

**CLOSURE COST ESTIMATE WORKSHEET FOR MSW LANDFILL FORM 1**

OWNER: \_\_\_\_\_

PERMIT NO. \_\_\_\_\_

CURRENT PERMIT RENEWAL YEAR: \_\_\_\_\_

Total Volume of Site: \_\_\_\_\_ CU. YDS.

TOTAL PERMITTED AREA: \_\_\_\_\_ ACRES

CONVERSION FACTOR: 4840.02 SQ. YDS./ACRE

AREA CURRENTLY OPEN: \_\_\_\_\_ ACRES

CONVERSION FACTOR: 0.3333 YDS./FT.

LARGEST AREA TO EVER BE OPEN AT ANY TIME: \_\_\_\_\_ ACRES (use this area for estimating closure costs)

ITEM	QUANTITY	UNITS	UNIT COST	COST	SUBTOTALS
<b>Low Permeability Soil Layer</b>					
Preparation of landfill to receive cover (final grading)		ACRE	\$53.75	\$	
Clay--compacted, off-site		CU. YD.	\$10.63	\$	
Clay--compacted, on-site		CU. YD.	\$5.67	\$	
<b>Low Permeability Soil Layer Subtotal</b>					<b>\$</b>
<b>Geomembrane and Drainage Layer</b>					
Drainage material--sand		CU. YD.	\$11.00	\$	
Drainage material--geogrid		SQ. YD.	\$4.18	\$	
Geomembrane		SQ. YD.	\$3.90	\$	
<b>Geomembrane and Drainage Layer Subtotal</b>					<b>\$</b>
<b>Protective Soil (Vegetative) Layer</b>					
Soil--off-site		CU. YD.	\$5.20	\$	
Soil--on-site		CU. YD.	\$1.77	\$	
Seeding and mulching		ACRE	\$1,500.00	\$	
<b>Protective Soil (Vegetative) Layer Subtotal</b>					<b>\$</b>
<b>Erosion Control</b>					
Terraces		Lin. FT.	\$0.55	\$	
Grass ditching/channels		Lin. FT.	\$9.00	\$	
Riprap ditching/channels		Lin. FT.	\$13.00	\$	
<b>Erosion Control Subtotal</b>					<b>\$</b>
<b>Gas System</b>					
Gas vents, # of vents, average depth		Lin. FT.		\$	
<b>Passive System</b>					
Passive well head flare		EACH		\$	
<b>Active System</b>					
Flare, BTU/hour		EACH		\$	
Ancillary gas equipment		Lump Sum		\$	
<b>Gas System Subtotal</b>					<b>\$</b>
<b>Professional Services</b>					
Engineering (Bid Documents)		Lump Sum		\$	
Topographic and Boundary Survey		Lump Sum		\$	
Engineering (Construction Oversight)		Lump Sum		\$	
<b>Professional Services Subtotal</b>					<b>\$</b>
<b>Total Closure Cost Subtotal</b>					<b>\$</b>
<b>Miscellaneous</b>					
10% Administration and Contingency (Total Closure Cost Subtotal x 10%)				\$	
				\$	
				\$	
<b>Misc. Subtotal</b>					<b>\$</b>
<b>TOTAL CURRENT CLOSURE COST</b>					<b>\$</b>

*(Instructions and explanations of bid items and sources of unit costs are provided on the back of this page.)*

Contact Person/Cost Estimate Prepared By: \_\_\_\_\_

Phone Number: \_\_\_\_\_

# CLOSURE COST ESTIMATE WORKSHEET FOR MSW LANDFILL FORM 1

## NOTES:

The closure cost estimate should reflect all expenses required for a third party to perform closure activities on your landfill. The closure activities must be based on the largest area ever to need final closure as per State requirements and the specifics of your closure plan. KDHE has supplied some third party unit costs for certain items based on previously submitted estimates, Means Cost Guides (*Environmental Remediation Cost Data-Assemblies, Environmental Remediation Cost Data-Unit Price and Site Work & Landscape Cost Data*) and other estimates provided to KDHE by contractors. The Means estimates were multiplied by a factor of 0.85 to adjust national averages to locations in Kansas. You may line out the KDHE-supplied unit costs and write in numbers obtained from actual bids for your site or bids from third party contractors. However, please supply KDHE with the source of your unit cost.

Some unit costs are not provided. KDHE could not obtain usable data to establish a unit cost, or the item is too site-specific. The permittee should complete these unit costs based on characteristics of their particular site.

## CLOSURE ITEMS:

### **Low Permeability Soil Layer**

**Preparation of landfill to receive cover (final grading):** Cost includes grading of waste, daily or intermediate cover, and stockpiles to the required base grades and to develop a working surface on which to apply final cover. (Source: Means 18-05-0101)

**Clay--compacted, off-site:** Cost includes purchase of the clay, hauling and spreading of the clay, addition of water and compaction. This layer must have a minimum thickness of 18". *Do not include this item if clay is available on-site.* (Source: Means 12.1-220-5150 + clay Means 33-08-0507-02081-2241)

**Clay--compacted, on-site:** Cost includes hauling and spreading of on-site materials, addition of water and compaction. This layer must have a minimum thickness of 18". (Source: Means 12.1-220-5150)

### **Geomembrane and Drainage Layer**

**Drainage material--sand:** Cost includes purchase of material and installation of sand drainage layer above the geomembrane with a minimum thickness of 6". If a geogrid is used, no sand is required. (Source: state-wide average from last year's estimates)

**Drainage material--geogrid:** Cost includes installation of a drainage geogrid above the geomembrane. (Source: state-wide average from last year's estimates)

**Geomembrane:** Cost includes installation of the geomembrane liner. (Source: state-wide average from last year's estimates)

### **Protective Soil (Vegetative) Layer**

**Soil--off-site:** Cost includes purchasing and hauling soil to the landfill and spreading of soil on top of the low permeability layer or drainage layer to a depth capable of protecting the low permeability from desiccation due to freeze-thaw. This layer should also be capable of supporting vegetation. *Do not include this item if soil is available on-site.* (Source: state-wide average + soil Means 17-03-0424)

**Soil--on-site:** Cost includes the loading of on-site soil and spreading of soil on top of the low permeability layer or drainage layer to a depth capable of protecting the low permeability layer from desiccation due to freeze-thaw. This layer should also be

capable of supporting vegetation. (Source: state-wide average from last year's estimates)

**Seeding and mulching:** Cost includes seeding and application of 1" of straw mulch. (Source: state-wide average from last year's estimates)

### **Erosion Control**

**Terraces:** Cost includes the construction of soil terraces to control erosion. (Source: US Natural Resources Conservation Service)

**Grass ditching/channels:** Cost includes the construction of grass-lined ditches to provide drainage from the top of the landfill. (Source: Means 33-05-0805)

**Riprap ditching/channels:** Cost includes the construction of riprap-lined ditches to provide drainage from the top of the landfill. Riprap should be used where flow velocities are in excess of 5 feet/sec. (Source: Means 33-05-0804)

### **Gas System**

**Gas vents:** Cost includes installation of a large diameter boring installation of piping, installation of gravel pack, and filling of the annular space with low permeability material.

**Well head flare:** Cost includes installation of a passive well head flare with an auto-ignited solar-powered ignition unit.

**Flare:** Cost includes installation of a flare/blower unit.

**Ancillary piping:** Cost includes all necessary materials and labor to connect individual wells into an active system including but not limited to piping, trench, cuts, valves and sampling ports. Cost for equipment already installed need not be included.

### **Professional Services**

**Engineering (bid documents):** Cost should include development bid documents for project letting from existing closure plans.

**Topographic and boundary survey:** Cost should include development final closure survey and establishment of final waste boundaries.

**Engineering (construction oversight):** Cost includes all construction quality assurance inspections and testing required to properly close the landfill and preparation of the certification of closure report.

### **Miscellaneous**

**Administration and contingency:** Cost should include third party administration of closure and any additional cost contingencies. Assume 10%.

**POST-CLOSURE COST ESTIMATE WORKSHEET FOR MSW LANDFILL FORM 2**

OWNER: \_\_\_\_\_

PERMIT NO. \_\_\_\_\_

CURRENT PERMIT RENEWAL YEAR: \_\_\_\_\_

Total Volume of Site: \_\_\_\_\_ CU. YDS.

TOTAL PERMITTED DISPOSAL AREA: \_\_\_\_\_ ACRES  
(use this area for estimating post-closure cost)

CONVERSION FACTOR: 4840.02 SQ. YDS./ACRE  
CONVERSION FACTOR: 0.3333 YDS./FT.

ITEM	QUANTITY	UNITS	UNIT COST	COST	SUBTOTALS
<b>Cover Repair for 5% of the Landfill Area</b>					
5% of the landfill area, _____ acres					
Soil--off-site		CU. YD.	\$5.20	\$	
Soil--on-site		CU. YD.	\$1.77	\$	
<b>Cover Repair Subtotal</b>					<b>\$</b>
<b>Seeding (Reseed 5% of the Landfill Area)</b>					
5% of the landfill area, _____ acres					
Seeding and mulching		ACRE	\$1,500.00	\$	
<b>Seeding Subtotal</b>					<b>\$</b>
<b>Leachate Collection</b>					
generation rate _____ gal./ac./yr.					
Operation and maintenance of leachate collection system		yr.		\$	
Leachate hauling distance, _____ miles, _____ # trips/year		trip		\$	
Leachate treatment		gal.		\$	
Leachate management and treatment on site		Lump Sum		\$	
Leachate sampling		trip		\$	
Leachate analysis		event		\$	
<b>Leachate Collection Subtotal</b>					<b>\$</b>
<b>Landfill Gas Monitoring</b>					
Quarterly methane monitoring at site boundary		event		\$	
<b>Landfill Gas Monitoring Subtotal</b>					<b>\$</b>
<b>Landfill Gas Extraction System</b>					
Reinstallation of methane vents (1% of the total system length/yr.)		Lin. FT.		\$	
Operation and maintenance of gas extraction system		Million CU. FT.		\$	
<b>Landfill Gas Extraction System Subtotal</b>					<b>\$</b>
<b>Groundwater Monitoring</b>					
# wells in the approved system					
Sampling personnel labor (2 events/year min.)		hr.	\$35.00	\$	
Sample event mobilization (2 events/year min.)		mile	\$0.40	\$	
Analytical costs (2 events/year min.)		sample	\$220.00	\$	
Monitoring well maintenance		well	\$13.00	\$	
Monitoring well replacement (_____ total lin. ft. of all groundwater wells)		total well footage	\$0.20	\$	
<b>Groundwater Monitoring Subtotal</b>					<b>\$</b>
<b>Inspections and Recordkeeping</b>					
Inspections and recordkeeping		Lump Sum		\$	
<b>Inspections and Recordkeeping Subtotal</b>					<b>\$</b>
<b>Remedial System Operations</b>					
Remedial system operations		Lump Sum		\$	
<b>Remedial System Operations Subtotal</b>					<b>\$</b>
<b>Estimated Annual Post-Closure Cost</b>	(sum of all subtotals above)				<b>\$</b>
<b>Administration and Contingency</b>					
Administration and Contingency (Total Estimated Post-Closure Cost x 10%)				\$	
<b>Administration and Contingency Subtotal</b>					<b>\$</b>
<b>TOTAL ESTIMATED ANNUAL POST-CLOSURE COST</b>					<b>\$</b>
<b>ESTIMATED 30 YEAR POST-CLOSURE COST</b>					<b>\$</b>
		Annual x 30			

*(Instructions and explanations of bid items and sources of unit costs are provided on the back of this page.)*

Contact Person/Cost Estimate Prepared By: \_\_\_\_\_

Phone Number: \_\_\_\_\_

# POST-CLOSURE COST ESTIMATE WORKSHEET FOR MSW LANDFILL FORM 2

## NOTES:

The post-closure cost estimate should reflect all expenses required for a third party to perform post-closure maintenance activities on your landfill. The post-closure activities must be based on the area for the entire landfill as per State requirements and the specifics of your post-closure plan. The post-closure estimate is calculated on an annual basis and is multiplied by 30 to reflect the required 30-year post-closure maintenance period. KDHE has supplied some third party unit costs for certain items based on previously submitted estimates, Means Cost Guides (*Environmental Remediation Cost Data-Assemblies, Environmental Remediation Cost Data-Unit Price and Site Work & Landscape Cost Data*) and other estimates provided to KDHE by contractors. The Means estimates were multiplied by a factor of 0.85 to adjust national averages to locations in Kansas. You may line out the KDHE-supplied unit costs and write in numbers obtained from actual bids for your site or bids from third party contractors. However, please supply KDHE with the source of your unit cost.

Some unit costs are not provided. KDHE could not obtain usable data to establish a unit cost, or the item is too site-specific. The permittee should complete these unit costs based on characteristics of their particular site.

## POST CLOSURE ITEMS:

### **Cover Repair for 5% of the Landfill Area**

**Soil-off-site:** Cost includes purchasing and hauling soil to the landfill and spreading of soil to fill depressions caused by settlement and erosional rills and gullies. *Do not include this item if soil is available on-site.* (Source: state-wide average + soil Means 17-03-0424)

**Soil-on-site:** Cost includes loading on-site soil and spreading of soil to fill depressions caused by settlement and erosional rills and gullies. (Source: state-wide average from last year's estimates)

### **Seeding (Reseed 5% of the Landfill Area)**

**Seeding and mulching:** Cost should include reseeding areas where vegetation has died, failed to establish or eroded away. (Source: state-wide average from last year's estimates)

### **Leachate Collection**

**Operation and maintenance of leachate collection system:** Cost should include pumping of leachate into storage tanks, pumps or trucks. The cost for electricity and labor should be factored in as well as replacement and repair of pumps, switches and other equipment necessary to keep the system operational.

**Leachate hauling:** Cost should include transporting leachate to a public treatment works.

**Leachate treatment:** Cost should include treatment of leachate at a public treatment works in order to discharge to the waters of the state. Costs are site specific depending on where leachate is currently taken.

**Leachate management and treatment on-site:** Cost should include the operations and maintenance of on-site treatment systems such as evaporation ponds. The cost estimate should include all inspections and repairs necessary to operate the system.

**Leachate sampling:** Cost includes drawing leachate samples for analysis. The cost should include mobilization and mileage to bring personnel on-site.

**Leachate analysis:** Cost includes annual leachate analysis for each unit for parameters listed in K.A.R. 28-29-107 (i)(6)(B).

### **Landfill Gas Monitoring**

**Quarterly methane monitoring at site boundary:** Cost includes monitoring the methane at all existing methane monitoring wells or through bar punching at the property boundary four times a year. The cost should include mobilization and mileage to bring personnel on-site.

### **Landfill Gas Extraction System**

**Reinstallation of methane vents:** Cost includes replacement of gas vents which fail during the closure period. The cost should include all elements including installation of gas vents as described on the closure form and should be the same unit cost. This number should assume 30% of the methane vents will be replaced during the 30-year post-closure period or 1% of the total installation cost each year.

**Operation and maintenance of gas extraction system:** Cost includes daily or frequent inspections, electricity, maintenance and repair cost required annually to keep the current or designed gas extraction system operational.

### **Groundwater Monitoring**

**Groundwater sampling personnel labor:** Cost should include labor cost to transport personnel to the site and sample wells at a rate of one well per hour. (Source: median hourly rate for ten KDHE leaking underground storage tanks contractors who perform work in the state)

**Groundwater sample event mobilization:** Cost includes transporting personnel and equipment to the site. (Source: median hourly rate for ten KDHE leaking underground storage tanks contractors who perform work in the state)

**Groundwater analytical cost:** Cost includes analysis of groundwater samples from all monitoring wells within the approved system twice a year for all constituents listed in Appendix I of K.A.R. 28-29-113 for landfills. (Source: average labor cost across the state + 10%)

**Groundwater monitoring well maintenance:** Cost includes replacement of well pads and padlocks. Price is prorated over 30 years and anticipates four hours of labor per well over 30 years.

**Groundwater monitoring well replacement:** Cost includes replacement of 30% of the groundwater wells over the 30-year post-closure period. The \$0.20/total well footage anticipates 30% replacement of all the monitoring wells within 30 years and a well installation rate of \$20/ft.

### **Inspections and Recordkeeping**

**Inspections and recordkeeping:** Cost includes annual inspection and preparation reports outlining required post-closure maintenance and cost of updating the operating record to include all sampling and required recordkeeping.

### **Remedial Systems Operations**

**Remedial system operations:** If your landfill is currently operating a remedial system or performing long-term corrective action, the annual cost to operate that system must be included.

### **Administration and Contingency**

**Administration and contingency:** Cost should include third party administration of closure and any additional cost contingencies. Assume 10%.

**ESTIMATED LIFE WORKSHEET FOR MSW LANDFILL FORM 3**

OWNER: \_\_\_\_\_

PERMIT NO. \_\_\_\_\_

CURRENT PERMIT RENEWAL YEAR: \_\_\_\_\_

CONVERSION FACTOR: 4840.02 SQ. YDS./ACRE

CONVERSION FACTOR: 0.3333 YDS./FT.

<b>Landfill Site Data:</b>	<b>QUANTITY</b>	<b>UNITS</b>
Total Site Area		ACRES
Total Area Permitted to Receive Waste		ACRES
Total Area Currently Open		ACRES
Total Area That Received Final Cover		ACRES

<b>Identify Cells That Received Final Cover by Name or Phase:</b>	<b>AREA</b>	<b>UNITS</b>
1. Name or Phase:		ACRES
2. Name or Phase:		ACRES
3. Name or Phase:		ACRES
4. Name or Phase:		ACRES

<b>Life of Cell / Landfill Data:</b>	<b>QUANTITY</b>	<b>UNITS</b>
Annual Average Tonnage Received (A)		Tons
Average Compacted Density of Waste (B)		lbs/CU. YD.
Soil-to-Waste Ratio (C) *		
<b>Calculation For Annual Volume:</b>	<b>QUANTITY</b>	<b>UNITS</b>
Annual Volume (CU.YDS.) = [(A x 2000)/B] x [1+C]		CU. YDS.
Total Volume Capacity of Original Site		CU. YDS.
Total Remaining Volume Capacity of Site		CU. YDS.
Remaining Life of Landfill		YEARS

Contact Person/Cost Estimate Prepared By: \_\_\_\_\_

Phone Number: \_\_\_\_\_

\* Soil used for daily and intermediate cover occupies landfill airspace. The soil-to-waste ratio accounts for the landfill space occupied by soil. Most soil-to-waste ratio estimates range from 1:3 (33%) to 1:10 (10%). KDHE recommends 1:6 (16.7%).