H COMPLETE

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 609421

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	3a. USQ Required?	4. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	T.W. Seifert, Environmental Engineering, R1-51, 373-0119	[] Yes [X] No	2/5/96
	5. Project Title/No./Work Order No.	6. Bldg./Sys./Fac. No.	7. Approval Designator
	Tank Farm Transition Projects	Tank Farm Facilities	E^co
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.)	9. Related ECN No(s).	10. Related PO No.
	WHC-SD-WM-ER-079, All Sheets, Rev. 0 2/21/96	N/A	N/A

11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	N/A	N/A Cog. Engineer Signature & Date	N/A Cog. Engineer Signature & Date

12. Description of Change

COST ANALYSIS FOR FINAL DISPOSAL OF DOUBLE-SHELL TANK WASTE, WHC-SD-WM-ER-079, Rev. 0, is REVISED to *COST ANALYSIS FOR FINAL DISPOSAL OF DOUBLE-SHELL TANK WASTE*, WHC-SD-WM-ER-079, Rev. 1.

13a. Justification (mark one)

Criteria Change	[]	Design Improvement	[]	Environmental	[X]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

13b. Justification Details

The COST ANALYSIS FOR FINAL DISPOSAL OF DOUBLE-SHELL TANK WASTE provides the Department of Energy (DOE) and DOE contractors with a better understanding of costs associated with the transfer, storage, and treatment of liquid mixed waste within the Double-Shell Tank System (DST). In order to evaluate waste minimization/pollution prevention ideas, it is necessary to have reliable cost data that can be used in cost/benefit analyses; preparation of funding requests and/or proposals; and provide a way for priortizing and allocating limited resources. This cost per gallon rate will be used by DST waste generators to assess the feasibility of Pollution Prevention Opportunity Assessments (P2OA) and to determine the cost avoidances or savings associated with the implementation of those P2OA.

14. Distribution (include name, MSIN, and no. of copies)

See Distribution Sheet.

RELEASE STAMP

DATE FEB 22 1996 STA: 3 HANFORD RELEASE ID 58

A-7900-013-2 (11/94) GEF095

A-7900-013-1 (06/92)

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 609421

15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog. Eng. (T.W. Seifert) T.W. Seifert	2/6/96	PE	
Cog. Mgr. (R.D. Gustavson) R.D. Gustavson	2/8/96	QA	
QA		Safety	
Safety		Design	
Environ. (C.J. Geier) C.J. Geier	2/21/96	Environ.	
Other		Other	
		DEPARTMENT OF ENERGY	
		Signature or a Control Number that tracks the Approval Signature	
		ADDITIONAL	

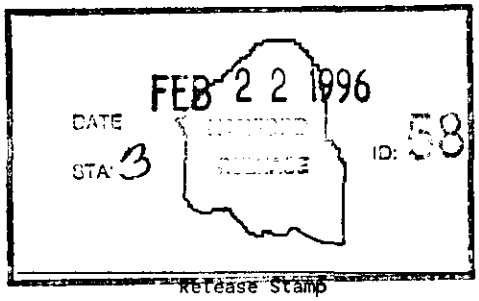
COST ANALYSIS FOR FINAL DISPOSAL OF DOUBLE-SHELL TANK WASTE

T.W. SEIFERT AND K.D. MARKILLIE
Westinghouse Hanford Company and Stone & Webster Engineering Corporation, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: 609421 UC: 2030
Org Code: 77530 Charge Code: N1571
B&R Code: EW3120071 Total Pages: 28 24 KMB 2/22/96

Key Words: Cost Analysis; Waste Minimization; Pollution Prevention; Double-Shell Tank System; 242-A Evaporator; Cost/Benefit Analyses; Pollution Prevention Opportunity Assessment; Treatment, Storage, and Disposal Fees; Proposals; Funding Requests.

Abstract: The *COST ANALYSIS FOR FINAL DISPOSAL OF DOUBLE-SHELL TANK WASTE* provides the Department of Energy (DOE) and DOE contractors with a better understanding of costs associated with the transfer, storage, and treatment of liquid mixed waste within the Double-Shell Tank System (DST). In order to evaluate waste minimization/pollution prevention ideas, it is necessary to have reliable cost data that can be used in cost/benefit analyses; preparation of funding requests and/or proposals; and provide a way for prioritizing and allocating limited resources. This cost per gallon rate will be used by DST waste generators to assess the feasibility of Pollution Prevention Opportunity Assessments (P2OA) and to determine the cost avoidances or savings associated with the implementation of those P2OAs.



Release Approval Date

Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number WHC-SD-WM-EER-090	Page 4

(2) Title

COST ANALYSIS FOR FINAL DISPOSAL OF DOUBLE-SHELL TANK WASTE

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
	(7)		
1 RS	Revised 23 pages (complete document) per ECN 609421	2/6/96	R.D. Gr... 2/8/96

A-7320-005 (08/91) WEF168

COST ANALYSIS FOR MANAGEMENT OF DOUBLE-SHELL TANK WASTE

WHC-SD-WM-ER-079, REV. 1

Kim D. Markillie
Stone & Webster Engineering Corporation

and

Thomas W. Seifert
Westinghouse Hanford Company

February 5, 1996

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CERCLA	*Comprehensive Environmental Response, Compensation and Liability Act*
CFR	Code of Federal Regulations
DOE	Department of Energy
DST	Double Shell Tank
EPA	Environmental Protection Agency
P2OA	Pollution Prevention Opportunity Assessment
PFP	Plutonium Finishing Plant
PUREX	Plutonium Uranium Reduction Extraction Facility
RCRA	*Resource Conservation and Recovery Act*
TCO	Terminal Cleanout Operation
TWRS	Tank Waste Remediation System
WHC	Westinghouse Hanford Company
WVR	Waste Volume Reduction

EXECUTIVE SUMMARY

This report describes the costing method used to acquire waste management cost data for routine operations at the Tank Farm Transition Projects Double Shell Tank system. Waste volumes from single shell tanks were specifically excluded from this effort.

The method developed to gather information was based primarily on activity based costing, which is a common industrial engineering practice used to identify and assess opportunities to reduce costs. Facilities sending waste to the Double Shell Tank (DST) system include the Plutonium Uranium Reduction Extraction (PUREX) facility, B-Plant, S-Plant, T-Plant, 100 Area Basin Cleanout, 105-F and 105-H Basins, 300 Area, 400 Area, and Plutonium Finishing Plant (PFP). These waste volumes have been projected for a 5-year period for this study. A flow diagram was designed to display the direct and indirect budget descriptions associated with transferring, storing and treating waste.

This study will provide the Department of Energy (DOE) and DOE contractors with a better understanding of costs associated with waste management processes. Other potential benefits include providing cost data for sites to perform consistent cost/benefit analyses of waste minimization/pollution prevention options identified during pollution prevention opportunity assessments (P2OA), providing a means for prioritizing and allocating limited resources for waste minimization/pollution prevention and providing a means of calculating cost avoidance/savings in order to prepare proposals for funding requests on investments in the P2OA process.

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) requires that any permit issued under section 3005(h) of the Resource Conservation and Recovery Act (RCRA) for the treatment, storage, or disposal of hazardous waste at facilities that generate and manage hazardous waste on-site, have a waste minimization program in place. Part of the Hanford Site integrated management strategy for pollution prevention is to minimize the quantities of hazardous and/or radioactive mixed waste generated, thereby reducing waste management costs and associated costs while minimizing the impact to human health and the environment.

Waste generating facilities are required under federal and state regulations, to determine waste quantities and provide a plan for reduction of those waste quantities by implementing a waste minimization program. Waste minimization regulations and laws include: U.S. Department of Energy Order 5400.1; Washington Administrative Code 173-303 and 173-307; RCRA 40 CFR 262 and 265; Pollution Prevention Act of 1990; and Executive Order 12856.

RCRA requires that as a condition of a permit, the permittee certify at least annually that the generator of hazardous waste has a program in place to reduce the volume or quantity and toxicity of waste to the degree it is economically practicable. The Pollution Prevention Act states that facilities required to report releases to the EPA for the toxic release inventory provide documentation of their procedures for preventing the release of hazardous materials and for reusing those materials. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires generators of hazardous wastes to evaluate and document their procedures for controlling the environmental impact of operations. Some states, including Washington, have enacted legislation that requires waste minimization/pollution prevention. This plan addresses the Washington State legislation for waste minimization/pollution prevention.

Waste minimization is the use of materials, processes, or practices that reduce or eliminate the creation of pollutants or wastes at the source. It includes practices that reduce the use of hazardous and nonhazardous materials, energy, water, or other natural resources. The practice of waste minimization enables cost avoidance/savings to be quantified.

The benefits of a waste minimization/pollution prevention program at the Hanford Site include:

- Significant reduction in the generation of mixed waste managed as low level and high level waste requiring storage, treatment and disposal;
- Improved accuracy of generator waste volume projections;
- Significant reduction of operational risks and worker exposures;
- Development and implementation of new waste technologies at the Hanford Site that may be used at other DOE sites around the nation.

In order to evaluate the feasibility of waste minimization/pollution prevention opportunities and their implementation, it is necessary to determine the costs related to treatment, storage, and disposal of wastes. DST waste generators on the Hanford Site can use the cost data identified in this document to assess the feasibility of waste minimization/pollution prevention ideas and to determine the cost avoidances/savings associated with implementation of those ideas.

2.0 PURPOSE AND SCOPE

The purpose of this document is to calculate the cost per gallon associated with the direct costs of transfer, storage (East and West Tank Farms), volume reduction (242-A Evaporator), and treatment of generated mixed waste within the DST system. Indirect costs such as upgrades to associated facilities and processes, monitoring, permitting, regulatory compliance, training and characterization are also estimated. This document identifies waste generation sources and their estimated annual waste volumes for the next five years (1996-2000).

The following exceptions were made in evaluating costs associated with waste handling, storage, and processing:

- No initial capital costs were included;
- Facility depreciation was not taken into consideration;
- Technology development costs were not taken into consideration.

All of the costs in this document were derived over a 5-year period, fiscal years 1996-2000, where available. Sources of the estimated waste volumes include: PUREX facility, B-Plant, S-Plant, T-Plant, 100 Area Basin Cleanout, 105-F and 105-H Basins, 300 Area, 400 Area, PFP, and miscellaneous DST waste additions. These estimated volumes are assumed to be transferred to the DSTs and are summarized in TABLE 3-1.

The results of this document will be used as a partial basis for completion of a specific P2OA. The P2OA will evaluate the feasibility of application of an assessment to generators of waste received into the DST system. The P2OA will also provide recommendation to DOE as to which costs should be applied to the generator assessment. The primary purpose of a generator assessment would be to encourage implementation of waste minimization activities at the waste generating source.

3.0 BENEFITS OF AVOIDABLE WASTE MANAGEMENT COSTING

The impact of waste being generated at the current rates has both environmental and economic impacts. In principle, this program will reduce the volume of solid and secondary waste generated by the waste handling activities at the DST system and will encourage the Hanford Site generators to use innovative and available waste minimization/pollution prevention technology. The cost per gallon of receipt, treatment and storage of mixed waste, will be used to calculate a cost avoidance/savings associated with waste minimization/ pollution prevention activities.

The use of data to calculate an assessment on generators has the potential to:

- Promote waste minimization/pollution prevention activities at the source of generation;
- Reduced operational risks including exposure through a reduction in transfers;
- Reduce the need for more tank space, thus reducing the need for new tanks;
- Promote further research to define other costs and processes;
- Promote significant cost avoidance/savings to the Department of Energy in the future.

An analysis of opportunities to reduce or mitigate the environmental impact of waste generation is scheduled to be performed by each facility that is currently sending waste to the DST system. These analyses may include both quantitative and qualitative measures of improvement, such as changes in facility design, raw material usage, facility processes and waste management.

4.0 METHODOLOGY

The method established to conduct a cost analysis for the management of DST waste is based on two primary documents published by Tank Waste Remediation Services (TWRS). The first document, *Tank Waste Remediation System Multi Year Work Plan* (Jordan 1995), is a document that summarizes and projects the direct and indirect costs for transferring, storing, treating, and disposing of waste that enters into the DST system. The method developed to gather information for this document was based on activity based costing. Activity based costing is used to identify and assess opportunities to reduce cost and is a tool that provides a systematic and straight forward method to fully document the costs of waste management activities. Costs taken from this document include fully burdened labor rates, materials, contract purchases, site services and internal assessments.

The second document, *Operational Waste Volume Projections* (Koreski and Strode 1995), actually projects the amount of waste predicted to enter the DST system prior to any waste minimization measures that may be implemented. The methodology of the waste volume projection includes volume predictions from each of the operating facilities and projects that will contribute waste to the DST inventory. These volume predictions are then entered into a database of past waste gains, transfers, and evaporation to determine future waste volume amounts.

Both documents portray an accurate figure of expected activities and associated costs at the TWRS facilities. These documents have been used to assess a cost per gallon for transferring, storing, and treating waste by determining the cost of each specified activity and dividing that figure by the projected waste volume of the activity. Options are then derived by separating the total of direct and indirect costs of a specified activity from each major category of waste management. This separation merely shows what costs are associated with the activities taking place in the DST system.

5.0 DIRECT AND INDIRECT COSTS

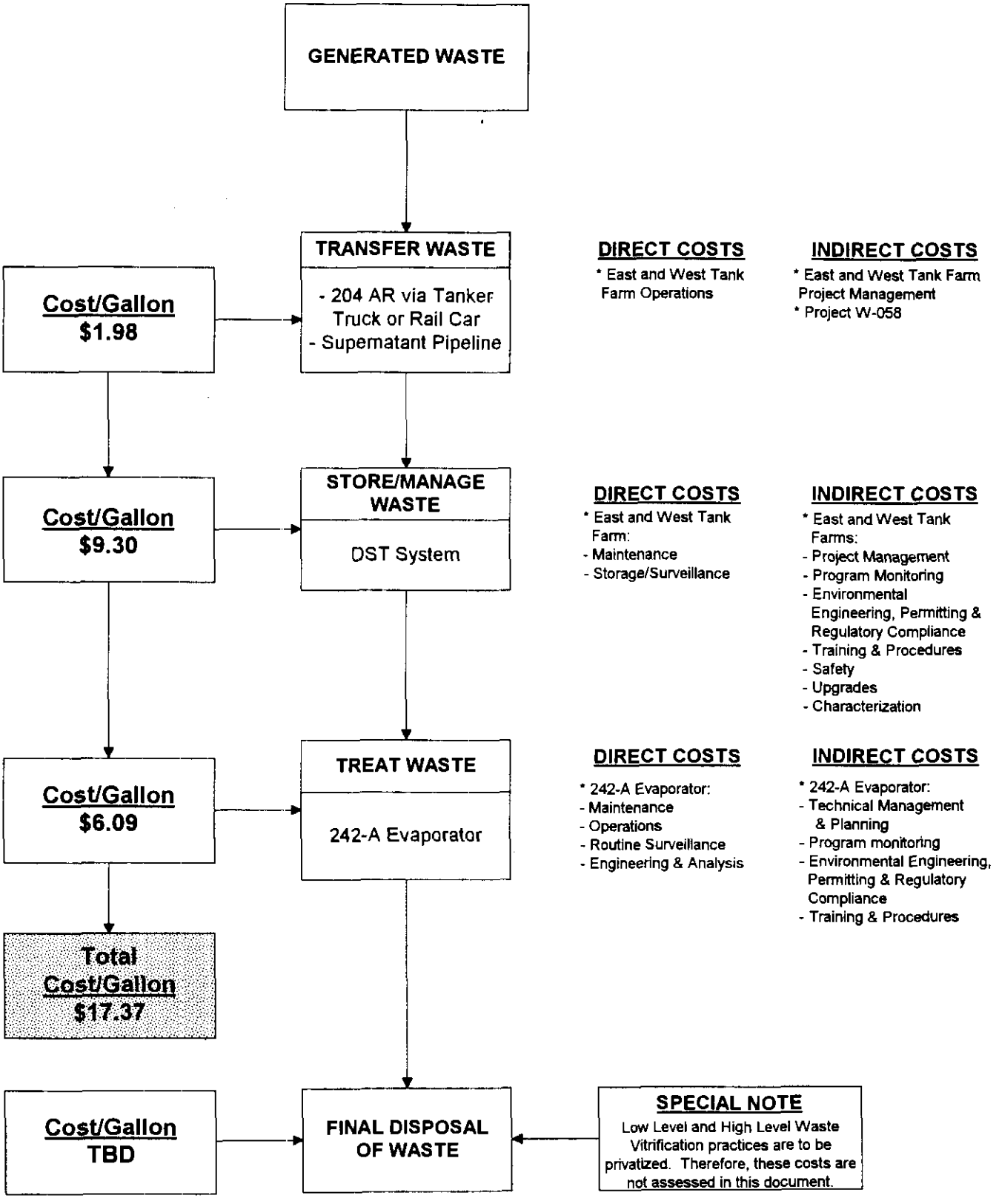
This section is designed to quantify the cost of transferring, storing and treating generated waste, based on the projected amount of waste generated per individual facility. The following sections outline the direct and indirect costs associated with transferring, maintaining and treating waste stored in the DST system and provides a basis for calculating a cost per gallon (formulas).

The process flow and estimated costs of waste transfer, storage and treatment activities for fiscal years 1996 through 2000 are displayed in Figure 5-1. Direct costs include labor and nonlabor costs that are attributable to a specific waste management activity and are incurred only during the performance of the activity taking place within the TWRS infrastructure. The additional activities, are classified as indirect costs that are not specifically related to the performance of the task, but must be allocated to perform the task. Direct and indirect costs have been combined to create a total budget of a specified activity (i.e. treating waste in the 242-A Evaporator) which can then be used with the total waste volume of the specified activity, to calculate a cost per gallon. There are no single shell tank waste management costs assessed in this document.

Figure 5-1 gives an overall view of waste processes associated with generating an estimated cost analysis for transferring, storing/managing, and treating waste stored in the DST system. Direct and indirect cost activities have been identified and incorporated into the total cost/gallon. Activities associated with final disposal of waste are not assessed in this document, because of the possibility for privatization.

The following sections summarize the direct and indirect costs in more detail.

FIGURE 5-1
ACTIVITY FLOW DIAGRAM OF DIRECT AND INDIRECT COSTS



5.1 COST TO TRANSFER WASTE

Waste is transferred from the waste generators via tanker truck, rail car, high-level liquid waste cask or pipeline. The cost of waste transferred from generating facilities depends on the amount of waste being transferred and labor involved in the transfer action. A period of January 1994 through July 1995 is used to estimate transfer volumes (Seifert 1995). These volumes portray approximately how many transfers were performed in the given time frame and the volume of each transfer. The cost per transfer is derived by using the activity based costing equation below (Equation 1). The fully burdened labor rates and equipment costs are obtained from the soft reporting financial database system (WHC 1995).

EQUATION 1:

$$A=(B)(C)+D$$

A = Estimated activity cost
B = Labor hours required to perform the activity
C = Dollars per labor hour (fully burdened)
D = Equipment and material costs to perform the activity (fully burdened)

The estimated activity costs per each transfer method as described above, totalled $13,101/transfer for tanker truck; $12,009/transfer for rail car; and $8,406/transfer for pipeline.

TABLE 5-1 depicts the number of individual transfers and the waste volume per transfer. The cost per gallon per transfer (for Subsets [A], [B], and [C]) is derived by dividing the "cost per transfer" by the "gallons per each individual transfer". The estimated cost per gallon, as shown in Equation 2, is derived by taking the mean of the "[A], [B], and [C]" as defined below.

EQUATION 2:

$$\sum [A]+[B]+[C]=Cost/Gallon=\$1.98/gallon$$

[A] = $13,101/each transfer volume for tanker truck
[B] = $12,009/each transfer volume for rail car
[C] = $8,406/each transfer volume for pipeline

TABLE 5-1
TRANSFER VOLUMES TO THE DST SYSTEM (1/95 - 12/95)

Gallons per Transfer[1]		
[A] Trailer Truck Transfers	[B] Rail Car Transfers	[C] Pipeline Transfers
12320	10450	5500 4675 4675 4400 4675 4400 4125
12265	10450	3850 4125 4400 4400 4400 4400 3850
10450	4950	5500 4400 4263 3850 3438 3988 4125
8800	10725	6325 3025 4125 3575 4125 3850 5363
5500	12375	4125 42488 750 5500 8250 4263 6050
6325	6600	5500 5225
4950	20625	
3438		

5.2 COSTS TO STORE/MANAGE WASTE

Waste sent to the tank farms is placed in the DSTs where it is stored until further treatment occurs and/or transfer to the 242-A Evaporator for volume reduction. The storage costs have been estimated using all operating and maintenance costs not directly associated with transferring waste. TWRS budgeted costs are categorized by year. The costs associated with storage in the DSTs have been presented as the total (East and West) area budget applied to the DSTs (Jordan 1995).

Direct costs associated with the DST system include:

- Operations
- Maintenance
- Storage
- Surveillance

Indirect costs outline the activities that are secondarily related, yet necessary to the operations of TWRS. Indirect costs were added to their respective direct cost categories and then calculated as a total cost using the given waste volumes processed for each category. These indirect costs are detailed below.

Various activities comprise the indirect costs associated with the DST system. These activities include:

- Program Monitoring
- Integrity Assessment
- Environmental Engineering
- Permitting & Regulatory Compliance
- Training & Procedures

- Pretreatment
- Waste Disposal
- Waste Tank Safety
- Upgrades
- Characterization

Although not all of the activities are ancillary to the DST system, it is necessary to consider these support activities when estimating budgets. These costs were incorporated in the overall cost of operating the DST system and were used in Equation 3 to obtain a cost per gallon to store waste. The estimated budget figures for all activities except characterization, were obtained from the multi year work plan (Jordan 1995).

Costs for management and control of upgrade projects outlined in the multi year work plan (Jordan 1995), have been included as an indirect cost for the DST system. Characterization budgets for fiscal years 1996-2000 were provided by characterization program management within TWRS (Kelley 1995). Project modifications affecting costs will require revised calculations. The total projected annual waste volumes were taken from Koreski and Strode (1995).

These activities have estimated costs associated with them which are outlined in TABLE 5-2. Calculating these costs is achieved by dividing the annual direct and indirect budget by the annual projected waste volume from the DST system (TABLE 5-3) for the years 1996 through 2000 and taking the mean over the 5-year span. Equation 3 portrays the calculation process.

EQUATION 3:

$$\sum (A)/(B) = Cost/Gallon = \$9.30/gallon$$

A = Annual direct and indirect budget for Tank Farms[1]
B = Annual DST waste inventory[2]

The estimated cost per gallon of waste processed in the East and West Tank Farms is approximately $9.30.

TABLE 5-2
EAST AND WEST TANK FARM DIRECT AND INDIRECT COSTS

Activity	Fiscal Year Costs (000's)[1]				
	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
East Tank Farms - Direct Costs					
Maintenance	12,229	9,329	8,888	8,934	7,127
Operation	12,202	11,541	11,979	13,086	12,289
Storage/ Surveillance	5,000	6,353	5,595	4,583	4,360
East Tank Farms - Indirect Costs					
Project Management	7,040	7,092	7,305	5,941	5,218
Monitoring	2,321	2,291	2,361	2,480	2,111
Environmental Engineering, Permitting & Regulatory Compliance	2,481	2,361	2,428	2,128	2,251
Training & Procedures	3,008	3,168	3,266	2,072	1,703
Waste Tank Safety	49,672	48,500	47,600	45,000	30,000
Upgrades Management and Control	21,582	13,164	12,095	12,000	10,000
Characterization	15,400	14,300	12,500	10,000	8,000
Integrity Assessments	1,049	1,078	1,108	1,139	1,171
Shipping Support	8,446	8,256	8,011	9,281	9,553
Operational Safety Requirements	790	724	761	---	---
Safety Documentation Upgrades	3,087	1,147	1,182	1,213	1,250
Upgrades Program Management	4,349	1,969	2,028	---	---

TABLE 5-2
EAST AND WEST TANK FARM DIRECT AND INDIRECT COSTS

Activity	Fiscal Year Costs (000's)[1]				
	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
Upgrades Qualification Life Extension	1,011	547	577	500	309
Long Length Equipment Disposal	6,384	2,124	2,613	2,914	---
General Plant Projects	5,428	2,161	2,685	----	
Project W-314 Upgrade	12,546	14,675	24,761	5,000	5,000
Project W-030 Upgrade	3,784	734	---	---	---
West Tank Farms - Direct Costs					
Maintenance	9,995	8,714	8,800	9,500	7,300
Operation	6,433	6,282	7,469	5,839	5,794
Storage/ Surveillance	3,329	3,397	3,594	2,100	1,700
West Tank Farm - Indirect Costs					
Project Management	6,459	5,282	5,479	4,550	4,250
Monitoring	1,969	2,026	2,087	1,769	1,569
Environmental Engineering, Permitting & Regulatory Compliance	2,240	2,228	2,292	1,692	1,690
Training & Procedures	1,426	1,433	1,477	1,177	1,120
Project W-058 Upgrade	12,636	27,722	890	35,041	28,732
Annual Cost Total	222,296	208,598	189,831	152,898	123,765

TABLE 5-2
EAST AND WEST TANK FARM DIRECT AND INDIRECT COSTS

Activity	Fiscal Year Costs (000's)[1]				
	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
Annual Waste Inventory (kgal)	19,948	16,788	19,419	21,055	21,086
Cost/Gallon/Year	11.14	12.43	9.78	7.26	5.87

Note:
[1] Tank Farm Budgets taken from Jordan 1995.
--- Signifies these activities were completed..

TABLE 5-3
WASTE VOLUMES ENTERING THE DST SYSTEM

Waste Volume Location	Fiscal Year Volume (kgal)[1]				
	1996	1997	1998	1999	2000
Starting Inventory	19,261	21,113	19,943	20,960	21,735
B Plant	60	60	60	60	60
S Plant	25	30	30	30	30
T Plant	37	47	49	68	89
300 Area	54	54	54	54	54
400 Area	6	6	6	6	6
Tank Farm (Line)	120	120	120	120	120
Evaporator Flushes	100	100	100	100	85
PFP Lab w/Solids	5	7	7	7	7
Tank 102-SY Solids Retrieval	0	0	0	400	0
Tank 105-AW Solids Retrieval	0	0	0	1,164	0
PUREX TCO w/Flush	229	0	0	0	0
B Plant TCO w/Flush	0	99	99	99	99
100N TCO w/Flush	2,160	0	0	0	0
100K F&H w/Flush	0	0	763	360	0
Facility Generation plus Cross-Site Flushes	401	702	498	287	101
New Waste Additions Total	3,197	1,225	1,786	2,755	651
Total Waste Before Evaporator	22,488	22,438	21,729	23,715	22,386
Actual Evaporator WVR	-2,510	-5,550	-2,310	-2,660	-1,300
Annual Waste Inventory	**19,988**	**16,788**	**19,419**	**21,055**	**21,086**

Note:
[1] Waste Volumes taken from Koreski and Strode 1995.

5.3 COSTS TO TREAT WASTE

The 242-A Evaporator is responsible for reducing the amount of liquid waste stored in the DST system. Waste is processed by the 242-A Evaporator which results in the production of process condensate and slurry. Process condensate is sent to the Liquid Effluent Retention Facility and slurry is returned to the DST system.

The following direct costs are associated with the 242-A Evaporator system:

- Operations
- Maintenance
- Routine Surveillance
- Engineering & Analysis

Much like the indirect costs associated with the DST system, the 242-A Evaporator has support activities and corresponding costs that need to be accounted for when discussing budgetary allocations. These indirect costs consist of the following activities:

- Technical Management & Planning
- Program Monitoring
- Environmental Engineering
- Permitting & Regulatory Compliance
- Training & Procedures

The estimated cost per gallon of waste processed in the 242-A Evaporator is derived by taking the annual direct and indirect budgets (TABLE 5-4) and dividing it by the annual estimated waste volume to be processed in the 242-A Evaporator (Koreski and Strode 1995). The mean of fiscal years 1996 through 2000 is then used for the final estimated cost per gallon of waste processed in the 242-A Evaporator. Equation 4 summarizes this calculation effort.

EQUATION 4:

$$\sum (A)/(B) = Cost/Gallon = \$6.09/gallon$$

A = Annual direct and indirect budget for 242-A Evaporator[1]
B = Annual waste inventory for 242-A Evaporator[2]

Note:

[1] Annual 242-A Evaporator budget figures are taken from Jordan 1995.
[2] Annual 242-A Evaporator waste inventory is from Koreski and Strode 1995.

The estimated cost per gallon of waste being processed at the 242-A Evaporator is approximately $6.09.

TABLE 5-4
242-A EVAPORATOR DIRECT AND INDIRECT COSTS AND WASTE VOLUMES

Activity	Fiscal Year Costs (000's)				
	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
242 A Evaporator - Direct Costs					
Maintenance	3,017	2,912	2,999	2,821	2,906
Operation	1,744	1,776	1,834	2,249	2,315
Routine Surveillance	1,722	1,719	1,781	2,271	2,338
Engineering & Analysis	4,765	4,039	3,932	3,960	4,080
242 A Evaporator - Indirect Costs					
Technical Management & Planning	3,917	3,675	3,809	4,445	4,579
Monitoring	937	960	989	1,022	1,052
Environmental Engineering, Permitting & Regulatory Compliance	1,210	920	943	976	1,005
Training & Procedures	865	1,019	1,050	942	970
Annual Cost Total	18,177	17,020	17,337	18,686	19,245
Annual Waste Inventory[2] (kgal)	3,260	7,340	3,000	3,460	1,690
Cost/Gallon/Year	5.58	2.32	5.78	5.40	11.39

Note:
[1] Tank Farm Budgets taken from Jordan 1995.
[2] Waste volumes taken from Koreski and Strode 1995.

5.4 LOW LEVEL AND HIGH LEVEL WASTE VITRIFICATION

The Low Level and High Level Waste Vitrification facilities have the potential to be privatized, therefore, ultimate waste disposal budget and operating costs have not been used for this study.

6.0 SUMMARY

As seen in the data outlined in this document, the costs for each group of activities have been estimated. This document has attempted to present credible, well documented cost estimates for transferring, storing, and treating waste types being sent to the TWRS DST system. The final cost of managing waste at the DST system (direct plus indirect costs) is $17.37 per gallon of waste. Actual waste volumes and operational budgets have the potential to vary from the predictions estimated in the waste projection document (Koreski and Strode 1995) and the multi year work plan (Jordan 1995). Any changes in these documents should be incorporated into this cost document where necessary.

7.0 REFERENCES

Jordan, K.N., 1995, *Tank Waste Remediation System Multiple Year Work Plan*, WHC-SP-1101, Revision 1, Westinghouse Hanford Company, Richland, Washington.

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