

## **Topic: Closure and Post-Closure Cost Estimates**

### **Disclaimer**

The information provided in this guidance document is general in nature, and is not to be construed as either regulatory in nature, or as sufficient in addressing all closure and post closure cost issues pertaining to a specific site and facility which are required to comply with the applicable TCEQ rules and federal regulations. Applicants should also refer to the applicable rules found in or incorporated by 30 TAC Chapter 350, Subchapter B, 30 TAC Chapter 335, Subchapter F, and 30 TAC Chapter 335, Subchapter H.

Note: This guideline does not address corrective action costs. Corrective action costs are to be separately determined for purposes of meeting the financial assurance requirements for a compliance plan.

### **Introduction**

An owner or operator of a hazardous waste treatment, storage, or disposal facility must prepare detailed written estimates of the current costs of closing the facility or units, and the current costs of monitoring and maintaining them after closure. These detailed cost estimates must be based on those activities and procedures specified in the facility closure and post-closure plans, and are used in determining the financial assurance dollar amounts required by the permit for closure and post-closure care. The basic assumptions which apply to these cost estimates include the following:

- The costs are in current dollars for a third party to conduct and complete all closure and post- closure activities.
- The cost estimate must be based on the cost of final closure at the point in the facility's active life when the extent and manner of its operation would make closure the most expensive. This situation may be interpreted as the abandonment of the facility at full capacity, with no operable on-site equipment, and with off-site shipment and disposal during closure of wastes, waste residues, decontamination wastes, contaminated stormwater, and leachate.
- The cost estimates must be based on the maximum inventory of wastes on-site over the active life of the facility.
- The closure cost estimate is not to incorporate any salvage value that may be realized from the sale of hazardous wastes, facility structures, equipment, land, or other assets associated with the facility at the time of closure.
- Where contingent closure is required for surface impoundments, waste piles, or tank units, the contingent closure and post-closure costs must also be supplied, with the more expensive of the costs of clean closure versus contingent closure being included in the total facility closure and post-closure costs.
- Closure costs are one-time costs, while post-closure costs are annual costs multiplied by either the full 30 year post-closure care period, or the post-closure care period remaining at the time the estimate is prepared.

- Apply a 10% contingency factor to account for unknowns and omissions in the final total for the closure and post-closure care cost estimates.

Cost estimates may be either developed as engineering line-item-based estimates or based upon contractor bids from owner or operator furnished bid specifications. In either case, the detailed information must be provided to the TCEQ.

The costs of performing specific analytical tasks should be established using bids from commercial laboratories which reflect the matrices to be analyzed, the number of samples to be analyzed, the methods to be used, and the data quality objectives for the task. Incidental costs such as laboratory analytical costs may be obtained from a laboratory accredited by the state of Texas to perform environmental analyses.

### **Closure Cost Estimate**

The closure cost estimate should include, as a minimum and as applicable, the following one-time cost line items:

- Design cost to provide construction level design details for the closure;
- Inventory of wastes including consulting fees, soil and groundwater investigations to determine the extent of contamination and report preparation;
- Removal or decontamination of wastes, equipment, and structures including removal and management of liquid wastes, liner removal from surface impoundments, etc.;
- Management of wastes, including off-site disposal of wastes, contaminated media and liners, transporting costs, contaminated storm water and leachate;
- Management of run-on, run-off, and storm water including installation of berms, temporary retention ponds to contain storm water run-off and run-on, etc.;
- Installation of leachate collection and any additional control or monitoring features as necessary;
- Final landfill cover material and installation including, as applicable:
  - clay material, placement, and compaction;
  - any geomembranes, drainage layers or other cover layers;
  - vegetative layer material placement and grading, or placement of other approved layer to protect the compacted soil layer;
  - seeding, fertilization, soil amendments and mulch; and
  - Quality assurance and quality control tests;
- Consulting fees for the closure report;

- Survey plat, public notices, and deed notices; and
- The addition of a 10% contingency fee for unknowns and omissions.

### **Post Closure Cost Estimate**

The post-closure cost estimate should include, as a minimum and as applicable, the following annual cost line items:

- Final cover maintenance and repair including erosion repair and vegetation repair, and ongoing mowing and reseeded, etc.;
- Maintenance of run-on, run-off, and storm water control structures;
- Maintenance of signs, fencing and other security systems, survey monuments, etc.;
- Maintenance and operation of leachate collection systems including sampling and analysis, treatment, and off-site disposal;
- Maintenance and operation of groundwater monitoring wells systems including monitoring well replacement as necessary, sampling and analysis, treatment and off-site disposal of bailed water, and preparation of periodic reports as required by the permit and including any consulting fees;
- The computation of the total annual costs multiplied by the remaining post-closure care period or by 30 years if the post closure care period has not commenced to arrive at the total post closure care cost;
- The addition of a 10% contingency fee for unknowns and omissions; and
- Post-Closure notices, surveys, and deed notices.

### **Waste management units generally subject to closure and basic actions necessary for closure and post-closure:**

#### **Landfills:**

The closure and post-closure requirements for permitted landfills are specified under the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B, and 30 TAC §335.174.

1. Remove all accumulated liquids and dispose of properly.
2. Identify and remove all surrounding surface soils contaminated with waste due to facility operations and place in open cells.
3. Place clean fill or Class 3 waste in open cells to reach a necessary grade prior to capping. This material should be compacted to minimize long-term settlement.
4. Remove or decontaminate all equipment and related structures and dispose of

wastes generated at an authorized facility.

5. Landfills must have a final cover with erosion protection and provisions for long term security and monitoring. Final cover costs for hazardous waste landfills shall be based on landfill cover design as specified in EPA Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments EPA 530-SW-89-047 or other more current EPA documents regarding design of hazardous waste landfill cover. Nonhazardous waste landfill cover systems must conform with the design criteria in TCEQ Guidance Document No. 3: Landfills.
6. Place a final cover over the entire landfill. The cover should have a permeability less than or equal to that of the bottom liner. The cover shall be sloped to prevent surface-water ponding, minimize erosion, and to minimize settlement effects.
  - a. In cases where the bottom liner consists of undisturbed soil or compacted clay, the final cover should consist of compacted clay. Class I landfills located in areas of high precipitation should have a drainage layer of sand followed by a layer of topsoil placed above the compacted clay. Class II landfills generally may eliminate the drainage layer in the cover design but should have a layer of topsoil placed above the compacted clay cap.
  - b. In cases where the bottom liner is a synthetic material, the final cover should consist of the following:
    1. A layer of compacted clay covering the waste;
    2. A synthetic liner having the same physical and chemical properties as the bottom liner placed over the compacted clay;
    3. A layer of sand covering the synthetic liner;
    4. A final layer of topsoil;
    5. Storm water should be managed in accordance with all applicable rules and permit conditions until completion of the above closure activities. Upon their completion, dikes, ditches, berms, and other storm water control structures should be constructed, removed, or altered as necessary to facilitate prompt drainage of the site on a permanent basis;
    6. The entire landfill area should have a self-sustaining vegetative cover or other method of erosion control established; and
    7. The post-closure care period for hazardous waste landfills is 30 years in accordance with 30 TAC §335.174 and 40 CFR §264.117 through §264.120 including maintenance and monitoring throughout the post-closure care period specified in the permit under 40 CFR §264.117. The post-closure care period for Class 1 nonhazardous and Class 2 landfills typically is 30 years. Class 3 landfills should not require any post-closure maintenance. Post-

Closure care should include the following procedures for the entire post-closure care period unless otherwise noted.

- a. Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other deterioration;
- b. Maintain the vegetative cover through periodic mowing, fertilization, and reestablishment of vegetation until the cover becomes self-sustaining;
- c. Maintain and monitor the leak detection system in accordance with 40 CFR §264.301(c)(3) and §264.301(c)(4) and §264.303(c), as required in 30 TAC §335.174(b)(3), and comply with all other applicable leak detection system requirements of this part;
- d. Continue to operate the leachate collection and removal system at an appropriate frequency until leachate is no longer detected (if applicable);
- e. Maintain and operate the groundwater monitoring system at least semiannually. Wells or other devices should be inspected, collection of water samples attempted, and recovered samples analyzed for groundwater quality parameters;
- f. Prevent run-on and run-off from eroding or otherwise damaging the final cover;
- g. Inspect at least annually all boundary fences and repair or replace as necessary; and
- h. Protect and maintain surveyed benchmarks used in complying with 40 CFR §264.309, as required by 30 TAC §335.174(b)(6);

**Landfill Closure and Post Closure Cost Assumptions:**

- A. For below-grade units, the active area of the landfill is assumed to be filled to half of the below-grade capacity. The landfill must be filled to near ground surface with Class 3 waste or clean fill. Above-grade landfills need no additional fill.
- B. Landfills must have a final cover with erosion protection and provisions for long term security and monitoring. Final cover costs for hazardous waste landfills will be based on constructing a graded, final cover of compacted clay (3 ft), a drainage layer, 80 mil synthetic liner, and 2 ft of topsoil cover. Nonhazardous waste landfills may use lesser dimensions.
- C. No special measures are necessary to allow equipment access to the landfill

during closure or post closure.

- D. Post-Closure care begins as of the closure certification date. For illustrative purposes, a 30-year post-closure period has been used as the basis for computing post-closure costs. Landfills that have been previously certified closed will have a shorter post closure period.
- E. You can reasonably assume that several groundwater monitoring wells may need to be replaced during a post closure period.
- F. No extraordinary procedures for containment of escaped wastes are included in this guidance. Releases to groundwater will be addressed in a Compliance Plan or similar corrective action authorization.
- G. Data needed to complete a cost estimate for each unit:
  - perimeter dimensions of active area (ft);
  - fill volume of active area (cubic yards);
  - local as-delivered costs of imported fill;
  - number of groundwater monitoring wells;
  - the analytical cost per well for each sampling event;
  - local average monthly rainfall amounts for two wettest consecutive months (applicable to uncovered areas only); and
  - equipment rental and labor rates.

**Example Worksheet for Landfill Closure Cost Estimates**

<b>Project Cost Categories</b>	<b>Cost Estimate</b>
Furnishing, installing, operating, and removing stormwater management equipment	\$
Furnishing, excavating, grading, and compacting clay material	\$
Furnishing and installing synthetic membrane	\$
Furnishing and installing final cover drainage system	\$
Furnishing geotextile	\$
Furnishing, excavating, grading, compacting fill	\$
Furnishing and grading sand cover	\$
Furnishing and grading topsoil	\$
Furnishing and grading cap fill	\$
Sampling and analysis	\$
Equipment rental	\$
Vegetative cover, seeding, fertilizing	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$

Project Cost Categories	Cost Estimate
10% contingency	\$
Estimated Unit Closure Cost Total	\$__ (20__ dollars)

**Example Worksheet for Landfill Post-Closure Cost Estimates**

<b>Project Cost Categories</b>	<b>Cost Estimate</b>
Inspection: security (signs and fencing, benchmarks, final cover)	\$
Maintenance: vegetative cover (mowing, re-seeding, fertilizing vegetative cover, dike)	\$
<b>Groundwater monitoring and analysis:</b>	
Groundwater sample collection (# wells x #hrs./sampling event x # sampling events)	\$
Groundwater sample analysis (# wells x 4 samples/well x # events/yr)	\$
<b>Leachate characterization sample:</b>	
Contaminated leachate disposal-profiling	\$
Contaminated leachate disposal - transportation	\$
Contaminated leachate disposal-disposal fee	\$
Plug and abandon monitoring wells during 30 yrs. post-closure care	\$
Annual report preparation & submittal to TCEQ	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% Contingency	\$
Estimated Annual Post-Closure Cost Total	\$ (20 dollars)

**Land Treatment Units:**

The closure and post-closure requirements for permitted land treatment units (LTU) are specified under the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B, and 30 TAC §335.172.

Two general options exist for closure of land treatment units at facilities. Facilities which have elevated levels of heavy metals or other persistent toxins in the soil should perform closure according to Option 1 below, unless a satisfactory alternative means of facility closure is established. Please refer to Technical Guideline No. 5 and other appropriate guidance documents for information on the concentrations which would call for Option 1. Other facilities should reflect closure according to Option 2.

- Option 1:
  1. Remove sufficient soil such that remaining soil contains background or otherwise acceptable levels of waste constituents and dispose of all wastes generated at an authorized facility and
  2. Disc and fertilize soil and establish vegetative cover.
- Option 2:
  1. After waste application ceases, continue all operations (including pH control) necessary to maximize degradation, transformation, or immobilization of waste constituents within the treatment zone;
  2. Continue all operations in the treatment zone to minimize run-off of waste constituents;
  3. Maintain the run-on control system and the run-off management system;

4. Control wind dispersal of waste if required;
5. Continue to comply with any prohibitions or conditions concerning growth of food-chain crops;
6. Continue groundwater monitoring and other applicable monitoring;
7. Establish and maintain a self-sustaining vegetative cover on the portion of the facility being closed at such time that the cover will not substantially impede degradation, transformation, or immobilization of waste constituents in the treatment zone; and
8. During the post-closure period, the owner or operator should continue to comply with Items 5 through 7 above.

**Land Treatment Unit Closure and Post Closure Cost Assumptions:**

- A. All land treatment units have recently received the maximum permitted application of waste.
- B. Post-Closure is required when units are closed in accordance with the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B. Post-Closure care is also required for units which have documented release to groundwater which requires corrective action such as a Compliance Plan or institutional controls, then you must provide for post closure care.

Please use the appropriate portions of the landfill closure and post closure activities table when estimating closure and post closure as a landfill.

- C. Data needed to complete a cost estimate for each unit:
  - estimated length of time to incorporate last waste application into LTU in weeks or months;
  - amount of tilling and watering during final waste incorporation;
  - total surface area of the unit in acres;
  - equipment rental and labor rates; and
  - analytical costs for soil core and soil pore moisture samples.

**Example Worksheet for Land Treatment Unit Closure Cost Estimates**

<b>Project Cost Categories</b>	<b>Cost Estimate</b>
<b>Annual unsaturated zone monitoring:</b>	
Geoprobe	\$
Soil sample collection	\$
Lysimeter sample collection	\$
Chemical analysis	\$
<b>Annual groundwater monitoring:</b>	
Groundwater sample collection (# wells x #hrs./sampling event x # sampling events)	\$
Groundwater sample analysis (# wells x 4 samples/well x # events/yr)	\$
<b>Sampling and analysis:</b>	
Soil core sampling	\$
Soil core analysis	\$
Geoprobe	\$
Chemical analysis	\$
Sample evaluation and risk-based closure	\$
Perform assessment report	\$
Establish vegetative cover	\$
Tilling and watering equipment rental	\$
Decontamination of ancillary equipment	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% Contingency	\$
Estimated Unit Closure Cost Total	\$ (20 dollars)

**Waste Piles:**

The closure and post-closure requirements for permitted waste piles are specified under 40 CFR §264.258, as adopted by 30 TAC §335.152(a)(19), and the Texas Risk Reduction Program of 30 TAC Chapter 350 Subchapter B.

The closure and post-closure plan requirements for waste piles are dependent upon the liner system employed to control waste migration. A new waste pile should have a liner designed, constructed, and installed to prevent any migration of wastes out of the pile into the adjacent subsurface soils, ground water, or surface water at any time during the active life (including the closure period) of the unit. The owner or operator of an existing facility should demonstrate that the in-place liner system satisfies this requirement. If this demonstration cannot be made, the owner or operator should develop a closure plan satisfying the requirements of Option 1 and a contingent closure plan and contingent post-closure plan as outlined in Option 2. In this case the cost estimate calculations are only required to represent the cost of complying with the contingent closure plan and contingent post-closure plan. It should be noted that owners or operators of waste piles will be required to remove all waste and contaminated soil practicable at closure.

- Option 1 - New and existing waste piles which comply with liner requirements:
  1. Remove all waste and contaminated soil and dispose of at an authorized facility. The amount of contaminated soil to be removed should be based on the service life of the waste management unit and the permeability of the liner;

2. Remove or decontaminate all containment system components, subsoils, structures, and equipment which are contaminated with waste or leachate and dispose of all waste generated at an authorized facility; and
  3. Verify proper decontamination with representative soil sampling and analyses.
- Option 2 - Existing waste piles which do not comply with liner requirements:
    1. Prepare a closure plan for complying with the requirements in Option 1 above and
    2. Prepare a contingent closure plan and a contingent post-closure plan for complying with all closure and post-closure requirements that apply to landfills in the event that after making all reasonable efforts to remove or decontaminate all waste, contaminated subsoils, structures, and equipment the owner or operator finds that not all contaminated materials can be practicably removed or decontaminated.

**Waste Piles Closure and Post Closure Cost Assumptions:**

- A. Waste piles are full to permitted capacity.
- B. Closure includes removal of wastes, liners, and contaminated soil. These wastes, liners, and contaminated soil are then sent off-site for disposal. Waste piles with nonrigid liners or no liners also require soil or liner removal during closure. Rigid liners require cleaning after waste removal.
- C. After removal of waste and contaminated storm water, slab areas are decontaminated by a hot wash. When decontaminating these areas, you can reasonably assume a washwater generation rate of 0.1 gallons per square foot of area.
- D. Representative soil samples should be collected from beneath the waste pile or, for rigid liners, as close as is diagonally practical. This sampling is part of the demonstration that all waste is removed.
- E. In 40 CFR §264.258(b), if the owner or operator finds that not all contaminated subsoils can be practically removed or decontaminated, he must close the facility and perform post-closure in accordance with the closure and post-closure care requirements that apply to landfills (30 TAC §335.174). Please use the appropriate portion of the landfill activities table when estimating closure and post-closure as a landfill.

A contingent post closure plan is required if hazardous waste piles do not have liners that satisfy 40 CFR §264.251(a)(1) or are not exempt from the liner requirement.

You should use the appropriate portions of the landfill closure and post closure activities table when estimating closure and post closure as a landfill.

- F. Data needed to complete a cost estimate for each unit:

- maximum permitted waste pile capacity in cubic yards;
- estimated total cubic yards of contaminated liner and soil;
- local average monthly rainfall amounts for two wettest consecutive months (applicable to uncovered areas only);
- round trip distances and costs to off-site processing and disposal sites; and
- waste treatment and disposal costs, equipment rental rates, and labor rates.

**Example Worksheet for Waste Pile Closure Cost Estimates**

<b>Project Cost Categories</b>	<b>Cost Estimate</b>
Removal and off-site disposal of accumulated waste(s)	\$
Verification sampling and analysis	\$
Removal and disposal of contaminated soils for off-site disposal	\$
Equipment decontamination	\$
Earth construction (excavation, backfilling, and compaction of soils)	\$
Closure verification report	\$
Deed certification	\$
Equipment rental	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% contingency	\$
Estimated Unit Closure Cost Total	\$____ (20__ dollars)

**Surface Impoundments:**

The closure and post-closure requirements for permitted surface impoundments are specified under the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B, and 30 TAC §335.169.

The closure and post-closure plan requirements for surface impoundments are dependent upon the liner system employed to control waste migration. New impoundments should have a liner designed, constructed, and installed to prevent any migration of wastes out of the impoundment into the adjacent subsurface soil, or ground water, or surface water at any time during the active life (including the closure period) of the impoundment. If the owner or operator of an existing facility intends to remove all waste at closure and is unable to demonstrate compliance with the liner requirements for new facilities, he should prepare a closure plan which complies with the requirements in Option 1, and a contingent closure plan and contingent post-closure plan which comply with the requirements in Option 2. In this case the cost estimate calculations are only required to represent the cost of complying with the contingent closure plan and contingent post-closure plan. It should be noted that owners or operators who prepare a closure plan for removal of all waste and a contingent closure and post-closure plan for closure as a landfill will be required to remove all waste and contaminated soil practicable at closure.

- Option 1: Storage and Treatment Impoundments (All wastes are removed at closure):
  1. Remove all waste and contaminated soil and dispose of at an authorized facility;
  2. Remove or decontaminate all containment system components, subsoils, structures, and equipment which are contaminated with waste or leachate and dispose of all wastes generated at an authorized facility; and
  3. Verify proper decontamination with representative soil sampling and analyses.
- Option 2: Disposal Impoundments (Wastes remain at closure):
  1. Treat, evaporate, or remove all free liquid and dispose of any

- removed waste at an authorized facility;
2. Stabilize remaining sludges and contaminated soil to a bearing capacity sufficient to support the final cover;
  3. Remove or decontaminate all equipment, piping, and related structures which are contaminated with waste or leachate and dispose of all wastes generated at an authorized facility;
  4. If necessary, add clean fill or Class III waste to reach final elevation prior to capping;
  5. Install a cover system in accordance with the requirements that apply to landfills; and
  6. Comply with all post-closure requirements that apply to landfills including maintenance and monitoring throughout the post-closure care period.

### **Surface Impoundment Closure and Post Closure Cost Assumptions:**

- A. Surface impoundments are full to permitted capacity. Contents by volume are based on 10% sludge and 90% liquid.
- B. Closure involves removal of liquid and sludge waste, liners, and contaminated soil. These liquid wastes, sludges, liners, and contaminated soil are then transported off-site for disposal.
- C. A minimum of four soil samples should be collected from beneath the surface impoundment. This sampling is part of the demonstration that all waste is removed.
- D. Close the surface impoundment in accordance with 30 TAC §335.169 and provide post-closure care for a landfill under 30 TAC §335.174, and the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B. Post-Closure care is also required for units which have documented release to groundwater necessitating corrective action plans such as Compliance Plans or institutional controls. Please use the appropriate portion of the landfill closure activities table for estimating costs.

Contingent post closure plans are required for hazardous waste surface impoundments that do not have synthetic liners that satisfy 40 CFR §264.221(a) or are not exempt from the liner requirement.

You should use the appropriate portions of the landfill closure and post closure activities table when estimating closure and post closure as a landfill.

- E. Data needed to complete a cost estimate for each unit:
  - maximum permitted surface impoundment volume in gallons or cubic yards;
  - estimated total cubic yards of contaminated liner and soil;

- local average monthly rainfall amounts for two wettest consecutive months (applicable to uncovered areas only);
- round trip distances and costs to off-site treatment and disposal sites; and
- waste treatment and disposal costs, equipment rental rates, and labor rates.

**Example Worksheet for Surface Impoundment Closure Cost Estimates**

Project Cost Categories	Cost Estimate
<b>If clean closure:</b>	
Sludge dewatering equipment rental	\$
Sludge, liner, and contaminated soil disposal	\$
Sludge, liner, and contaminated soil incineration	\$
Transportation of bulk sludge, liner and contaminated soil	\$
Dispose of sludge	\$
Soil samples beneath unit	\$
<b>If waste is left in place:</b>	
Sludge stabilization equipment rental	\$
Stabilization reagents	\$
Physical tests (stability, bearing capacity)	\$
Sampling and analysis	\$
Install clay cap	\$
Equipment rental (spreaders, compactors)	\$
Seeding, fertilizing, watering vegetative cover	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% contingency	\$
Estimated Unit Closure Cost Total	\$ (20 dollars)

**Container Storage Area:**

The closure and post-closure requirements for permitted container storage area are specified under 40 CFR §264.178, as adopted by 30 TAC §335.152(a)(7), and the Texas Risk Reduction Program of 30 TAC Chapter 350 Subchapter B.

1. Remove all wastes and dispose of at an authorized facility. In computing the volume of waste subject to proper disposition at closure, assume that all on-site storage and processing facilities are at maximum permitted capacity and that storm water resulting from the average of the wettest two consecutive months has accumulated within each diked area used for secondary containment.
2. Remove or decontaminate all equipment, piping, containment structures, and any associated spill residues and dispose of all wastes generated at an authorized facility.
3. Inspect storage and/or processing units and appurtenant equipment and piping to verify that leakage has not occurred and that decontamination has been completed.

**Container Storage Area Closure Cost Assumptions:**

- A. Container storage areas are full to permitted capacity. Container storage areas may have drums or other types of portable containers such as tank trailers, dumpsters, roll-off boxes, etc. The procedures described herein should be modified for these cases.
- B. No escape of waste outside of control areas has occurred. Decontamination involves container and storm water removal followed by a hot wash of the containment areas. When decontaminating these areas, you can reasonably assume a washwater generation rate of 0.1 gallons per square foot of area.
- C. All wastes, washwaters, and stormwaters are sent off-site for processing and disposal.
- D. No post-closure care is required.
- E. Data needed to complete a cost estimate for each unit:
  - maximum permitted number of drums or containers and the volume of the waste either in gallons or cubic yards;
  - total square feet of the permitted container storage area;
  - local average monthly rainfall amounts for two wettest consecutive months (applicable to uncovered areas only);
  - round trip distances and costs to off-site disposal sites; and
  - waste treatment and disposal costs, equipment rental rates, and labor.

**Example Worksheet for Container Storage Area Closure Cost Estimates**

<b>Project Cost Categories</b>	<b>Cost Estimate</b>
Removal of waste	\$
Decontamination of the container storage area and equipment	\$
Sampling and analysis	\$
Transportation of wastes	\$
Treatment and disposal of wastes	\$
Demolition and removal of the containment system	\$
Removal of contaminated soils	\$
Backfilling	\$
Equipment rental	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% contingency	\$
Estimated Unit Closure Cost Total	\$___(20__dollars)

**Tank Systems:**

The closure and post-closure requirements for permitted tank systems are specified under 40 CFR §264.197, as adopted by 30 TAC §335.152(a)(8), and the Texas Risk Reduction 30 TAC Chapter 350 Subchapter B.

1. Remove all wastes and dispose of at an authorized facility. In computing the volume of waste subject to proper disposition at closure, assume that all on-site storage and processing facilities are at maximum permitted capacity and that storm water resulting from the average of the wettest two consecutive months has accumulated within each diked area used for secondary containment.
2. Remove or decontaminate all equipment, piping, containment structures, and any associated spill residues and dispose of all wastes generated at an authorized facility.
3. Inspect storage and/or processing units and appurtenant equipment and piping to verify that leakage has not occurred and that decontamination has been completed.

**Tank Systems Closure Cost Assumptions:**

- A. Tanks are full to permitted capacity.
- B. Tank systems are well maintained with no leakage or spillage.
- C. Closure involves removal of waste and ancillary equipment decontamination.
- D. After removal of waste and contaminated storm water, secondary containment areas are decontaminated by a hot wash. When decontaminating these areas, you can reasonably assume a washwater generation rate of 0.1 gallons per square foot of area.
- E. All wastes, washwaters, and stormwaters are sent off-site for processing and disposal.
- F. Representative soil samples should be collected from beneath the secondary containment or as close as is diagonally practical. This sampling is part of the

demonstration that all waste is removed.

- G. Contingent post closure plans are required for hazardous waste tanks that do not have secondary containment that satisfies 40 CFR §264.193(b)-(f) or have not been granted a variance from the secondary containment requirement. You should use the appropriate portions of the landfill closure and post closure activities table when estimating closure and post closure as a landfill.
- H. In 40 CFR §264.197, if the owner or operator demonstrates that all contaminated soils can not be practicably removed or decontaminated as required, then the owner or operator must close the tank system and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills (30 TAC §335.174). Please see the appropriate portion of the landfill closure activities table for estimating costs.
- I. Data needed to complete a cost estimate for each unit:
- maximum permitted tank capacity in gallons or cubic yards;
  - total square feet of the permitted secondary containment area;
  - local average monthly rainfall amounts for two wettest consecutive months (applicable to uncovered areas only);
  - round trip distances and costs to off-site treatment and disposal sites; and
  - waste treatment and disposal costs, equipment rental rates, and labor rates.

**Example Worksheet for Tanks Closure Cost Estimates**

<b>Project Cost Categories</b>	<b>Cost Estimate</b>
Removal of waste	\$
Purging of the tank system	\$
Decontamination of the tank system and equipment	\$
Sampling and analysis	\$
Transportation of wastes	\$
Treatment and disposal of wastes	\$
Flushing the tank and ancillary piping	\$
Disassembly and loading of the tank and ancillary piping	\$
Demolition and removal of the containment system	\$
Removal of contaminated soils	\$
Backfilling	\$
Equipment rental	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% contingency	\$
Estimated Unit Closure Cost Total	\$____(20__dollars)

**Incinerator, Boiler and Industrial Furnace Units:**

The closure requirements for a permitted incinerator or boiler and industrial furnace are specified under 40 CFR §264.351, as adopted by 30 TAC §335.152(a)(13); 40 CFR §266.102(e)(11), as adopted by 30 TAC §335.221(a)(6); and the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B.

1. Remove all wastes and dispose of at an authorized facility. In computing the volume of waste subject to proper disposition at closure, assume that all on-site storage and processing facilities are at maximum permitted capacity and that storm water resulting from the average of the wettest two consecutive months has accumulated within each drainage control area used for secondary containment.
2. Remove or decontaminate all equipment, piping, containment structures, and any associated spill residues and dispose of all wastes generated at an authorized facility.
3. Inspect storage and/or processing units and appurtenant equipment and piping to verify that leakage has not occurred and that decontamination has been completed.

**Incinerator, Boiler and Industrial Furnace Unit Closure Cost Estimate Assumptions:**

- A. At closure, the incinerator, boiler, or industrial furnace is assumed to be mechanically inoperative.
- B. Drainage control areas associated with the combustion device and its ancillary components are assumed to contain a volume of drainage equivalent to the average rainfall amount occurring during the wettest 2 consecutive months or the maximum storage volume, whichever is the smaller quantity.
- C. No escape of waste outside of control areas has occurred. Decontamination involves storm water removal, hot wash of drainage control slabs, and removal of combustion unit refractory.
- D. No post closure care is required.
- E. Data needed to complete a cost estimate for each unit:
  - drainage control area (ft<sup>2</sup>) and maximum storage volume (gal);
  - estimated refractory volume (cu. yd.);
  - local average monthly rainfall amounts for two wettest consecutive months (applicable to uncovered areas only);
  - round trip distances and costs to off-site processing and disposal sites; and
  - waste treatment and disposal costs, equipment rental rates, and labor rates.

**Example Worksheet for Incinerator, Boiler and Industrial Furnace Unit Closure Activities**

Project Cost Categories	Cost Estimate
Removal of slag and ash	\$
Hydroblasting of combustion chamber, containment area	\$
Transportation of washwater and rainwater	\$
Refractory disposal and transportation	\$
Decontamination of ancillary equipment	\$
Sampling and chemical analysis	\$
Equipment rental	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% contingency	\$
Estimated Unit Closure Cost Total	\$ (20 dollars)

**Drip Pads Closure and Post Closure Cost Assumptions:**

The closure and post-closure requirements for permitted drip pads are specified under 40 CFR §264.575, as adopted by 30 TAC §335.152(a)(15), and the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B.

- A. Closure involves removal of waste residues, liners, and contaminated soil. These wastes, liners, and contaminated soil are then transported off-site for disposal.
- B. A minimum of two soil samples should be collected from beneath the drip pad or as close as is diagonally practical. This sampling is part of the demonstration that all waste is removed.
- C. Post-Closure is required when units are closed in accordance with the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B. If the unit has a documented release to groundwater which requires corrective action such as a Compliance Plan or institutional controls, then post closure care must be provided.

A contingent post closure plan is required if the hazardous waste drip pads do not have synthetic liners that satisfy 40 CFR §264.573(b)(1).

You should use the appropriate portions of the landfill closure and post closure activities table when estimating closure and post closure as a landfill.

- D. Data needed to complete a cost estimate for each unit:
  - total square feet of the permitted drip pad;
  - local average monthly rainfall amounts for two wettest consecutive months (applicable to uncovered areas only);
  - round trip distances and costs to off-site disposal sites; and
  - waste treatment and disposal costs, equipment rental rates, and labor rates.

**Example Worksheet for Drip Pad Closure Cost Estimates**

<b>Project Cost Categories</b>	<b>Cost Estimate</b>
(if applicable) Disposal of waste	\$
(if applicable) Transportation of waste	\$
Decontamination of contaminated stormwater/washwater	\$
Equipment rental (portable pressure washer, detergent)	\$
Soil samples beneath the unit	\$
Sampling and chemical analysis	\$
Equipment rental	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% contingency	\$
Estimated Unit Closure Cost Total	\$____(20__dollars)

**Containment Building Closure and Post Closure Cost Assumptions:**

The closure and post-closure requirements for permitted containment buildings are specified under 40 CFR §264.1102, as adopted by 30 TAC §335.152(a)(20), and the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B.

- A. Closure involves removal of waste residues, liners, and contaminated soil. These wastes, liners, and contaminated soil are then transported off-site for disposal.
- B. A minimum of two soil samples should be collected from beneath the containment building or as close as is diagonally practical. This sampling is part of the demonstration that all waste is removed.
- C. In 40 CFR §264.1102, close the drip pads and provide post-closure care for a landfill under 30 TAC §335.174, and the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B. If the unit has a documented release to groundwater which requires corrective action such as a Compliance Plan or institutional controls, then for post closure care must be provided.

You should use the appropriate portions of the landfill closure and post closure activities table when estimating closure and post closure as a landfill.

- D. Data needed to complete a cost estimate for each unit:
  - maximum permitted volume of waste in cubic yards;
  - total square feet of the permitted containment building area;
  - round trip distances and costs to off-site disposal sites; and
  - waste treatment and disposal costs, equipment rental rates, and labor rates.

**Example Worksheet for Containment Building Closure Cost Estimates**

<b>Project Cost Categories</b>	<b>Cost Estimate</b>
Removal of waste	\$
Decontamination of the containment building	\$
Sampling and chemical analysis	\$
Transportation of wastes	\$
Treatment and disposal of wastes	\$
Demolition and removal of the floor	\$
Demolition and removal of the building	\$
Removal of the containment building	\$
Removal of contaminated soils	\$
Backfilling	\$
Equipment rental	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% contingency	\$
Estimated Unit Closure Cost Total	\$___(20__dollars)

**Miscellaneous Units Closure and Post Closure Cost Assumptions:**

The closure and post-closure requirements for permitted miscellaneous units are specified under 40 CFR §264.601 and §264.603, as adopted by 30 TAC §335.152(a)(16), and the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B.

- A. Closure involves removal of waste residues, liners, and contaminated soil. These wastes, liners, and contaminated soil are then transported off-site for disposal.
- B. Cost assumptions can be based on applicable assumptions of other comparable unit types.
- C. Post-Closure is required when units are closed in accordance with the Texas Risk Reduction Program 30 TAC Chapter 350, Subchapter B. If the unit has a documented release to groundwater which requires corrective action such as a Compliance Plan or institutional controls, then post closure care must be provided.

If a disposal unit, you should use the appropriate portions of the landfill closure and post closure activities table when estimating closure and post closure as a landfill.

- D. Data needed to complete a cost estimate for each unit:
  - maximum permitted volume of waste either in gallons or cubic yards;
  - total square feet of the permitted area;
  - local average monthly rainfall amounts for two wettest consecutive months (applicable to uncovered areas only);
  - round trip distances and costs to off-site disposal sites; and
  - waste treatment and disposal costs, equipment rental rates, and labor rates.

**Example Worksheet for Miscellaneous Unit Closure Cost Estimates**

<b>Project Cost Categories</b>	<b>Cost Estimate</b>
(if applicable) Incineration or landfilling	\$
Transportation of bulk waste	\$
Decontamination of wastes	\$
(if applicable) Disposal of liner	\$
Equipment rental (portable pressure washer, detergent)	\$
Disposal of wash water	\$
Transportation of wash water	\$
Sampling and chemical analysis	\$
PE Closure Certification	\$
Engineering, mobilization, site preparation, etc.	\$
Subtotal	\$
10% contingency	\$
Estimated Unit Closure Cost Total	\$ (20 dollars)