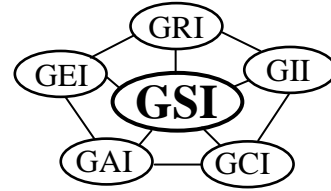


Geosynthetic Institute

475 Kedron Avenue
Folsom, PA 19033-1208 USA
TEL (610) 522-8440
FAX (610) 522-8441



GRI White Paper #17

**“Regulatory Status of Post-Closure Care of MSW Landfills
in the United States”**

by

Robert M. Koerner, PhD, PE, NAE
Director - Geosynthetic Institute
Emeritus Professor – Drexel University
Phone 610-522-8441
Fax 610-522-8442
robert.koerner@coe.drexel.edu

Jamie R. Koerner
Special Projects Coordinator
Geosynthetic Institute
Phone 610-522-8440
Fax 610-522-8442
jrkoerner@verizon.net

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GRI White Paper #17

Regulatory Status of Post-Closure Care of MSW Landfills in the United States

BACKGROUND

The U. S. Environmental Protection Agency's municipal solid waste (MSW) regulations contain the following criteria regarding final covers of landfills (RCRA, Title 40, Part 258.60).

- The cover's permeability (hydraulic conductivity) must be less than either 1×10^{-5} cm/sec or that of the liner beneath the waste mass.
- The cover must minimize infiltration.
- The cover must minimize erosion.
- It must be placed within one-year after the last waste is deposited.
- An alternative can be approved by the individual State's Solid Waste Director.

Additionally, Part 258.61 of the above U.S. EPA regulations relates to "post-closure care" of the landfill as follows:

- The post-closure care period is set at thirty (30) years.
- The cover must maintain its integrity and effectiveness.
- The owner/operator must maintain leachate collection.
- The owner/operator must monitor groundwater.
- The owner/operator must maintain and operate gas monitoring.

Lastly, Part 258.72 of the above U.S. EPA regulations addresses "financial assurance" of the closed landfill as follows:

- An estimated cost of maintenance is required by a "third-party" firm.

- It is based on the most expensive maintenance costs during the thirty years of post-closure.
- There is an annual adjustment for inflation.
- The owner must provide continuous coverage until released by demonstrating accordance with a post-closure plan made by an independent registered professional engineer or approved by the State Director.

RATIONAL FOR SURVEY

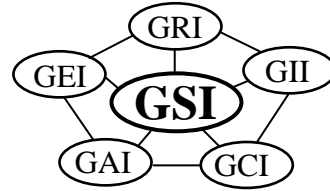
Back in the 1980's when these U.S. EPA RCRA regulations were promulgated, thirty (30) years seemed "forever" into the future. Today, thirty years is essentially "now" for many landfill sites. As such, it was suggested that GSI conduct a survey as to the individual states' positions on post-closure of MSW landfills. This white paper is the result of such a survey.

The survey was sent to all fifty state EPA agencies and we received responses from thirty-two (32) of them. It should be noted that two were unable to comply due to staffing issues and we suspect many of those not responding were constrained likewise. We sincerely thank all them in this regard and all have been sent a copy of this White Paper.

The survey form follows and the response by the various states is given in the Appendix.

Geosynthetic Institute

475 Kedron Avenue
Folsom, PA 19033-1208 USA
TEL (610) 522-8440
FAX (610) 522-8441



March 23, 2010

Re: Post Closure Care of Landfills

Dear EPA Regulator,

We have more than a few recent inquiries regarding post closure care of closed landfills within the customary thirty-year timeframe and beyond. As a result, we ask if you will fill out this brief survey. Of course, the responses will be tabulated and sent to you in due course.

I – Immediately after “topping-off” the landfill:

- (a) What is the time before final cover is placed? _____
- (b) Can an exposed geomembrane (FML) be used? _____
If so, for what time and under what conditions? _____

II – Within the thirty-year post closure time period:

- (a) Must a bond be posted? _____
- (b) For what time duration? _____
- (c) For what amount of money? _____
What special conditions? _____

III – Beyond the traditional thirty-year post closure time period:

- (a) Has your state addressed this issue? no _____
- (b) How far out in time is being considered? _____
- (c) Please describe status... _____

Thank you very much.

Jamie Koerner
Special Projects

Robert M. Koerner, Ph.D., P.E, NAE
Director – Geosynthetic Institute

COMMENTARY ON SURVEY RESULTS

Regarding the *time before final cover is placed* on a MSW landfill, Figure 1 shows the very large differences between the various states. The time to begin final cover installation is 30 days, with many at 180 and 360 days, after the last waste is placed. The longest is two years.

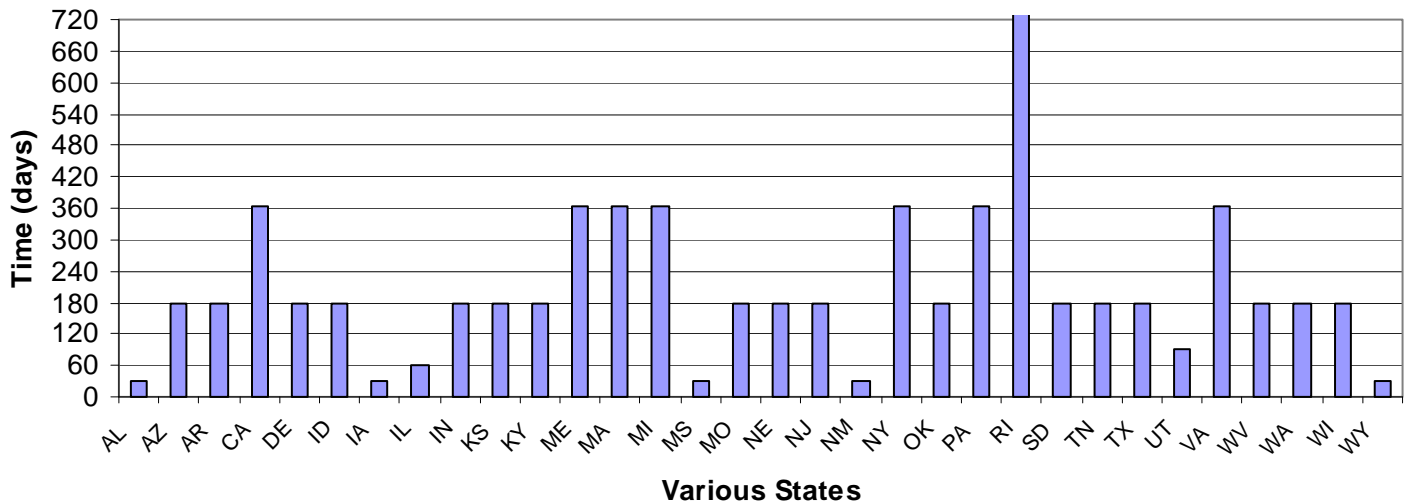


Figure 1 – Time to begin final cover installation on filled MSW landfills.

It is assumed that the final landfill cover is a multi-layered arrangement of both soil and geosynthetics. That said, with the advent of several geomembrane types having exposed durability of thirty years and longer, we asked the regulators about the allowable use of an *exposed geomembrane cover* for this thirty year period with the following responses.

- Yes – 7
- No – 16
- Conditionally – 9

Regarding the *necessity of an actual performance bond*, fifteen states required an insurance bond while seventeen required that the owner must instead demonstrate financial assurance. The time duration for such bonds is indeed thirty years for twenty-one states. Two states require forty years, and eight require a bond for the entire post-closure period. The *amount of the bond* varies from state-to-state (see the Appendix), but one state is quite specific at \$100,000 per acre adjusted for inflation.

Regarding the situation of *times beyond the initial thirty-year* post closure period, sixteen states are beginning to address the issue and several have a draft policy or are considering time extensions. Comments like “possibly indefinite”, until the waste is “stabilized”, or “as long as necessary” are also mentioned.

COMMENTARY GOING FORWARD

While the issue of final covers within the first thirty years of closure varies from state-to-state, beyond that time is just now beginning to weigh on the minds of state environmental agency personnel.

One point is certain, each state has their own opinion on the topic and this is certainly allowed from the perspective of the U.S. EPA. Also, in addition to the regulatory position, an owner (or owner’s representative) of a MSW landfill must investigate the situation since the financial implications are large. This longer than thirty years perspective also reflects on the degree of conservatism that the design engineer should use in crafting the site-specific closure plans and specifications. It will be most interesting to see how the future works out in this regard.

Appendix – State Agency Response to Survey

Post Closure Care of Landfills	AL	AZ	AR	CA	DE	ID	IA	IL	IN	KS	KY
What is the time before final cover is placed?	30 days	30 days – 180 days	30 days-180 days	Not specified max 1 year	180 days	30 days – 180 days	30 days	60 days	180 days	30 days – 180 days	Completed within 180 days
Can an exposed geomembrane (FML) be used?	No	No	Not banned	Yes	Yes	Yes	No	No	No	No	Not by regulation
If so, for what time and under what conditions?			Equivalent long-term performance	Until it needs to be replaced due to lack of function	Not considered final – after 10 yrs provide update	Depends on how implemented		Need site-specific adjusted standard		Variance - would have to support long-term integrity	Considered as an alternate design
Within the thirty-year post closure time period, must a bond be posted?	Yes	Not necessarily	Yes	Bond is one of the financial assurances	Bond is one of the financial assurances	Must demonstrate financial assurance	Not necessarily	Yes	Yes	Bond is one of several mechanisms accepted	Yes
For what time duration?	30 yrs	30 yrs – duration of post closure	Entire period of PC care	15 year fund	From initial permit to end of post closure care	30 yrs – but can be shortened or extended		Entire post-closure period	30 years	30 years with 5 year extensions or rolling 30 year	30 years
For what amount of money?	Depends on size of landfill	Varies	20% of annually adjusted cost estimate	Based on approved estimate of 30 years	Total cost	Estimate to carry out post closure plan over 30 yrs		No less than cost of post-closure care estimate	Depends on the landfill	Cover remaining post closure care costs	Approved closure estimate
Beyond the traditional thirty-year post closure period, has your state addressed this issue?	Yes	Yes	No	Yes	No	Idaho has no landfills with post-closure care for 30 yrs	No	Yes	Somewhat – have a draft policy	No	No
How far out in time is being considered?	Extended every permit renewal	Director can change post - closure period		15 year fund is maintained until waste poses no threat				Until landfill no longer poses a threat	As long as it takes to stabilize the landfill	Likely be extended based on site’s risk to health and environment	

Appendix (cont)

Post Closure Care of Landfills	ME	MA	MI	MS	MO *	NE	NJ	NM	NY	OK	PA
What is the time before final cover is placed?	1 year	90 days – 1 year if new lift is placed	30 days- 1 year if new lift is placed	30 days	90 days – 180 days	6 months	No min. time, temp cover used up to 180 days	30 days	1 year	90 days – 180 days	1 year
Can an exposed geomembrane (FML) be used?	Yes	No	No	No	No	No	No	No	Don't Prohibit	No	No
If so, for what time and under what conditions?	Intermediate cover			Require an erosion layer			Might allow on a case by case basis		Intermediate cover possible	Geonet drainage layer and 1' topsoil placed on top of FML	
Within the thirty-year post closure time period, must a bond be posted?	No, other mechanisms are accepted	Yes	Yes	Appropriate financial assurance mechanism	Financial assurance is required for entire period	Yes	DEP Escrow account	Bond is one of the allowed mechanisms	Financial assurance required	Must demonstrate financial assurance	Yes
For what time duration?		30 years	30 years	30 years	Entire post closure period	30 yrs	Closure and 30 yrs post - closure	Entire period of PC care	30 years	Minimum of 30 yrs	30 year calculation, then hold for 10 years
For what amount of money?		Based on post-closure monitoring estimate	Ave. is about \$100,000/acre; adjusted for inflation	For the estimated post-closure cost of the facility		Site specific	\$1/ton	Annual written estimate required	Varies by size and complexity - updated annually	Based on unit cost list provided in rules	Varies – based upon site
Beyond the traditional thirty-year post closure period, has your state addressed this issue?	Only to say post-closure period can be extended if necessary	No, but starting to be a topic of discussion	Yes	No	Yes	No	Only preliminary discussions	No	Some discussion on individual site basis	Allow post-closure period to be extended	No
How far out in time is being considered?			Require restrictive covenant for 50 years post closure		A “rolling” 30 year require is implemented in many facilities	Regulations - can change post-closure period	Possibly indefinite		Site-specific decision	Non-specified	Currently open ended

* response if for Hazardous Waste Landfill

Appendix – (cont)

Post Closure Care of Landfills	RI	SD	TN	TX	UT	VA	WV	WA	WI	WY
What is the time before final cover is placed?	2 years	30 days – 180 days	Completed within 180 days		90 days	30 days, unless additional waste placed, then it is 1 year	6 months	30 days – 180 days	30 days – 180 days (in accordance to plan)	Promptly
Can an exposed geomembrane (FML) be used?	No	Unknown	No	Yes	No	Yes	No	Yes	No	Don't prohibit
If so, for what time and under what conditions?		FML's rarely used, No request for use	Would consider under a variance	Alternative final cover		Filling to grades steeper than approved	Final cap is installed in its entirety	Needs to be equivalent in infiltration and protection		
Within the thirty-year post closure time period, must a bond be posted?	Yes	Bond is one of the allowed mechanisms	Yes	Yes or other financial insurance	Yes	A bond or other financial mechanisms	Yes	Yes, or other financial instrument	Financial responsibility is required	Yes
For what time duration?	30 years	30 years	30 years	Min of 30 years	Until stable or 30 years, whichever is longer	30 years	30 years	30 years	40 years	Entire post-closure period
For what amount of money?	Cover post-closure costs	Current amount for post closure X 30 years	Total post closure care cost plus inflation rate	Cover post-closure care cost estimate	none	Depends on the estimate	Based on closure, post-closure and corrective action estimates	Cover post-closure care, updated annually	Varies with size and complexity of site	3% of their estimated post-closure cost
Beyond the traditional thirty-year post closure period, has your state addressed this issue?	No	No	Yes	No	Yes	Some discussion, case by case basis	No	Yes	Yes	Yes – minimum of 30 years, but does not terminate automatically
How far out in time is being considered?			20 years	Case by case for exposed geomembranes	Until stable	Possibly five years, depending on circumstances		As long as necessary to protect environment	Landfill owners have perpetual responsibility	Facility specific decision