Facility Name: _____

SUMMARY WORKSHEET

	Activity8 **Some of the activities listed below are conducted routinely as part of closure of tank systems. The owner or operator, however, might intend or be required to conduct additional activities to effect closure at the unit. Worksheets for estimating the costs of such additional activities are listed in italic type.**	Worksheet Number	Cost ($)
1.	Removal of Waste	TS-3	
2.	*Tank System Purging (ignitible wastes only)*	TS-4	
3.	*Flushing the Tank and Piping*	TS-5	
4.	*Disassembly and Loading*	TS-6	
5.	*Demolition and Removal of Containment System*	TS-7	
6.	*Removal of Soil*	TS-8	
7.	*Backfill*	TS-9	
8.	Decontamination	TS-10	
9.	Sampling and Analysis	TS-11	
10.	Transportation	TS-12	
11.	Treatment and Disposal	TS-13	
12.	**Subtotal of Closure Costs (Add lines 1 through 11)**		
13.	Engineering Expenses (approximately 10% of closure costs, excluding certification of closure [Multiply line 12 by 0.10])		
14.	Certification of Closure	TS-14	
15.	**Subtotal (Add engineering expenses and cost of certification of closure to closure costs) (Add lines 12, 13, and 14)**		
16.	Contingency Allowance (approximately 20% of closure costs, engineering expenses, and cost of certification of closure) (Multiply line 15 by 0.20)		
TOTAL COST OF CLOSURE ***(add lines 15 and 16)***			**$**

The information entered in this inventory worksheet will be used to complete those worksheets that are appropriate for estimating the cost of closure for tank systems. If the design characteristics of the tank system to be evaluated do not conform to the format of the worksheet below, alternative calculations may be used to determine accurately the surface areas of all structures to be decontaminated and demolished, and the volumes of all structures, soils, and materials to be removed.[a] Depending on the activities to be conducted to effect closure at the unit, it may not be necessary to complete all sections of this inventory worksheet.

1	**UNIT DESCRIPTION AND MAXIMUM PERMITTED CAPACITY** Describe the unit to determine the cost of the activities to be conducted to close it.		
1.A	Type of tank system (aboveground or on-ground)[b]		
1.B	Maximum permitted capacity of tank	gal	
1.C	Total length of ancillary piping	ft	
1.D	Maximum capacity of ancillary piping (Refer to Page 5 of 5 of this worksheet for guidance on estimating the capacity of ancillary piping)	gal	
1.E	Maximum capacity of tank and ancillary piping (Add lines 1.B and 1.C)	gal	
1.F	Type of secondary containment system	Double-wall tank Vault Lined containment system (external to tank) Other (explain)	
2	**INTERIOR SURFACE AREA OF TANK SYSTEM** Determine the interior surface area of the tank system to determine costs of decontamination.		
2.A	Interior surface area of tank (Refer to Page 4 of 5 of this worksheet for guidance on estimating the interior surface area of a tank.)	ft^2	
2.B	Ancillary piping (Refer to Page 5 of 5 of this worksheet for guidance on estimating the interior surface area of ancillary piping.)	ft^2	
2.C	**Surface Area of Tank System (Add lines 2.A and 2.B)**		**ft^2**
2.D	**Surface Area of Tank System in yd^2 (Divide line 2.C by 9)**		**yd^2**

3 SURFACE AREA OF SECONDARY CONTAINMENT SYSTEM PAD

Determine the surface area of the secondary containment system pad to calculate costs for decontaminating and demolishing the pad. Demolition of the secondary containment system pad is an additional activity that might be conducted if the owner or operator intends to demolish the pad at the time of closure.

3.A	Length	ft	
3.B	Width	ft	
3.C	**Surface Area of Secondary Containment System Pad (Multiply line 3.A by line 3.B)**		**ft^2**
3.D	**Surface Area of Secondary Containment System Pad in yd^2 (Divide line 3.C by 9)**		**yd^2**

4 VOLUME OF SECONDARY CONTAINMENT SYSTEM PAD

Calculate the volume of the secondary containment system pad to determine the cost of removing the pad. Removal of the secondary containment system pad is an additional activity that might be conducted if the owner or operator intends to remove the pad at the time of closure.

4.A	Thickness	ft	
4.B	Thickness in yards (Divide line 4.A by 3)	yd	
4.C	**Volume of Secondary Containment System Pad in yd^3 (Multiply line 3.D by line 4.B)**		**yd^3**

5 SURFACE AREA OF SECONDARY CONTAINMENT SYSTEM BERM

Calculate the interior surface area of the secondary containment system berm, or curbing, to determine the cost of decontaminating and demolishing the berm. Demolition of the secondary containment system berm is an additional activity that might be conducted if the owner or operator intends to demolish the berm at the time of closure.

5.A	Length	ft	
5.B	Height	ft	
5.C	**Surface Area of Secondary Containment System Berm (Multiply line 5.A by line 5.B)**		**ft^2**
5.D	**Surface Area of Secondary Containment System Berm in yd^2 (Divide line 5.C by 9)**		**yd^2**

6 VOLUME OF SECONDARY CONTAINMENT SYSTEM BERM

Calculate the volume of the secondary containment system berm, or curbing, to determine the cost of removing the berm. Removal of the secondary containment system berm is an additional activity that might be conducted if the owner or operator intends to remove the berm at the time of closure.

6.A	Thickness	ft	
6.B	Thickness in yards (Divide line 6.A by 3)	yd	
6.C	**Volume of Secondary Containment System Berm in yd^3 (Multiply line 5.D by line 6.B)**		**yd^3**

7 SURFACE AREA OF OTHER STRUCTURES IN SECONDARY CONTAINMENT SYSTEM

Calculate the surface area of all additional structures that are part of the secondary containment system at the unit that will be decontaminated or demolished at the time of closure (for example, ramps or sumps). Demolition of other structures is an additional activity that might be conducted if the owner or operator intends to demolish the structures at the time of closure.

7.A	**Surface Area of Other Structures**	**ft^2**
7.B	**Surface Area of Other Structures in yd^2 (Divide line 8.A by 9)**	**yd^2**

8 VOLUME OF OTHER STRUCTURES IN SECONDARY CONTAINMENT SYSTEM

Calculate the volume of all additional structures that are part of the secondary containment system at the unit to determine costs of removing those structures. Removal of other structures is an additional activity that might be conducted if the owner or operator intends to remove such structures at the time of closure.

8	**Volume of Other Structures**	**yd^3**

9 VOLUME OF CONTAMINATED SOIL TO BE REMOVED

Calculate the volume of contaminated soil to be removed. Removal of contaminated soil is an additional activity that might be conducted if the removal of such soil will be required at the time of closure.

9.A	Length	ft	
9.B	Width	ft	
9.C	Depth	ft	
9.D	**Volume of Contaminated Soil to be Removed (Multiply line 9.A by line 9.B by line 9.C)**		**ft^3**
9.E	**Volume of Contaminated Soil to be Removed in yd^3 (Divide line 9.D by 27)**		**yd^3**

Notes:

[a] For example, if a secondary containment system pad is circular in shape rather than rectangular, the user would be unable to calculate the surface area of that pad using the method prescribed in section 2 of this inventory worksheet. Rather, the surface area of such a pad could be calculated using the equation πr^2.

[b] Owners and operators of in-ground and underground storage tanks are not eligible to use standardized permits.

Interior Surface Areas of Tanks of Various Capacities
Reference for Line 2.A

Capacity (gal)	Approximate Diameter (ft)	Approximate Height or Length (ft)	Surface Area(ft^2)
DIMENSIONS OF VERTICAL TANKS			
5,000	9	10.5	424
10,000	11.5	13	677
15,000	13	15	878
20,000	15	15	1,060
25,000	16	17	1,257
30,000	17	18	1,415
DIMENSIONS OF HORIZONTAL TANKS			
5,000	6	23	490
10,000	8	26	754
15,000	9.5	29	1,007
20,000	10	34	1,225
25,000	10.5	38	1,427
30,000	11	42	1,641

Standard Equations for Calculating the Interior Surface Areas of Tanks
Reference for Line 2.A

Shape	Equation[a]
Cylinder	$2\pi rh$
Circle	πr^2
Cone	$r\pi\sqrt{r^2 + h^2}$

Notes:

[a] r = radius
h = height

Properties of Standard Wall Steel Pipe[a] Reference for Lines 1.C and 2.B

Nominal Size (inches)	Inside Diameter (inches)	Inside Volume (gal/ft)[b]	Inside Surface Area (ft^2/ft)[c]
.75	0.824	0.0276	0.217
1	1.049	0.0448	0.274
1.25	1.380	0.0776	0.362
1.5	1.610	0.106	0.421
2	2.067	0.174	0.540
2.5	2.469	0.248	0.646
3	3.068	0.384	0.802
4	4.026	0.661	1.06
6	6.065	1.500	1.59
8	7.981	2.59	2.09
10	10.020	4.09	2.62
12	12.090	5.95	3.17
14	13.250	7.17	3.46
16	15.250	9.48	3.99
18	17.250	12.09	4.52
20	19.250	15.19	5.04
24	23.250	22.13	6.08

Notes:

[a] Modified from Carrier Air Conditioning Company, Inc., *Carrier System Design Manual*, 1973, Chapter 1, page 3-2

[b] Gallons per linear foot of straight pipe

[c] Square feet per linear foot of straight pipe

1	Maximum volume of waste to be removed from the tank and ancillary piping (Enter from worksheet TS-2, line 1.E)	gal	
2	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
3	Labor and equipment cost per work hour[b]	$	
4	Work rate required to remove waste from tank and ancillary piping[c]	work hr/gal	
5	Number of hours required to remove waste from tank and ancillary piping (Multiply line 1 by line 4) (One hour minimum; round up to the half-hour)	work hrs	
TOTAL COST OF REMOVAL OF WASTE FROM TANK AND ANCILLARY PIPING (Multiply line 3 by line 5) (Enter total on Worksheet TS-1, line 1)			**$**

Notes:

[a] Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct each activity.

[b] Enter the estimated cost per work hour of all labor and equipment needed to remove waste from the unit.

[c] Enter the estimated number of hours required to remove one gallon of waste from the tank system. If, for example, it will take 1 minute to remove each gallon of waste from the system, enter a work rate of 0.017 (1 divided by 60) for removing the waste. If an estimate of the total number of hours required to remove waste from the tank and ancillary piping has already been formulated, you may bypass this step and enter that number directly on line 5.

Complete this worksheet only if the contents of the tank system are ignitible.

1	Maximum capacity of tank system (Enter from Worksheet TS-2, line 1.E)	gal	
2	Amount of dry ice needed to purge tank system (Divide line 1 by 100 gal and multiply value by 1.5 lbs)	lbs	
3	Cost of one pound of dry ice	$ /lb	
4	Cost of dry ice needed to purge tank system (Multiply line 2 by line 3)		$
5	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
6	Labor cost per work hour[b]	$	
7	Work rate required to purge tank system per gal capacity[c]	work hr/ gal capacity	
8	Number of hours required to purge tank system (Multiply line 1 by line 7) (One hour minimum; round up to the half-hour)	work hrs	
9	Labor cost to purge tank system (Multiply line 6 by line 8)		$
TOTAL COST OF TANK SYSTEM PURGING (Add lines 4 and 9) (Enter total on Worksheet TS-1, line 2)			**$**

Notes:

[a] Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct each activity.

[b] Enter the estimated cost per work hour of all labor and equipment needed to purge the tank system.

[c] Enter the estimated number of hours required to purge the tank system for every gallon of capacity. If, for example, it will take 1 minute for every gallon of capacity to purge the tank system, enter a work rate of 0.017 (one divided by 60) for purging the tank system. If an estimate of the total number of hours required to purge the tank system has already been formulated, you may bypass this step and enter that number directly on line 8.

1	Maximum capacity of the tank and ancillary piping (Enter from Worksheet TS-2, line 1.E)	gal	
2	Number of times tank and ancillary piping will be flushed (if unknown, assume 1)		
3	Total volume of flushing solution (Multiply line 1 by line 2)	gal	
4	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
5	Labor and equipment cost per work hour[b]	$	
6	Work rate required to flush tank and ancillary piping[c]	work hr/gal	
7	Number of hours required to flush tank and ancillary piping (Multiply line 3 by line 6) (One hour minimum; round up to the half-hour)	work hrs	
8	Subtotal of labor and equipment costs to flush tank and ancillary piping (Multiply line 5 by line 7)		$
9	Total volume of flushing solution (Enter from line 3). (The flushing solution generated may be disposed of in drums or as bulk liquid. If the volume is too large to be handled effectively by placement in drums, use worksheet TS-13B (for water-based flushing solution) or TS-12 and TS-13A (for a solvent solution) to calculate the transportation, treatment, and disposal cost. If the flushing solution is to be placed in drums, complete lines 10 through 12.)	gal	
10	Number of drums required to contain flushing solution (Divide line 9 by 55 gallons per drum; round up to the nearest whole number)	drums	
11	Cost of one drum	$ /drum	
12	Cost of drums needed to contain flushing solution (Multiply line 10 by line 11)		$
TOTAL COST OF FLUSHING OF TANK AND ANCILLARY PIPING (Add lines 8 and 12) (Enter total on Worksheet TS-1, line 3)			**$**

Remember to calculate costs for transporting, treating, and disposing of the wastes in drums that are generated from this activity, using worksheets TS-12 and TS-13A, respectively. If the wastes are to be managed as a bulk liquid, use worksheet TS-13B.

FLUSHING THE TANK AND PIPING - Page 2 of 2

Notes:

[a] Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct each activity.

[b] Enter the estimated cost per work hour of all labor and equipment needed to flush the tank system.

[c] Enter the estimated number of hours required to flush the tank system for every one gallon of flushing solution. If, for example, it will take 1 minute for every gallon of flushing solution to flush the tank system, enter a work rate of 0.017 (1 divided by 60) for flushing the tank and piping. If an estimate of the total number of hours required to flush the tank and piping has already been formulated, you may bypass this step and enter that number directly on line 7.

This worksheet can be used to determine the costs of disassembling and loading aboveground or on-ground tanks and ancillary piping.[a]

1 DISASSEMBLY OF ANCILLARY PIPING			
1.A	Length of ancillary piping to be disassembled (Enter from worksheet TS-2, line 1.C)	ft	
1.B	Level of PPE assumed for this activity (protection level D, C, or B)[b]	level of PPE	
1.C	Labor and equipment cost per work hour[c]	$	
1.D	Work rate required to disassemble one ft of pipe[d]	work hr/ft	
1.E	Number of hours required to disassemble ancillary piping (Multiply line 1.A by line 1.D) (One hour minimum; round up to the half-hour)	work hrs	
1.F	**Cost to Disassemble Ancillary Piping (Multiply line 1.C by line 1.E)**		**$**
2 LOADING			
2.A	Capacity of tank (Enter from worksheet TS-2, line 1.B)	gal	
2.B	Level of PPE assumed for this activity (protection level D, C, or B)[b]	level of PPE	
2.C	Labor and equipment cost per work hour[e]	$	
2.D	Work rate required to load tank per gallon capacity[f]	work hr/ gal capacity	
2.E	Number of hours required to load tank (Multiply line 2.A by line 2.D) (One hour minimum; round up to the half-hour)	work hrs	
2.F	**Cost to Load Tank (Multiply line 2.C by line 2.E)**		**$**
TOTAL COST OF DISASSEMBLY AND LOADING (Add lines 1.F and 2.F) (Enter total on Worksheet TS-1, line 4)			**$**

Notes:

[a] Owners and operators of in-ground and underground tank systems are not eligible to use standard permits.

[b] Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct each activity.

[c] Enter the estimated cost per work hour of all labor and equipment needed to disassemble ancillary piping.

[d] Enter the estimated number of work hours required to disassemble one foot of ancillary piping. If, for example, it will take 10 minutes to disassemble each foot of ancillary piping, enter a work rate of 0.167 (10 divided by 60) for disassembling the piping. If an estimate of the total number of hours required to disassemble the piping has already been formulated, you may bypass this step and enter that number directly on line 1.E.

[e] Enter the estimated cost per work hour of all labor and equipment needed to load components of the on-ground or aboveground tank system. In addition to costs for labor, this cost should include the average cost per work hour of rental of all equipment and purchase of all supplies needed to conduct this activity.

[f] Enter the estimated number of work hours per gallon of capacity required to load the components of the on-ground or aboveground tank system. If, for example, it will take 1 minute for every gallon of capacity to load components of the tank system, enter a work rate of 0.017 (1 divided by 60) for loading the system. If an estimate of the total number of hours required to load the tank system has already been formulated, you may bypass this step and enter that number directly on line 2.E.

DEMOLITION AND REMOVAL OF CONTAINMENT SYSTEM - Page 1 of 2

1 DEMOLITION OF CONTAINMENT SYSTEM			
1.A	Area of containment system (Enter from worksheet TS-2; add lines 3.C, 5.C, and 7.A)	ft^2	
1.B	Level of PPE that you are assuming for this activity (protection level D, C, or B)[a]	level of PPE	
1.C	Labor and equipment cost per work hour[b]	$	
1.D	Work rate required to demolish one ft^2 of containment system[c]	work hr/ft^2	
1.E	Number of hours required to demolish the containment system (Multiply line 1.A by line 1.D) (One hour minimum; round up to the half-hour)	work hrs	
1.F	**Cost of Demolition of the Containment System (Multiply line 1.C by line 1.E)**		**$**
2 REMOVAL AND LOADING OF CONTAINMENT SYSTEM			
2.A	Volume of the containment system (Enter from worksheet TS-2; add lines 4.C, 6.C, and 8)	yd^3	
2.B	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
2.C	Labor and equipment cost per work hour[d]	$	
2.D	Work rate to remove and load one yd^3[e]	work hr/yd^3	
2.E	Number of hours required to remove and load the containment system (Multiply line 2.A by line 2.D) (One hour minimum; round up to the half-hour)	work hrs	
2.F	Subtotal of labor and equipment costs to remove and load the containment system (Multiply line 2.C by line 2.E)		$
2.G	Number of debris box containers needed to hold the containment system (Divide line 2.A by 20 yd^3 per container; round up to the nearest whole number)	containers	
2.H	Cost of one 20-yd^3-capacity debris box container (rent per week)	$ /container	

DEMOLITION AND REMOVAL OF CONTAINMENT SYSTEM - Page 2 of 2

2.I	Cost of containers (Multiply line 2.G by line 2.H)	$
2.J	Cost of mobilization and demobilization (flat rate)	$
2.K	**Cost to Remove and Load Containment System (Add lines 2.F, 2.I, and 2.J)**	**$**
TOTAL COST OF DEMOLITION AND REMOVAL OF CONTAINMENT SYSTEM (Add lines 1.F and 2.K) (Enter total on worksheet TS-1, line 5)		**$**

Notes:

[a] Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct each activity.

[b] Enter the estimated cost per work hour of all labor and equipment needed to demolish the containment system.

[c] Enter the estimated number of work hours required to demolish one ft^2 of the containment system. If, for example, it will take 5 minutes to demolish one ft^2 of the containment system, enter a work rate of 0.083 (5 divided by 60) to demolish the system. If an estimate of the total number of hours required to demolish the containment system has already been formulated, you may bypass this step and enter that number directly on line 1.E.

[d] Enter the estimated cost per work hour of all labor and equipment needed to remove and load the containment system. In addition to costs for labor, this cost should include the average cost per work hour of rental of all equipment and purchase of all supplies needed to conduct this activity.

[e] Enter the estimated number of work hours required to remove and load one yd^3 of the containment system. If, for example, it will take 5 minutes to remove and load one yd^3 of the containment system, enter a work rate of 0.083 (5 divided by 60) to remove and load the system. If an estimate of the total number of hours required to remove and load the containment system has already been formulated, you may bypass this step and enter that number directly on line 2.E.

1	Volume of contaminated soil to be removed (Enter from worksheet TS-2, line 9.E)	yd^3	
2	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
3	Labor and equipment cost per work hour[b]	$	
4	Work rate required to remove one yd^3[3,c]	work hr/yd^3	
5	Number of hours required to remove soil (Multiply line 1 by line 4) (One hour minimum; round up to the half-hour)	work hrs	
6	Subtotal of labor and equipment costs to remove soil (Multiply line 3 by line 5)		$
7	Number of debris box containers needed to hold soil (Divide line 1 by 20 yd^3 per container; round up to the nearest whole number)	containers	
8	Cost of one 20-yd^3-capacity debris box container (rent per week)	$ /container	
9	Cost of containers (Multiply line 7 by line 8)		$
10	Cost of mobilization and demobilization (flat rate)		$
	TOTAL COST OF REMOVAL OF SOIL (Add lines 6, 9, and 10) (Enter total on Worksheet TS-1, line 6)		**$**

Notes:

[a] Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct each activity.

[b] Enter the estimated cost per work hour of all labor and equipment needed to remove soil.

[c] Enter the estimated number of work hours required to remove one yd^3 of soil. If, for example, it will take 5 minutes to remove one yd^3 of soil, enter a work rate of 0.083 (5 divided by 60) to remove the soil. If the total number of hours required to remove soil already is known, you may bypass this step and enter that number directly on line 5.

To calculate the cost of backfilling, the total volume of fill material required must be estimated. Add the volumes of all subsurface materials removed to determine the total volume of fill material needed.

1	Volume of fill (Enter from Worksheet TS-2; add lines 4.C and 9.E, as appropriate)[a]	yd^3	
2	Compaction factor[b]		
3	Volume of additional fill required because of compaction factor (Multiply line 1 by line 2)	yd^3	
4	Total volume of fill needed (Add lines 1 and 3) (One yd^3 minimum; round up to the nearest whole number)	yd^3	
5	Level of PPE assumed for this activity (protection level D, C, or B)[c]	level of PPE	
6	Labor, material, and equipment cost per yd^3[d]	$ /yd^3	
7	Subtotal of labor, material, and equipment costs to backfill (Multiply line 4 by line 6)		$
8	Cost of mobilization and demobilization (flat rate)		$
TOTAL COST OF BACKFILL (Add lines 7 and 8) (Enter total on worksheet TS-1, line 7)			**$**

Notes:

[a] If the structures, or portions of the structures, identified in sections 7 and 8 of the inventory worksheet are below the ground surface, the additional volumes of fill that will be required should be added to this estimate.

[b] Enter an appropriate factor in the form of a decimal (for example, 0.25) to account for the compaction of fill material. U.S. Environmental Protection Agency, *Final Guidance Manual: Cost Estimates for Closure and Post-Closure Plans (Subparts G and H)*, January 1987, EPA/530-SW-87-009, Volume III, pg. 7-10 suggests a compaction factor for native soil for slope and fill of 0.25.

[c] Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct each activity.

[d] Enter the estimated cost per yd^3 of all labor, material, and equipment needed to conduct backfilling.

DECONTAMINATION SUMMARY SHEET - Page 1 of 1

Facility Name: _____

DECONTAMINATION SUMMARY WORKSHEET

	Activity	Worksheet Number	Cost ($)
1.	Decontamination of Unit by Steam Cleaning or Pressure Washing	TS-10A	
2.	Decontamination of Unit by Sandblasting	TS-10B	
3.	Decontamination of Heavy Equipment	TS-10C	
TOTAL COST OF DECONTAMINATION ***(Add lines 1, 2, and 3)*** ***(Enter total on Worksheet TS-1, line 8)***			**$**

DECONTAMINATION OF UNIT BY STEAM CLEANING OR PRESSURE WASHING - Page 1 of 2

1	Area of unit to be decontaminated (Enter from Worksheet TS-2; add lines 2.C, 3.C, 5.C, and 7.A)	ft^2	
2	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
3	Labor and equipment cost per work hour[b]	$	
4	Work rate to steam clean or pressure wash one ft^2[c]	work hrs/ft^2	
5	Number of hours required to steam clean or pressure wash the unit (Multiply line 1 by line 4) (One hour minimum; round up to the half-hour)	work hrs	
6	Subtotal of labor and equipment cost to decontaminate the unit by steam cleaning or pressure washing (Multiply line 3 by line 5)		$
7	Volume of decontamination fluid (Multiply line 1 by 4 gal/ft^2)[d] (The decontamination fluids generated may be disposed of in drums or as bulk liquid. If the volume is too large to be handled effectively by placement in drums, use worksheet TS-13B to calculate the cost of transportation and disposal. If the decontamination fluids are to be placed in drums, complete lines 8 through 10.)	gal	
8	Number of drums required to contain decontamination fluid for removal (Divide line 7 by 55 gallons per drum; round up to the nearest whole number)	drums	
9	Cost of one drum	$ /drum	
10	Cost of drums needed to contain decontamination fluid (Multiply line 8 by line 9)		$
	TOTAL COST OF DECONTAMINATION OF UNIT BY STEAM CLEANING OR PRESSURE WASHING (For bulk liquids, enter from line 6. For liquids in drums, add lines 6 and 10.) (Enter total on Worksheet TS-10, line 1)		**$**

Remember to calculate costs for transporting, treating, and disposing of all decontamination fluids in drums that are generated from this activity, using worksheets TS-12 and TS-13A, respectively. If decontamination fluids are to be managed as a bulk liquid, use Worksheet TS-13B.

DECONTAMINATION OF UNIT BY STEAM CLEANING OR PRESSURE WASHING - Page 2 of 2

Notes:

[a] *Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct this activity.*

[b] *Enter the estimated cost per work hour of all labor and equipment needed to decontaminate the unit by steam cleaning or pressure washing.*

[c] Enter the estimated number of work hours required to steam clean or pressure wash one ft^2 of surface area. If, for example, it is estimated that it will take 10 minutes to steam clean or pressure wash one ft^2 of surface area, enter a work rate of 0.167 (10 divided by 60) for steam cleaning or pressure washing the unit. If an estimate of the total number of hours required to decontaminate the unit has already ben formulated, you may bypass this step and enter that number directly on line *5*.

[d] U.S. Environmental Protection Agency, *Final Guidance Manual: Cost Estimates for Closure and Post-Closure Plans (Subparts G and H)*, November 1986, EPA/530-SW-87-009, Volume III, pg. 5-3. *The generation rate provided is recommended for this activity. However, alternative generation rates also may be used, if appropriate.*

DECONTAMINATION OF UNIT BY SANDBLASTING - Page 1 of 2

1	Area of unit to be decontaminated (Enter from Worksheet TS-2; add lines 2.C, 3.C, 5.C, and 7.A)	ft^2	
2	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
3	Labor and equipment cost per work hour[b]	$	
4	Work rate to sandblast one ft^2[,c]	work hrs/ft^2	
5	Number of hours required to sandblast the unit (Multiply line 1 by line 4) (One hour minimum; round up to the half-hour)	work hrs	
6	Subtotal of labor and equipment cost to decontaminate unit by sandblasting (Multiply line 3 by line 5)		$
7	Volume of material used for sandblasting (Multiply line 1 by 2 lbs/ft^2)[d]	lbs	
8	Number of drums required to contain decon-tamination sands for removal (Divide line 7 by 808.89 lbs per drum; round up to the nearest whole number)[e]	drums	
9	Cost of one drum	$ /drum	
10	Cost of drums needed to contain decontamination sands (Multiply line 8 by line 9)		$
TOTAL COST OF DECONTAMINATION OF UNIT BY SANDBLASTING (Add lines 6 and 10) (Enter total on Worksheet TS-10, line 2)			**$**

DECONTAMINATION OF UNIT BY SANDBLASTING - Page 2 of 2

Notes:

[a] *Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct this activity.*

[b] *Enter the estimated cost per work hour of all labor and equipment needed to decontaminate the unit by sandblasting.*

[c] Enter the estimated number of work hours required to sandblast one ft^2 of surface area. If, for example, it is estimated that it will take 10 minutes to sandblast one ft^2 of surface area, enter a work rate of 0.167 (10 divided by 60) for sandblasting the unit. If an estimate of the total number of hours required to sandblast the unit has already been formulated, you may bypass this step and enter that number directly on line *5*.

[d] U.S. Environmental Protection Agency, *Final Guidance Manual: Cost Estimates for Closure and Post-Closure Plans (Subparts G and H)*, January 1987, EPA/530-SW-87-009, Volume III, pg. 5-3. The generation rate provided is recommended for this activity. However, alternative generation rates also may be used, if appropriate.

[e] Unit weight of medium sand, on average, equals 110 lbs/ft^3. Using the conversions of 0.1337 ft^3/gal and 55-gal/drum, the calculation is: 110 lbs/ft^3 x 0.1337 ft^3/gal x 55 gal/drum = 808.89 lb/drum.

1	Number of hours needed to decontaminate all heavy equipment used during closure of the unit (Enter from Page 3 of 3 of this worksheet)	work hrs	
2	Cost of rental of steam cleaner per hour	$ /hr	
3	Subtotal rental costs for steam cleaner (Multiply line 1 by line 2)		$
4	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
5	Labor cost per work hour[b]	$	
6	Subtotal of labor costs (Multiply line 1 by line 5)		$
7	Volume of decontamination fluid (Multiply line 1 by 100 gallons per hour) (The decontamination fluids generated may be disposed of in drums or as bulk liquid. If the volume is too large to be handled effectively by placement in drums, use worksheet TS-13B to calculate the cost of transportation and disposal. If the decontamination fluids are to be placed in drums, complete lines 8 through 10.)	gal	
8	Number of drums required to contain decon-tamination fluid for removal (Divide line 7 by 55 gallons per drum and round up to the nearest whole number)	drums	
9	Cost of one drum	$ /drum	
10	Cost of drums (Multiply line 8 by line 9)		$
11	Cost of construction of temporary decontamination area for heavy equipment (Include this cost if no permanent decontamination area exists) **NOTE: THIS COST USUALLY IS INCURRED ONLY ONCE FOR THE CLOSURE OF ALL UNITS**		$

12	Cost of demolition of temporary decontamination area for heavy equipment (Include this cost if no permanent decontamination area exists) **NOTE: THIS COST USUALLY IS INCURRED ONLY ONCE FOR THE CLOSURE OF ALL UNITS**	$
	TOTAL COST OF DECONTAMINATION OF HEAVY EQUIPMENT (Add lines 3, 6, 10, 11, and 12) (Enter total on worksheet TS-10, line 3)	**$**

Remember to calculate costs for transporting, treating, and disposing of all wastes in drums that are generated from this activity, using worksheets TS-12 and TS-13A, respectively. If decontamination fluids are to be managed as a bulk liquid, use worksheet TS-13B.

Notes:

[a] *Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct this activity.*

[b] *Enter the estimated cost per work hour of all labor required to decontaminate heavy equipment.*

Decontamination Times for Heavy Equipment[a] Reference for Line 1

Use the following estimates to calculate the total number of hours needed to decontaminate all heavy equipment that will be used for closure activities.

Equipment	Decontamination Time (Hours)
Forklift	1
Rotary disc	1
Tractor	2
Tank wagon	2
Front-end loader	3
Dozer	3
Backhoe	3
Front shovel	3

Notes:

[a] U.S. Environmental Protection Agency, *Final Guidance Manual: Cost Estimates for Closure and Post-Closure Plans (Subparts G and H)*, January 1987, EPA/530-SW-87-009, Volume III, pg. 5-2. Decontamination times provided for specific pieces of equipment are recommended for this activity. However, alternative times also may be used, as appropriate.

SAMPLING AND ANALYSIS SUMMARY SHEET - PAGE 1 of 1

Facility Name: _____

SAMPLING AND ANALYSIS SUMMARY WORKSHEET

	Activity	Worksheet Number	Cost ($)
1.	Drilling and Subsurface Soil Sampling & Analysis	TS-11B	
2.	Concrete Core Sampling & Analysis	TS-11C	
3.	Wipe Sampling & Analysis	TS-11D	
4.	Surface Water/Liquid Sampling & Analysis	TS-11E	
5.	Soil/Sludge/Sediment Sampling & Analysis	TS-11F	
TOTAL SAMPLING AND ANALYSIS COST ***(Add lines 1 through 5)*** ***(Enter total on Worksheet TS-1, line 9)***			**$**

SAMPLE INVENTORY - Page 1 of 2

The information entered on this inventory worksheet will be used in completing the appropriate worksheets to determine the cost of sampling and analysis during closure. Depending on the types of samples to be collected and analyzed, it may not be necessary to complete all sections of this inventory worksheet.

1 NUMBER OF DRILLING AND SUBSURFACE SOIL SAMPLES

In the space below, identify the number of boreholes and the number of subsurface soil samples per borehole to be collected for each individual unit. Record the total number of samples to be collected in the box provided.

1	**Number of Subsurface Soil Samples** **Boring Diameter:**	**boreholes**	**samples/borehole**	**total samples**

2 NUMBER OF CONCRETE CORE SAMPLES

In the space below, identify the number of concrete core samples to be collected for each individual unit. Record the total number of samples to be collected in the box provided.

2	**Number of Concrete Core Samples**	**total samples**

3 NUMBER OF WIPE SAMPLES

In the space below, identify the number of sample locations and the number of wipe samples per location to be collected for each individual unit. Record the total number of samples to be collected in the box provided.

3	**Number of Wipe Samples**	**locations**	**samples/location**	**total samples**

4 NUMBER OF SURFACE WATER/LIQUID SAMPLES

In the space below, identify the number of grab samples taken on lakes, rivers, or ponds and samples taken of liquid wastes such as rinsate and surface water. Record the total number of samples to be collected in the box provided.

4	**Number of Aqueous Samples**	**locations**	**samples/location**	**total samples**

5 NUMBER OF SOIL/SLUDGE/SEDIMENT SAMPLES

In the space below, identify the number of grab samples taken of surface soil, sludge, sediment, or concrete chips and the number of samples per location to be collected for each individual unit. Record the total number of samples to be collected in the box provided.

5	**Number of Nonaqueous Samples**			
		locations	**samples/location**	**total samples**

Use this worksheet to estimate the cost of collecting samples of subsurface soil or rock. This worksheet assumes the use of a drill rig or other mechanical equipment to bore or core soil and rock, by various drilling methods.

1	**COLLECTING SUBSURFACE SOIL SAMPLES - 2-1/2-INCH-DIAMETER BOREHOLE**		
1.A	Number of boreholes to be drilled (Enter from worksheet TS-11A, line 1)	boreholes	
1.B	Total depth of all boreholes (Add all depths. If the depths are not known, estimate the average depth of the boreholes to be drilled and multiply the estimated depth by line 1.A)	ft	
1.C	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
1.D	Labor and equipment cost per work hour[b]	$ /work hr	
1.E	Work rate to drill 2-1/2-inch-diameter hole[c]	work hr/ft	
1.F	Number of hours required to drill total depth of 2-1/2-inch-diameter holes (Multiply line 1.B by line 1.E) (One hour minimum; round up to the half-hour)	work hrs	
1.G	**Cost to Drill 2-1/2-inch Borings (Multiply line 1.D by line 1.F)**		**$**
2	**COLLECTING SUBSURFACE SOIL SAMPLES - 4-INCH-DIAMETER BOREHOLE**		
2.A	Number of boreholes to be drilled (Enter from worksheet TS-11A, line 1)	boreholes	
2.B	Total depths of all boreholes (Add all depths. If the depths are not known, estimate the average depth of the boreholes to be drilled and multiply the estimated depth by line 2.A)	ft	
2.C	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
2.D	Labor and equipment cost per work hour[b]	$ /work hr	
2.E	Work rate to drill 4-inch-diameter hole[d]	work hr/ft	
2.F	Number of work hours required to drill total depth of 4-inch-diameter holes (Multiply line 2.B by line 2.E) (One hour minimum; round up to the half-hour)	work hrs	
2.G	**Cost to Drill 4-inch Borings (Multiply line 2.D by line 2.F)**		**$**

3	**ANALYZING SUBSURFACE SOIL SAMPLES**		
3.A	Determine the cost of analysis per sampling event for subsurface soil samples (Enter from Page 3 of 3 of this worksheet)	$ /event	
3.B	Number of sampling events	events	
3.C	**Cost to Analyze Subsurface Soil Samples (Multiply line 3.A by line 3.B)**		**$**
	TOTAL COST OF COLLECTION AND ANALYSIS OF SUBSURFACE SOIL SAMPLES (Add lines 1.G, 2.G, and 3.C) (Enter total on Worksheet TS-11, line 1)		**$**

Notes:

[a] Because workers who are encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours needed to conduct this activity.

[b] Enter the estimated cost per work hour of all labor and equipment needed to collect boring and subsurface soil samples. Costs may vary significantly, depending upon the method of drilling to be used.

[c] Enter the estimated number of work hours per foot required to drill a 2½-inch-diameter hole and collect subsurface soil samples. If, for example, it is estimated that it will take 45 minutes per foot to drill a 2½-inch-diameter hole and collect a sample, enter a work rate of 0.750 (45 divided by 60) for conducting those activities. The work rate should account for the time required to mobilize equipment; collect, handle, and pack the samples; and decontaminate the sampling team and all its sampling equipment. If an estimate of the total number of hours required to drill 2½-inch-diameter holes and collect subsurface soil samples has already been formulated, you may bypass this step and enter that number directly on line 1.F.

[d] Enter the estimated number of work hours per foot required to drill a 4-inch-diameter hole and collect subsurface soil samples. If, for example, it is estimated that it will take 45 minutes per foot to drill a 4-inch-diameter hole and collect a sample, enter a work rate of 0.750 (45 divided by 60) for drilling the hole. The work rate should account for the time required to mobilize equipment; collect, handle, and pack the samples; and decontaminate the sampling team and all sampling equipment. If an estimate of the total number of hours required to drill 4-inch holes and collect subsurface soil samples has already been formulated, you may bypass this step and enter that number directly on line 2.F.

Estimated Analytical Cost per Sampling Event
Reference for Line 3.A

Column 1 Analytical Parameter and Method	Column 2 Cost of Analysis ($) per Parameter	Column 3 Number of Analyses, including QC Analyses[a]	Column 4 Total Cost of Analysis ($) per Parameter per Event (Multiply Column 2 by Column 3)
TOTAL COST OF ANALYZING SUBSURFACE SOIL SAMPLES (Sum of all costs in Column 4)			**$ /event**

Notes:

[a] *Determine the total number of samples to be analyzed at the time of closure. The number of quality control (QC) samples typically is estimated at 20 percent of the total number of samples to be analyzed.*

Coring may be necessary to collect samples from hard surfaces, such as concrete.

1	**COLLECTING CONCRETE CORE SAMPLES**		
1.A	Number of concrete core samples to be collected (Enter from worksheet TS-11A, line 2)	core samples	
1.B	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
1.C	Labor and equipment cost per work hour[b]	$	
1.D	Work rate to drill a 3-inch-diameter core sample boring to a depth of 6-inches[c]	work hr/sample	
1.E	Number of hours required to drill 3-inch-diameter borings (Multiply line 1.A by Line 1.D) (One hour minimum; round up to the half-hour)	work hrs	
1.F	**Cost to Collect Concrete Core Samples (Multiply line 1.C by line 1.E)**		**$**
2	**ANALYZING CONCRETE CORE SAMPLES**		
2.A	Determine the cost of analysis per sampling event for concrete core samples (Enter from Page 2 of 2 of this worksheet)	$ /event	
2.B	Enter the number of sampling events	events	
2.C	**Cost to Analyze Concrete Core Samples (Multiply line 2.A by line 2.B)**		**$**
	TOTAL COST OF COLLECTION AND ANALYSIS OF CONCRETE CORE SAMPLES (Add lines 1.F and 2.C) (Enter total on worksheet TS-11, line 2)		**$**

Notes:

[a] *Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct this activity.*

[b] Enter the estimated cost per work hour of all labor and equipment needed to collect concrete core samples.

[c] Enter the estimated number of work hours required to drill a 3-inch diameter core sample boring to a depth of 6 inches. If, for example, it is estimated that it will take 45 minutes to drill one 3-inch diameter core sample boring, enter a work rate of 0.750 (45 divided by 60) for conducting that activity. *The work rate should account for the time required to mobilize equipment; collect, handle, and pack the samples; and decontaminate the sampling team and all sampling equipment.* If an estimate of the total number of hours required to drill 3-inch-diameter borings has already been formulated, you may bypass this step and enter that number directly on line 1.E.

Estimated Analytical Cost per Sampling Event
Reference for Line 2.A

Column 1 Analytical Parameter and Method	Column 2 Cost of Analysis ($) per Parameter	Column 3 Number of Analyses, including QC Analyses[a]	Column 4 Total Cost of Analysis ($) per Parameter per Event (Multiply Column 2 by Column 3)
TOTAL COST OF ANALYZING CONCRETE CORE SAMPLES (Sum of all costs in Column 4)			**$ /event**

Notes:

[a] **Determine the total number of samples to be analyzed at the time of closure. The number of quality control (QC) samples typically is estimated at 20 percent of the total number of samples to be analyzed.**

Wipe samples often are used to assess the presence or extent of contamination on hard, relatively nonporous surfaces. In general, wipe sampling is used only when the contaminant of concern has a heavy, persistent characteristic, meaning it does not easily volatilize or leave the surface being sampled.

1 COLLECTING WIPE SAMPLES			
1.A	Number of wipe samples to be collected (Enter from worksheet TS-11A, line 3)	samples	
1.B	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
1.C	Labor and equipment cost per work hour[b]	$	
1.D	Work rate required to collect one sample[c]	work hr/sample	
1.E	Number of hours required to collect all samples (Multiply line 1.A by line 1.D)	work hrs	
1.F	**Cost to Collect Wipe Samples (Multiply line 1.C by line 1.E)**		**$**
2 ANALYZING WIPE SAMPLES			
2.A	Cost of analysis per sampling event for wipe samples (Enter from Page 2 of 2 of this worksheet)	$ /event	
2.B	Number of sampling events	events	
2.C	**Cost to Analyze Wipe Samples (Multiply line 2.A by line 2.B)**		**$**
TOTAL COST OF COLLECTION AND ANALYSIS OF WIPE SAMPLES (Add lines 1.F and 2.C) (Enter total on Worksheet TS-11, line 3)			**$**

Notes:

[a] *Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct this activity.*

[b] Enter the estimated cost per work hour of all labor and equipment needed to collect wipe samples.

[c] Enter the estimated number of work hours required to collect one wipe sample. If, for example, it is estimated that it will take 10 minutes per sample to collect wipe samples, enter a work rate of 0.167 (10 divided by 60) for collecting the samples. *The work rate should account for the time required to mobilize equipment; collect, handle, and pack the samples; and decontaminate the sampling team and all sampling equipment.* If an estimate of the total number of hours required to collect wipe samples has already been formulated, you may bypass this step and enter that number directly on line 1.E.

Estimated Analytical Cost per Sampling Event
Reference for Line 2.A

Column 1 Analytical Parameter and Method	Column 2 Cost of Analysis ($) per Parameter	Column 3 Number of Analyses, including QC Analyses[a]	Column 4 Total Cost of Analysis ($) per Parameter per Event (Multiply Column 2 by Column 3)
TOTAL COST OF ANALYZING WIPE SAMPLES (Sum of all costs in Column 4)			**$ /event**

Notes:

[a] *Determine the total number of samples to be analyzed at the time of closure. The number of QC samples typically is estimated at 20 percent of the total number of samples to be analyzed.*

Surface water/liquid samples are grab samples taken from lakes, rivers, or ponds, and samples taken of liquid wastes such as rinsate and wastewater. This worksheet is not to be used to estimate the cost of sampling and analyzing other aqueous media, such as groundwater.

1 COLLECTING SURFACE WATER/LIQUID SAMPLES			
1.A	Number of surface water/liquid samples to be collected (Enter from worksheet TS-11A, line 4)	samples	
1.B	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
1.C	Labor and equipment cost per work hour[b]		
1.D	Work rate required to collect one sample[c]	work hr/sample	
1.E	Number of hours required to collect all samples (Multiply line 1.A by line 1.D)	work hrs	
1.F	**Cost to Collect Surface Water/Liquid Samples (Multiply line 1.C by line 1.E)**		**$**
2 ANALYZING SURFACE WATER/LIQUID SAMPLES			
2.A	Cost of analysis per sampling event for surface water/liquid samples (Enter from Page 2 of 2 of this worksheet)	$ /event	
2.B	Number of sampling events	events	
2.C	**Cost to Analyze Surface Water/Liquid Samples (Multiply line 2.A by line 2.B)**		**$**
	TOTAL COST OF COLLECTION AND ANALYSIS OF SURFACE WATER/LIQUID SAMPLES (Add lines 1.F to line 2.C) (Enter total on Worksheet TS-11, line 4)		**$**

Notes:

[a] *Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct this activity.*

[b] Enter the estimated cost per work hour of all labor and equipment needed to collect surface water/liquid samples.

[c] Enter the estimated number of work hours required to collect one surface water/liquid sample. If, for example, it is estimated that it will take 10 minutes per sample to collect surface water/liquid samples, enter a work rate of 0.167 (10 divided by 60) for collecting the samples. *The work rate should account for the time required to mobilize equipment; collect, handle, and pack the samples; and decontaminate the sampling team and all sampling equipment.* If an estimate of the total number of hours required to collect surface water/liquid samples has already been formulated, you may bypass this step and enter that number directly on line 1.E.

Estimated Analytical Cost per Sampling Event
Reference for Line 2.A

Column 1 Analytical Parameter and Method	Column 2 Cost of Analysis ($) per Parameter	Column 3 Number of Analyses, including QC Analyses[a]	Column 4 Total Cost of Analysis ($) per Parameter per Event (Multiply Column 2 by Column 3)
TOTAL COST OF ANALYZING SURFACE WATER/LIQUID SAMPLES (Sum of all costs in Column 4)			**$ /event**

Notes:

[a] *Determine the total number of samples to be analyzed at the time of closure. The number of QC samples typically is estimated at 20 percent of the total number of samples to be analyzed.*

Soil/sludge/sediment samples are grab samples of surface soil, sludge, sediment, or concrete chips. Such samples are shallow samples, that is, they are typically collected at depths of less than 1.5 feet below the ground surface.

1	**COLLECTING SOIL/SLUDGE/SEDIMENT SAMPLES**		
1.A	Number of soil/sludge/sediment samples to be collected (Enter from worksheet TS-11A, line 5)	samples	
1.B	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
1.C	Labor and equipment cost per work hour[b]	$	
1.D	Work rate required to collect one sample[c]	work hr/sample	
1.E	Number of hours required to collect all samples (Multiply line 1.A by line 1.D)	work hrs	
1.F	**Cost to Collect Soil/Sludge/Sediment Samples (Multiply line 1.C by line 1.E)**		**$**
2	**ANALYZING SOIL/SLUDGE/SEDIMENT SAMPLES**		
2.A	Cost of analysis per sampling event for soil/sludge/sediment samples (Enter from Page 2 of 2 of this worksheet)	$ /event	
2.B	Number of sampling events	events	
2.C	**Cost to Analyze Soil/Sludge/Sediment Samples (Multiply line 2.A by line 2.B)**		**$**
	TOTAL COST OF COLLECTION AND ANALYSIS OF SOIL/SLUDGE/SEDIMENT SAMPLES (Add lines 1.F and 2.C) (Enter total on Worksheet TS-11, line 5)		**$**

Notes:

[a] *Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct this activity.*

[b] Enter the estimated cost per work hour of all labor and equipment needed to collect soil/sludge/sediment samples.

[c] Enter the estimated number of work hours required to collect one soil/sludge/sediment sample. If, for example, it is estimated that it will take 10 minutes per sample to collect soil/sludge/sediment samples, enter a work rate of 0.167 (10 divided by 60) for collecting the samples. *The work rate should account for the time required to mobilize equipment; collect, handle, and pack the samples; and decontaminate the sampling team and all sampling equipment.* If an estimate of the total number of hours required to collect soil/sludge/sediment samples has already been formulated, you may bypass this step and enter that number directly on line 1.E.

Estimated Analytical Cost per Sampling Event
Reference for Line 2.A

Column 1 Analytical Parameter and Method	Column 2 Cost of Analysis ($) per Parameter	Column 3 Number of Analyses, including QC Analyses[a]	Column 4 Total Cost of Analysis ($) per Parameter per Event (Multiply Column 2 by Column 3)
TOTAL COST OF ANALYZING SOIL/SLUDGE/SEDIMENT SAMPLES (Sum of all costs in Column 4)			**$ /event**

Notes:

[a] *Determine the total number of samples to be analyzed at the time of closure. The number of QC samples typically is estimated at 20 percent of the total number of samples to be analyzed.*

Depending on the activities being conducted, it may not be necessary to complete all sections of the transportation worksheet.

1	**TRANSPORTATION OF WASTE IN DRUMS**		
1.A	Number of drums of waste	drums	
1.B	Cost to transport one truckload of 55-gallon drums to the nearest treatment or disposal facility that will accept the waste	$ /truckload	
1.C	Number of truckloads needed to transport waste in drums (Divide line 1.A by 80 drums per truckload; round up to the nearest whole number)	truckloads	
1.D	**Cost to Transport Waste In Drums (Multiply line 1.B by line 1.C)**		**$**
2	**TRANSPORTATION OF BULK LIQUIDS**		
2.A	Gallons of liquid waste	gal	
2.B	Cost to transport one truckload of bulk liquids to the nearest treatment or disposal facility that will accept the waste	$ /truckload	
2.C	Number of truckloads needed to transport bulk free liquid waste (Divide line 2.A by 6,900 gallons per truckload; round up to the nearest whole number)	truckloads	
2.D	**Cost to Transport Bulk Liquid Waste (Multiply line 2.B by line 2.C)**		**$**
3	**TRANSPORTATION OF BULK WASTE**		
3.A	Number of waste debris boxes	debris boxes	
3.B	Cost to transport one truckload of bulk waste to the nearest treatment or disposal facility that will accept the waste	$ /truckload	
3.C	**Cost to Transport Bulk Solid Waste (assume one debris box can be hauled on each truck) (Multiply line 3.A by line 3.B)**		**$**
	TOTAL COST TO TRANSPORT WASTE (Add lines 1.D, 2.D, and 3.C) (Enter total on Worksheet TS-1, line 10)		**$**

TREATMENT AND DISPOSAL SUMMARY SHEET - Page 1 of 1

Facility Name: _____

SUMMARY WORKSHEET

	Activity	Worksheet Number	Cost ($)
1.	Treatment and Disposal of Waste	TS-13A	
2.	Transportation and Disposal of Decontamination Fluids	TS-13B	
TOTAL COST OF TREATMENT AND DISPOSAL *(Add lines 1 and 2)* *(Enter total on Worksheet TS-1, line 11)*			**$**

1	**TREATMENT AND DISPOSAL OF WASTE 1**		
1.A	Volume of waste in yd^3 to be treated or disposed of (If the waste is not recorded in yd^3, use the factors in Table 1 of this worksheet to convert to yd^3)	yd^3	
1.B	Number of pounds per yd^3 of waste (Select from Table 2 of this worksheet the density of material that most closely resembles the density of the waste to be treated or disposed of)	lb/yd^3	
1.C	Amount in lbs of waste to be treated and disposed of (Multiply line 1.A by line 1.B)	lb	
1.D	Amount in tons of waste to be treated and disposed of (Divide line 1.C by 2,000)	tons	
1.E	Treatment and disposal cost per ton	$ /ton	
1.F	**Cost to Treat and Dispose of Waste 1 (Multiply line 1.D by line 1.E)**		**$**
2	**TREATMENT AND DISPOSAL OF WASTE 2**		
2.A	Volume of waste in yd^3 to be treated or disposed of (If the waste is not recorded in yd^3, use the factors in Table 1 of this worksheet to convert to yd^3)	yd^3	
2.B	Number of pounds per yd^3 of waste (Select from table 2 of this worksheet the density of material that most closely resembles the density of the waste to be treated or disposed of)	lb/yd^3	
2.C	Amount in lbs of waste to be treated and disposed of (Multiply line 2.A by line 2.B)	lb	
2.D	Amount in tons of waste to be treated and disposed of (Divide line 2.C by 2,000)	tons	
2.E	Treatment and disposal cost per ton	$ /ton	
2.F	**Cost to Treat and Dispose of Waste 2 (Multiply line 2.D by line 2.E)**		**$**

3	**TREATMENT AND DISPOSAL OF WASTE 3**		
3.A	Volume of waste in yd^3 to be treated or disposed of (If the waste is not recorded in yd^3, use the factors in Table 1 of this worksheet to convert to yd^3)	yd^3	
3.B	Number of pounds per yd^3 of waste (Select from Table 2 of this worksheet the density of material that most closely resembles the density of the waste to be treated or disposed of)	lb/yd^3	
3.C	Amount in lbs of waste to be treated and disposed of (Multiply line 3.A by line 3.B)	lb	
3.D	Amount in tons of waste to be treated and disposed of (Divide line 3.C by 2,000)	tons	
3.E	Treatment and disposal cost per ton	$ /ton	
3.F	**Cost to Treat and Dispose of Waste 3 (Multiply line 3.D by line 3.E)**		**$**
4	**TREATMENT AND DISPOSAL OF WASTE 4**		
4.A	Volume of waste in yd^3 to be treated or disposed of (If the waste is not recorded in yd^3, use the factors in Table 1 of this worksheet to convert to yd^3)	yd^3	
4.B	Number of pounds per yd^3 of waste (Select from Table 2 of this worksheet the density of material that most closely resembles the density of the waste to be treated or disposed of)	lb/yd^3	
4.C	Amount in lbs of waste to be treated and disposed of (Multiply line 4.A by line 4.B)	lb	
4.D	Amount in tons of waste to be treated and disposed of (Divide line 4.C by 2,000)	tons	
4.E	Treatment and disposal cost per ton	$ /ton	
4.F	**Cost to Treat and Dispose of Waste 4 (Multiply line 4.D by line 4.E)**		**$**
	TOTAL COST OF TREATMENT AND DISPOSAL (Add lines 1.F, 2.F, 3.F, and 4.F) (Enter total on Worksheet TS-13, line 1)		**$**

Table 1
Volume Conversion Factors

Volume: To Convert	Multiply By	To Obtain
Gallons	4.951×10^{-3}	Cubic yards
Cubic feet	27	Cubic yards
Liters	1.31×10^{-3}	Cubic yards
Cubic meters	1.308	Cubic yards

Table 2
Bulk Densities[a]

Bulk Densities of Selected Materials	
Material	**Bulk Density or Range (lb/yd^3)**
Water	1,685.8
Sludge	1,620 - 2,430
Soil[b]	2,025 - 3,240
Cement[c]	4,050
Demolition rubble	2,430 - 3,240
Steel[c]	13,230

Notes:

[a] Densities are derived from the U.S. Environmental Protection Agency's Office of Solid Waste and Emergency Response (OSWER) Policy Directive #9476.00-6, 1987.

[b] Soils rich in organic matter and soils that have large amounts of fine particles have lower bulk density than soils poor in organic matter and rich in sand particles.

[c] Densities are derived from Standard Handbook for Civil Engineering, 3rd Edition, 1983.

If the amount of decontamination fluids generated during closure exceeds a volume that can be handled effectively by placing the waste in drums, such fluids may be handled and disposed of as a bulk liquid. This worksheet may be used to determine the cost to transport and dispose of wastewater generated during closure as a bulk hazardous liquid.

1	Volume of decontamination fluid generated from closure activities. Add all volumes calculated for closure activity worksheets to determine the total volume of liquid to be transported and disposed of. _____ gal _____ gal _____ gal _____ gal _____ gal	total gal	
2	Level of PPE assumed for this activity (protection level D, C, or B)[a]	level of PPE	
3	Labor and equipment cost per work hour[b]	$	
4	Work rate to pump decontamination fluid to a holding tank (per gallon)[c]	work hrs/gallon	
5	Number of hours required to pump decontamination fluid to a holding tank (Multiply line 1 by line 3) (One hour minimum; round up to the half-hour)	work hours	
6	Subtotal of labor and equipment cost to pump decontamination fluid to a holding tank (multiply line 3 by line 5)		$
7	Number of days of rental of holding tank (Round up line 5 to nearest 8 hours; divide by 8 hours per day)	days	
8	Holding tank rental fee (10,000 gallon capacity) (flat rate per tank per day)	$ /day	
9	Number of tanks required (Divide line 1 by 10,000 gallons; round up to the nearest whole number)	tanks	
10	Subtotal of tank rental costs (Multiply lines 7, 8, and 9)		$
11	Removal cost per gallon of bulk liquid[d]	$ /gal	
12	Subtotal of removal cost for bulk liquids (Multiply line 1 by line 11)		$
TOTAL COST TO TRANSPORT AND DISPOSE OF DECONTAMINATION FLUID AS A BULK LIQUID (Add lines 6, 10, and 12) (Enter total on Worksheet TS-13, line 2)			**$**

TRANSPORTATION AND DISPOSAL OF DECONTAMINATION FLUIDS- Page 2 of 2

Notes:

[a] Because workers encumbered by health and safety equipment cannot perform activities as quickly as workers who are not so encumbered, requirements for higher levels of PPE will reduce the productivity of labor and equipment. PPE requirements therefore should be taken into account in determining the work rate and the total number of hours required to conduct each activity.

[b] Enter the estimated cost per work hour of all labor and equipment needed to pump decontamination fluid to a holding tank.

[c] Enter the number of work hours per gallon required to pump decontamination fluid to a holding tank. If, for example, a pump is used that can pump water at a rate of 5,000 gallons per hour, enter a work rate of 0.0002 hours per gallon (60 ÷5,000) ÷60) for conducting the activity. If an estimate of the total number of hours required to pump decontamination fluid to a holding tank has already bee formulated, you may bypass this step and enter that number directly on line 5.

[d] Enter the estimated cost per gallon of transporting and disposing of decontamination fluid as a bulk liquid.

1	Number of units requiring certification of closure[a]		
2	Cost of certification of closure per unit[b]	$	
TOTAL COST OF CERTIFICATION OF CLOSURE (Multiply line 1 by line 2) (Enter total on Worksheet TS-1, line 14)			**$**

Notes:

[a] Facilities closing multiple tanks in the same manner at the same time should incur cost of certification of closure only once.

[b] This cost includes the cost of performance of the following activities by a registered professional engineer: 1) reviewing the closure plan, 2) conducting a final closure inspection at the unit, and 3) preparing a certification of closure report.