



# Utah Division of Waste Management and Radiation Control

## Solid Waste Management Program

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## Preparation of Solid Waste Facility Closure and Post-Closure Cost Estimates

### Guidance

#### Introduction

This guidance is not a rule. It has been prepared to give the reader information, in plain language, about how the Division of Waste Management and Radiation Control (DWMRC) expects to interpret Utah Administrative Code (UAC) R315-302-3. In the event questions arise regarding the matters discussed in this guidance, the text of the rule will govern.

#### Cost Estimates and Financial Assurance

##### Closure

Owners or operators are required to provide cost estimates, in current dollars, for a third party to conduct and complete closure activities (i.e., hiring qualified contractors to perform closure activities). Estimates must equal the maximum closure costs at any time during the life of the facility or cell; or the permit life, whichever is shorter. Estimates must be included for each closure activity. If closure will be conducted in phases, cost estimates for completing each phase should be provided. A sample worksheet for estimating costs is attached to this guidance. A worksheet with costs for some of the items is also provided. The costs shown were developed for the Oklahoma Department of Environmental Quality and reflect costs in Oklahoma. Basic closure cost items should include, if applicable:

- Design cost to provide construction level design details for the closure.
- Ground water monitoring analysis costs, well maintenance costs, and well placement costs.
- Gas control system installation, if any is needed. Costs should include costs for surface and subsurface equipment and installation.
- Costs for any additional equipment to treat use or dispose of the gas.
- Final cover installation and material cost including:
  - a. Clay material acquisition, placement, and compaction.
  - b. Vegetative layer material acquisition, placement and grading or placement of any other approved layer to protect the compacted soil layer.

- c. Any geomembranes, drainage layers or other cover layers as required by the permit and closure plan.
- d. Seeding, fertilization, soil amendments and mulch.
- Installation of any additional control or monitoring features as necessary.
- Costs of construction oversight and administration.
- Estimates should include a percent of the total cost as a contingency that is based on the level of detail in the closure plan.

### **Post-Closure**

Provide cost estimates, in current dollars, for a third party to conduct and complete post-closure activities. Estimates must equal the maximum post-closure costs at any time during the post-closure period. Estimates should include figures for each post-closure activity and an estimate of the total cost of post-closure care for the thirty-year post-closure period. Include assumptions made in preparing the cost estimates. The basic post-closure cost items should include, if applicable:

- Final cover maintenance and repair. Use the following for estimating the amount of work to be done each year.
  - a. Erosion repair; use one foot of cover over 5% of the landfill area per year.
  - b. Vegetation repair; use 10% of the landfill area per year.
- Leachate collection, treatment, disposal and maintenance should include costs for:
  - a. Operation
  - b. Sampling and analyses
  - c. Maintenance and repair
- Ground water monitoring should include costs for:
  - a. Sampling
  - b. Analyses
  - c. Maintenance and repair
- Gas monitoring should include costs for:
  - a. Sampling
  - b. Analyses (if necessary)
  - c. Maintenance and repair
- Gas control systems, if required, should include costs for:

- a. Operation
  - b. Maintenance and repair
- Any other monitoring or sampling required by other environmental programs should be included in the total cost of post-closure care.
  - Record keeping and reporting is required by UAC R315-302-2 and the cost of these activities should be included in the total post-closure care cost estimate.
  - Cost of site inspections to oversee cover repairs and post-closure care.
  - Costs associated with demonstrating that the site is stable and that the post-closure care period can be terminated.
  - Costs of oversight and administration.
  - Estimates should include a percent of the total cost as a contingency.

### **Adjustments**

Landfill owners or operators must annually adjust their final closure and post-closure costs for inflation or facility modifications that would affect closure or post-closure care costs (R315-309-2(2)). The following describes how to perform an inflation adjustment calculation using an inflation factor.

The inflation factor is derived from the most recent annual "Implicit Price Deflator for Domestic Product" published by the U.S. Department of Commerce in its *Survey of Current Business*. The current years inflation adjustment is calculated by the Division each year and is posted on the division web page at <https://deq.utah.gov/division-waste-management-radiation-control> and is found under the heading "Inflation Factor."

The first annual adjustment should occur the first year after the permit is approved by the Director and each following year unless the actual closure costs are recalculated. The first adjustment should be made by multiplying the closure and post-closure care costs given in the permit application by the inflation factor. Subsequent adjustments should be made annually by multiplying the latest values for closure and post-closure care costs by the latest inflation factor. This process of adjustment should be utilized until the actual closure and post-closure care costs are recalculated. At the time of permit renewal and at the five year anniversary of the permit issuance the closure and post-closure care costs must be recalculated using the current approved design and current construction costs.

In developing cost estimates and annual updates, it may be helpful to enlist the assistance of contractors that could perform closure or post-closure activities. Selected contractors may be provided with specifications and assumptions and ask to develop the estimates based on your specifications. Copies of documentation of the contractors' estimates should be included in the permit application. A line-by-line review and calculation along with determination of the average cost for each item should be done based on each contractor's estimates.

If any corrective action program is anticipated during the post-closure period, contact DWMRC for more information. A detailed cost estimate and additional financial assurance instrument are required for corrective action.

### **Additional Information**

The initial closure and post-closure plans are submitted as part of a permit application and become part of the approved permit. Subsequent changes due to permit modifications, regulatory changes, operational changes, or unforeseen circumstances (e.g., increase/decrease in fill rate or premature closure with less than the total acreage utilized) which substantially affect the time schedule or costs of closure and post-closure will necessitate closure and post-closure plan and cost estimate modifications. These modifications must be submitted to the Director for approval. In addition, adjustments to the cost estimates must be submitted with the annual report and be approved by the Director. Any change in the financial assurance mechanism must be submitted to, and receive Director approval.

**Landfill Closure Cost Estimate Worksheet**

A brief description of each line item, as numbered in the tables, is given immediately following this series of tables.

Item	Unit Measure	Cost/Unit	No. Units	Total Cost	Source	Note
1.0	Engineering and Preliminary Site Work					
1.1	Topographic Survey					
1.2	Boundary Survey for Closure					
1.3	Site Evaluation					
1.4	Development of Plans					
1.5	Contract Administration Bidding and Award					
1.6	Administrative Costs for the Certification of Final Cover and Closure Notice					
1.7	Project Management; Construction Observation and Testing					
1.8	Monitor Well Consultant Cost					
1.9	Other Environmental Permit Costs					
1.10	Disposal of Final Wastes					
1.10.1	Disposal Cost					
1.11	Remove Temporary Buildings					
1.12	Remove Equipment					
1.13	Repair/Replace Perimeter Fencing					
1.14	Clean Leachate Lines					
<b>Subtotal</b>						
<b>Contingency (10% to 50%)</b>						
<b>Engineering Total</b>						

Item	Unit Measure	Cost/Unit	No. Units	Total Cost	Source	Note
2.0 Construction						
2.1 Final Cover System						
2.1.1 Completion of Sidewall Liner						
2.1.1a Soil Placement						
2.1.1b Soil Processing						
2.1.1c Soil Amendment						
2.1.1d Soil Purchase						
2.1.1e Soil Transportation						
2.1.2 Drainage Layer on Sidewall						
2.1.2a Geotextile Filter Fabric						
2.1.2b Geonet/Geotextile Composite						
2.1.2c Geomembrane Sidewall Liner						
2.2 Completion of Top Cover						
2.2.1 Infiltration Layer (Compacted Clay)						
2.2.1a Soil Placement (Compacted)						
2.2.1b Soil Processing						
2.2.1c Soil Amendment						
2.2.1d Soil Purchase						
2.2.1e Transportation						
2.2.2 Geosynthetic Clay Layer						
2.2.2a Geosynthetic Clay Installation						
2.2.3 Flexible Membrane Cover						

Item	Unit Measure	Cost/Unit	No. Units	Total Cost	Source	Note
2.2.3a Flexible Membrane Installation						
2.2.4 Drainage Layer						
2.2.4a Geonet/Geotextile						
2.2.4b Sand Layer						
2.2.4c Soil Cover						
2.2.4d Geonet/Geotextile Composite						
2.3 Erosion Layer Placement						
2.3.1 Soil Purchase						
2.3.2 Soil Transportation						
2.3.3 Soil Processing						
2.3.4 Soil Amendmen						
2.3.5 Soil Placement						
2.4 Revegetation						
2.4.1 Seeding						
2.4.2 Fertilize						
2.4.3 Mulch						
2.5 Site Grading and Drainage						
2.6 Site Fencing and Security						
2.7 Leachate Collection System Completion						
<b>Subtotal</b>						
<b>Contingency (10% to 50%)</b>						
<b>Construction Total</b>						

Item	Unit Measure	Cost/Unit	No. Units	Total Cost	Source	Note
3.0 Gas Collection System						
3.1 System Design						
3.2 Completion of Gas Collection System						
3.3 Equipment and Installation						
3.3.1 Place Sand						
3.3.2 Install Geonet and Geotextile						
3.3.3 Install Passive Vents						
3.3.4 Install, Rework or Replace Gas Control Equipment						
<b>Subtotal</b>						
<b>Contingency (10% to 50%)</b>						
<b>Gas Collection Total</b>						

Item	Unit Measure	Cost/Unit	No. Units	Total Cost	Source	Note
4.0 Monitor Well Installation Cost						
4.1 Ground Water Monitoring Well Installation, Reworking, or Replacement						
4.2 Install, Rework, or Replace Methane Probe/s						
4.3 Monitor Well, or Methane Probe Plugging						
<b>Subtotal</b>						
<b>Contingency (10% to 50%)</b>						
<b>Monitor Well Installation Total</b>						



**Calculation of Total Closure Costs**

Engineering Total: \_\_\_\_\_

Construction Total: \_\_\_\_\_

Gas Collection Total: \_\_\_\_\_

Ground Water Total: \_\_\_\_\_

\_\_\_\_\_% Contract  
Performance Bond: \_\_\_\_\_

SUBTOTAL: \_\_\_\_\_

DEQ Review Fee  
(\$90.00 per Hour): \_\_\_\_\_

Legal Fees  
(\_\_\_\_\_% Of Subtotal): \_\_\_\_\_

TOTAL CLOSURE COSTS: \_\_\_\_\_

**Landfill Post-Closure Care Cost Estimate Worksheet**

Item	Unit Measure	Cost/Unit	No. Units	Total Cost	Source	Note
1.0	Engineering Costs					
1.1	Post-Closure Plan and Post-Closure permits					
1.2	Site Inspection and Record keeping (annual)					
1.3	Correctional Plans and Specifications (annual)					
1.4	Administration Costs					
1.5	Site Monitoring					
1.5.1	Ground Water Monitoring					
1.5.1a	Ground Water Sample Collection					
1.5.1b	Ground Water Sample Analysis					
1.5.1c	Ground Water Sample Analysis Review and Reporting					
1.5.2	Landfill Gas Monitoring					
1.5.2a	Gas Monitoring Data Collection					
1.5.2b	Gas Monitoring Data Review and Reporting					
2.0	Maintenance Costs					
2.1	Cover Maintenance Costs					
2.1.1	Soil Replacement					
2.1.2	Vegetation Reseeding					
2.2	Equipment Maintenance					
2.2.1	Ground Water well Maintenance and Replacement					
2.2.2	Methane Probe Maintenance and Replacement					

<b>Item</b>	<b>Unit Measure</b>	<b>Cost/Unit</b>	<b>No. Units</b>	<b>Total Cost</b>	<b>Source</b>	<b>Note</b>
2.2.3 Gas Collection System Operation						
2.2.4 Gas Collection System Maintenance and Repair						
2.2.5 Leachate Collection System						
2.2.5a Leachate Collection System Repair and Maintenance						
2.2.5b Clean Leachate Lines						
3.0 Final Plugging of Monitoring Wells						
3.1 Final Plugging of Methane Probes						
3.2 Final Plugging of Ground Water Monitoring Wells						
3.3 Gas Control Equipment Removal						
4.0 Leachate Disposal						
5.0 Site Maintenance						
5.1 Repair of Surface Water Diversion Structures						
5.2 Repair of Fences and Gates						
5.3 General Maintenance						
6.0 Demonstration of stability						
<b>Subtotal</b>						
<b>Contingency (10% to 50%)</b>						
<b>Post-Closure Care Total</b>						

**Total Closure and Post-Closure Costs**

Total Closure Costs: \_\_\_\_\_

Total Post-Closure Care Costs: \_\_\_\_\_

Total Cost: \_\_\_\_\_

## **DESCRIPTION OF LINE ITEMS**

**Source** List the source of the data used such as DEQ guidance or RS Means etc.

**Note** Give any explanatory information.

### **Closure Costs**

#### **1.0 Engineering**

Note – The “Units” in the worksheet, whether acres to be closed or cubic yards of soil to be used etc., should be justified in the documentation of the closure costs.

Engineering costs have been divided into seven major items: topographic survey, waste boundary field notes, site evaluation, development of plans, contract administration, bidding and award, administrative costs, and closure inspection and testing. The items may each have a variety of tasks but the nature of the work in the various tasks has been combined in the major items.

##### **1.1 Topographic Survey**

A topographic survey will generally be required to ascertain the existing height and top slope of the landfill so that permit compliance can be evaluated and the final closure system, drainage system and final grading can be engineered.

##### **1.2 Boundary Survey**

A Boundary survey is a metes and bounds description that is required for filing the closure notice and making the required changes on the record of title or deed.

##### **1.3 Site Evaluation**

The site evaluation includes a site inspection to identify waste disposal areas, analyze drainage and erosion protection needs, and to determine other site operational features that may not be in compliance with the permit. Analysis of ground water samples, landfill gas analysis, operation records, etc. should also be included.

##### **1.4 Development of Plans**

The final closure plan includes the final cover system design and specifications, grading and drainage plans, specifications for revegetation, design of any other site improvements required, and preparation of a closure schedule. This item also includes the coordination of the closure plan with the Utah Division of Waste Management and Radiation Control, including the required notifications and reporting.

##### **1.5 Contract Administration**

##### **1.6 Administrative Costs**

##### **1.7 Closure Inspection and Testing**

Closure inspection and testing costs include the cost of a Professional Engineer to observe the closure construction, perform appropriate cover thickness and permeability verifications, and prepare an evaluation report upon completion of the closure.

##### **1.8 Ground Water Monitor Well Consultant Costs**

Consultant costs for monitor well installation include preparation of work plans, well installation observation, well development, and the data analysis report.

### 1.9 NPDES Construction Storm Water Permit Compliance Package

The consultant is to prepare all necessary plans, specifications, and other documents necessary for compliance with all applicable federal and state laws and requirements necessary for the closure of the site. One of these required steps is compliance with the Federal Clean Water Act.

#### 1.10 Disposal of Final Wastes

Any onsite waste that is not in the disposal cell must be placed in the cell or disposed of at a permitted facility if the waste can not be placed in the current open cell.

#### 1.11 Remove Temporary Buildings

Onsite buildings that are not being used for post-closure care operations at the site must be removed and disposed of.

#### 1.12 Remove Equipment

Onsite equipment that is not being used for post-closure care operations at the site must be removed and disposed of.

#### 1.13 Repair/Replace Perimeter Fencing

#### 1.14 Clean Leachate Lines

### **2.0 Construction Costs**

Closure construction costs include those for construction of the final cover system, site grading, and drainage improvements. Other construction costs may be necessary to correct on-site problems.

#### 2.1 Final Cover System

The standard final cover system at Class I, Class II, and some Class V Landfills is an infiltration layer that is a minimum of 18 inches of earthen material that has a permeability less than or equal to the permeability of any bottom liner system or if there is no liner in the landfill unit, no greater than the permeability of the natural soils, or a permeability of no greater than  $1 \times 10^{-5}$  cm/sec, whichever is less, and an erosion layer of a minimum of 6 inches of earthen material that is capable of sustaining plant growth. If a Flexible Membrane Liner (FML) is included in the landfill liner system, it may be necessary to install a Flexible Membrane Cover (FMC) along with the infiltration layer to attain the required permeability. In addition, it is a common practice to place a drainage layer over the infiltration layer to remove water that has percolated through the erosion layer. Also, revegetation of the erosion layer is required to protect the entire final cover system as is revegetation of all disturbed areas.

##### 2.1.1 Completion of the Sidewall Liner

Completion of the sidewall liner is necessary when the waste is not placed at a permanent grade or when no sidewall liner has been placed. In general, if the waste is not placed at a final grade and new final grades have been assumed, the completion of this sidewall liner is required.

##### 2.1.2 Drainage Layer on Sidewall (if required)

For ease of construction, this drainage layer along the sidewall area to be developed could consist of a “geonet” or “geogrid” system and is measured in terms of square yards of placement.

## 2.2 Completion of the Top Cover

### 2.2.1 Infiltration Layer (Compacted Clay)

The infiltration layer of the final cover system consists of an 18-inch thick layer of compacted soil or other earthen materials with a permeability matching that of the bottom liner or native soils, but not greater than  $1 \times 10^{-5}$  cm/sec.

### 2.2.2 Geosynthetic Clay Layer

A compacted clay liner may be used at certain landfill sites to meet the permeability requirements of the rules.

### 2.2.3 Flexible Membrane Cover

A flexible membrane cover will be necessary at certain landfill sites where the required permeability cannot be attained in the infiltration layer by earthen materials alone. Similar material is used for the FMC as is used for the FML, but typically requires more flexibility and less chemical resistance.

### 2.2.4 Drainage Layer

A drainage layer is commonly used between the erosion layer and the infiltration layer. Two alternative designs are available:

- The use of a sand layer covered with a geotextile filter fabric; and
- The use of a geonet/geotextile composite.

In either case, a pipe is required around the base of the cover slopes to collect the infiltrated storm water from the drainage layer. The cost of the collection pipe system should be incorporated into the costs for the drainage layer. If a sand layer and geotextile filter fabric are used, then the geonet/geotextile composite item will not be used.

## 2.3 Erosion Layer Placement

The erosion layer must be a minimum of 6 inches of earthen material capable of sustaining plant growth. The existing site topsoil is generally acceptable for this application, although a layer thicker than 6 inches may be required if the soil used has high shrink/swell characteristics that would promote cracking or to prevent frost from penetrating the infiltration layer. If acceptable soil is available on-site, only the cost of placement need be included. Where soils are not available the costs of obtaining and transporting the soils must be added.

## 2.4 Revegetation

Revegetation includes the activities necessary to provide vegetative erosion protection over the surface of the completed final cover. In some instances, temporary vegetation measures are used to establish vegetation quickly until permanent vegetation can be developed. The costs are based on seeding with grasses or other shallow rooted plants and the application of appropriate fertilizer. Other methodologies may include sodding, or hydro mulch applications, etc.

## 2.5 Site Grading and Drainage

Site grading and drainage include the final grading of the site, drainage improvements and sedimentation controls for proper closure of the site.

## 2.6 Site Fencing and Security

Site fencing and security are to be added to secure any area of the landfill which has received waste and is undergoing closure but may not have been fenced.

## 2.7 Leachate Collection System Completion

In the event of forced closure, there may be circumstances where the leachate collection system has not been completed. In this event, the leachate collection system must be completed with permanent outfalls and permanent clean outs installed.

## **3.0 Gas Collection System**

Some landfill closures may require the installation of a gas collection system. This system may consist of collection pipes, gas collection layer and surface equipment to dispose of or use the gas

### 3.1 System Design

Where closure is required prior to the complete filling of the cell or site, changes in the design of the gas collection system may be required.

### 3.2 Completion of Gas Collection System

In the event of forced closure, there may be circumstances where the gas monitoring system, if required, has not been installed completely in association with the unit to be closed. The gas monitoring system may include the installation of pipes, monitoring well, or probes necessary to conduct the required monitoring.

### 3.3 Equipment and Installation

## **4.0 Monitor Well Installation**

A ground water monitoring well network, if monitoring was required at the landfill unit, should have been installed prior to the beginning of any waste disposal operations. In the event of forced closure of a site, it may become necessary to relocate some monitoring wells. This may require the proper plugging of those well locations that are no longer suitable. Gas monitoring at the site may require the installation of methane monitoring wells or the relocation or reworking of existing methane monitoring wells.

### 4.1 Ground Water Monitor Well Installation, Reworking, or Replacement

Monitor well installation, rework or replacement includes all labor (including consultant labor) and materials to do the necessary work including surveying.

### 4.2 Install, rework, or Replace Methane Probe/s or Wells

Methane probe or well installation, rework, or replacement includes all labor (including consultant labor) and materials to do the necessary work including surveying.

### 4.3 Monitor Well or Methane Probe/Well Plugging

Includes all costs for the plugging of wells and probes.

## **Contingency Costs and Legal Fees**

Including in the cost estimates an estimated 10 percent contingency cost. However, please note that the contingency cost may be increased considerably where only general closure plans are submitted as part of the permit application. A estimated 25 percent cost associated with the legal fees may be prudent.



## **Calculation of the Totals for Closure**

The Engineering Total, Construction Total, Gas Collection Total, and the Ground Water Total should be added. A percentage of construction should be set aside for the Contractor's Performance Bond. In addition to that, the 10 percent contingency factor should be built into each category. A space for contingency legal fees has been provided; this may be from zero to as much as 25 percent of the total closure costs.

Please note: These factors are subject to review and may change with subsequent drafts of this document.

## **Post-Closure Care**

The post-closure care period is established to be 30 years or as long as the Director determines is required for the facility or unit to become stabilized and to protect human health and the environment. During this period, maintenance must be ongoing to assure the integrity and effectiveness of the final cover and other required systems. Also included in this section is the cost for disposal of leachate, since leachate may still be generated during the post-closure care period. The costs for post-closure care are divided into engineering costs, construction costs and leachate disposal costs.

### **1.0 Engineering Costs**

Engineering costs include the preparation or amendment of a post-closure plan, site inspections, site monitoring, preparation of a post-closure permit, and preparation of correctional plans if required.

#### **1.1 Post-Closure Plan**

The post-closure plan provides a schedule for routine maintenance of the final cover system, the landfill security system, and the gas and groundwater monitoring systems. It also contains a schedule for the sampling and analysis of ground water and gas monitoring.

#### **1.2 Site Inspections**

Site inspections should be performed at least semiannually, for some landfill classes, and quarterly, for other landfill classes. Inspections should include identification of areas experiencing settlement or subsidence, identification of erosion or other drainage-related problems, inspection of the fencing, and inspection of the leachate collection system and monitoring systems.

#### **1.3 Correctional Plans and Specifications**

Correctional plans and specifications include the costs for an engineering consultant to prepare plans and specifications to correct problems identified during the site inspections. This cost is obviously dependent upon the quality of care taken during the closure of the site and ongoing maintenance during previous post-closure care years. The cost may be higher during earlier post-closure care years and taper down to zero during the end of the post-closure care period.

#### **1.4 Administration Costs**

General costs of operating the post-closure care program and of compiling and submitting reports.

#### **1.5 Site Monitoring**

Site monitoring is the cost to perform semiannual ground water sampling and analysis for each on-site monitoring well. Gas monitoring is performed on a quarterly basis during the post-closure care period and should be included. Any gas collection system that is active may require monitoring and can be included here or in section 2.2.3.

## **2.0 Maintenance Costs**

Post-closure maintenance costs include the costs to correct any problems determined by the site inspections and as specified by the engineer's correctional plans and specifications. These costs will also include any ongoing site maintenance that is needed throughout the post-closure care period.

### **2.1 Cover Maintenance Costs**

Subsidence and erosion of the cover may occur. These areas must be repaired and the vegetation reestablished. Also any damage to the compacted soil layer or the FMC, if present, must be repaired.

### **2.2 Equipment Maintenance**

Ground water monitoring wells and any sampling equipment may need repair or replacement. Gas collection system surface equipment may need repair or replacement. Gas monitoring wells may need to be repaired or replaced. Leachate collection system equipment may need maintenance or replacement.

## **3.0 Final Plugging of Monitoring Wells**

At the end of the post-closure care period the monitoring wells must be plugged in accordance with Utah Division of Water Rights rules.

## **4.0 Leachate Disposal**

Leachate disposal costs are difficult to estimate and would be required only at landfills that have a liner and a leachate collection system. Since the landfill will be closed, recirculating of leachate back into the landfill would not be possible. The owner or operator should base cost estimates on an average rate of leachate generation during the past few years of active life of the landfill unit and the cost of treatment that may be available or developed. Another factor that complicates matters is that, during the post-closure period, the volume of leachate being generated should decrease substantially because the landfill unit has received a final cover.

## **5.0 Site Maintenance**

General maintenance of the site will continue throughout the post-closure period. Items such as fences and gates or other access controls, needed buildings and access roads will need to be maintained.

## **6.0 Demonstration of Stability**

The post-closure care period is not automatically ended at the end of 30 years. A site must be shown to be stable and not present a threat to health or the environment. Making the demonstration may require both analysis of current data and collection of new information. Both of these activities will require expenditures that must be allowed for.

**Landfill Closure and Post-Closure Care Reference Costs**

The following are reference costs developed by the Oklahoma Department of Environmental Quality and may be used as a guide in preparation of cost estimates for closure and post-closure care of Utah landfills (2022 update).

## 2022 Worksheet for Calculating Closure and Post-closure Cost Estimates

All site data necessary to calculate estimates of closure and post-closure costs can be gathered by completing table H.1. Data from Table H.1 should be inserted into Tables H.2 and I.1 to complete calculations.

### Table H.1 Site Data

**Facility Name:**

**Permit Number:**

Description	Quantity	Units
Total Permitted Area		acres
Active Portion		
Composite Lined		acres
Soil Lined		acres
Area of Largest Cell/Phase Requiring Final Cap		
Composite Lined		acres
Soil Lined		acres
Perimeter Fencing		linear feet
Groundwater Monitoring Wells		VLF
Methane Gas Probes		VLF
Terraces		linear feet
Letdown channels		linear feet
Perimeter drainage ditches		linear feet
Average Daily Flow		tons/day
Landfill Disposal Cost		\$/ton

VLF = Vertical linear feet. The sum of the depths of all monitoring wells.

**Table H.2 Closure Cost Estimate**

**Facility Name:**

**Permit Number:**

	<b>Task/Service</b>	<b>Quantity</b>	<b>Units</b>	<b>Multiplier<sup>a</sup></b>	<b>Unit Cost<sup>b</sup></b>	<b>Subtotal</b>
<b>1</b>	<b>Preliminary Site Work</b>					
a	Conduct Site Evaluation	1	Lump sum	1	\$3,323.40	\$3,323.40
b	Dispose Final Wastes					
	Average Daily Flow	<sup>c</sup>	tons/day			
	Disposal Cost	<sup>d</sup>	tons/day	5	<sup>e</sup>	
c	Remove Temporary Building(s)	1	lump sum	1	\$3,047.57	\$3,047.57
d	Remove Equipment	1	lump sum	1	\$2,487.72	\$2,487.22
e	Repair/Replace Perimeter Fencing		linear feet	0.25	\$3.26	
f	Clean Leachate Line(s)	1	lump sum	1	\$1,505.27	\$1,505.27
<b>2</b>	<b>Monitoring Equipment</b>					
a	Rework/Replace Monitoring Well(s)		VLF	0.25	\$69.89	
b	Plug Abandoned Monitoring Well(s)		VLF	0.25	\$27.98	
c	Rework/Replace Methane Probe(s)		VLF	0.25	\$60.35	
d	Plug Abandoned Methane Probe(s)		VLF	0.25	\$22.05	
e	Rework/Replace Remediation and/or Gas Control Equipment	1	lump sum	0.05	<sup>f</sup>	
<b>3</b>	<b>Construction</b>					
a	Complete Site Grading to include on- and off-site borrow areas		acres	1	\$1,317.64	
b	Construct Final Cap					
	Compacted On-site Clay Cap or		cubic yards	1	\$4.74	
	Compacted Off-site Clay Cap or		cubic yards	1	\$7.68	
	Install Geosynthetic		square feet	1	\$0.48	

	Clay Liner Cap					
c	Construct Landfill Gas Venting Layer					
	Place Sand or		acres	1	\$35,232.50	
	Install Net and Geotextile		square feet	1	\$0.34	
d	Install Passive Landfill Gas Vents		acres	1	\$844.03	
e	Install Flexible Membrane Liner		square feet	1	\$0.37	
f	Drainage Layer					
	Place Sand or		acres	1	\$35,232.50	
	Install Net and Geonet		square feet	1	\$0.34	
g	Place On-site Topsoil		cubic yards	1	\$2.03	
	Place Off-site Topsoil		cubic yards	1	\$16.26	
h	Establish vegetative cover, including on- and off-site borrow areas		acres	1	\$500.04	
4	<b>Drainage/erosion control</b>					
a	Construct Terraces		linear feet	1	\$8.52	
b	Construct Letdown Channels		linear feet	1	\$8.00	
c	Clean Perimeter Drainage Ditches		linear feet	0.50	\$6.49	
5	<b>Tasks Not Identified</b>					
6	<b>Subtotal</b>					
7	<b>Administrative Services</b>	1	lump sum	0.10	₤	
8	<b>Technical and Professional Services</b>	1	lump sum	0.12	₤	
9	<b>Closure Contingency</b>	1	lump sum	0.10	₤	
10	<b>Total Final Closure</b>					h

<sup>a</sup> Multipliers are determined from the *Solid Waste Financial Assurance Program Report*, December 22, 2000.

<sup>b</sup> Unit costs include a 0.95% inflationary adjustment for 2011.

<sup>c</sup> New facilities: Insert the value for “W” in OAC 252:515-27-8(a)(2). Existing facilities: Insert reported annual tonnage for the previous year, divided by 312 operating days per year (52 weeks per year x 6 operating days per week).

- d Insert number of tons/day from above.
- e Insert landfill disposal cost per ton of waste (\$/ton).
- f Input capital cost for gas control/remediation equipment, if installed at the site.
- g Input subtotal from line 6.
- h Add rows 6 through 9.

**Table I.1 Post-closure Cost Estimate**

**Facility Name:**

**Permit Number:**

	<b>Task/Service</b>	<b>Quantity</b>	<b>Units</b>	<b>Multiplier<sup>a</sup></b>	<b>Unit Cost<sup>b</sup></b>	<b>Subtotal</b>
1	<b>Site maintenance</b>					
a	Site Inspections	4	per year	30	\$604.56	\$72,547.20
				8		\$19,345.92
b	General Maintenance	1	per year	30	\$1,812.52	\$54,375.60
				8		\$14,500.16
c	Remediation and/or Gas Control Equipment	1	lump sum	0.3 <sup>c</sup>	<sup>d</sup>	
2	<b>Monitoring equipment</b>					
a	Rework/Replace Monitoring Well(s)		VLF	0.25	\$70.34	
b	Plug Abandoned Monitoring Well(s)		VLF	0.25	\$27.98	
c	Final Plugging of Monitoring Wells		VLF	1	\$27.98	
d	Rework/Replace Methane Probe(s)		VLF	0.25	\$60.35	
e	Plug Abandoned Methane Probe(s)		VLF	0.25	\$22.05	
f	Final Plugging of Methane Probes		VLF	1	\$22.05	
g	Final Plugging of Piezometer(s)		VLF	1	\$22.05	
3	<b>Sampling and analysis</b>					
a	Groundwater Monitoring Wells		wells	60	\$651.90	
				16	\$160.90	
b	Methane Gas Probes		probes	60	\$42.30	
c	Surface Water Monitoring Points		points	60	\$78.57	
d	Leachate		sample	60	\$126.59	
4	<b>Final cover maintenance</b>					
a	Mow and Fertilize Vegetative Cover		acres	30	\$200.00	



				8		
b	Repair Erosion, Settlement, and Subsidence for On-site Soils		acres	30	\$2.90	
	Repair Erosion, Settlement, and Subsidence for Off-site Soils		acres	30	\$17.34	
				8		
c	Reseed Vegetative Cover		acres	0.20	\$500.03	
5	<b>Leachate management</b>					
a	Clean Leachate Line(s)	1	per year	30 (30 yrs)	\$1,550.27	\$46,507.98
b	Maintain Leachate Collection System and Equipment	1	per year	30 (30 yrs)	\$2,408.40	\$72,251.88
c	Collect, Treat, Transport, and Dispose of Leachate		gal/yr	30	\$0.31	
6	<b>Tasks not identified</b>					
7	<b>Subtotal</b>					
7	<b>Administrative Services</b>	1	lump sum	0.06	f	
8	<b>Technical and Professional Services</b>	1	lump sum	0.07	f	
9	<b>Post-closure Contingency</b>	1	lump sum	0.10	f	
10	<b>Total Post-closure</b>					g

a Multipliers are determined from the *Solid Waste Financial Assurance Program Report*, December 22, 2000.

b Unit costs include a 0.95% inflationary adjustment for 2011.

c 5% of equipment capital cost, maintenance performed once per 5 yrs for 30 years.

d Input capital cost for gas control/remediation equipment, if installed at the site.

e If the approved groundwater monitoring plan requires monitoring for alternative constituents, unit costs shall be calculated in accordance with OAC 252:515-27-52(b) or (c).

f Input subtotal from line 7.

g Add lines 7 through 10.