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Standard Guide for Evaluation and Selection of Alternative Daily Covers (ADCs) for Sanitary Landfills[1]

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1. Scope

1.1 This guide is intended to assist specifiers and end users in assessing the different options available for sanitary landfill daily cover materials described as alternative (non-soil) daily covers (ADCs). Traditional daily cover consists of at least 6 in. of soil spread over the working faces of sanitary landfills. Alternative systems are attractive to landfill operations in order to conserve landfill disposal space, among other reasons.

1.2 This guide assists in understanding different performance features of broad classifications of ADCs, and determining the extent and degree to which different ADCs are able to "control disease vectors, fires, odors, blowing litter, and scavenging, without presenting a threat to human health and the environment," as intended by United States Environmental Protection Agency (USEPA) regulations.

1.3 This guide is not intended to provide cost information regarding the various ADCs as a standard guide, it does not dictate a protocol for the practice and testing of ADCs, but rather provides valuable information, guidance, and recommendations to interested parties concerning the many options available.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4982 Test Methods for Flammability Potential Screening Analysis of Waste

E96/E96M Test Methods for Water Vapor Transmission of Materials

2.2 *Other Standards*[3]

Solid Waste Disposal Facility Criteria, USEPA, Technical Manual EPA 530-R-93-017, Cover Material Requirements, 40 CFR 258 21, Nov 1993

"The Use of Alternative Materials for Daily Cover at Municipal Solid Waste Landfills" EPA 600/R-93/172 PB 92-227197 July 1993

Alternative Daily Cover Regulations, California Environmental Protection Agency, Title 27, Division 2, Subdivision 1, Chapter 3, Subchapter 4, Article 2, Section 20680 CIWMB Daily Cover and Section 20690 CIWMB Alternative Daily Cover

3. Terminology

3.1 *alternative daily cover, n*—an alternative to the traditional 6-in. (15-cm) soil cover required by the USEPA for landfill working faces to "control disease vectors, fires, odors, blowing litter, and scavenging, without presenting a threat to human health and the environment."

3.2 *foam, n*—a synthetic material sprayed and combined with air to form closed-cell air pockets.

3.3 *geosynthetic, n*—a planar product manufactured from polymeric material used with soil, rock, earth, or other geotechnical engineering related material as an integral part of a man-made project, structure, or system.

3.4 *indigenous, adj*—native to a particular region.

3.5 *leachate, n*—contaminated water resulting from the combination of waste with precipitation.

3.6 *nonreusable, adj*—in geosynthetics, a fabric or film intended to be placed once and then disposed of, discarded, or left in place.

3.7 *reusable, adj*—in geosynthetics, a fabric or membrane material intended to be retrieved and installed more than once to perform the cover function.

3.8 *sanitary landfill, n*—a regulated disposal site for the deposition of commercial and household wastes.

3.9 *working face, n*—the area of a landfill in which waste is actively being deposited.

4. Significance and Use

4.1 This guide provides information which the regulator/permit officials, engineers, waste disposal operators, and others will find helpful to (*1*) understand and distinguish between the

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

many choices available; (*2*) understand the performance feature considerations for living up to EPA regulations for landfill daily covers, and (*3*) understand the various requirements and differences for putting these covers into practice at landfills.

5. Classifications of ADCs

5.1 *Foams*—Foam ADCs are applied to the working face of sanitary landfills using foam generation and application equipment specifically designed for that particular foam. Both hardening and non-hardening foams are currently available. These foam layers are effectively broken-up by the placement of additional wastes on the next operating day, and therefore does not interfere with fluid movement.

5.2 *Spray-On Slurries*—Most slurries are paper-based. The paper-based slurry ADCs are applied to the working face of sanitary landfills using standard hydro-seeding equipment. Certain types of slurries may require some modification of the hydro-seeding equipment. The slurries are allowed to harden to form a crust or shell over the working face. This covering is also broken-up by the placement of additional wastes on the next operating day.

5.3 *Geosynthetics:*

5.3.1 *Reusable*—Reusable geosynthetic ADCs consist of various types of fabric or plastic membranes that have either been developed or adapted for use as a daily cover material. Panels fabricated from these materials are placed over the working face at the end of the day, and retrieved prior to the start of the next operating day. Some landfills use special mechanized equipment to facilitate the placement and retrieval of panels.

5.3.2 *Nonreusable*—Nonreusable geosynthetic ADCs consist of less durable disposable films or fabrics, intended to be left in place without retrieval. Special equipment also exists to facilitate the placement and anchoring of these materials to cover the working face of landfills. The cover may contain pro-degradant additives to accelerate degradation within the waste to cease the interception of fluids.

5.4 *Indigenous Materials*—Indigenous ADCs consist of various types of locally available waste products for disposal (for example, sludges, ash, shredded tires, shredded green waste, pulverized construction and demolition debris, automobile recycling fluff, foundry sand, and so forth) placed onto the working face of landfills in a manner similar to soil cover. They often require physical or chemical modification for consistency and workability, and evaluation for the presence of potentially hazardous constituents. Processed indigenous materials such as treated sludges and asphalt-stabilized soils are available from manufacturers who are able to provide such products with consistent properties. Manufacturers should have the necessary supporting data available for review. Unprocessed ADCs can vary significantly with respect to physical and chemical characteristics and composition, depending on the particular source. In addition, suitability and acceptability are dependent on site-specific climatic and operational conditions and regulatory requirements. Because of the wide variety of processed and unprocessed indigenous materials, only key factors and considerations related to the use and performance of these materials can hereby be presented.

6. Features and Considerations (see Table 1)

6.1 *Summary*—See discussion for clarification.

6.2 *Discussion:*

6.2.1 *Methods of Application:*

6.2.1.1 Manifold-equipped units apply foam as equipment traverses the working face. Self-propelled units with manifold applicator applies foam as the unit backs down the working face. Handheld hose-equipped units apply foam as the crew walks next to or across the working face, or both.

6.2.1.2 Most slurries use truck-mounted or trailer-mounted standard hydro-seeding equipment with little or no modification. It is applied through the spray tower located on the platform of the hydro-seeding equipment using appropriate nozzles. The use of a hand-held hose may be suitable for certain applications. In at least one case, a specially designed storage unit and mobile applicator is required by the manufacturer. Care must be taken to avoid skimping on the thickness of application.

6.2.1.3 At some sites, ancillary equipment (for example, tow bar, lifting bar, reel, or rollers) are used to facilitate placement of geosynthetic panels (both reusable and nonreusable) and reduce wear and tear. Tires, sandbags, or ballast soil are placed along the edges to anchor the panels.

6.2.1.4 The preparation of the working face prior to placement of a geosynthetic panel and the care taken in placement of the panel can have a significant impact on the effective life of a panel. Consequently, operators should ensure that the working face is properly compacted to provide a smooth surface, and that protruding objects which could damage panels are eliminated. In addition, during placement of panels, measures should be taken to prevent unnecessary stress on the material and minimize snagging while dragging the panel across the working face.

6.2.1.5 Most indigenous materials may be spread and compacted in the same manner as traditional sands and gravels. Dozers and front-end loaders are usually used to spread the material. Compaction can be accomplished with single-drum rollers, dozer tracks, or loader tires, or combination thereof.

6.2.2 *Post-Application Requirements :*

6.2.2.1 When equipment is used to apply ADCs there is clean-up and maintenance. Cleanup often takes place by hosing with water or compressed air, or both.

6.2.2.2 Many ADCs have no other post-application requirements but are simply broken up by the placement of wastes on subsequent days.

6.2.2.3 Reusable geosynthetic panels are normally removed from the working face prior to the start of the next operating day. Hence, the necessary personnel and equipment have to be available, and sufficient time allowed, for this activity to be performed prior to the arrival and disposal of waste at the working face. This may require modification of the work schedule for site personnel. Furthermore, depending on the season of the year and operating hours at the site, panel retrieval may have to be performed while it is still dark, requiring extra precaution against accidents or injury.

6.2.2.4 Retrieval of geosynthetic panels is accomplished by reversal of the procedures used to place them. Anchoring materials are first removed and stockpiled near the working

TABLE 1 Features and Considerations (see Section 6)

Feature/Consideration	Foams	Spray-on Slurries	Reusable Geosynthetics	Nonreusable Geosynthetics	Indigenous Materials
Methods of Application	Self propelled or towed equipment with manifold distribution, or truck mounted with handheld hose	Truck mounted or trailer mounted hydro-seeding equipment w/spray tower and nozzle.	Manually, towed with compactors, or spread w/specialty wide panel deployment equipment	Manually, or spread w/specialty unwinder attached to dozer/ compactor and placing ballast soil to anchor	Most often spread with dozers as with traditionally daily cover. Varied.
Post-Application Requirements a) Equipment Clean-up/ Maintenance	High	Low	Low if placed w/equipment	Low if placed w/equipment	Low
b) Remove Cover?	No	No	Yes	No	No
Application in Different Climates a) Rain	Some not recommended for use during rain. Others can withstand drizzle/light rainfall or light to moderate rainfall.	Can apply in light rain. Once cured, can withstand moderate to heavy rainfall.	Some have no constraints while others can absorb water, increasing panel weight	Rain tends to help anchor cover	Generally OK, but sludge and mulch are unsuitably applied in rain due to excessive run-off
b) Wind	Can apply in 20–40 mph winds. Adheres to working face.	Can generally apply in winds up to 45 mph	Depends on ballast mechanism. High winds can pick and destroy.	Increase ballast material. Small panels, disposable nature reduce impact of wind damage	Most forms OK but yard waste and auto fluff are excessively effected
c) Freezing Temp/Snow	Can apply under freezing conditions, but equipment must be protected. Some equipment has freeze protection system.	Can apply in freezing temperatures or snow	Some have no constraints. In others, if moisture has been absorbed, panels can freeze, making their placement and retrieval more difficult.	Shift to different ballast material w/no moisture content (eg crushed glass instead of sand)	Generally no Constraints. Sludge and mulch have some difficulty in snow
d) Hot Weather	No constraints	No constraints	No constraints	No constraints	Dust generation in many cases (i.e. unprocessed materials)
Disease Vector Control? (Access by insects, vermin, pathogen contact.)	Discourages insects and birds from landing; rodents from digging	If proper thickness, discourages insects and birds from landing; rodents from digging	Can completely cover waste so as not to attract; Careful for pathogens in human rehandling	Can completely cover waste so as not to attract	Must be applied at sufficient thickness
Fire Control a) Combustible?	a) Most no, some yes	a)Some no, some yes. Materials should be tested per ASTM D4982.	a) Yes	a) Yes	a) Some yes, others no
b) Barrier to air/gas movement?	Low	Medium	High	High	Low to High
Odor and Air Emission Control?	Uniform coverage is key.	Uniform coverage of sufficient thickness is key. Material can be tested by ASTM E96/E96M permeation	Trap odors and other emissions while in place; release odors and other emissions when removed; can be tested by ASTM E96/E96M permeation	Trap odors and other emissions; can be tested by ASTM E96/E96M permeation	Dependent on thickness of application and compaction. Dredged materials can themselves be odorous.
Dust Control?	Yes	Yes	Yes	Yes	Many unprocessed materials generate dust
Blowing Litter Control?	Yes	Yes	Yes	Yes	Auto fluff among others unprocessed materials can generate litter
Water Infiltration Control (sheds rainwater)	Certain foams can shed water during moderate rains, once cured.	Hardening slurries shed water.	Shed rainwater very effectively when in place; allows infiltration when removed	Shed rainwater effectively for several layers of cover	Many processed materials can shed water once compacted. Others are too permeable to shed much water.
Landfill leachate and gas migration interference?	No interference.	No interference.	No interference; unless left or buried in place.	No interference with degradable material (containing a prodegradant); will interfere if non-degradable film	Ash-based wastes, dredged soils, clayey soils and cementitious foundry products can all create intervening layers