

OPERATIONS PLAN
PREPARED
FOR
ENVIRONMENTAL WASTE SOLUTIONS



CLASS II INDUSTRIAL WASTE LANDFILL

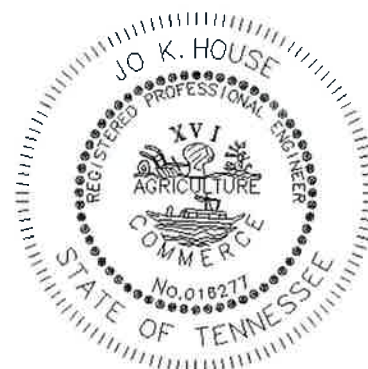
200 Omar Circle,
Camden, Tennessee 38320

PREPARED
BY



HOUSE ENGINEERING LLC
7308 River Park Drive
Nashville, Tennessee 37221

Revised March 2015





ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1. INTRODUCTION.....	1
1.1 SITE HISTORY.....	1
1.2 PURPOSE OF THE OPERATIONS MANUAL.....	1
1.3 GENERAL INFORMATION.....	3
2.0 NARRATIVE DESCRIPTION OF THE FACILITY AND OPERATION.....	4
2.1 FACILITY OPERATOR.....	4
2.2 LOCATION OF THE FACILITY.....	4
2.3 BUFFER ZONES.....	4
2.4 FAULT AREAS.....	5
2.5 SEISMIC IMPACT ZONES.....	5
2.6 UNSTABLE AREAS.....	6
2.7 ACCESS CONTROL.....	6
2.8 METHODS AND SEQUENCE OF OPERATION.....	8
2.9 TYPES AND ANTICIPATED VOLUMES OF SOLID WASTES.....	10
2.10 NUMBER OF ACRES TO BE FILLED AND PHASE DEVELOPMENT PLANS.....	12
2.11 WASTE HANDLING AND COVERING PROGRAM.....	13
2.12 LANDFILL OPERATING EQUIPMENT.....	20
2.13 LITTER CONTROL.....	21
2.14 RUN-ON, RUN-OFF, AND EROSION CONTROL.....	21
2.15 LEACHATE COLLECTION AND HOLDING FACILITIES MANAGEMENT.....	25
2.16 DUST CONTROL.....	30
2.17 FIRE SAFETY.....	30
2.18 PERSONNEL SERVICES / COMMUNICATIONS.....	32
2.19 CONSTRUCTION QUALITY ASSURANCE PLAN.....	32
2.20 GAS MIGRATION CONTROL STANDARDS.....	32
2.21 GROUNDWATER MONITORING PROGRAM.....	35
2.22 LOCATION IN FLOODPLAINS.....	35
2.23 ENDANGERED AND THREATENED SPECIES.....	35
2.24 RANDOM INSPECTION PROGRAM.....	36
2.25 SEALING OF BOREHOLES.....	38
2.26 PERMANENT BENCHMARK.....	38



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



TABLE OF CONTENTS (continued)

SECTION	PAGE
2.27 WETLANDS	38
2.28 AIRPORT SAFETY	40
2.29 FUTURE PLANNING	41
2.30 MONITORING AND RECORDS	41
2.31 BASIS OF DESIGN	42

ILLUSTRATIONS

Drawing 1 - Typical Liner/Leachate Collection System Configurations	9
Drawing 2 - Waste Separation Between Phases	15
Drawing 3 - Leachate Collection Corridor (Burrito Wrap)	26
Drawing 4 - Conceptual Landfill Gas System	34
Drawing 5 - Typical Subtitle D Landfill Liner System	44
Drawing 6 - Typical Subtitle D Liner System	44

TABLES

Table 1: Waste Volume Estimates	11
Table 2 - Order of Landfill Development	12
Table 3 - Landfill Developmental Sequence	13
Table 4 - Alternate Final Cover Configurations	19
Table 5: Soil Requirements	20
Table 6: Sediment Basin/Pond Storage Volume	22
Table 7: Seed Guidelines	24
Table 8 - Proposed TDSWM Regulatory Alternate Liner Sections	27
Table 9: Leachate Collection Stone Equipment Placement Requirements	28
Table 10: Leachate Collection Summary	28

APPENDIX 1 – FIGURES AND MAPS

FIGURE 1	Site Location Map
FIGURE 2	FEMA Map
FIGURE 3	EWS Aerial Photo

APPENDIX 2 – AIR MONITORING / GAS MITIGATION PLAN

AIR MONITORING PLAN
GAS MITIGATION PLAN

APPENDIX 3 – SPECIES REVIEW

ENDANGERED SPECIES REVIEW

APPENDIX 4 – LEAK DETECTION PROGRAM

LEAK DETECTION PROCEDURAL MANUAL

APPENDIX 5 – WASTE ACCEPTANCE PROCEDURE AND FORMS

WASTE ACCEPTANCE PROCEDURE NARRATIVE
WASTE PROFILE SHEET
CLIENT WASTE MANAGEMENT PROCEDURE FORM



1. INTRODUCTION

1.1 SITE HISTORY

Custom Tire and Recycle (CTR) submitted an application and was originally issued a permit to operate a Class IV Tire Monofill (permit # DML 03-0108) approximating ten acres at 200 Omar Circle in Camden, Tennessee on July 11, 2000.

In May 2003, a request was submitted to the Tennessee Division of Solid Waste Management (TDSWM) requesting a minor modification to the Class IV permit which would allow the disposal of coal ash from the TVA fossil fuel plant in New Johnsonville, Tennessee. The request for the minor modification to the permit allowing CTR to dispose of coal ash in the Class IV Monofill was granted to CTR on May 19, 2003.

In September 2004, CTR formally issued a request to Benton County and the city of Camden to secure local approval to expand the footprint as required by the Jackson Law. The Benton County Commission voted to authorize the requested expansion on September 20, 2004 and the City of Camden voted unanimously to authorize the expansion request on October 11, 2004.

In January 2007, CTR submitted the Part I application for the locally approved expansion to the TDSWM. A preliminary Class II industrial permit number (IDL 03-0212) has been assigned to the CTR facility based upon the information provided in the Part I application.

In 2009, CTR sold the landfill to Environmental Waste Solutions, LLC (EWS) at which time the permit was transferred. EWS then submitted a minor modification to the TDSWM to modify the Class II Landfill bottom liner system so the aluminum smelter waste stream could be accepted.

1.2 PURPOSE OF THE OPERATIONS MANUAL

An Operations Manual was originally prepared for the Waste Tire Monofill as required by the Tennessee Division of Solid Waste Management (TDSWM) Rule 1200-1-.04(9)(c). The Operations Manual provided a narrative detailing a method of operation that would provide an efficient operation based upon 1) the projected and current waste disposal volumes and 2) the proposed layout of the landfill footprint.

An Operations Manual was also prepared and submitted to the TDSWM as part of the minor modification submittal in 2003 and again in 2007 to dispose of coal ash. This document replaces all previous Operations Manuals approved for this facility.

This document revises each of the existing Operations Manuals previously prepared for the facility. This modification to the Operations Manual includes information relevant to the proposed expansion which extends the currently permitted footprint approximately 32 acres to the south. It should be noted that this document will serve as the facility Operations Manual as required per the TDSWM Rule 0400-11-01-.04(9)(c).

It shall also be noted that the other associated documents and Permit Drawings have been revised to comply with the last revision to the TDSWM regulations (May 2010). A "phased development plan," (as defined on page 65.002 of the TDSWM regulations) utilizing



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



topographical surveys and projected disposal generation rates has been prepared so as to operate efficiently. An estimate of the landfill footprint required to provide 5 years of disposal capacity will be developed (it should be noted that the limits of the 5 year landfill development will cross phase boundaries) The aerial extent of the landfill footprint at the end of five years will be closed (where applicable) and begin post-closure care as a new five year developmental phase is constructed. This process will continue until the entire permitted area has been closed or until the landfill is no longer needed. This Operations Manual has been written to accommodate the operation, closure and post-closure of the entire landfill footprint.

The following narrative description and Operations Manual, for the Class II Landfill facility located in Camden, Tennessee, is submitted in accordance with the TDSWM, Rule 1200-1-.04-(9)(c). The requirements for developing a narrative description and an operating plan that are major components of the Permit for a landfill are described in this rule. A discussion of the facility operations is included to ensure that the facility continues to operate in a manner that satisfies the current revised TDSWM regulations originally promulgated in July of 1993 by the TDSWM.

Information within the Operations Manual has been correlated to the permit requirements detailed in the TDSWM regulations. Sections within this report are numbered and titled with respect to the regulations to aid in the review process.

The Operations Manual is one of several required landfill permit documents. As previously stated the required permit documents and accompanying Permit Drawings have been upgraded to comply with the TDSWM regulations.

Based upon the TDSWM regulations the permit for the EWS Class II Landfill should include the following documents and Permit Drawings, as follows:

- Document I -Operations Manual
- Document II -Closure/Post-Closure Plan
- Document III -Hydrogeological Investigation Reports
- Document IV Groundwater Monitoring Plan
- Document V Construction Quality Assurance Plan

- Attachment I - Permit Drawings
- Attachment II - Design Calculations
- Attachment III Permit Correspondence



1.3 GENERAL INFORMATION

As previously described the site of the Class II Landfill is located at 200 Omar Circle in Camden, Benton County, Tennessee. The site is currently permitted as a Class II Landfill under IDL 03-0212.

The type wastes to be disposed of in the permitted landfill facility are limited to Class II solid waste materials as defined in Rule 0400-11-01-.01(3).

Topographic maps generated from site surveys and on-site observations indicate that ground surface elevations within the proposed landfill extension, range from a maximum of approximately 469 feet above Mean Sea Level (MSL) in the north central quadrant of the proposed landfill extension area to an elevation approximating 376 feet above MSL at the southeastern tip of the proposed extension.

The Permit Drawings indicate that the landfill is permitted to extend to elevation 568 feet MSL. The 2011 modification to the EWS Class II Landfill was limited to a reconfiguration of the liner/leachate collection system.

The 2012 modification is focused on redefining the waste stream accepted at the EWS Class II Landfill as well as providing proper procedures for management of those wastes.

The 2014 modifications included a redesign of the leachate collection sump in Phase 4 which eliminated a geomembrane liner penetration and incorporated a sidewall riser sump design. The type GCL was also modified in Phase 4 which provided flexibility in using the most appropriate GCL for the wastes types disposed. Finally, an additional alternate daily cover was identified for use within the phases of the landfill dedicated to SAS wastes.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



The following *italicized text* is copied verbatim from the Tennessee Division of Solid Waste Management Rule 0400-11-01-.04(9)(c). For clarity of discussion, each item requested by the State is provided under said heading.

2.0 NARRATIVE DESCRIPTION OF THE FACILITY AND OPERATION

Rule 0400-11-01.04(9)(c)1. *The part II permit application must include, with appropriate references to the engineering plans and hydrogeological report, a narrative clearly identifying the following issues:*

2.1 FACILITY OPERATOR

Rule 0400-11-01.04(9)(c)(1) *Identifies the name of the individual responsible for operation and maintenance of the facility.*

The current individual responsible for operation of the disposal facility is:

*Mr. Chris White
President
Environmental Waste Solutions, LLC
4521 Trousdale Drive,
Nashville, Tennessee 37204*

2.2 LOCATION OF THE FACILITY

Rule 0400-11-01.04(9)(c)2. *Describes the location of the facility using roads and highways.*

The location of the permitted landfill facility has not changed from its present location at 200 Omar Circle in Camden, Tennessee. The limits of the facility have been expanded to extend to the southernmost boundary of the abandoned chert pit. The site can also be located on the Camden, Tennessee USGS quadrangle at north latitude 36° 3' 16" and west longitude 88° 05' 16" at an average elevation of 400 feet above mean sea level datum (MSL). The location of the facility is depicted as Figure 1 in Appendix 1 of this document.

2.3 BUFFER ZONES

Rule 0400-11-01.04(9)(c)3. *Describes the facilities compliance with all applicable buffer zone standards listed in paragraph (3) of this Rule. Each buffer zone standard must be specifically addressed referencing the closest property lines, residences, wells, and bodies of water as appropriate, and maps may be attached for easy descriptions and reference or otherwise demonstrate compliance.*

Rule 0400-11-01-.04(3)(a) *Class I Disposal Facilities must be located, designed, constructed, operated and maintained such that the fill areas are, at a minimum:*

1. *100 feet from all property lines;*

The Permit Drawings illustrate that the landfill is located a minimum of 100 feet from all property lines.

2. *500 feet from all residences, unless the owner of the residential property agrees in writing to a shorter distance;*

Two local property owners have residences within 500 feet of the waste fill. The owners have signed affidavits previously provided during the original landfill permitting process.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



3. *500 feet from all wells determined to be down gradient and used as a source of drinking water by humans or livestock; and*

The closest drinking water well is located approximately 2,500 feet to the north east of the proposed extension. (See Appendix 3 of the Hydrogeologic Investigation Report.)

4. *200 feet from the normal boundaries of springs, streams, lakes, (except that this standard shall not apply to any wet weather conveyance nor to bodies of water constructed and designed to be a part of the facility);*

No bodies of water are within the 200 foot limit. Figure 2 "FEMA Map" illustrates the waste footprint relative to Charlie Creek and Cypress Creek which border the Class II waste footprint to the west and south.

5. *A total site buffer with no constructed appurtenances within 50 feet of the property line.*

The Permit Drawings depict the location of all constructed appurtenances. The drawings demonstrate that there are no constructed appurtenances planned in the landfill expansion within 50 feet of the property line that surrounds the facility.

2.4 FAULT AREAS

Rule 0400-11-01-.04(9)(c)4. *Describes its compliance with applicable siting and requirements for fault areas.*

Rule 0400-11-01-.04(2)(u) *New Class I and II SWLF units and lateral extension shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates in the Narrative Description of the Facility and Operations Manual that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the SWLF unit and will be protective of human health and the environment.*

A review of published geologic information indicates the proposed landfill is not located within 200 feet of a fault that has had displacement in Holocene time.

2.5 SEISMIC IMPACT ZONES

Rule 0400-11-01-.04(9)(c)5. *Describes its compliance with applicable siting and requirements for seismic impact zones.*

Rule 0400-11-01-.04(2)(v) *New Class I and II SWLF units and lateral extension shall not be located in seismic impact zones unless the owner or operator demonstrates that all containment structures including liners, leachate collection systems and surface water control systems are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The owner or operator must place the demonstration in the Narrative Description of the Facility and Operations Manual.*

Originally, the TDSWM required coal ash fill projects to obtain a Class II landfill permit. Based upon this designation all applicants for a Class II landfill permit must prepare a seismic evaluation. A seismic evaluation for this site is provided in Appendix E of the Hydrogeologic Investigation. The evaluation has been performed to conform to the procedures detailed in the TDSWM "Earthquake Evaluation Guidance Document". The results of the evaluation demonstrate that the proposed containment structures for the EWS landfill can resist the projected maximum horizontal acceleration of 0.339 g's.



2.6 UNSTABLE AREAS

Rule 0400-11-01-.04(9)(c)6. *Describes its compliance with applicable siting and requirements for unstable areas.*

Rule 0400-11-01-.04(2)(w) *Owners or operators of new Class I and II SWLF units, existing Class I and lateral expansions located in an unstable area must demonstrate that engineering measures have been incorporated into the SWLF units designed to ensure that the integrity of the structural components of the SWLF unit will not be disrupted. The owner or operator must place the demonstration in the Narrative Description of the Facility and Operations Manual operating record. The owner or operator must consider the following factors, at a minimum, when determining whether an area is unstable:*

1. *On-site or local soil conditions that may result in significant differential settlements;*

The cherty soil materials that extend under the limits of the proposed waste footprint have a low potential for compressibility due to the cemented lenses of chert and strength properties of the cherty soil materials. In addition, the projected rate of loading will further minimize the potential for differential settlement.

2. *On-site or local geologic or geomorphologic features; and*

There are no on-site or local geologic or geomorphological features such as sinkholes and voids within the overburden materials that could create unstable conditions.

3. *On-site or local human-made features or events (both surface and subsurface).*

The mining of the chert materials have not created any unstable conditions at the site.

2.7 ACCESS CONTROL

Rule 0400-11-01.04(9)(c)7. *Describes the barriers, signs, procedures, and other measures to be used to control access to and use of the facility.*

Rule 0400-11-01.04(2)(b) Control of Access and Use.

1. *The Facility must have an artificial or natural barrier which completely surrounds the active portion of the facility and must have a means to control entry, at all times, through the gate or other entrances to the active portion of the facility.*

A wire security fence will be constructed around the perimeter of the site to control entry to the site. The location of the fence is depicted on the Permit Drawings, which accompany this document. The existing gates, terrain, and vegetation will be utilized to further restrict unauthorized access to the disposal area. Access to the facility is available from Omar Circle and Hildon King Road which serves the Camden Wastewater Treatment Plant. Hildon King Road has a gate that is locked by the Camden Wastewater Department at the end of each day.

2. *If open to the public, the facility must have clearly visible and legible signs at the points of public access which indicate the hours of operation, the types of materials that will or will not be accepted, emergency telephone numbers, schedule of charges, and any other necessary information.*

A sign has been posted at the landfill entrance that details the hours of operation and emergency contact information. Speed limits for vehicles are posted on signage along the on-site access road leading to the waste footprint. Presently, the EWS facility



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



accepts waste materials from secondary aluminum smelters as well as TDSWM approved industrial type wastes as are defined in *Rule 0400-11-01-.01(2). of the TDSWM Rules and Regulations Governing Solid Waste Disposal..* Future waste disposal plans could include coal ash generated at the TVA Power Plant at New Johnsonville, Tennessee or other industrial wastes.

3. *If the facility is open to the public, or if it is otherwise necessary for proper operation, roads within the facility, easements, and parking areas shall be designed, constructed, and maintained so as to be accessible in all weather conditions. Traffic control signs shall be provided as necessary to promote an orderly traffic pattern to and from the solid waste discharge area to maintain efficient operating conditions.*

The entire length of road to the limits of the landfill footprint has an asphalt surface course to provide all weather access. In addition, the materials within the waste footprint are used as sub-base material to provide support for roadways.

Periodic maintenance of the roads includes re-grading the surface to restore the crown, adding gravel as needed and cleaning roadside ditches to ensure drainage. Ramps are constructed along the completed fill areas to provide temporary access to the working face. Temporary turnaround areas are constructed at the working face of the landfill to provide for proper unloading of the delivery trucks. The design and proposed location of the roads are shown on the Permit Drawings provided in Attachment I of this permit application.

4. *The facility must have trained personnel present and on duty at all times it is in operation to assure compliance with operational requirements and to prevent entry of unauthorized wastes.*

Landfill personnel have been trained to properly operate the facility and manage the type wastes approved for disposal at the facility.

5. *Class I landfill facilities shall have a certified operator or attendant on site during the hours of operation who is trained and certified as provided at Rule 0400-11-01-.12.*

A sufficient number of TDSWM certified operators will be on staff to ensure that there is always at least one certified operator on site at all times.

6. *There must be no scavenging at the facility. Any salvaging or recycling operations must be conducted at safe, designated areas (not working face) and times, and in a sanitary manner.*

Scavenging is not permitted at the facility. Only drivers may exit their vehicles, and then only to un-tarp, unlatch, etc. Spotters and operators at the working face along with site management work together to guarantee these policies are upheld. Scavenging is not anticipated since the facility will not be open to the general public.



2.8 METHODS AND SEQUENCE OF OPERATION

Rule 0400-11-01.04(9)(c)(8) *Describes the method and sequence of operations at the disposal facility.*

1. Preparation of Landfill Base

The disposal facility has been designed as a phased cell type development. Preparation of the site for the construction of each phase will require excavation of variable quantities of soil materials to attain the permitted base grades. However, the site will be developed in four discrete phases to optimize leachate collection and allow for maximum compaction of the wastes. (See Permit Drawings in Attachment I)

Landfill Base Preparations for Cells 2, 3, and 4

The typical landfill barrier system for the landfill will consist of a combination of different materials which include at a minimum:

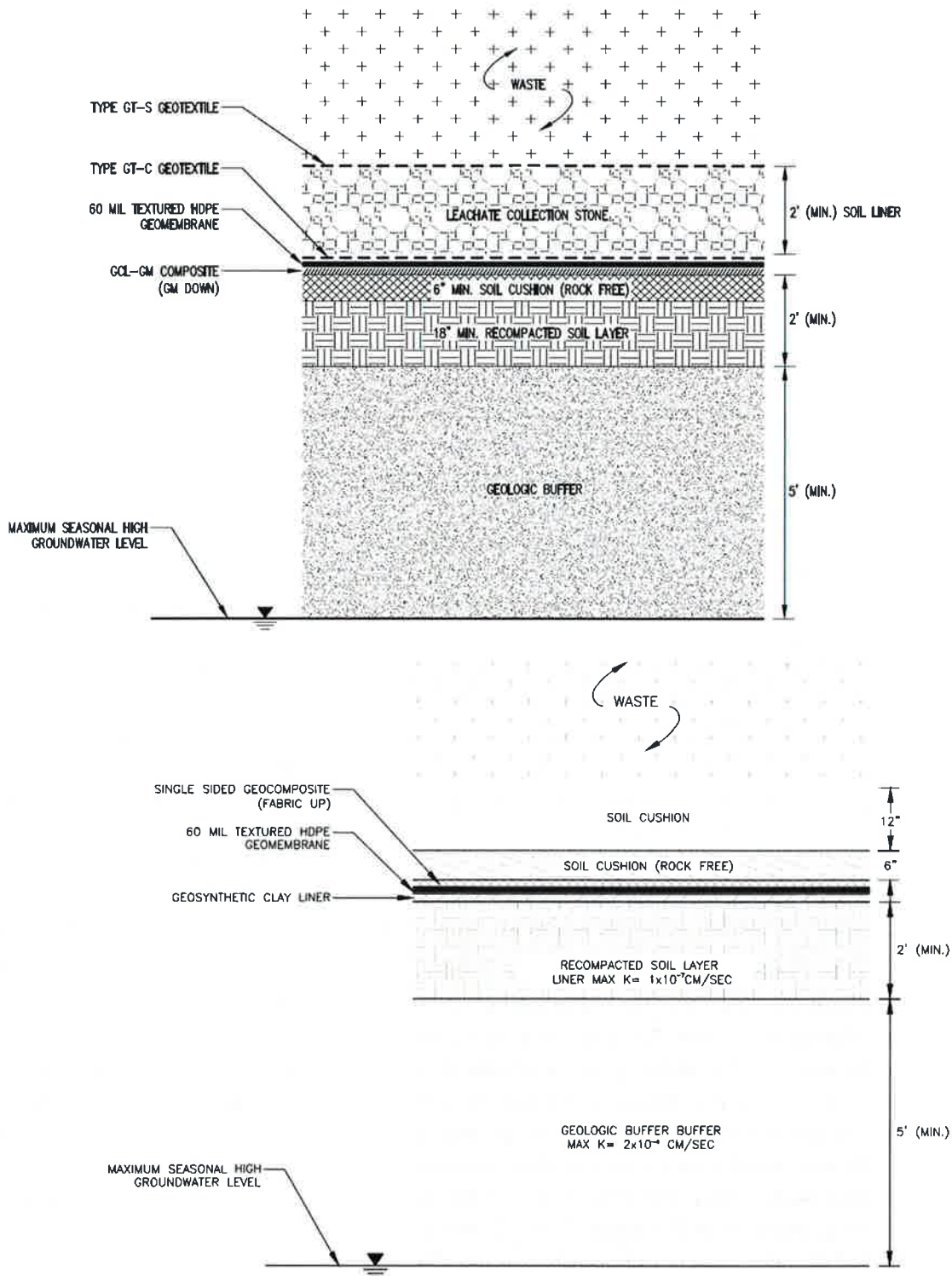
- 5 feet geologic buffer with a maximum permeability of 2.24×10^{-5} cm/sec of in-situ material separated from the uppermost groundwater table;
- two feet of re-compacted clayey soil material with the top six inches rock free;
- a Geocomposite Clay Liner (GCL),
- a 60 mil textured HDPE geomembrane;
- a leachate collection layer consisting of either a non-woven cushion geotextile, a layer of washed river gravel or a geocomposite drainage layer with a protective cover layer.

The procedures and specifications for proper placement of the liner system are provided in the Construction Quality Assurance Plan (Document V of this permit application). A review of the soil hydraulic conductivity testing (ASTM D5084) performed on remolded soil samples taken from within the vertical and horizontal limits of the proposed waste footprint revealed hydraulic conductivity (K) test results that ranged from 8.6×10^{-8} cm/sec at boring B-5 to 2.5×10^{-7} cm/sec. More detailed information regarding the physical properties of the soil and rock materials at the site are provided in Document III (Hydrogeologic Investigation Reports). Drawing 1 and Drawing 2 provided in this document illustrate the typical bottom liner configuration for the EWS Class II Landfill.

As previously stated this disposal facility has been designed as a phased type development. At this site, waste will be deposited within four distinct phases. Each of the phases have been designed and contoured so that the boundaries of each phase are topographic highs which direct leachate to a dedicated sump at the lowest elevation of each phase. Waste filling will begin at the sump in each phase and continue north. Two waste working faces will be employed due to the required segregation of secondary aluminum smelter waste from industrial wastes that may be incompatible to co-mingle. As previously stated the area of the landfill projected to provide the first five (5) years of disposal capacity will include Phase 2 and a portion of Phase 3. Please refer to Section 2.10 of this document and Sheet 10 of the Permit Drawings.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Drawing 1 – Typical Liner/Leachate Collection System Configurations
(See Table 7 for more detailed explanation of alternate liner system components)



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Excavation and construction will proceed to the grades and elevations indicated by the base contours depicted on the Permit Drawings. The progression of the development of the four phases is depicted on Drawing 10 of the Permit Drawings. The base grades of the landfill have been designed with slopes to provide a minimum post-settlement slope of two percent to the leachate collection header pipes. These slopes are expected to be maintained under the anticipated loading of the landfill. Excessive differential settlement of the soils beneath the site is not anticipated to be of a critical concern due to the relatively slow rate of filling and to the fact that the majority of the base soils have been pre-consolidated.

The design grades have been prepared to ensure proper drainage and maximize the capacity of the facility while maintaining the stability of the slopes. The cell construction shall be performed in a timely manner so that the landfilling operations are not interrupted, while minimizing the amount of exposed earth and the length of time such earth is exposed.

Approved wastes delivered to the facility will be loaded into trucks equipped with a tarp and a sealed tailgate. A temporary turnaround area shall be constructed at the working face of the landfill to provide for proper unloading of the delivery trucks.

Excavation and construction will proceed to the grades and elevations indicated by the base contours depicted on the Permit Drawings. The progression of the development of the landfill is depicted on Sheet 10 of the Permit Drawings. The base grades of the landfill have been designed with slopes to the sumps areas of no less than 2%. These slopes are expected to be maintained under the anticipated loading of the landfill. Excessive differential settlement of the soils beneath the site is not anticipated to be of a critical concern due to the relatively slow rate of filling and to the fact that the base soils have been pre-consolidated.

The design grades have been prepared to ensure proper drainage and maximize the capacity of the facility while maintaining the stability of the slopes. The cell construction shall be performed in a timely manner so that the landfilling operations are not interrupted, while minimizing the amount of exposed earth and the length of time such earth is exposed.

Secondary Aluminum Smelter Waste and any other approved wastes delivered to the facility will be loaded into trucks equipped with a tarp and a sealed tailgate. Coal ash will be transported to the EWS Class II landfill and unloaded within the footprint of the permitted fill. A temporary turnaround area shall be constructed at the working face of the landfill to provide for proper unloading of the delivery trucks.

2.9 TYPES AND ANTICIPATED VOLUMES OF SOLID WASTES

Rule 0400-11-01.04(9)(c)(9) *Describes the types and anticipated volumes of solid wastes to be disposed of and the sources which generate the waste, and for special wastes, the physical and chemical characteristics of the wastes and any special handling procedures to be utilized.*

Types and Volumes of Wastes -

The types of wastes permitted for the disposal at the Class II Landfill are stated verbatim from the Tennessee Department of Environment and Conservation definition of a Class II Landfill as follows:



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Class II Disposal Facility: A landfill that receives waste generated by one or more industrial or manufacturing plants and that is used or is to be used for the disposal of solid waste generated by such plants, which may include industrial wastes, commercial wastes, institutional wastes, farming wastes, bulky wastes, landscaping and land clearing wastes, construction/demolition wastes, discarded automotive tires, and dead animals as defined in Rule 0400-11-01-.01(2). of the TDSWM Rules and Regulations Governing Solid Waste Disposal.

EWS will accept industrial and special wastes in the section of the landfill designated as Phase 4 only after an evaluation of the physical and chemical properties of the waste stream has been performed by EWS and submitted to the TDSWM for approval. A procedure has been developed by EWS and is provided in Appendix 5 of this document that details the steps necessary to evaluate the potential waste stream relative to compatibility with other industrial and specials wastes disposed at the Class II Landfill. The focus of the procedure is to minimize the potential for a reaction between different waste types and to provide the most effective method to manage disposal of the waste in the landfill. Wastes determined by EWS to be incompatible with in-place waste materials will be disposed of in separate cells with appropriate separation measures such as soil berms or geosynthetic barriers. EWS will maintain a record as to the location incompatible wastes are disposed in the Class II Landfill on a map kept at the landfill office.

As the landfill progresses EWS will maintain this procedure for all special wastes targeted for disposal in the Class II Landfill.

Table 1: Waste Volume Estimates

Landfill Demographic	Unit	Number of Units
Gate Unit Weight of Waste Materials (Smelter Waste)	Lbs./Yd ³	2,000
In-Place Unit Weight of Waste Material (Smelter Waste)	Lbs./Yd ³	2,000
Smelter Waste Disposal Rate	Tons/day	250
In-place Volume of Smelter Waste Consumed	Yd ³ / day	250
Average Gate Unit Weight of Industrial Wastes	Lbs./Yd ³	450
Average In-Place Unit Weight of Industrial Wastes	Lbs./Yd ³	1,200
Industrial Waste Disposal Rate	Tons/day	150
In-Place Volume of Industrial Waste consumed	Yd ³ / day	250
Total In-Place Volume of Waste Consumed	Yd ³ / day	500
In-Place Volume Consumed	Yd ³ / Year	130,000
Net Disposal Volume	Yd ³	5,231,890
Number of Working Days	Days/Year	260
Life of Facility	Years	40



Waste Restrictions

Rule 0400-11-01-.04(2)(k)1. *A facility may receive for disposal only those solid wastes it is allowed to manage under the terms of its permit.*

EWS will limit the types of waste received at the Class II Landfill to the wastes listed in the narrative definition of Class II Landfills which includes "solid waste generated by such plants, which may include industrial wastes, commercial wastes, institutional wastes, farming wastes, bulky wastes, landscaping and land clearing wastes, construction/demolition wastes, discarded automotive tires, and dead animals".

It should be noted that EWS modified the liner/leachate collection system for the entire Class II Landfill to comply with the Class I Subtitle D Landfill prescriptive standards in 2011.

The existing landfill facility has previously been granted permission by the TDSWM to dispose of waste tires, coal ash from the TVA steam plant at New Johnsonville, Tennessee, and construction/demolition wastes.

The secondary smelter waste stream was added to the approved wastes list for the EWS Class II Landfill as a result of the 2009 minor modification. Secondary aluminum smelter waste was then approved for disposal in Phase 2 of Cell 1 in 2010 and Cell 1 of Phase 3 in 2011. EWS must submit a request and receive approval from the TDSWM if any industrial or special wastes other than secondary aluminum smelter wastes are targeted for disposal in the landfill. The procedure for securing approval from the TDSWM along with the forms to be used in the approval process is provided in Appendix 5 Waste Approval Procedure and Forms of this document.

2.10 NUMBER OF ACRES TO BE FILLED AND PHASE DEVELOPMENT PLANS

Rule 0400-11-01.04(9)(c)(10) *Identifies the number of acres to be filled and the total number of acres to be permitted, including buffer zone acreage (Note: If the site is to be developed in accordance with a phased development plan, each parcel must be separately addressed. If minimum closure areas are to be utilized such proposal must be described here and delineated in the closure plans):*

Table 2 - Order of Landfill Development

PHASE	CELL	AREA (acres)
1	1	3.5
	2	4.3
	3	2.7
Phase 1 Subtotal		10.5
2	1	4.9
Phase 2 Subtotal		4.9
3	1	3.5
	2	3.4
	3	3.6
	4	3.5
Phase 3 Subtotal		14.0
4	1	4.6
	2	4.4
	3	4.0
Phase 4 Subtotal		13.0
Total Landfill Area		42.4

Originally, the permitted footprint of the EWS Landfill approximated 10 acres. The 2007 landfill extension increased the waste footprint to approximately 42.4 acres. The total acreage owned by EWS at this site approximates 128 acres.

The landfill has been designed with four phases based upon management of leachate as well as waste types. Each phase is divided into cells and the order of development of the phases and cells is depicted on the engineering plans. The approximate area of each phase and cell is presented in Table 2. However, the development of the landfill will not mimic the phases since the design of the phases was based entirely on leachate management. The order of phase/cell development is presented in Table 3.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Table 3 - Landfill Developmental Sequence

Secondary aluminum smelter (SAS) waste will be confined to Phases 1, 2, and 3. Most all other industrial wastes will be confined to Phase 4 of the EWS Class II Landfill. However, some inert waste determined to be compatible or have a stabilizing effect on secondary aluminum smelter waste may be placed in the phases designated for SAS waste if approved in writing by the TDSWM. More specifically, gypsum waste types have been reported by the EPA as providing a potential for stabilization of SAS waste materials.

Industrial Waste Section Developmental Sequence	Secondary Aluminum Smelter Waste Section Developmental Sequence
	Phase 2 - Cell 1
	Phase 3 - Cell 1
Phase 4-Cell 1	Phase 3 - Cell 2
	Phase 1 - Cell 1
Phase 4-Cell 2	Phase 3 - Cell 3
	Phase 3 - Cell 4
Phase 4-Cell 3	Phase 1 - Cell 3

2.11 WASTE HANDLING AND COVERING PROGRAM

Rule 0400-11-01.04(9)(c)(11) *Describes the waste handling and covering program to include but not necessarily be limited to, descriptions of:*

- (i) *Unloading, spreading, and compacting operations;*
- (ii) *The frequencies and depths of initial, intermediate, and final cover;*
- (iii) *And, the cover material(s) to be utilized, including the estimated volumes to be needed (show initial, intermediate, and final earthwork calculations) and their sources and availability (See also Rule 0400-11-01-.04(2)(h)).*

(i.) *Unloading, Spreading and Compaction Operations*

Access

Traffic will be clearly directed to the appropriate active access road. For the active lined landfill, all vehicles entering the unit will use the active ramp to avoid damaging the liner system. Traffic speed on the ramp should be less than 10 MPH.

The location of access roads during waste placement will be determined by operations personnel in order to reflect waste placement strategy. Additionally, access will be maintained for site monitoring locations.

First Lift of Waste Placement Procedures

Special precautions must be taken during placement of the first lift of waste above the liner and leachate collection system on the cell floor and also along the interior side slopes. The thickness of the leachate collection layer has been increased to two feet to further protect the geosynthetic liner materials. The initial loads of waste are placed in the cell by trucks backing to the edge of the cell berm and unloading waste inside the cell. The location of the initial access way into the cell will depend in part on fill progression in adjacent cells. For example, if an adjacent cell is sufficiently filled so that access is obtainable from the adjacent cell then waste trucks may enter the new cell from this location. A low ground pressure bulldozer or equivalent earth moving vehicle will then push the waste over the primary leachate collection layer. This process will



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



continue until a minimum 5-foot thickness of refuse has been placed on the primary leachate collection layer. Next, cover material will be placed and compacted on the refuse layer to allow waste vehicles to enter into the cell on top of the waste and to turn around before leaving the cell. During placement of the initial refuse layer, a laborer will be stationed at the bottom of the lift to observe the placement of this waste. If objects are spotted that could possibly damage the liner system, they will be removed and disposed of in a manner that will not jeopardize the liner system. Large objects (i.e., heavy metal items, etc.) will be sorted out and recycled.

General Unloading Procedures

Waste transportation vehicles will arrive at the working face at random intervals. There may be a number of vehicles unloading waste at the same time, while other vehicles are waiting. To maintain control over the unloading of waste, a limited number of vehicles will be allowed on the working face at a time. The actual number will be determined by the truck spotter. This procedure will be used to minimize the potential for unloading un-acceptable waste and to control disposal activity. Operations at the working face will be conducted in a manner which will encourage the efficient movement of transportation vehicles to and from the working face, and to expedite the unloading of waste.

The approach to the working face will be maintained such that two or more vehicles may safely unload side by side. A vehicle turn-around area large enough to enable vehicles to arrive and turn around safely with reasonable speed will be provided adjacent to the unloading area. The vehicles will back to a vacant area near the working face to unload. Upon completion of the unloading operation, the transportation vehicles will immediately leave the working face area. Personnel will direct traffic necessary to expedite safe movement of vehicles.

Waste unloading at the landfill will be controlled to prevent disposal in locations other than those specified by site management. Such control will also be used to confine the working face to a minimum width, yet allow safe and efficient operations. The width and length of the working face will be maintained as small as practical in order to maintain the appearance of the site, control windblown waste, and minimize the amount of cover required each day. With the exception of new phase transitions, only one working face will be active on any given day, with all deposited waste in other areas covered by either daily (or approved alternatives), intermediate, or final cover, as appropriate.

Number of Working Face(s)

The variability of the industrial waste types permitted for the EWS Class II Landfill requires the use of more than one working face to ensure that there will be no adverse synergistic effects created from mixing waste streams. Specifically, the secondary aluminum smelter waste will continue to be monofilled and separated from other types of wastes which may create an



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



undesirable effect. Only, inert wastes which would provide a stabilizing effect as determined from the waste approval procedure detailed in Appendix 5 of this document will be considered in the sections of the landfill designated for secondary smelter waste.

Spreading and Compaction Procedures

The procedures for placement and compaction of solid waste include: unloading of vehicles, spreading of waste into 3 foot lifts, and compaction on relatively flat slopes using a landfill compactor and a minimum number of three full passes.

The use of portable signs with directional arrows and portable traffic barricades will facilitate the unloading of wastes to the designated disposal locations. These signs and barricades will be placed along the access route to the working face of the landfill or other designated areas which may be established.

Procedures for Secondary Aluminum Smelter Waste Disposal

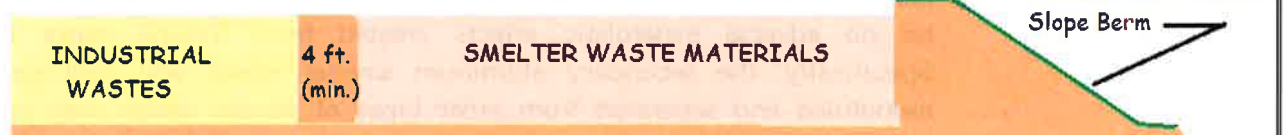
The wastes from secondary aluminum smelters (SAS) will be managed as per the following criteria;

1. The waste cannot be disposed during periods of rainfall.
2. The waste must be covered in a timely manner to minimize infiltration (tarps or compacted clay soil). This would be immediately under most conditions.
3. The waste must be immediately covered in the event of rainfall.
4. Intermediate cover for this waste shall consist of either one foot of clay soil, soil treated with zeolites or one foot of soil overlain by a GRC — geosynthetic rain cover
5. The HDPE liner must have a two foot buffer layer above it to prevent potential damage due to the heat generation potential of SAS waste.
6. SAS waste must be segregated from other waste(s) that are not compatible due to the potential for adverse reactions such as the release of ammonia and exothermic reactions. Therefore, the SAS will be adequately separated to prevent contact with the other wastes where the industrial wastes adjoin SAS waste phases. Soil berms approximating four feet in thickness will be constructed between the industrial wastes placed in Phase 4 to provide a lateral barrier to separate the SAS waste materials. The interior slopes of the soil berms will be cut vertically prior to waste placement. Exterior slopes will also be constructed as depicted in Drawing 2 to further encapsulate the SAS waste. The final lateral thickness of the soil berm will provide a minimum of three feet between the SAS waste materials and industrial waste materials in Phase 4.

Drawing 2 - Waste Separation Between Landfill Phases

Industrial Waste - Phase 4

SAS Waste Phases - 1, 2, and 3





ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Procedures for Coal Combustion Wastes / Approved TDSWM Industrial Wastes
Coal ash or other TDSWM approved waste materials will be transported to the landfill in trucks and will be deposited at the base of the working face. Unloading of all vehicles will be observed by facility personnel to ensure compliance with waste restriction requirements. In addition, unloading of coal ash will be confined to as small a working area as possible. From there the waste will be spread in shallow (less than three foot) layers using typical tracked earth moving equipment. The earthmoving equipment will repeatedly pass over the deposited material to achieve maximum compaction. Typical fill progression is represented in the engineering plans and in .

Alternate methods of unloading, spreading and compaction will be implemented for approved industrial wastes on a case by case basis.

(ii) *The frequencies and depths of initial, intermediate, and final cover;*

Initial/Daily Cover

The compacted solid waste will be covered at the end of the day with six inches of soil or with an alternate daily cover as permitted by the TDSWM. Daily cover will be stripped prior to the commencement of following days' waste disposal operations to provide a pathway for leachate to migrate to the leachate collection system and to help minimize leachate outbreaks on the exterior side slopes.

Environmental Waste Solutions (EWS) has requested in 2014 to implement the use of an alternate daily cover system for the fill areas designated for disposal of secondary aluminum smelter waste (SAS). EWS is of the opinion that the use of foundry sand incorporated with the 12 mil DuraSkrum geosynthetic will provide a more protective system to enhance the minimization of infiltration, the generation of odors, and the minimization of emissions from the smelter waste fill. An explanation of the basis for this opinion is provided in the following paragraphs.

! Basis for the Use of Foundry Sand as a Protective Base for Placement of the DuraSkrum Daily Cover

The physical nature of the SAS is often somewhat bulky as is crushed concrete with edges which could compromise the integrity of the 12 mil reinforced DuraSkrum geosynthetic which is incorporated in the daily cover of the ASW. The use of a bulldozer to perform some grading and leveling still leaves some uneven edges and crevices within the SAS which could compromise the DuraSkrum integrity. However, a layer of foundry sand could be placed over the top surface of the SAS to fill crevices and actually form a much more level base for placement of the DuraSkrum. The DuraSkrum would also have more intimate contact with the foundry sand base which would also help to preserve its integrity with future placement of SAS. Another benefit in using the foundry sand as a base layer would be in extending the service life of the heavy equipment used for grading of the SAS since the sand would most likely reduce the amount of time the heavy equipment is in direct contact with the SAS.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL

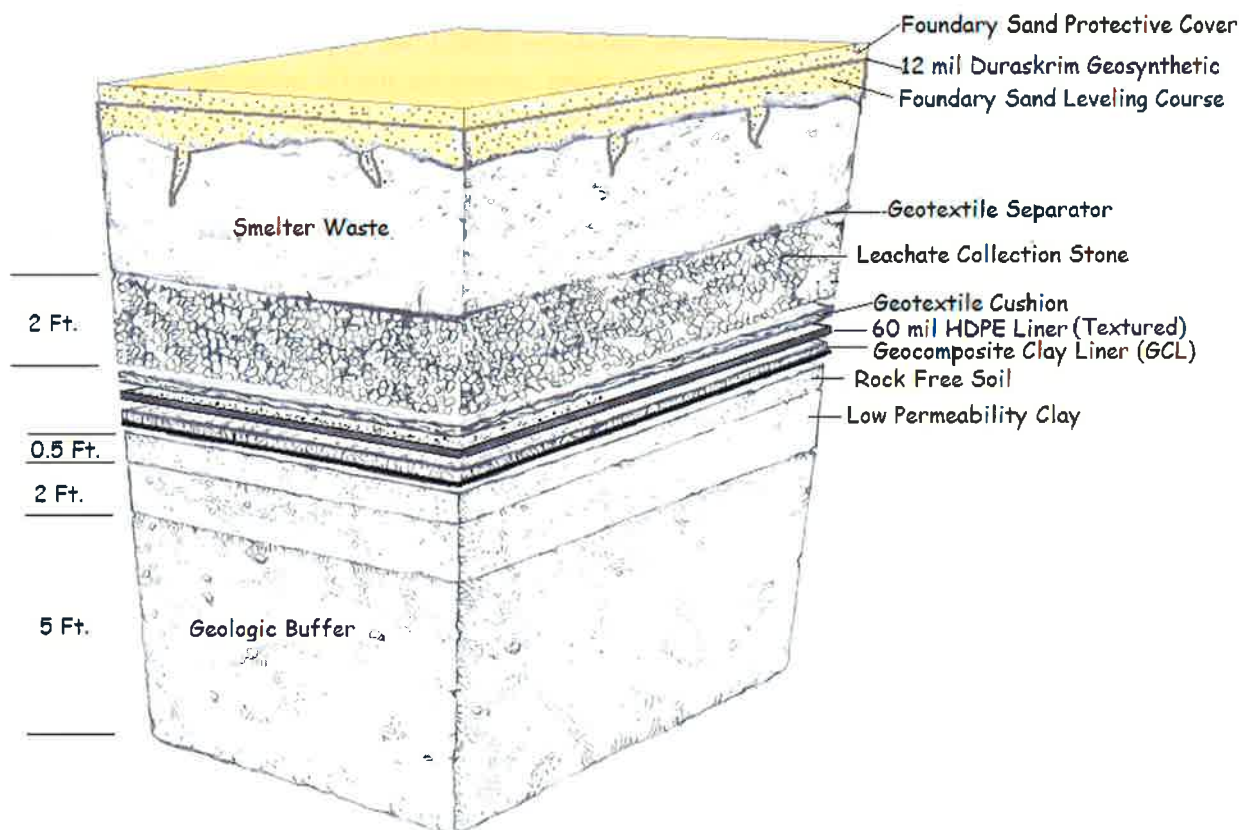


! Basis for the Use of Foundry Sand as a Protective Base for Placement of the DuraSkrum Daily Cover

Placement of the foundry sand above the DuraSkrum daily cover will provide for a protective cover or cushion layer to help to minimize potential damaging impacts from dumping of the SAS above the DuraSkrum. Based upon the unloading conditions at the working face EWS estimates that as much as 12 inches of foundry sand could also be spread above the DuraSkrum as an additional protective cover.

In summary, the preservation of the integrity of the DuraSkrum will minimize infiltration of moisture and the generation of gas. It is also believed by House Engineering (HE) that moist clay soil placed above SAS materials prolongs the period it takes to stabilize the SAS. The use of sand which is not as moist and has no hygroscopic moisture in combination with the DuraSkrum should provide a better cover section with respect to minimizing the sustained reaction period of SAS. An isometric section of the proposed use of foundry sand is provided as Drawing 3 of this document which serves as a detailed rendering of the incorporation of foundry sand in the daily cover section.

Drawing 3 – Foundry Sand / DuraSkrum Daily Cover Typical Section





ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



In conclusion, HE has established criteria that the foundry sand must satisfy prior to its use as previously described as follows:

- Lab analytical testing of foundry sand as per the TDSWM Policy Notebook to determine the chemical composition of the foundry sand must be performed to ensure that there is no potential for reaction with the SAS wastes.
- The lab analysis must be completed every two years or whenever process changes occur which may affect composition of the sand whichever is more frequent as per TDSWM policy pn091 and:
- Determine the gradation of the foundry sand as well as hydraulic conductivity of the sand.

It should be noted that studies in Wisconsin (TRC Environmental Corp., 2012) have determined that a lot of foundry sand contains approximately 15% sodium bentonite content which has resulted in hydraulic conductivities which average 6.8×10^{-8} cm/sec.

It should also be noted that research performed by Abichou, Benson, and Edil, (Journal of Geotechnical and Geoenvironmental Engineering, December, 2000) determined that the hydraulic conductivity of foundry sands appeared unaffected by permeants such as salt solution and MSW leachate in short (75 days) and long term (433 days or approximately 5 pore volumes) tests they performed. The study also revealed that for five out of six sands the hydraulic conductivity was unaffected by frost and desiccation.

Therefore, the use of foundry sand has been demonstrated that it can be used as a hydraulic barrier comparable to clay soil in landfill applications.

Intermediate Cover

Rule 0400-11-01-.04(6)(a)4. of the TDSWM Solid Waste Regulations states the following:

Except for those completed portions to be finally closed (e.g., the final lift), all surfaces which will be left exposed for a period of over thirty days (e.g., initial and intermediate lifts) must be covered by an intermediate cover consisting of at least a one-foot layer of compacted soil or other material approved by the Commissioner.

The EWS Class II Landfill will apply an intermediate cover of 1 foot of soil (or an alternate approved material) for any surface which will be left exposed for a period longer than 30 days.

Final Cover

As waste disposal operations extend to the permitted final grades of the landfill, the intermediate cover and final cover shall be placed according to Document II "Closure/Post-Closure Plan" (C/PC Plan) of this Class II Landfill Permit Package.

The TDSWM regulations require a 3 foot minimum thickness of soil within the final cover system. Twelve inches of the soil cover is for the support of vegetation. In addition, a minimum of 24 inches of soil will be placed in the final cover as a low permeability "infiltration layer" consisting of fine-grained,



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



low permeability soils. The design of the final cover system is described further in the C/PC Plan. Final grades are also illustrated in the Permit Drawings. The final cover system will be placed within 90 days after the final lift is completed. The following table provides a summary of the alternate final cover configurations for the EWS Class II Landfill.

Table 4 - Alternate Final Cover Configurations

Final Cover Components	Proposed TDSWM Regulatory Compliant Alternate Final Cover Sections			
	Phase Designation Specific to Alternate Final Cover Section			
	Industrial Waste Phase 4 (Alternate 1)	Industrial Waste Phase 4 (Alternate 2)	Secondary Smelter Waste Phases 1,2,3 (Alternate 1)	Secondary Smelter Waste Phases 1,2,3 (Alternate 2)
Vegetative Support Layer	1.0 Ft. Vegetative Support	Closure Turf	1.0 Ft. Vegetative Support	Closure Turf
Low Permeability Soil Layer	2.0 Ft. Soil Infiltration Layer (6" Rock Free Soil Above Geosynthetics)		1.0 Ft. Soil Infiltration Layer (6" Rock Free Soil Above Geosynthetics)	
Geocomposite Drainage Net	Double Sided Geocomposite	NA	Double Sided Geocomposite	NA
Flexible Membrane Liner	40 mil LLDPE textured	50 mil Super Grip Net	40 mil LLDPE textured	50 mil Super Grip Net
Base Layer for Geosynthetics	1 Ft. Intermediate Cover (6" Rock Free Soil at Geosynthetic Interface)	1 Ft. Intermediate Cover (6" Rock Free Soil at Geosynthetic Interface)	1 Ft. Intermediate Cover (6" Rock Free Soil at Geosynthetic Interface)	1 Ft. Intermediate Cover (6" Rock Free Soil at Geosynthetic Interface)

It should be noted that the east and south slopes of Phase 2, Cell 1 have been closed using Closure Turf™.

Other alternate final cover systems may be used upon demonstration to the satisfaction of the Commissioner that the alternate final cover system provides equivalent or superior performance to the minimum performance standard presented in Rule 0400-11-01-.04(8)(c)3.(iii).

- (iii) *And, the cover material(s) to be utilized, including the estimated volumes to be needed (show initial, intermediate, and final earthwork calculations) and their sources and availability and as per Rule 0400-11-01-.04(2)(h) - Availability of Cover Material - Cover material sufficient to meet the initial and intermediate cover requirements of this rule must be available at the facility. If such material must be hauled in from off-site, at least a 30-day supply shall be maintained on-site at all times.*

The site will maintain a 30 day supply of cover material. The type of cover material will include on-site soils and imported clay materials. The physical characteristics of the on-site soil borrow materials that will be used for cover at the site have been defined during the permit process. The minimum requirements for the soil and geosynthetic components of the final cover can be seen in Attachment III, "CQA Plan" of the permit application. The tests listed in



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



the following paragraphs have been performed on the site soils to be used for cover material as per the referenced ASTM standard:

1. Standard Proctor (ASTM D698);
2. Atterberg Limits (ASTM D4318);
3. Grain Size Analysis (ASTM D422, D1140);
4. Hydraulic Conductivity (ASTM D5084);
5. Classification (ASTM D2487);

Table 5: Soil Requirements

DESCRIPTION	UNITS	QUANTITY
Soil required for Vegetative Support layer (12") of Final Cover	CU.YD.	64,520
Soil Required Low Permeability (24") layer of Final Cover	CU.YD.	129,040
Daily/Intermediate Cover Required	CU.YD.	509,671
TOTAL SOIL REQUIRED	CU.YD.	703,231
Soil Available from Excavation within Landfill Footprint	CU.YD.	871,727
Soil Available within On-Site Borrow Pit	CU.YD.	160,000
TOTAL SOIL AVAILABLE	CU.YD.	1,031,727
NET SOIL AVAILABLE (SURPLUS)	CU.YD.	328,496

2.12 LANDFILL OPERATING EQUIPMENT

Rule 0400-11-01.04(9)(c)(12) Describes the operation equipment to be utilized (including back-up equipment) and their source and availability.

Rule 0400-11-01.04(2)(g) Operating Equipment – At Class disposal facilities, and at Class II, Class III and Class IV disposal facilities unless the Commissioner deems some other arrangement as adequate for proper facility operation, there must be maintained on-site operating equipment capable of spreading and properly compacting the volume of solid wastes received, and capable of handling the earthwork required. Back-up equipment must be available within 24 hours of primary equipment breakdown.

There is and will be adequate on-site equipment capable of spreading and proper compaction of the volume of waste materials, and capable of handling the earthwork required to operate the proposed disposal facility. The following is a representative list of the major equipment to be used during operation of the disposal facility:

- 1 Bull Dozer
- 1 Dump Truck
- 1 Track Mounted Backhoe
- 1 Water Truck

The equipment list may be modified as necessary to satisfy regulatory requirements. Additional equipment is available locally if the need arises.

The site is also equipped with support equipment such as pressure washers, pick-up trucks, and pumps. Other small tools and supplies necessary for the proper operation and maintenance of the equipment is available on-site. Maintenance on the vehicles shall be provided by in-house personnel or at one of the commercial locations in the area. Repairs that cannot be made by in-house personnel will be contracted out. In the event both front line and back up equipment become inoperable, EWS maintains the ability to have a replacement piece available within twenty-four (24) hours, provided by local heavy equipment dealerships.



2.13 LITTER CONTROL

Rule 0400-11-01.04(9)(c)(13) *Describes the structures and procedures to be used in controlling and collecting litter.*

Rule 0400-11-01.04(2)(d) – *A facility must be operated and maintained in a manner to minimize litter. Fencing, diking and/or other practices shall be provided as necessary to confine solid wastes subject to dispersal. All litter must be collected for disposal in a timely manner.*

Aluminum smelter waste, coal combustion wastes, and waste tires do not produce litter. Construction/demolition wastes produce limited amounts of litter. However, litter controls will be installed in the event wastes are accepted which could generate litter at the facility.

2.14 RUN-ON, RUN-OFF, AND EROSION CONTROL

Rule 0400-11-01.04(9)(c)(14) *Describes how run-on and run-off collection and holding and erosion control facilities will be managed, including the disposition of collected waters and residues and a comparison of before and after flows in the drainage ways leaving the site.*

Rule 0400-11-01-.04(2)(i) *Run-on, Run-off, and Erosion Control*

1. *The operator must design, construct, operate, and maintain a run-on control system capable of preventing flow onto the active portion of the facility for all flow up to and including peak discharge from a 24-hour, 25- year storm.*

The plan for storm water run-on control is designed to minimize erosion of the on-site areas. Diversion berms will be constructed as necessary to prevent run-on storm water from entering the active portion of the landfill. A perimeter channel has been designed around the entire footprint to convey surface water from the landfill. Should storm water become impounded near the active portion of the landfill as a result of diverting it, this storm water will be pumped into the perimeter channel in which it will be allowed to flow to the respective sedimentation basin. See Attachment II "Design Calculations" for storm water control structure design calculations.

2. *The operator must design, construct, operate, and maintain a run-off management system to collect and control at least the peak flow resulting from a 24-hour, 25 year storm.*

The run-off management system for the site includes storm water drainage control structures which have been designed to minimize erosion of off-site areas, minimize conveyance of sediment laden storm water off site as well as to minimize water pollution. Tack-on benches have been designed for placement every 90 feet of slope length and will be constructed as the fill progresses such that no more than 90 feet of slope length is ever exposed before vegetation is established. In this way, the slope is effectively terraced to reduce the time of concentration thereby reducing the peak flow and the potential for rill development. A network of conveyance channels and culverts has been designed around the disposal facility to carry storm water run-off to one of the two sediment ponds. Rows of silt fencing, enhanced silt fencing, straw wattles or straw bales will be placed as needed at the base of the fill areas to control sediment. These structures will reduce the accumulation of sediment in the sediment basin and will also prevent excessive amounts of sediment from being transported to off-site areas. The tentative locations of these erosion control structures are depicted on the erosion detail sheet of the Permit Drawings.



Two sediment ponds have been designed for the expansion. The drainage area for Pond 1 approximates 25 acres, resulting in a required needed volume of approximately 5.35 acre-feet to accommodate the 24 hour/25 year storm event. The drainage area for Pond 2 approximates 26.5 acres resulting in a required volume of approximately 6.85 acre-feet to accommodate the 24 hour/25 year storm event. Pond 1 is located south of the landfill footprint while Pond 2 is located west of the landfill footprint. Pond 2 is also located within the 100 year floodplain of Charlie Creek, however, all grading associated with Pond 2 results in a net cut in the floodplain. Calculations associated with the sediment ponds are provided in Attachment II "Design Calculation" section. These sediment ponds will be monitored periodically to ensure that runoff is controlled at the Class II facility.

3. *Holding facilities (e.g. sediment basins) associated with run-on and run-off control systems must be designed to detain at least the water volume resulting from a 24-hour, 25 year storm and to divert through emergency spillways at least the peak flow resulting from a 24-hour, 100 year storm.*

Basin Storage Design Basis

The sediment basins have been designed to retain the entire volume of storm water run-off from the 24 hour, 25 year storm event.

Sediment Storage Design Basis

The sediment storage for each of the sediment basins have been designed to provide at least 0.1 acre-feet per acre of for the largest disturbed area which will drain to the pond during the life of the landfill. Best management practices (BMPs) will be implemented should sediment-laden water become problematic and not settle adequately prior to discharge from the basin. Specifically, the basin can be retrofitted with skimmer-type discharge structures, such as the Faircloth Skimmers™. The number of skimmer-type discharge structures required is based upon the requirement to discharge the entire volume of runoff produced from a 100 year storm event in 72 hours neglecting any discharge through the emergency spillway without overtopping the basin.

Table 6: Sediment Basin/Pond Storage Volume

Pond	Maximum Drainage Area (ac)	Sediment Storage Volume (ac-ft)	Peak Elevation 24-hr, 25 yr (MSL)	Peak Elevation 24-hr, 100 yr (MSL)	Q ₂₅ , Inflow (cfs)	Q ₂₅ , Outflow (cfs)	Q ₁₀₀ , Inflow (cfs)	Q ₁₀₀ , Outflow (cfs)	Volume 25 yr Storm (ac-ft)	Pond Volume to Principal Spillway El. (ac-ft)
1	19.0	0.6	390.3	91.3	46.8	2.8	57.2	12.9	5.35	5.35
2	24.6	0.7	389.1	390.8	60.6	2.8	74.1	13.5	6.85	6.85

Note:

- * Volume of 25 year storm event calculated using spreadsheet provided by TDEC.

Principal Spillway Design Basis

The principal spillways have been designed to pass a 24 hour, 25 year storm event that occurs when the pond is already filled with the entire volume of storm water run-off collected from a previous 24 hour, 25 year storm event. The spillway opening has been designed to pass the second 24 hour, 25 year event in 72 hours.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Emergency Spillway Design Basis

The emergency spillway has been established at the second 24 hour, 25 year peak storm elevation based upon weir flow through the principal spillway. The elevation of the top of the containment berm has been established based upon the 24 hour, 100 year peak storm elevation over the emergency spillway plus 1 foot of freeboard and six inches of settlement.

These design requirements have been developed by Abe Almassi (TDSWM 1992).

4. *Collection and holding facilities associated with run-on and run-off control systems must be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system.*

Basin Maintenance

Inspection Interval

Sediment basins are to be inspected on quarterly intervals. In the event the basins or any of the structural components of the ponds have been damaged they will be repaired immediately.

Sediment Removal Trigger

Basins will be cleaned of sediment as needed to maintain adequate storage volume. Sediment will be removed from the basins when the design sediment storage capacity is reduced by 60 percent. A staff gauge will be installed in each of the basins to provide an indication of the level of accumulated sediment. Removal of sediment shall not extend below the constructed base grade of the basins.

Sediment Management Criteria

Sediment removed from the basins will be managed as follows;

- Sediment removal operations are to be performed prior to winter months,
- Sediment removed from the basins shall be placed at the approved on-site cover soil stockpile locations,
- Sediment may be used for daily cover after drying/processing,
- Sediment will be seeded and strawed after spreading, and,
- Sediment shall not be placed on sloping ground unless processed for use as topsoil.

It should be noted that the area for storing/wasting of sediment will be determined at the point in time the basin is determined to have accumulated the maximum sediment capacity as indicated by the staff gauge. ES personnel will contact the TDSWM and submit a minor modification for selection of the sediment storage waste area. This rationale is based upon uncertainty as to the projected level of site development at the time when a pond reaches its' sediment storage capacity.

5. *Run-on and run-off must be managed separately for leachate unless otherwise approved by the Commissioner.*

Run-on and run-off are diverted to the storm water channels and into the storm water sediment basins.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



6. *The operator must take other erosion control measures as necessary to control erosion at the site.*

Rows of silt fencing, enhanced silt fencing, straw wattles or straw bales will be placed as needed at the base of excavated slopes, fills, stockpiles, and borrow areas until a vegetative cover is established. Such structures shall be placed downslope of the exposed areas to intercept the maximum amount of siltation contained in the runoff from the facility. If the length of the exposed area exceeds 150 feet, a series of barriers at no more than 100 foot spacing may be required. In some instances, erosion control blankets or other measures as prescribed within the Tennessee Erosion and Sediment Control Handbook may be required. Installation details of the recommended barrier systems are included on the "Erosion and Sediment Control Details" sheet of the Permit Drawings.

Temporary seeding operations will be implemented to inhibit erosion within areas which will not be filled on or capped for over 90 days. Permanent seeding will be implemented on all areas of the disposal facility which have been completed. Re-vegetation operations may be required in the borrow area as part of the implementation of the stabilization of the borrow areas. The following guidelines will be followed in establishing final cover:

Seeding – Permanent seeding shall only be performed between March 15 and May 15 or between August 15 and October 15. At other times, sodding or seeding with temporary seed shall be made until the desired spring or late summer seeding time. Seeding shall not be performed on frozen or muddy grounds or when prevailing winds exceed five (5) miles per hour. Grass seed shall be clean, fresh stock, and labeled in accordance with the Federal Seed Act and shall be produced by a recognized manufacturer and guaranteed by the dealer. The seed shall have the State of Tennessee certification. Recommended seed mixtures as well as rates and time of application are provided in Table Four (4).

Table 7: Seed Guidelines

SEASON	SEED*	APPLICATION RATE (POUNDS PER ACRE)
Spring (March 15 – May 15)	Kentucky 31 Fescue and	50
	White Clover and	25
	Weeping Lovegrass	15
Summer (May 15 – August 15)	Bermuda Grass (hulled)	50
Fall (August 15 – October 15)	Kentucky 31 Fescue and	60
	White Clover	15
Winter-Temporary (October 15 – March 15)	Annual Ryegrass and	50
	White Clover	10

Other seed blends may be utilized upon approval from the TDSWM

Fertilizer – The fertilizer used at the EWS Class II Landfill is an agricultural grade of 17-17-17 or equivalent 1-1-1 ratio fertilizer. Fertilizer shall be commercial / agricultural grade, free-flowing, uniform in composition and shall conform to State and Federal



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



regulation. Fertilizer shall bear the manufacturer's guaranteed statement of analysis. The rate of application is presently and shall be for all future seeding operations be at a rate equivalent to 1000 lbs. / acre. Fertilizer may be applied with the use of a bulk spreader, drop type spreader, hydro-seeder or any other equipment capable of providing even coverage. The application shall result in an even spreading of the fertilizer over the entire area. Care shall be taken as not to spill the fertilizer in the areas to be seeded during the loading and spreading of the fertilizer.

Lime – Lime shall be ground or pulverized agricultural grade limestone containing no less than 85 percent total carbonates and shall be ground to such fineness that at least 50 percent will pass a 100 mesh sieve and at least 90 percent will pass a 20 mesh sieve. Lime shall be applied at a minimum rate of two tons per acre. Lime may be applied with the use of a bulk spreader, drop type spreader, hydro seeder or any other equipment capable of providing even coverage. The application shall result in an even spreading of the lime over the entire area.

Mulching – Mulch shall be hay mulch or *Wood cellulose fiber*. Wood cellulose fiber used for hydraulic mulching shall consist of specifically manufactured commercially available products containing wool cellulose fiber, recycled newsprint fibers, or a combination of these materials. The wood cellulose fiber or newsprint fiber will contain no growth or germination inhibiting factor and shall contain a dye for color. The dye shall allow the operator to monitor the amount of mulch being applied to the area to insure proper coverage. The application of wood cellulose fiber mulch shall be in a slurry mix through a hydro-seeder. The slurry mixture shall be constantly agitated from the initial mixing point until the material is discharged onto the ground. The material shall then be applied over the seeded area in a manner not disruptive to the placement of seed.

Hay mulch will be the preferred mulch at the EWS Class II Landfill. The hay mulch shall be from oats, wheat and or barley and shall be free of noxious weeds and noxious weed seeds. The hay shall not contain sticks, rocks, or other objectionable material and will not be wet, moldy, or otherwise undesirable. Hay mulch shall be applied at the rate of 92 lbs. / 1000 sq. ft. The application of the hay mulch will be through a blower or other approved equipment capable of shredding the material bale and distributing it evenly over the seeded areas. The application of mulch will take place no more than 24 hours after the seeding operation of the area.

2.15 LEACHATE COLLECTION AND HOLDING FACILITIES MANAGEMENT

Rule 0400-11-01.04(9)(c)(15) *Describes how leachate collection and holding facilities will be managed, including the disposition of collected leachate.*

Also refer Rule 0400-11-01.04(4) Leachate Migration Control Standards

A leachate collection system has been designed to comply with the rules specific to the management of leachate. The leachate collection and holding systems (LCS) incorporate several specific components to satisfy the intent of the regulations. The major components include the following:

- low permeability composite liner,
- leachate collection pipes and collection media,



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL

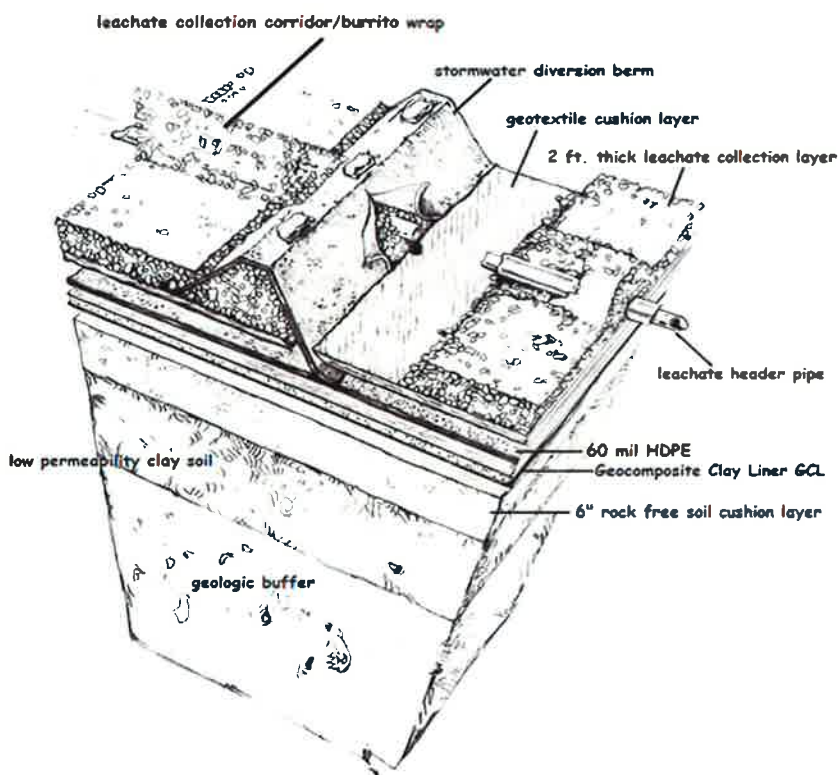


- leachate collection sumps and pumps,
- force main piping, and
- a leachate tank farm.

The aforementioned individual components of the LCS will be described in the following paragraphs. The low permeability composite liner system will be detailed initially as the regulatory criteria are also presented in *Rule 0400-11-01.04(4) Leachate Migration Control Standards*.

Low Permeability Composite Liner

As previously discussed, alternate liner leachate collection systems compliant with the TDSWM Subtitle D regulations specific to the LCS have been developed for the EWS disposal facility. The purpose of developing alternate composite liner designs is to provide an alternate equivalent liner design in the event certain materials are more cost effective or more readily available but which can still demonstrate equivalency with the TDSWM prescriptive liner/leachate collection system. The proposed conceptual designs are often referred to as corridor or "burrito wrap" leachate collection type systems. Drawing 2 of this document provides a conceptual illustration of the corridor/burrito style leachate collection system proposed for the EWS Class II Landfill. Drawing 2 depicts the inter-cell storm water berm between the active phase and the inactive phase of the landfill. Drawing 2 and Drawing 3 provide a close-up of the alternate equivalent liner sections.



Drawing 4 - Leachate Collection Corridor (Burrito Wrap)

Calculations have been performed to demonstrate the equivalency of the proposed liner/leachate collection system with the prescriptive TDSWM landfill liner/leachate collection system. This "equivalency demonstration" is provided in Section 2.30 "Basis of Design" of this document. The specific components of the EWS proposed liner/leachate collection system for the SAS waste disposal phases include at a



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



minimum the following component layers, from bottom to top;

- a minimum of 5 feet of geologic buffer soil materials
- a 1.5 foot low permeability compacted clay liner,
- a 0.5 foot low permeability rock free compacted soil layer,
- a laminate backed geosynthetic clay liner (GCL) (this layer will be limited to an elevation equal to the elevation in the floor of the landfill that is 1.0 foot above each leachate collection sump in the phases with SAS waste materials,
- a 60 mil textured HDPE geomembrane liner,
- a non-woven geotextile cushion layer,
- a 2.0 foot siliceous gravel leachate collection layer (geocomposite drainage net with 2 feet of soil cushion will replace this layer on all interior side slopes),

The proposed alternate composite liner designs which provide a barrier system equivalent to the prescriptive TDSWM Subtitle D liner system are summarized in the following table.

Table 8 - Proposed TDSWM Regulatory Alternate Liner Sections

Landfill Liner Components	Proposed TDSWM Regulatory Compliant Alternate Liner Sections			
Leachate Collection System	Phase Designation Specific to Alternate Liner Section			
	Industrial Waste Phase 4 (Alternate 1)	Industrial Waste Phase 4 (Alternate 2)	Secondary Smelter Waste Phases 1,2,3 (Alternate 1)	Secondary Smelter Waste Phases 1,2,3 (Alternate 2)
	1.5 Ft.Siliceous Aggregate Non-woven Geotextile Cushion	Geocomposite Drainage Net blanketed with min. 6" Rock Free Soil and an additional 1 foot of cushion material above the rock free soil	2.0 Ft.Siliceous Aggregate Non-woven Geotextile Cushion	Geocomposite Drainage Net blanketed with min. 6" Rock Free Soil and an additional 1.5 feet of cushion material above the rock free soil
Flexible Membrane Liner	60 mil HDPE textured	60 mil HDPE textured	60 mil HDPE textured	60 mil HDPE textured
Clay Liner	2 Ft. Low Permeability Soil with $K = 1 \times 10^{-7}$ cm/sec	2 Ft. Low Permeability Soil with $K = 1 \times 10^{-7}$ cm/sec	2 Ft. Low Permeability Soil with $K = 1 \times 10^{-7}$ cm/sec	2 Ft. Low Permeability Soil with $K = 1 \times 10^{-7}$ cm/sec
Geologic Buffer (Equivalent to 5 ft. of 1×10^{-6} cm/sec)	Geocomposite Clay Liner (GCL) w/o laminate backing plus 5' of existing site soils	Geocomposite Clay Liner (GCL) w/o laminate backing plus 5' of existing site soils	Geocomposite Clay Liner (GCL) w laminate or polymer protection plus 5' of existing site soils	Geocomposite Clay Liner (GCL) w laminate or polymer protection plus 5' of existing site soils
	low permeability soil w $K = 1 \times 10^{-7}$ cm/sec plus 4 Ft. Existing Soils	low permeability soil w $K = 1 \times 10^{-7}$ cm/sec plus 4 Ft. Existing Soils	5.0 Ft. of Existing Geologic Buffer Materials above the seasonal high water table	5.0 Ft. of Existing Geologic Buffer Materials above the seasonal high water table

Leachate Collection Pipes and Collection Media

The proposed EWS Class II Landfill will be divided into four phases. The design of the LCS pipe sizes and spacing is based upon the regulatory requirement to maintain less than one foot of leachate head above the composite liner. Hydraulic analyses were performed using the HELP computer model developed by the Corps of Engineers (COE) to determine the pipe diameter and pipe spacing required to comply with the maximum of one foot of leachate above the liner requirement.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Pipe strength calculations were also performed to determine the required ratio of the diameter of the pipe to the pipe wall thickness (DR) to withstand the predicted loading conditions induced by the waste filling operations.

Placement of the collection media (2 feet of siliceous stone) on interior side slopes shall proceed from the bottom of the slope upwards. Equipment shall not be driven directly on the cushion geotextile or underlying 60 mil geomembrane liner during placement of the siliceous stone or protective cover soil above the geocomposite drainage net. The equipment used to place the stone or protective cover soil above the geosynthetic liner components shall comply with the requirements set forth in Table 6.

Table 9: Leachate Collection Stone Equipment Placement Requirements

Maximum Allowable Equipment Ground Pressure (psi)	Thickness of Overlying Stone (ft.)
< 5	1.0
< 10	1.5
< 20	2.0
> 20	3.0

Leachate Collection Sumps and Pumps

Leachate collection sumps have been designed to manage leachate collected within the EWS Class II Landfill. Three gravity sumps will convey leachate from within the landfill to exterior manholes and a force main system. In addition, each of the sumps has been fitted with sidewall riser pipes to remove leachate and maintain the maximum one foot head above the liner criteria in the event that the gravity system malfunctions. In addition, each sump will be filled with coarse aggregate and will have a storage capacity of approximately 1,400 gallons (accounting for 30% porosity in the stone between top of pump and top of sump elevation) for operation of the side wall riser pumps.

The allowable maximum leachate head elevation for each sump will be established as the elevation representing one foot above the elevation of the crest of the top of the sump slope. Table 5 summarizes the proposed bottom of the sump elevation for each phase/cell of the landfill.

A leak detection system (LDS) has been designed for each sump at the EWS Class II Landfill. The Leak Detection Procedural Manual is provided in Appendix 4 of this document that provides a design schematic as well as sampling, monitoring, and response procedures to be implemented for each LDS constructed.

Table 10: Leachate Collection Summary

Landfill Phase / Cell	Area Draining to Sump (Acres)	Base of Sump Elevation (FT. MSL)	Groundwater Table (Feet MSL)
Phases 1 and 2	15	384	376
Phase 3	13	388	380
Phase 4	12	388.5	381.5

Note: Phase 1 and 2 drain to the same sump.

The actual sump elevations will be established based upon the as-built topographic survey performed after construction of each individual sump.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Force Main Piping

A force main pipe system has been designed to convey collected leachate to the leachate tank farm. The force main, which is proposed to be constructed of HDPE pipe with a DR of 11, will be equipped with lift stations situated at critical locations to ensure proper conveyance to the leachate tank farm. The required nominal pipe diameter required for the force main system has been estimated at 2 inches. It should also be noted that exposed piping will be insulated to inhibit freezing.

Leachate Pipe Cleaning Equipment and Methods

High pressure water jet pipe cleaning is the standard method for cleaning of leachate collection piping. The EWS Class II Landfill leachate collection system has been designed with High Density Polyethylene (HDPE) pipe. Waste industry standards specific to HDPE pipe cleaning recommends pumping equipment be capable of providing a minimum of 60 gallons per minute (gpm). The equipment should also be capable of sustaining pressure between 2,000 and 2,500 pounds per square inch (psi) to effectively remove the scale buildup within the HDPE pipe.

Leachate Pipe Cleaning Frequency

Prior to waste placement the leachate collection pipes should be inspected to ensure that the pipe network has not been compromised or clogged with debris during construction. An appropriate method will be selected to demonstrate that the leachate carrying capacity of the pipe network is complies with the intended design flow capacity.

After waste filling operations are initiated it is recommended that the inspection and cleaning of the leachate collection piping be conducted a minimum of once every 3 years, when leachate levels in the system are low. Although leachate flows are continuous year round, the rates are lowest in late summer or early fall and this is the preferred time of year to clean the system. Although it is presently recommended to inspect and clean the leachate collection piping at least once every 3 years, the stress on cleaning the leachate collection system may change if the leachate quality changes over time. The cleaning frequency should actually be governed by the extent of encrustation and sediment buildup observed during each inspection event and, therefore, may be subject to change.

Leachate Tank Farm Storage Capacity, Disposal Options, and Record Keeping

The leachate storage tanks will be glass-fused-to-steel or stainless steel (or equal) for protection against corrosion and all tanks will be situated inside a secondary containment area consisting of another larger diameter tank. The initial leachate storage tank has been sized to provide approximately 115,000 gallons of leachate which presently exceeds the 30 days of storage for the estimated average leachate generation rate of 2,150 gallons/day. This estimate of tank storage capacity is based upon the leachate generation rates for the initial years of operation. As the site is further developed "actual leachate generation rates" will be evaluated and the number of tanks will be installed according to actual quantities of leachate generated.

The secondary containment for the initial leachate storage tank has a capacity of at least 121,355 gallons (which is more than the 110% of the total capacity of the current storage tank when accounting for volume occupied by non-leaking tanks).



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



The City of Bruceton, and Huntington, Tennessee are presently providing disposal for the leachate generated on-site. In the event that either of these leachate management options becomes inaccessible EWS will deliver the leachate to one of OnSite Environmental's locations in either Nashville or Memphis, Tennessee.

Accurate accounting of the volume of leachate collected is a necessary component of the leachate management at the EWS Class II Landfill. Leachate generation and disposal volumes have and will continue to be closely tracked to determine the cost of disposal. Records of leachate generation have and will be kept at the EWS Landfill office.

2.16 DUST CONTROL

Rule 0400-11-01-.04(9)(c)16. *Describes the dust control measures to be taken and when they would be implemented.*

Rule 0400-11-01.04(2)(j) *The operator must take dust control measures as necessary to prevent dust from creating a nuisance or safety hazard to adjacent and owners or to person engaged in supervising, operating, and using the site. The use of any oils other chemicals (other than water) for dust suppression must be approved in writing beforehand by the DSWM.*

In order to control dust at the site approximately 3,000 feet of the main entrance and waste fill access road is paved with asphalt. Water trucks are also employed when necessary to control dust on roads that are unpaved. Dust control measures will be implemented as necessary to prevent dust from creating a nuisance or safety hazard to adjacent landowners and facility personnel. Drainage ditches will be constructed along the roads as needed to promote drainage. In addition, roads and disturbed areas will be lightly sprayed with water to minimize blowing dust as necessary. The use of any oils or other chemicals (other than water) for dust suppression will be approved by TDSWM prior to application. Re-vegetation will be conducted as soon as practical to establish vegetative growth in areas where work has been completed so that dust problems and wind erosion will be minimized.

2.17 FIRE SAFETY

Rule 0400-11-01.04(9)(c)(17) *Describes the fire safety precautions to be taken, the types and availability of on-site fire suppression equipment, and/or the arrangements made with the local fire protection agency.*

Although secondary aluminum smelter wastes are exothermic there are no other waste materials in the landfill that could ignite. Coal combustion wastes have no potential for burning. However, should solid waste be delivered to the facility, which is burning, smoking or at a temperature that will potentially cause fire, it will be immediately removed from the facility entrance, unloading area and/or working face. The site Emergency Response Coordinator (ERC) will be immediately notified of the situation. If in the event that the fire cannot be controlled by on-site personnel, the Camden Fire Department will be immediately notified to aid in fire-fighting activities. The ERC and Emergency Response Team (ERT) may direct operations to cease and evacuate all facility personnel away from the fire area. The evacuation may require the movement of heavy equipment and/or solid wastes to reduce the risk of the fire from spreading. If necessary, the ERC and the Camden Fire Department will determine if additional fire departments are required to assist in controlling and/or exterminating the fire.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Rule 0400-11-01.04(2)(c) Fire Safety

1. *Except as specifically authorized by the Department:*

- (i) *The operator must not permit or engage in open burning of solid wastes at the facility. Any open burning that does occur must be immediately extinguished.*

Open burning of solid waste is strictly prohibited and will not be conducted by facility staff. The aluminum smelter wastes and coal combustion wastes accepted at the landfill are not susceptible to combustion. However, fire extinguishers will be placed in the landfill office, maintenance, and also in heavy equipment on site. The fire extinguishers will be properly maintained and recharged as necessary. The landfill personnel will be properly trained in the use of the fire extinguishers. A water truck is available on-site for use in controlling fires. In addition, landfill activities will be conducted in a manner, which will minimize the possibility of the outbreak of fire such as the placement of daily and intermediate cover

- (ii) *The operator must not allow solid wastes which are burning or smoldering to be deposited into the active portion of the facility. Any such wastes that are received must be deposited at a location safely removed from the active portion and extinguished before being deposited into the active portion.*

Should solid waste be delivered to the facility, which is burning, smoking or at a temperature that will potentially cause fire, it will be immediately removed from the facility entrance, unloading area and/or working face. The site Emergency Response Coordinator (ERC) will be immediately notified of the situation. In the event that the fire cannot be controlled by on-site personnel, the Camden Fire Department will be immediately notified to aid in the firefighting activities:

Camden Fire Department
119 West Main Street,
Camden, TN 38320
Telephone - (731) 584-4623

The site ERC and Emergency Response Team (ERT) may direct operations to cease and evacuate all facility personnel away from the fire area. If necessary, the ERC and the responding fire department will determine if additional fire departments are required to assist in controlling and/or exterminating the fire.

2. *The facility must have, on-site and continuously available, properly maintained fire suppression equipment in sufficient quantities to control accidental surface fires that may occur, or arrangements must be mad with the local fire protection agency to provide immediate firefighting services when needed. Additional earth moving equipment shall be brought to the facility as necessary to help suppress an underground fire.*

If possible, any solid waste that is found burning after unloading will be safely removed with excavating equipment to an open area where it may be extinguished by smothering with the earthen material or by dousing with water. Extinguishing the fire will be completed in such a manner so as to not incur further risk to the facility personnel or equipment. Facility personnel will attempt to extinguish the fire or smoldering material with facility fire control equipment such as soils, water, or fire extinguishers.



EWS will coordinate quarterly site visits with the Camden Fire Department to review expectations of the various parties, equipment limitations, access to the working face and phasing diagrams.

2.18 PERSONNEL SERVICES / COMMUNICATIONS

Rule 0400-11-01.04(9)(c)(18) *Describes the facilities and services available to facility personnel including shelter, drinking water, hand-washing and toilet facilities, and communication equipment.*

Also see Rules 0400-11-01.04(2)(e) Personnel Services and 0400-11-01.04(2)(f) Communications.

An office and a separate check station are located near the entrance of the landfill. In addition, a metal building structure that serves as a shop and break room for site employees is located along the coal ash fill access road. Each of the structures is climate controlled and furnished with restrooms and drinking water.

The facility has operating and effective communication devices (e.g., telephone, 2-way radio) capable of summoning emergency assistance on-site. Telephones are available to all facility personnel at each of the aforementioned structures at all times. In addition, cell phones and 2-way radios are available for personnel to carry with them as they perform duties on and around the landfill.

2.19 CONSTRUCTION QUALITY ASSURANCE PLAN

Rule 0400-11-01.04(9)(c)(19) *Describes in the construction quality assurance plan:*

- (i) *How each new "as-built" solid waste landfill unit(s) liner(s) and/or lateral expansion liner(s) and cover system(s) will be inspected and/or tested by a registered engineer as per 1200-1-.04(1)(c) during the construction or installation for uniformity, damage, and imperfections, and*
- (ii) *How each constructed section of the liner system or final cover system will be certified by a registered engineer.*

The Construction Quality Assurance (CQA) Plan for re-compaction of the geologic buffer, GCL placement, soil liner, geosynthetic materials and construction of the final cover system for this project is provided in the CQA Plan which is Document V of the EWS Class II Landfill Permit Package. All provisions included in the CQA Plan will be met during the construction sequence and will be certified by a registered engineer.

2.20 GAS MIGRATION CONTROL STANDARDS

Rule 0400-11-01.04(9)(c)(20) *Describes how the control and migration of explosive gases will be controlled and monitored;*

A field sampling and testing program was performed at the landfill to characterize the composition of the gas produced by the SAS waste materials. Three locations were sampled during the field testing program. The main leachate collection header pipe was sampled near the existing Cell 2 sump and at the upper end of Cell 2. A stainless steel probe was also extended into the waste mass near the center of the top deck of Cell 2. The test methods selected to characterize the composition of the gas included EPA CTM-027, EPA Method 18 and EPA Method TO-15. EPA CTM-027 was determined to be the most accurate method for detection of ammonia. The results of the laboratory testing of the gas samples indicated that there were three main compounds identified in



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



the gas. Those compounds included ammonia, methane, and hydrogen. The estimated percentages of these gases were reported by the laboratory as follows:

Ammonia – 50.7%, Methane – 36.4%, Hydrogen – 20.2%

It should be noted that the percentages total more than 100%. However, the EPA method allows up to a 10% variance for the test methods used to determine the percentages. In addition, ammonia was determined using EPA CTM-027 while Methane and Ammonia were quantified using EPA Method 18. It should be noted that EPA CTM-027 is considered the most accurate method for estimating ammonia concentrations in gas.

In order to determine the potential explosive nature of the gas the net heating value was calculated. The highest net heating value calculated from the three samples was determined to approximate 384 British Thermal Units (BTU) per Standard Cubic Foot (SCF) of gas from the sample taken within the waste mass. The heating value of landfill gas is known to range from 350 to 600 BTU/SCF. Therefore, the heating value of the gas generated at the EWS landfill was determined to be on the low end of the heating value range for Municipal Solid Waste (MSW) landfill gas.

Gas Migration Control Standards

Rule 0400-11-01.04(5)(a) *Class I Disposal Facilities must be designed, constructed, operated, and maintained such that any gases generated by decomposition or other reaction of solid waste are collected and vented, recovered, or otherwise managed such that:*

1. *There is no buildup of gas pressure under the final cover such that the functions of such cover (including any cap) are compromised;*

A landfill gas collection system has been designed to minimize gas buildup in the final cover.

2. *The concentration of explosive gases in facility structures (excluding gas control or recovery system components) does not exceed 25 percent of the lower explosive limit for the gases;*

Devices are provided on-site which provide real time gas measurements to determine gas concentrations near the shop and office.

3. *The concentration of explosive gases at the property boundary does not exceed the lower explosive limit for the gases;*

An AreaRAE Steel multi-gas monitor has installed for "fence line" or property boundary surveying of emissions at the EWS facility. The AreaRAE Steel is an ATEX-certified Multi Gas, wireless monitor. The AreaRAE is housed in a welded stainless-steel enclosure. An integrated wireless modem transmits real-time gas measurement data to the base station, which has been setup in the EWS office. The base station employs a standard Windows-based PC running ProRAE Remote software. The base station can simultaneously control and display readings for up to eight AreaRAE Steels and/or AreaRAE Steel Gammas (or other AreaRAE-compatible monitors, including MultiRAE Plus, MiniRAE 2000, ppbRAE Plus, Smiths APD-2000®, BAE ChemSentry®, and Coastal Environmental Systems Weatherpak®). This provides a multi-threat detection network that can monitor a wide geographic area.



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL

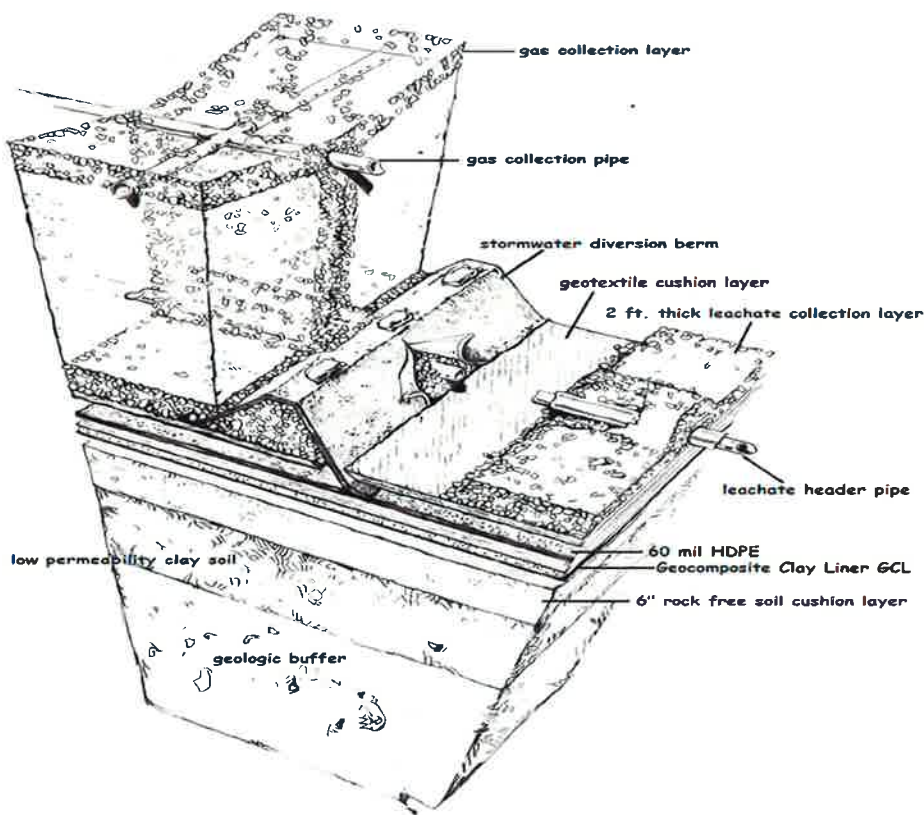


4. *The minimum frequency of monitoring shall be quarterly and the operator shall keep records to comply with the monitoring and records requirements at rule 0400-11-01-.02(4)(a)9; and monitoring shall include at least the following locations:*
- (i) *Underneath or in the low area of each on-site building;*
 - (ii) *At locations along the boundary as shown in the permit;*
 - (iii) *At any potential gas problem areas, as revealed by dead vegetation or other indicators; and*
 - (iv) *At any other points required by the permit.*

A MultiRAE Plus gas meter and Draeger tube sample devices are provided on-site to check a number of locations for the presence of ammonia. The sample locations will be identified in the Air Monitoring Plan. Readings will be taken at an interval established by the TDSWM and will be recorded and kept in the office as specified in the Air Monitoring Plan located in APPENDIX 2 of this document.

5. *Within 60 days of detection above the limits set in parts 1, 2, and 3 of this subparagraph, implement a Department approved remediation plan for the methane gas releases. Pending the remediation, the owner/operator must take all necessary steps to ensure immediate protection of human health.*

A system has been developed to collect the gas generated at the site. A conceptual drawing of the landfill gas system is provided on the following page. The gas collection



layer which is to be constructed of siliceous river gravel will be placed along the slope interfaces between landfill cells and in horizontal layers above lifts of waste. The landfill gas design will be adjusted as more information is available regarding the rate of gas generation of the potential of the waste to generate gas on a volumetric basis.

Drawing 5 - Conceptual Landfill Gas System



2.21 GROUNDWATER MONITORING PROGRAM

Rule 0400-11-01.04(9)(c)(21) *Describes the planned groundwater monitoring program.*

A ground water monitoring plan and sampling plan has been prepared for the EWS Class II Landfill. Three monitoring wells, (one upgradient and two downgradient wells) have been constructed at the site. Four discrete background sampling and the first semi-annual sampling event has been completed for each of the three groundwater wells. The groundwater monitoring plan prepared for the EWS Class II Landfill is provided as Document IV (Groundwater Monitoring Program) of this Class II landfill Permit Package.

2.22 LOCATION IN FLOODPLAINS

Rule 0400-11-01.04(9)(c)(22) *Includes an engineering statement of the flood frequency exposure and describes flood protection measures taken.*

Rule 0400-11-01-.04(2)(n) *Facilities must not be located within a 100-year floodplain unless it is demonstrated to the satisfaction of the Commissioner that*

1. *Location in the floodplain will not restrict the flow of the 100-year flood or reduce the temporary water storage capacity of the floodplain.*
2. *The facility is designed, constructed, operated, and maintained to prevent washout of solid waste.*

The 100 year flood plain as it relates to the Class II landfill is illustrated on a map provided in APPENDIX 1 of this document as well as in the Permit Drawings. The 100 year floodplain was defined from elevations taken from FEMA Map # 47005C0162D, Panel 162 of 330, dated December 16, 2005. Based upon a review of the maps it is evident that detailed flood studies have been performed at the location of this facility for Charlie Creek and Cane Creek which converge below the southern boundary of the waste footprint.

There will be minimal filling of material within the 100 year flood plain. Therefore, no cut and fill balance calculations will have to be executed for compensation of the loss of flood storage capacity. A portion of Sediment Pond 1 and 2 will be located within the floodplain; however, construction of the pond will provide more storage volume to offset the filling.

All wastes are properly covered with soil materials and berms are constructed to direct storm water away from the working face of the landfill to prevent washout of the coal ash into storm water runoff.

2.23 ENDANGERED AND THREATENED SPECIES

Rule 0400-11-01.04(9)(c)(23) *Describes the impacts the facility will have on endangered or threatened species of plants, fish, or wildlife or their habitat;*

Rule 0400-11-01.04(2)(m) *Facilities will be located, designed, constructed, operated, maintained, closed, and cared for during the post-closure care period in a manner that does not:*

1. *Cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife.*



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



2. *Result in the destruction or adverse modification of the critical habitat of endangered or threatened species.*

A species review was performed for the EWS Class II Landfill and it was determined that no endangered species were observed with a 1 to 4 mile radius of the site. The Species Review is provided in APPENDIX 3 of this document.

2.24 RANDOM INSPECTION PROGRAM

Rule 0400-11-01.04(9)(c)(24) *Describes the Random Inspection Program required under Rule 0400-11-01-.04(2)(s).*

The owner or operator of a permitted landfill must implement a program at the facility for detecting and preventing the disposal of regulated hazardous wastes, unauthorized special waste, and polychlorinated biphenyl (PCB)'s. This program must include at a minimum:

1. *Random inspection of five percent of the daily incoming loads.*

In order to conduct and satisfy the random inspection requirements the landfill must have control of the site access. The site will be equipped with a manned scale house during all hours of operation (and outside hours as necessary). Scale house personnel will be responsible for performing (at a minimum) random inspections of 5% of all daily loads brought to the landfill. The following tasks will be routinely performed at the scale house;

- Weigh all incoming waste,
 - Manually and/or automatically document waste information, and
 - Screen incoming waste (visual screening initially and automated with camera in the future).
2. *Inspection of suspicious loads.*

In order to perform the inspections and identify suspicious loads, personnel at the scale house will be adequately skilled and trained, including having the ability to carry out visual inspection of waste loads to establish the accuracy of the declared load information. This may be done by using an access gantry, or with the assistance of a CCTV camera mounted above the scale house. Personnel at the entry point will be regularly briefed on site operations such that they can direct the load to the appropriate disposal point.

In addition, provisions will be implemented for communication directly between the scale house personnel and the personnel at the waste unloading areas within the site to enable quick cross-checking of information related to waste loads, including waste load quantity and character, and to deal with any loads rejected as unsuitable at the working/tipping face.

All field employees will be responsible for visual inspection of unloading operations at the site to determine whether unapproved wastes have been brought to the site. EWS field employees will inform facility personnel of which trucking company is found transporting unapproved wastes to the site. Therefore, any unauthorized trucks that arrive on-site will be prohibited from entering the fill area. All employees at the working face will inspect the dumped loads for the presence of unapproved waste



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



materials. In the event unapproved waste is detected, the unapproved materials will be removed for proper disposal and the relevant parties contacted.

3. Training of facility personnel to recognize regulated hazardous waste.

The scale house will be capable of recording weights accurately from a computer system and generating reports. Reports and records will be kept on-site of all waste loads which include the date and weight. These records will also contain any observations made by the inspector. Random inspection records will be maintained in a bound notebook at the scale house office. The records will include the information specified in the rule. It is the policy of the TDSWM that random inspection records be kept for a minimum of three (3) years. The EWS Class II Landfill may, at its' discretion, choose to keep those records for a longer time.

4. Records of all inspections.

Personnel will be trained prior to assuming responsibilities for working the scale house and the waste working face. The training will include the following topics:

Waste Screening/Random Inspections/Hazardous Waste Identification

Procedures to exclude and/or prevent off-loading of unauthorized hazardous wastes

Recordkeeping, reporting, and record retention requirements

Emergency preparedness/corrective action plan/contingency plan

Industrial Waste

- Hazardous waste determination
- Industrial waste classification and coding
- Manifesting requirements
- Recordkeeping requirements

Special Waste Acceptance

(Also see Section 2.11 and Appendix 5 - Special Waste Acceptance Procedure and Forms)

- Criteria for accepting special waste to include:
- Disposal criteria
- Authorization requirements
- Recordkeeping, reporting, record

5. Procedures for notifying the proper authorities if a regulated hazardous waste is identified at the facility.

Notification Of Proper Authorities.

In the event prohibited or hazardous waste is discovered at the scale house or at the working face, the site manager, the Jackson Field Office and the waste generator will be contacted. Depending upon the location the prohibited or hazardous waste is identified the load will either be rejected or removed from the working face and disposed of properly.

EWS policy will be implemented to ensure that unapproved wastes are not placed in the Class II landfill. The potential for unapproved wastes to be delivered to the site is lower than other facilities due to the fact that the site is not open to the public. Check station personnel will coordinate with employees at the disposal working face to



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



identify unapproved wastes delivered to the site.

All field employees will be responsible for visual inspection of unloading operations at the site to determine whether unapproved wastes have been brought to the site. EWS will inform facility personnel of which trucking company is transporting the wastes to the site. Therefore, any unauthorized trucks that arrive on-site will be prohibited from entering the fill area.

Records are kept on-site of all waste loads which include the date and weight. These records will also contain any observations made by the inspector. All employees at the working face will inspect the dumped loads for the presence of unapproved waste materials. In the event unapproved waste is detected, the unapproved materials will be removed for proper disposal.

2.25 SEALING OF BOREHOLES

Rule 0400-11-01.04(2)(l)

Describes the procedure for sealing boreholes prior to construction of the landfill units.

Describes the procedure for sealing boreholes prior to construction of the landfill units.

Prior to excavation, all bore holes drilled or dug during subsurface investigation of the site, piezometers, and abandoned wells which are either in or within 100 feet of the areas to be filled must be backfilled with a bentonite slurry or other sealant approved by the Commissioner to an elevation at least ten feet greater than the elevation of the lowest point of the landfill base (including any liner), or to the ground surface if the site will be excavated less than ten feet below grade.

Prior to the preparation of the disposal facility base, any open boreholes, any abandoned piezometers, and/or abandoned wells drilled or installed during the Hydrogeologic Investigation which are either in or within 100 feet of the areas to be filled will be abandoned. The abandonment will consist of backfilling the boring/well with bentonite slurry or grout to an elevation at least ten feet greater than the elevation of the lowest point of the landfill base (including any liner), or to the ground surface if the site will be excavated less than ten feet below grade. Each sealing job should be considered as an individual problem, and methods and materials should be determined only after carefully considering the objectives outlined in the EPA Handbook of "Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells".

2.26 PERMANENT BENCHMARK

Rule 0400-11-01.04(2)(o)

Describes the requirements for maintaining a permanent benchmark. There must be installed on-site a permanent benchmark (e.g., a concrete marker) of known elevation.

Describes the requirements for maintaining a permanent benchmark. There must be installed on-site a permanent benchmark (e.g., a concrete marker) of known elevation.

Each of the groundwater wells will have a known elevation for the top of the casing and therefore may be utilized as benchmarks. Benchmarks will be installed during the operational life of the facility to help in surveying more efficiently.

2.27 WETLANDS

Rule 0400-11-01.04(2)(p)

Wetlands - Disposal facilities shall not be located in wetlands, unless the owner or operator can make the following demonstrations to the Commissioner:

Wetlands - Disposal facilities shall not be located in wetlands, unless the owner or operator can make the following demonstrations to the Commissioner:

1. Where applicable under section 404 of the Clean Water Act or Tennessee Water Pollution



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



Control Act, the presumption that practicable alternative to the proposed landfill is available which does not involve wetlands is clearly rebutted;

EWS has taken the necessary steps to design the landfill to avoid impacts to streams and wetlands in the vicinity of the proposed Class II landfill.

2. *The construction and operation of the landfill will not:*

(i) *Cause or contribute to violations of any applicable State water quality standard;*

The proposed EWS Class II Landfill has been designed to comply with the TDSWM standards which avoid violations of the State water quality standard.

(ii) *Violate any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act; and*

The proposed EWS Class II Landfill does not propose to secure a point source discharge permit for the leachate generated at the site. The EWS Class II Landfill has been designed to collect, control and properly discharge leachate impacted waters.

(iii) *Violate subparagraph (m) of this paragraph regarding the protection of endangered species;*

As previously stated a species review was performed for the EWS Class II Landfill and it was determined that no endangered species were observed with a 1 to 4 mile radius of the site.

3. *The landfill will not cause or contribute to significant degradation of wetlands. The owner or operator must demonstrate the integrity of the landfill unit and its ability to protect ecological resources by addressing the following factors:*

(i) *Erosion, stability, and migration potential of native wetland soils, mud and deposits used to support the landfill;*

Section 2.14 of this document provides a description of the practices which will be implemented to minimize erosion and the potential impacts to wetlands. Specific criteria are listed under *Sediment Management Criteria* in Section 2.14 of this document. In addition, a Storm Water Pollution Prevention Plan (SWPPP) as required by the Tennessee Division of Water Pollution Control (TDWPC) has been prepared to further minimize potential impacts to wetlands in the vicinity of the waste footprint.

(ii) *Erosion, stability, and migration potential of dredged and fill materials used to support the landfill;*

The procedures described in the previous paragraph will also be implemented to minimize impacts of soil borrow materials to wetlands.

(iii) *The volume and chemical nature of the waste managed in the landfill;*

The landfill has been designed with a liner and leachate collection system to prevent impacts to wetlands.

(iv) *Impacts on fish, wildlife, and other aquatic resources and their habitat from release of the solid waste;*

The purpose of the landfill design has been to protect human health and the environment. A liner/leachate collection system, and a storm water collection/control system will help protect fish, wildlife and other aquatic resources in the vicinity of the



ENVIRONMENTAL WASTE SOLUTIONS OPERATIONS MANUAL



proposed landfill.

(v) *The potential effects of catastrophic release of waste to the wetland and the resulting impacts on the environment; and*

Berms have been designed to encapsulate the landfill to prevent a release of waste to the wetlands and the environment.

(vi) *Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected.*

Other factors which will be employed at the site to protect the ecological resources of wetlands near the landfill will include the following:

- Phasing work to stabilize one area of the property before another is disturbed,
- Protecting on-site fauna, and
- Re-using indigenous materials whenever practical.

4. *To the extent required under Section 404 of the Clean Water Act or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent practicable as required by paragraph (a)(1) of this section, then minimizing unavoidable impacts to the maximum extent practicable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and practicable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands); and*

The EWS Class II landfill has been designed to minimize impacts to wetlands by not filling within wetlands considered "waters of the state". A 200 foot setback has also been maintained for all springs, streams and the pond indicated on the map.

5. *Sufficient information is available to make a reasonable determination with respect to these demonstrations.*

The footprint of the current landfill is completely within an abandoned chert pit.

2.28 AIRPORT SAFETY

Rule 0400-11-01.04(2)(r) *Describes the setbacks and procedures for Class I disposal facilities located near airports.*

The owners or operators of Class I disposal facilities located within 10,000 feet (3,048 meters) of any airport runway end used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway end used only by piston-type aircraft must include in the Narrative Description of the Facility and Operations Manual a demonstration that the unit does not pose a bird hazard to aircraft. The owners or operators proposing a new Class I disposal facility within a five-mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the appropriate Federal Aviation Administration (FAA) office.

The closest airport to the EWS Class II Landfill is the Camden Airport which is situated approximately 3.14 miles to the southwest.



2.29 FUTURE PLANNING

Rule 0400-11-01.04(2)(t) *Future Planning - All operators of Class I disposal facilities within the state of Tennessee shall file with the department, by May 1st of every year, an estimate of the remaining life of their site. This report shall include the original usable acreage of the site and the remaining unused portion at the time of the report. Where measuring facilities are available, an average monthly weight (or volume) estimate of the incoming waste shall be supplied. The department shall have final determination of the accuracy of the estimate. If the operator plans to operate a new landfill, a suitable site for the new facility shall be selected at least twelve months before the estimated date for expiration of the operating life of the existing facility, and as applicable, design and construction plans shall be submitted at least six months prior to the estimated date for expiration of the operating life of the existing facility to assure continued operation in an approved facility or site.*

The EWS Class II Landfill management has plans to provide the TDSWM with an annual remaining life report on or prior to May 1st of each year. In the event that the operator decides to operate a new landfill the site will be selected a minimum of 12 months prior to the expiration of the existing facility. Further, design and construction plans will be submitted at least six months prior to the estimated date for expiration of the operating life of the existing facility.

2.30 MONITORING AND RECORDS

Rule 0400-11-01.02(4)(a)9.(i) *Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.*

Individual sampling and analysis plans have been and will be prepared to sample the appropriate monitored activity.

Rule 0400-11-01.02(4)(a)9.(ii) *The permittee shall retain records of all required monitoring information. The permittee shall maintain records from all ground-water monitoring wells and associated ground-water surface elevations, for the active life of the facility, and for the post-closure care period as well. This period may be extended by request of the Commissioner at any time.*

EWS will maintain all records including groundwater monitoring information at the landfill office near the entrance to the site located off Omar Circle in Camden, Tennessee. Presently, it is proposed to retain the records in the storage room in the office during the post-closure period for access during sampling events.

Rule 0400-11-01.02(4)(a)9.(iii) *Records of monitoring information shall include:*

All monitor records will include the following information as specified in the TDSWM Rules and Regulations Governing Solid Waste Disposal:

- (I) The date, exact place, and time of sampling or measurements;
- (II) The individual(s) who performed the sampling or measurements;
- (III) The date(s) analyses were performed;
- (IV) The individual(s) who performed the analyses;
- (V) The analytical techniques or methods used (including equipment used); and
- (VI) The results of such analyses.



2.31 BASIS OF DESIGN

Equivalent Liner Design Introduction

The purpose of this narrative is to demonstrate equivalent environmental protection specific to the liner/leachate collection and final cover systems designed for the EWS Class II Landfill. The following paragraphs are taken from the TDSWM regulatory requirements for liner/leachate collection facilities at Class I Subtitle D landfills.

Rule 1200-01-07-.04

(4) Leachate Migration Control Standards

(a) Class I Disposal Facilities

1. *Such facilities must have a liner designed to function for the estimated life of the site and the post-closure care period. It shall be designed, constructed, and installed to ensure that the concentration values listed in Appendix III of this rule will not be exceeded in the uppermost aquifer at the relevant point of compliance. The liner must be:*
 - (i) *A composite liner consisting of two components; the upper component must consist of a minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1.0×10^{-7} cm/sec. FML components consisting of high density polyethylene (HDPE) shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component;*
2. *Underlying the liners shall be a geologic buffer which shall have:*
 - (i) *A maximum hydraulic conductivity of 1.0×10^{-5} cm/s and measures at least ten (10) feet from the bottom of the liner to the seasonal high water table of the uppermost unconfined aquifer or the top of the formation of a confined aquifer or*
 - (ii) *Have a maximum hydraulic conductivity of 1.0×10^{-6} cm/s and measures not less than five (5) feet from the bottom of the liner to the seasonal high water table of the uppermost unconfined aquifer or the top of the formation of a confined aquifer or*
3. *The compacted soil component of the composite liner shall be as follows:*
 - (i) *The compacted soil liners shall be free of sharp objects and be compatible with supporting soils and with leachate expected to be generated.*
 - (ii) *Admixtures (i.e., cement, bentonite, etc.) and special construction techniques may be used to improve the properties of the compacted soil liner provided that:*
 - (I) *In no case shall the liner thickness be less than two (2) feet;*
 - (II) *The modified liner shall achieve equivalent or superior performance to requirements of the minimum performance standard as described in this subparagraph.*
4. *Alternate liner designs may be used provided that:*
 - (i) *It is demonstrated to the satisfaction of the Commissioner that the liner design provides equivalent or superior performance to the minimum performance standard for a Class I facility as described in this subparagraph, and*
 - (ii) *When approving a design the Commissioner, shall consider at least the following factors:*
 - (I) *The hydrogeologic characteristics of the facility and surrounding land;*
 - (II) *The climatic factors of the area; and*
 - (III) *The volume and physical and chemical characteristics of the leachate.*



BASIS OF DESIGN FOR THE EWS CLASS II LANDFILL LINER SYSTEM

The primary approach considered when evaluating the equivalence of liner systems (Koerner and Daniel 1993) with the Subtitle D landfill regulations is stated as follows:

The "FLOW RATE EQUIVALENCE DEMONSTRATION APPROACH" is performed to demonstrate an alternate liner system's ability to limit the volume of flow through the liner system (i.e., how many gallons/acre/day) to a volume equal to or less than the TDSWM prescriptive composite liner system allows.

The following paragraphs provide an explanation and calculations used to evaluate the equivalency of the proposed alternate EWS liner/leachate collection system (LCS) with the prescriptive Subtitle D LCS using the aforementioned "flow rate" approach.

Flow Rate Equivalency Approach

To predict flow rate, an estimate of the liquid head acting on the liner system must be calculated. The actual volume of leachate flowing into the collector system can be estimated using the Hydrologic Evaluation of Landfill Performance (HELP) model. This, however, does not address leachate-collection system differences or specific regulatory requirements related to allowable head. For Subtitle D landfills, this regulatory head limit is 30 cm. Alternatively, the highest rate of leakage can be estimated by assuming that 30 cm of leachate is acting on a theoretical puncture of the geomembrane.

This represents the most conservative case, i.e., the most leakage, as compared to performing a HELP model analysis of the proposed landfill. Assuming good contact between the geomembrane and the compacted clay liner (CCL) or geocomposite clay liner (GCL), the leakage through the liner system is calculated as follows.

Flow Rate Equivalency Demonstration

Drawing 4 and Drawing 5 which are depicted in the following paragraphs illustrate the standard TDSWM prescriptive Subtitle D Class I liner/geologic buffer section. The section depicted provides a graphic of a typical composite liner with a 60 mil geomembrane overlying a fine grained CCL. This composite barrier has advantages over the use of either a geomembrane or CCL individually. The flow through a penetration in the geomembrane is reduced by the clay's presence and is calculated as follows (Giroud and Bonaparte, 1989):

Equation One (Geomembrane/Clay Liner):

$$Q = 0.21 h^{0.9} a^{0.1} K^{0.74}$$

Where;

h = the height of water standing on the geomembrane (m)

a = the area of the hole (m²)

K = the hydraulic conductivity of the underlying clay (m/sec).

Substituting 30 cm of leachate for (h) and a coefficient of hydraulic conductivity (K) of 1×10^{-7} cm/sec into the aforementioned equation results in a flow of 0.14 gallons/acre/day of leachate migration through the TDSWM prescriptive composite barrier and the typical Subtitle D section depicted both in Drawing 4 and Drawing 5. These drawings are presented on the following pages.



GIROUD'S EQUATION FOR FLOW THROUGH A GEOMEMBRANE , CCL

GEOMEMBRANE plus Compacted Clay Liner

$$Q = 0.21 a^{0.1} h^{0.9} K^{0.74}$$

HDPE Geomembrane

HDPE Geomembrane Liner Thickness = 60 mil = 0.00152 meters

where h = the height of the water standing on the geomembrane

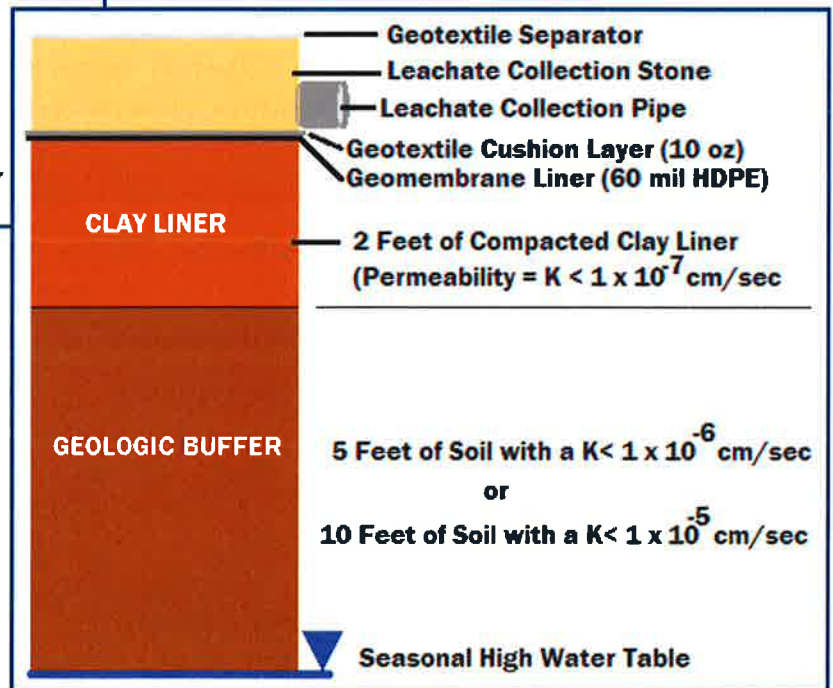
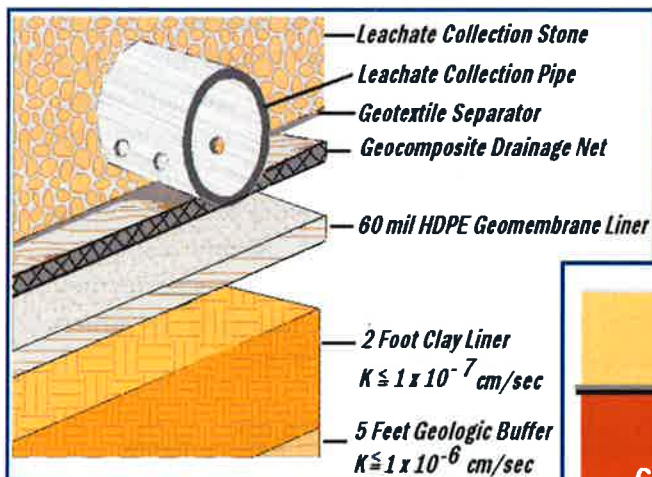
a = the area of the hole

K = the permeability of the underlying clay (m/sec)

HEIGHT WATER	AREA of HOLE	HYDRAULIC CONDUCTIVITY	NUMBER HOLES	FLOW PER HOLE	TOTAL FLOW
h	a	K		q	Q
(m)	(m ²)	(m/s)	# / acre	(m ³ /s)	(gal/acre/day)
0.305	0.00010	1.00E-09	1	6.28E-09	0.14

Note: The hydraulic conductivity used is the maximum rate specified by the Subtitle D regulations

Drawing 6 - Typical Subtitle D Landfill Liner System



Drawing 7 - Typical Subtitle D Liner System



Equation Two (Geomembrane plus Geocomposite Clay Liner (GCL)):

If a GCL is substituted for the CCL, the leakage through the composite liner is calculated as (Giroud, et al., 1992):

$$Q = 0.21 i_{ave} h^{0.9} a^{0.1} K^{0.74}$$

Where;

$$i_{ave} = 1 + Eh/t_{GCL}$$

t_{GCL} = thickness of GCL

$$E = 1 / [2 \ln (2R/b)]$$

$$R = 0.61 a^{0.05} h^{0.45} K^{-0.13}$$

b = diameter of hole (m)

h = the height of water standing on the geomembrane (m)

a = the area of the hole (m²)

K = the hydraulic conductivity of the underlying clay (m/sec).

Most commercial GCL materials sold in the United States use Wyoming sodium-type bentonite that develops a permeability of approximately 5×10^{-9} cm/sec when tested under the conditions specified in ASTM D 5887. This test uses an effective confining stress of only 5 psi and a head of 2 psi. Confining stresses in the real world application of GCLs far exceed those in the laboratory test so the permeability is considered conservative. The flow through a single 1 cm² hole in a geomembrane with 30 cm of water standing on a non-polyethylene backed GCL is 0.066 gallon/day which is an order of magnitude less than with the CCL composite. However, GCLs manufactured by CETCO with the polyethylene laminate develop even lower permeabilities approximating 5×10^{-10} cm/sec when tested under the conditions specified in ASTM D 5887. Actual long-term confining stresses acting on the GCL will be larger, resulting in lower GCL permeabilities. Recent testing by CETCO has revealed permeabilities of 5×10^{-11} cm/sec. The calculation provided below is performed on the proposed CTR liner/leachate collection system (see Drawing 1 and Drawing 2) which incorporates a GCL laminate material with a hydraulic conductivity of 5×10^{-10} cm/sec.

GIROUD'S EQUATION FOR FLOW THROUGH A GEOMEMBRANE , GCL

GEOMEMBRANE plus GEOCOMPOSITE CLAY LINER (GCL)

$$Q = 0.21 i_{ave} a^{0.1} h^{0.9} K^{0.74}$$

60 mil = 0.002 meters

where h = the height of the water standing on the geomembrane

a = the area of the hole

K = the permeability of the underlying clay (m/sec)

$$i_{ave} = 1 + Eh/t_{GCL}$$

t_{GCL} = thickness of GCL

$$E = 1/[2\ln(2R/b)]$$

b = diameter of hole (m)

$$R = 0.61a^{0.05}h^{0.45}K^{-0.13}$$

Height of Water (m)	Area of Hole (m ²)	Hydraulic Conductivity K (m/s)	GCL Thickness t_{GCL} (m)	Hole Diameter b (m)	E	R	i_{ave}	Number Holes	Flow Per Hole q (m ³ /s)	Total Flow Q (gal/acre /day)
0.300	0.0001000	5.00E-11	0.005	0.01	0.07	4.89	5.36	1	3.61E-09	0.082



Liner System Equivalency Summary

A review of the predicted leachate-flux rates reveals that the flux rate through a single puncture in the geomembrane/GCL composite (0.082 gal/acre/day) depicted in Drawing 4 and Drawing 5 is less than the flux rate through the regulatory geomembrane/CCL composite depicted in Drawing 3 (0.14 gal/acre/day) as calculated above. This means that for any equivalent quality of installation, i.e., number, size, and shape of penetrations per acre are identical, the alternative composite liner systems will have a lower rate of flux than the conventional CCL composite liner.

Therefore, the proposed liner/leachate collection system for the EWS Class II Landfill exceeds the TDSWM regulatory requirements.