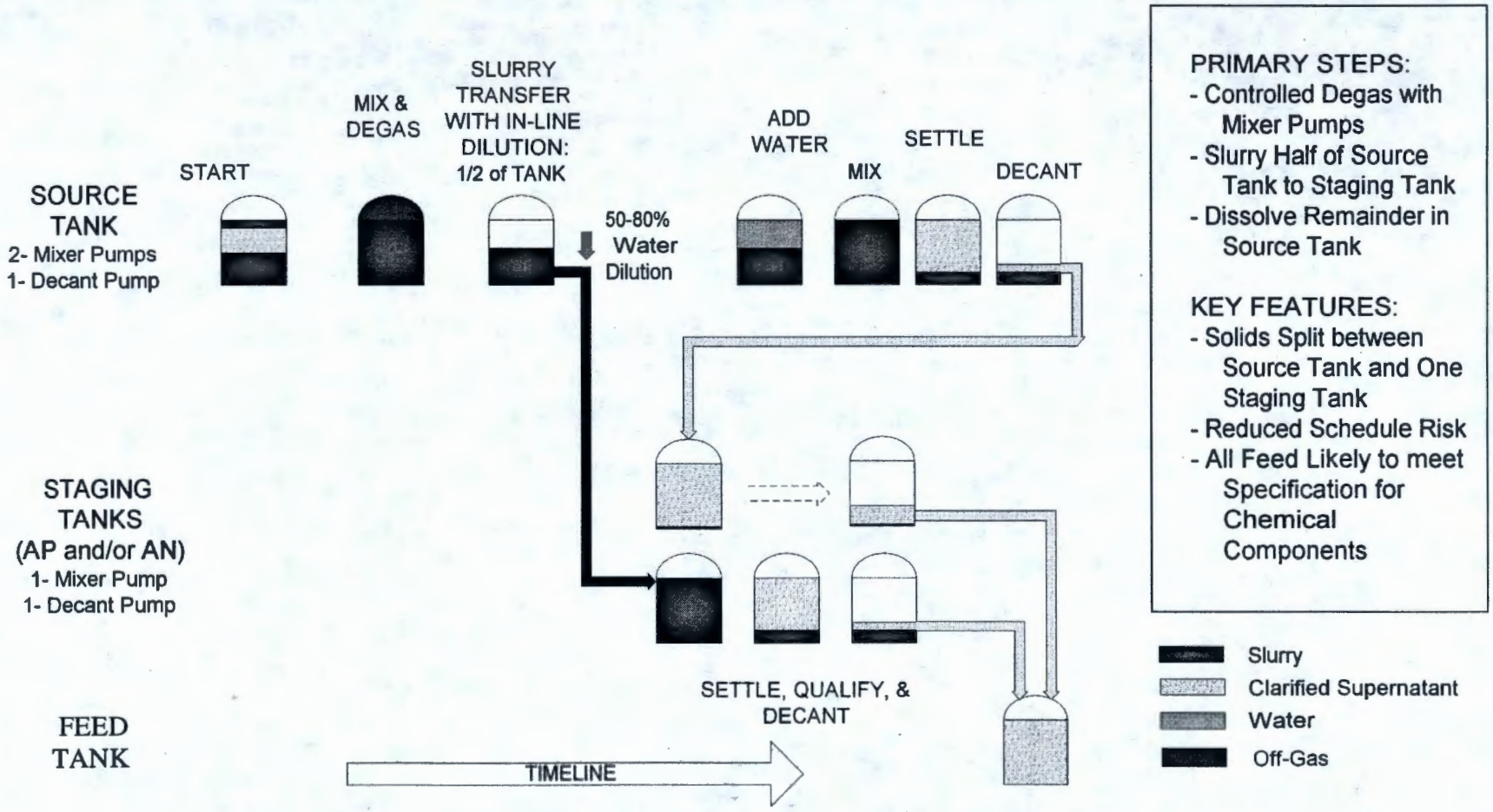


Figure 5. Alternative 3b – Combination with Single Staging Tank.

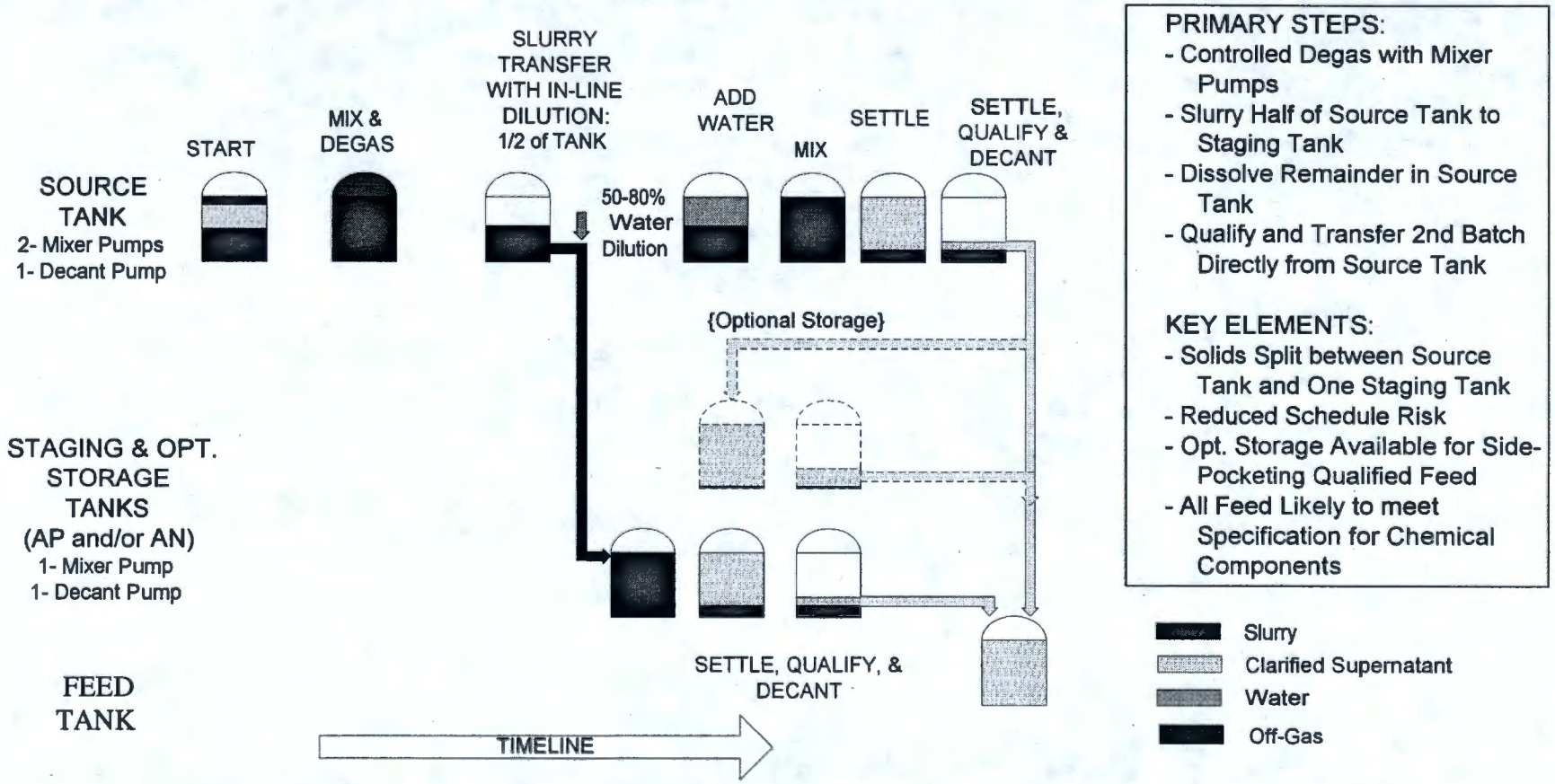


Figure 6. Alternative 4a – Decant.

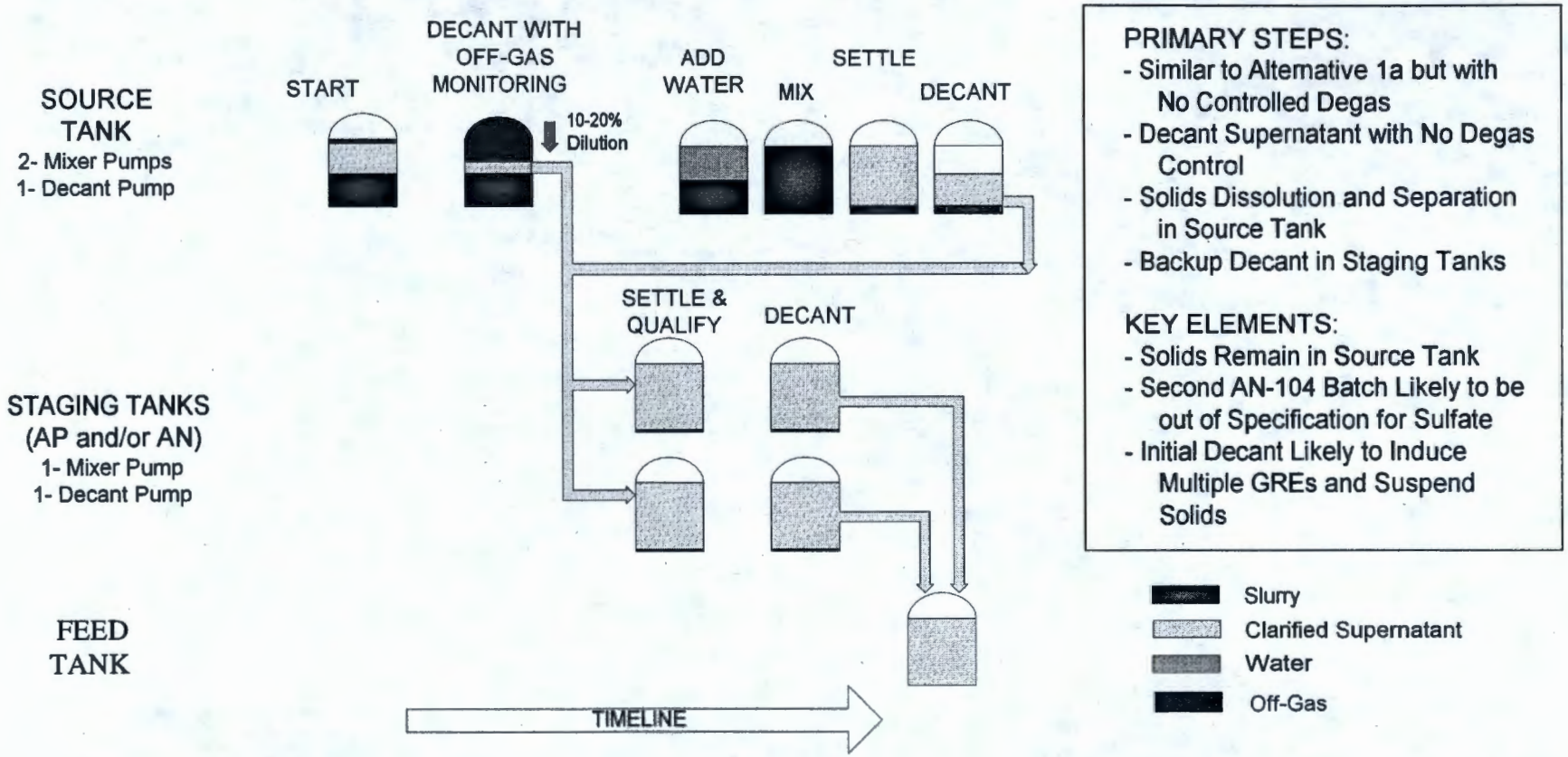
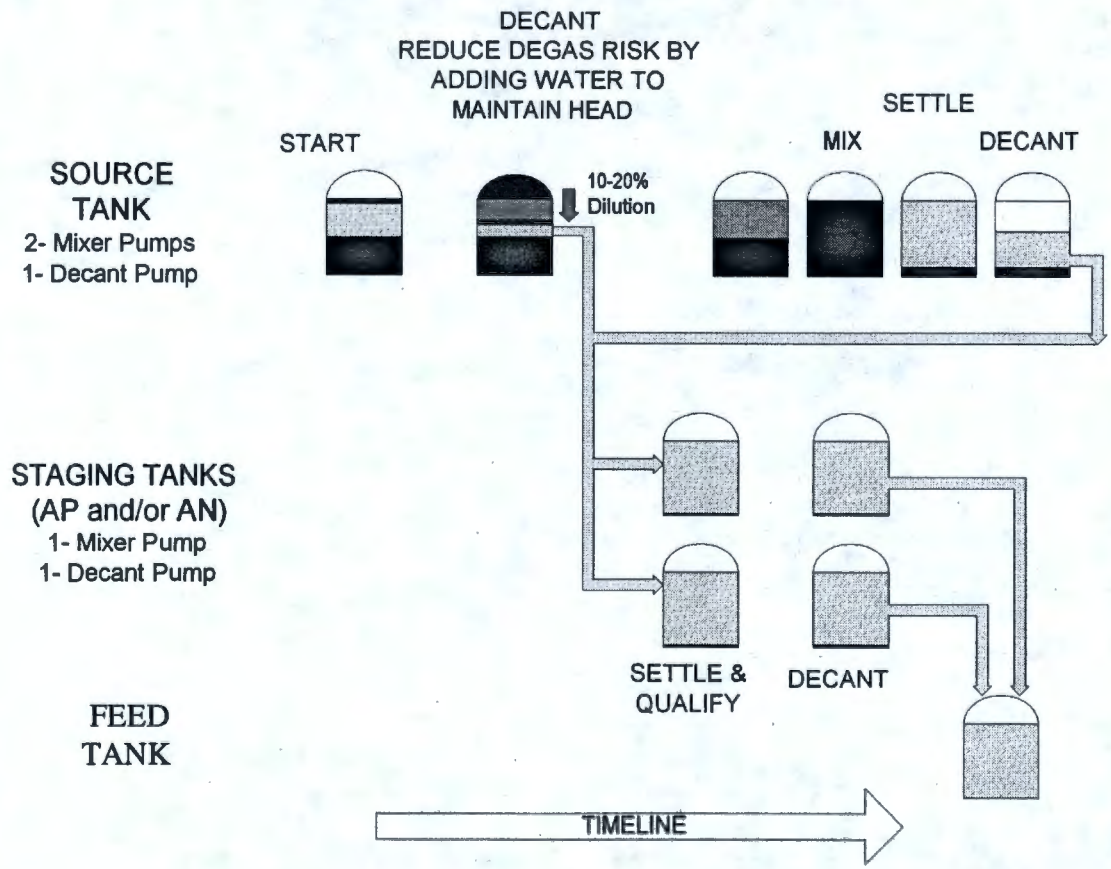


Figure 7. Alternative 4b – Decant with Simultaneous Water Addition (Feed and Bleed).



PRIMARY STEPS:
- Decant Supernatant
- Reduce Degas Risk by Adding Water To Maintain Head While Decanting
- Solids Dissolution and Separation in Source Tank
- Backup Decant in Staging Tanks

KEY FEATURES:
- Solids Remain in Source Tank
- Decreased Risk of Inducing a Gas Release Event Relative to Alternative 4a
- Second AN-104 Batch Likely to be out of Specification for Sulfate

Slurry
Clarified Supernatant
Water
Off-Gas

Figure 8. Alternative 4c – Decant with Staggered Pump Installation.

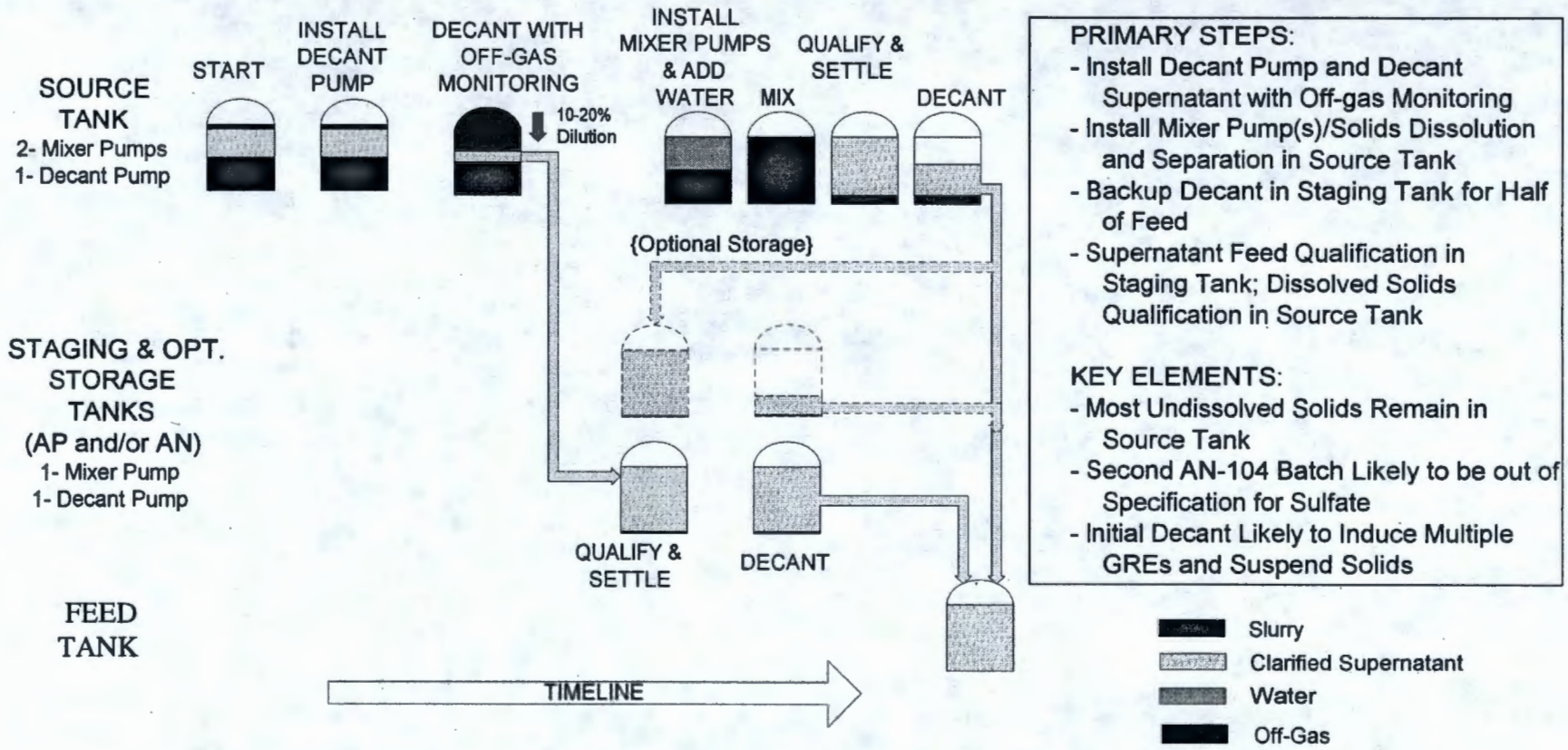
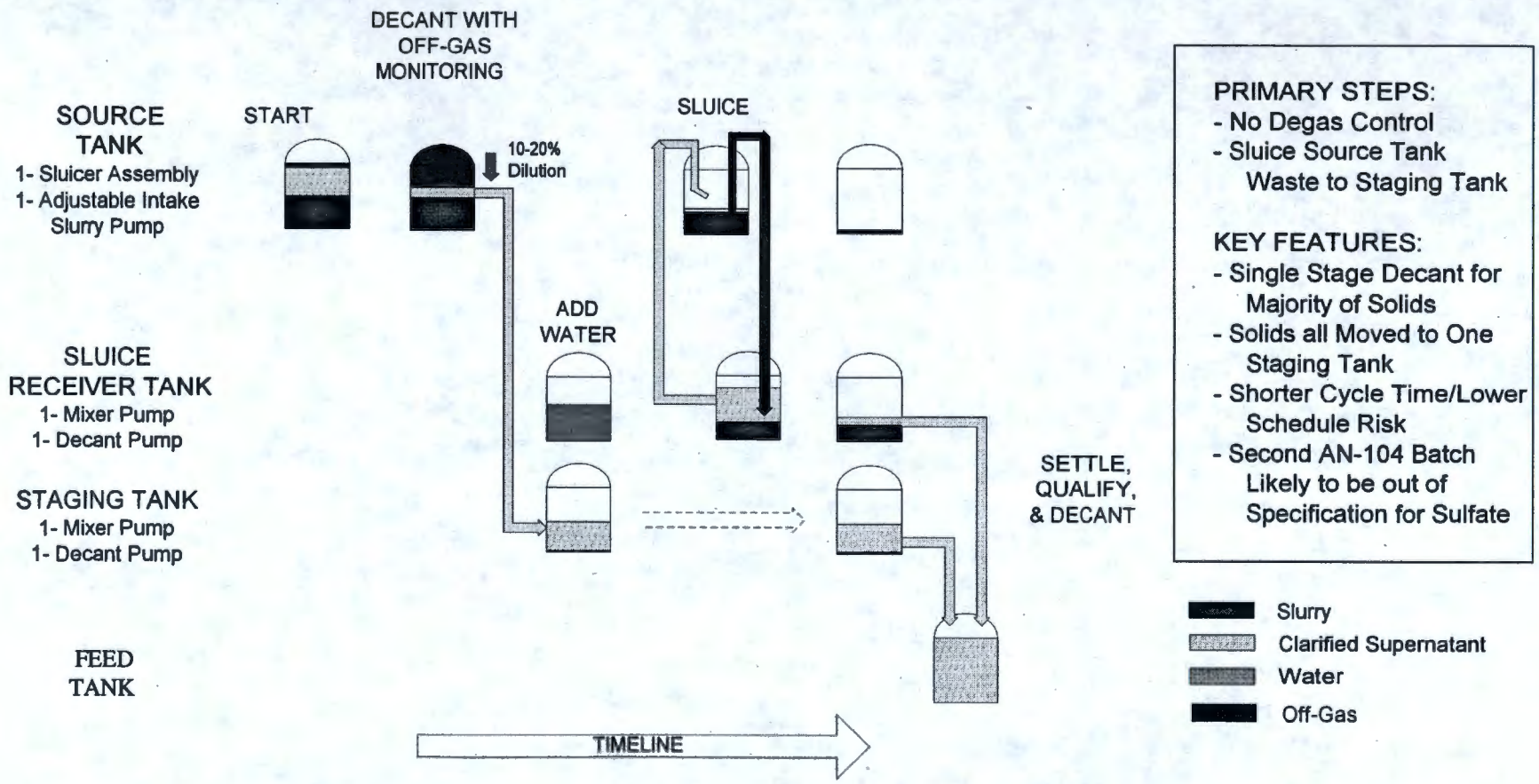


Figure 9. Alternative 5 – Sluicing.



DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	Retrieval System Development	Date 8/25/00
Project Title/Work Order: RPPDST Retrieval System Development		EDT No: ~~629065~~ 629276
HNF-4669 Rev 0 Title: *Decision Document for the Low-Activity Waste Retrieval Strategy for Tanks 241-AN-103, 214-AN-104, 241-AN-105, and 241-AW-101*		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
ONSITE					
CH2M HILL Hanford Group, Inc.					
T. J. Davis	S5-11	X			
R. A. Dodd	S5-07	X			
G. P. Duncan	R3-72	X			
S. J. Eberlein	R2-50	X			
H G. N. Hansen	R3-72	X			
M. D. Hasty	S7-01	X			
H. R. II Hopkins	R2-58	X			
J. Jo	R3-73	X			
J. G. Kristofzski	H6-63	X			
C. E. Leach	R1-44	X			
J. W. Lentsch	R3-25	X			
C. A. Meldron	S5-06	X			
T. C. Oten	R3-83	X			
R. S. Popielarczyk	H6-63	X			
H O. R. Rasmussen	S0-09	X			
R. W. Root	R2-50	X			
D. H. Shuford	R3-83	X			
Lockheed Martin Services, Inc.					
R. L. Rice (3)	R3-73	X			
Central Files	B1-07	X			
H EDMC	H6-08	X			
Numatec Hanford Corporation					
A. B. Carlson	R3-73	X			
P. J. Certa (2)	R3-73	X			
A. F. Choho	R3-73	X			
T. J. Conrads	R3-73	X			
J. D. Galbraith	R3-73	X			
J. S. Garfield	R3-73	X			
C. E. Grenard	R3-73	X			
R. M. Orme	R3-73	X			
E. A. Pacquet	R3-73	X			
C. A. Rieck	R3-73	X			
G. Senentz	R3-73	X			
W. L. Willis	R3-73	X			