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**ALTERNATIVE DAILY COVER M  
FOR MUNICIPAL SOLID WASTE I**

**RCRA Implementation  
Zone II  
Regions VI-X**



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In Association with:  
NUS Corporation  
ICF Technology, Inc.  
Versar, Inc.  
Ecology & Environment, Inc.  
HydroGeoLogic, Inc.

**ALTERNATIVE DAILY COVER MATERIALS  
FOR MUNICIPAL SOLID WASTE LANDFILLS**

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## 1.0 INTRODUCTION

This report presents the findings of an information search for materials that can be used instead of the 6-inch-thick layer of soil currently used as daily cover at municipal solid waste landfills (MSWLF). Alternative daily cover materials (ADCM) are being used at landfills that lack adequate soil to provide a 6-inch-thick daily cover or at landfills where operators wish to save landfill space. The information search was conducted by PRC Environmental Management, Inc. (PRC), for the U. S. Environmental Protection Agency (EPA) Region 9, under Contract No. 68-W9-0041 and Work Assignment No. R2919. This EPA project is intended to provide information on ADCMs to government agencies and operators of landfills.

The Code of Federal Regulations (CFR) mandate that solid waste disposed of in a MSWLF be covered with 6 inches of soil at the end of each working day or at more frequent intervals, if necessary [see 40 CFR Subparts 257.3-6 (a)<sup>1</sup>, 257.3-6 (c) 4, and 258.21 (a)]. The daily cover is intended to control or prevent disease vectors, fire, odor, blowing litter, and scavenging. The federal regulations also allow for the use of ADCMs at MSWLFs [see 40 CFR Subpart 258.21 (b)], if the ADCM is approved by the director of a state regulatory agency that has an EPA-approved MSWLF permit program.

The information presented in this report does not constitute EPA's endorsement or recommendation of any product, nor is it intended as an overall ranking of ADCMs. Likewise, the discussion presented here does not imply EPA's regulatory approval of any ADCM. ADCMs must be approved by state regulatory agencies, and those agencies should be consulted to obtain approval to use ADCMs. In addition, the information in this report neither addresses the use of ADCMs as an intermediate or final cover, nor does it discuss their use at disposal facilities other than MSWLFs. Performance of some ADCMs for a period longer than 1 day is mentioned in this report only for comparative purposes. Federal regulations require the daily application of a cover. Appropriate regulatory agencies should be consulted regarding use of an ADCM for periods longer than 1 day, such as for intermediate cover.

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<sup>1</sup>— Regulations provided by 40 CFR Subparts 257.3-6 (a) and 257.3-6 (c) 4 would be applicable only through October 9, 1993; after that regulations provided by 40 CFR Subpart 258.21 would become effective.

Because published information on ADCMs is limited, the information presented in this report is based primarily on interviews with ADCM users and manufacturers and regulatory personnel familiar with ADCMs. ADCMs reviewed in this report are divided into two categories: indigenous and commercial. Indigenous ADCMs generally consist of materials that are conventionally disposed of as wastes at MSWLFs; they are developed by individual landfill operators and are not commercially available. Commercial ADCMs are developed and manufactured by businesses that market and sell them to landfill operators. This report also discusses the disposal of shredded waste as an option to daily cover. Shredded waste is not an ADCM, but shredding waste before its disposal addresses many of the problems necessitating the use of a daily cover.

This section of the report discusses the functions of a daily cover; the problems associated with conventional, soil daily cover; the benefits of ADCMs; and the regulations that apply to ADCMs. Section 2.0 describes ADCMs developed by individual landfill operators (indigenous ADCM). Section 3.0 describes commercial ADCMs. Section 4.0 describes disposing of shredded waste as an alternative to daily cover. Section 5.0 summarizes the information gathered under this project and recommendations for future investigations. Section 6.0 presents a list of ADCM-related publications identified under this project, and Section 7.0 lists references cited in this report. The names, addresses, and phone numbers of selected people who have experience with each ADCM are presented in Appendix A.

## **1.1           FUNCTIONS OF A DAILY COVER**

The regulations in 40 CFR Subpart 258.21 (a) specify that a daily cover should control or prevent disease vectors, fire, odor, blowing litter, and scavenging. A daily cover is also generally expected to control dust, improve general site aesthetics, and act as a moisture barrier to prevent precipitation from infiltrating the waste. These functions are discussed below.

### **1.1.1 Functions Specified in Federal Regulations**

The following functions of a daily cover are specified in federal regulations:

- **Disease Vector Control**

Disease vectors are animals or insects that help spread diseases. Common disease vectors include birds, rodents, and mosquitos. The daily cover should control disease vectors by covering the waste that attracts them and by minimizing insect breeding areas at MSWLFs.

- **Fire Prevention**

The daily cover should be nonflammable and should minimize potential fire hazards by (1) limiting the movement of atmospheric oxygen into the waste and (2) impeding the spread of fire in the landfill.

- **Odor Control**

Decaying organic waste in MSWLFs produces foul odors that may escape to the atmosphere from the uncovered surface of the waste. The daily cover should control odors by preventing them from escaping to the atmosphere.

- **Blowing Litter Control**

Waste disposed of at MSWLFs includes paper, plastic sheets, and rags that may be picked up and carried away by the wind. The daily cover should control blowing litter by keeping it in place and protecting it from the wind.

- **Scavenging Control**

Scavenging animals, such as pigs, dogs, and birds, may be attracted to waste disposed of at MSWLFs. Scavenging animals seeking food and shelter at MSWLFs may be a nuisance or hazard to residents and activities in the general area of the landfill. For example, birds populating areas near MSWLFs are often a hazard to air traffic, especially when birds flock together

over the landfill. The daily cover should control scavenging by protecting waste from animals seeking food and shelter.

### **1.1.2 Other Expected Functions**

Controlling dust, improving site aesthetics, and providing a moisture barrier are other functions a daily cover is generally expected to perform. These functions are discussed below.

- **Dust Control**

Some soil, ash, and other fine-sized waste disposed of at MSWLFs may create dust-related problems during high winds. Therefore, the daily cover should control dust by protecting such wastes from being dispersed by the wind.

- **Site Aesthetics**

Different shapes, sizes, and colors of wastes disposed of at MSWLFs may produce an unsightly appearance at active portions of landfills. The daily cover should improve the general aesthetics of the landfill by providing a uniform color and surface over the waste.

- **Moisture Barrier**

Moisture infiltrating through uncovered waste at MSWLFs may generate leachate that can contaminate ground water if the landfill leaks. Therefore, the daily cover should provide a barrier to minimize the infiltration of moisture into the waste.

## **1.2 PROBLEMS WITH THE CONVENTIONAL SOIL DAILY COVER**

Soil is the most common daily cover material. When used properly, it performs all functions of the daily cover very well. Most landfills use native soil available on site. However, after more than a decade of regular use, the availability of soil has decreased at many landfills. Some landfills now purchase and transport soil from off-site sources, increasing the cost of operation. In areas with



limited access to soil suitable for use as daily cover, such as islands, transporting suitable soil from off-site sources is too costly.

Even where soil is readily available, its use for daily cover consumes landfill space that could be used for waste disposal. Weather conditions can also complicate the use of soil as daily cover. A daily cover of soil can create dust problems in dry and windy weather. After heavy rains, soil cover may become muddy, interrupting further waste disposal over itself until it dries. Therefore, even if soil is readily available without cost to the landfill operator, its use as a daily cover has an indirect cost in terms of reducing space available for waste disposal and suspending operations due to unworkable conditions at the working face.

### **1.3 POTENTIAL BENEFITS OFFERED BY ADCMS**

The use of ADCMs helps landfill operators overcome cost and availability problems associated with the use of conventional, soil daily cover. Indigenous ADCMs are generally available to landfill operators at no cost. Using some indigenous materials may actually generate revenue when a landfill operator charges a fee to accept a waste and then uses this waste as an ADCM. Commercial ADCMs must be purchased by landfill operators at costs that are generally competitive or lower than the cost of soil purchased for use as daily cover material.

Shredding waste before disposal is another alternative to the conventional, soil daily cover. Shredded waste is not an ADCM, but the disposal of shredded waste addresses many of the problems necessitating the use of daily cover, thereby potentially eliminating the need for daily cover.

A conventional, soil daily cover takes up at least 6 inches of landfill space each day. ADCMs, however, generally consume much less than 6 inches of landfill space, often consuming no additional space. Indigenous ADCMs eliminate consumption of any landfill space for daily cover, because they form a daily cover when disposed of in a planned way. Reusable commercial ADCMs, such as Fabrisoil™ and Typar® Daily Cover, do not consume any landfill space on a daily basis. Commercial ADCMs that cannot be reused, such as SaniFoam™ and ConCover™, consume only negligible landfill space. In short, ADCMs may cost less than a conventional, soil daily cover.

ADCMs save landfill space, thereby extending the life of the landfill, and increase revenue by increasing the landfill volume available for waste disposal.

#### **1.4 REGULATIONS APPLICABLE TO ADCMS**

In addition to federal regulations provided in 40 CFR Subpart 258.21, state regulations may also apply to the use of ADCMs. Such state regulations vary widely in their nature and scope. For example, some states, such as Pennsylvania, allow the use of ADCMs only on case-by-case basis, with provision for immediate action if a problem is found with a permitted ADCM (Dexter, 1991). California's Integrated Waste Management Board (CIWMB) has established guidelines and is currently developing a demonstration program to evaluate ADCMs (Smith, 1991).

Regulations provided in 40 CFR Subpart 258.21 were promulgated in October 1991; as a result, some states may soon revise or modify their regulations pertaining to ADCMs. Therefore, MSWLF operators should consult appropriate state agencies for the latest information on ADCM regulations.

Except under certain conditions, ADCMs discussed in this report satisfactorily perform all functions of the daily cover discussed in Section 1.1. The discussion of each ADCM in Sections 2.0 and 3.0 highlights its cost, possible difficulty in its application, and any special equipment needed for its preparation and application.

### **2.0 INDIGENOUS MATERIALS**

All indigenous ADCMs reviewed in this report are based on materials that are conventionally disposed of as wastes in MSWLFs. Such materials include the following:

- Ash from municipal waste incinerators and utility companies
- Automobile recycling fluff
- Compost-based material
- Petroleum-contaminated soil
- Material dredged from water bodies

- Foundry sand
- Green waste
- Sludge from municipal wastewater treatment plants
- Other indigenous materials

Using indigenous materials for daily cover avoids the availability- and cost-related problems associated with conventional, soil daily cover. More importantly, using indigenous ADCMs is the most efficient use of the landfill space, because indigenous materials are not only disposed of as waste but also form the daily cover.

All indigenous materials are applied with conventional earth-moving equipment available at most landfills, such as front-end loaders and scrapers. Therefore, application equipment and costs are not included in the following discussion of indigenous ADCMs.

## **2.1 ASH-BASED MATERIAL**

Several landfills in the United States and other countries, including the United Kingdom, use ash-based materials for daily cover. Bottom and fly ash from sources such as utility companies and municipal waste incinerators are used for daily cover, either separately or in combination. In addition, ash can be combined with sludge, soil, and lime to improve the consistency and workability of the daily cover. The thickness of ash-based daily cover varies from 3 to 6 inches, depending primarily on local regulations and the availability of ash. Some ash that contains hazardous contaminants, such as heavy metals, may be regulated as hazardous waste and barred from disposal at MSWLFs and cannot be used as an ADCM.

Almost all landfills using ash for daily cover receive the ash in a damp condition. Ash performs very well as daily cover as long as it remains damp. When ash is dry, however, it creates the potential for a number of problems. Once it dries, ash-based daily cover becomes very difficult to handle and can create dust-related problems in moderate to high winds. In addition, birds and other scavengers can pick through the dry ash-based cover. Wood and coal ash may contain partially burned material that may sustain a landfill-fire, especially if the fire starts when the ash is dry. For such reasons, some landfill operators use water sprinklers to keep the ash moist. Also, in warm

temperatures, fly ash-based material is not used over weekends and holidays because it may dry out and lose its effectiveness as a daily cover.

Ash-based ADCMs also cause problems when they are too wet. Ash-based materials do not perform well in heavy rains, because they may be washed away. Slope failure can also be caused by some ash that becomes slippery when very wet. In addition, ash with a high moisture content hinders the movement of heavy equipment.

For most landfills, using ash for daily cover costs nothing, and it is mutually beneficial to both the landfill operators and the ash-producing facilities. Some landfills charge a fee for accepting the ash, increasing their revenue when ash-based materials are used for daily cover. However, the current economics of ash-based daily cover may soon change in some areas, where ash is finding economically more beneficial uses, such as in manufacturing cement.

## **2.2 AUTOMOBILE RECYCLING FLUFF**

Automobile recycling fluff (ARF) is obtained by shredding nonmetallic automobile components. ARF primarily consists of pieces of foam, rubber, and plastic from automobile upholstery and insulation.

ARF is usually delivered to landfills in a moist condition and, as with ash, it performs well as an ADCM until it dries. However, unlike ash, ARF performs well in wet weather for the following reasons:

- Unlike wet soil or ash, ARF does not become slippery when wet, and wet ARF supports the movement of heavy equipment at the landfill.
- Wet ARF is easier to handle than wet soil because, unlike wet soil, it does not form mud.
- ARF with a high moisture content helps prevent landfill fires and erosion of daily cover by high winds.

In heavy rains, however, water can infiltrate through the ARF, possibly generating leachate. Other problems associated with the use of ARF as an ADCM include the following:

- Dry ARF may be flammable because of its foam and plastic contents.
- Small, dry pieces of foam may be blown away by winds.
- Small pieces of foam in ARF may catch on the application equipment, which may then disperse them to areas outside of the working face.
- Sharp objects in ARF may increase the wear on tires of equipment used on the working face.

Automobile recyclers often put home appliances in the trunk of automobiles before crushing and shredding them. In such cases, any polychlorinated biphenyls (PCB) in the appliances may contaminate the ARF. Asbestos in the brake pads of some automobiles may also contaminate the ARF. In addition, the ARF may be contaminated with lead or other hazardous substances in automobile components. Contaminated ARF may be regulated as a hazardous waste and barred from disposal at MSWLFs. Such contaminated ARF cannot be used as an ADCM.

## **2.3 COMPOST-BASED MATERIAL**

Compost is satisfactorily used as an ADCM either by itself or in combination with sewage sludge and wood waste. Like ash- and ARF-based ADCMs, compost-based ADCMs perform well only in damp conditions. Dry compost-based materials may create dust-related problems or help sustain landfill fires.

The cost of compost-based ADCMs may depend on several factors, including the following:

- Sorting of waste before composting
- Method of composting
- Distance of composting facility from the landfill
- Cost of purchasing compost from external sources, if required.

The limited availability of compost may restrict its regular use as an ADCM.

## **2.4 PETROLEUM-CONTAMINATED SOIL**

Petroleum-contaminated soil from sources such as gasoline stations is used as an ADCM at some landfills. It performs as a conventional, soil daily cover. Depending on the types and concentrations of contaminants in the soil, it may be regulated as a hazardous waste and barred from disposal at MSWLFs. Such contaminated soil cannot be used as an ADCM.

## **2.5 DREDGED MATERIAL**

Material obtained by dredging surface water bodies is drained for 10 to 48 hours before it is used as an ADCM. It performs well as an ADCM, except if it is not conditioned well before use or is used under extreme weather conditions. Dredged material may produce odors if it is obtained from benthic deposits and used without sufficient drying. In addition, it may attract birds and other scavengers if it contains worms and insects.

In wet weather, dredged material does not perform well as an ADCM, because it becomes slippery after absorbing excessive water. Very wet dredged material hinders vehicular traffic over the landfill and may cause slope failure. Very dry dredged material may create dust problems in heavy winds.

Using dredged material as an ADCM may be costly if it is normally marketed for other uses. For example, dredged material is often marketed as a soil conditioner, in which case the cost of using it as an ADCM would be prohibitively high.

Dredging itself may cause environmental degradation, and dredging operations may be regulated. If the dredged material is contaminated with hazardous constituents, it may be regulated as a hazardous waste and barred from disposal at MSWLFs. Such dredged material cannot be used as an ADCM.

## **2.6**

### **FOUNDRY SAND**

Foundry sand is generated when a foundry discards used dies. Some landfills use it successfully as an ADCM, and it performs well except under extreme weather conditions. Heavy rains may erode foundry sand and allow precipitation to infiltrate through the cover to the waste, possibly generating leachate. Warm temperatures and high winds may disperse the foundry sand, creating dust problems. Foundry sand is not regularly used as an ADCM because of its limited availability. Depending on the metals used for casting and their concentrations in the foundry sand, as well as the binder used to maintain the die's form, foundry sand may be regulated as a hazardous waste and barred from disposal at MSWLFs. Such foundry sand cannot be used as an ADCM.

## **2.7**

### **GREEN WASTE**

Green waste, such as lawn clippings, leaves, and tree branches, is used as an ADCM after grinding it and shredding it to particles that are under 5 inches in size. Green waste meets the requirements for a daily cover except under extreme weather conditions. Heavy rains may erode the cover material and allow precipitation to infiltrate through the cover to the waste, possibly generating leachate. High temperatures may dry out green waste, making it susceptible to fires. In addition, one landfill operator reported that using green waste as an ADCM increased the fly count in hot weather; however, this observation was not supported by comments from other operators. Birds tend to avoid green waste, perhaps because it emits odors. An advantage of using green waste is that it can be tightly compacted after grinding, thereby reducing the space required for its disposal.

Most landfills charge a fee for accepting green waste, and the final cost of using it for daily cover depends on the following factors:

- Fee charged for accepting green waste
- Cost of sorting green waste
- Cost of grinding green waste

Green waste is commonly used in southern California, primarily because of the infrequent precipitation in the area. In areas with heavy rains, it may not be possible to use green waste as

ADCM, because it is much more permeable than soil. California's Assembly Bill No. 939 (AB 939) provides additional incentives for the future use of green waste as an ADCM. Under AB 939, landfills using green waste as a daily cover may be entitled to a credit for waste recycling (Coke, 1991).

## **2.8 SLUDGE-BASED MATERIAL**

Several landfills treat sludge with lime and ash or mix it with soil before using the sludge mixture for daily cover. Currently, the BKK landfill in West Covina, California, uses a 1-foot thick layer of sludge-based material as a foundation for a 1-foot thick soil layer that serves as daily cover. At the BKK landfill, sewage sludge is mixed with sodium silicate, fly ash, and cement. The mixture is allowed to cure for 2 hours before being used as a foundation for the daily cover. The heat released during the curing process reduces the pathogens and odors in the sewage sludge (Wackerly, 1991). Cured material is applied as a foundation for daily cover and compacted by dozers.

A detailed study at the BKK landfill found treated sewage sludge-based material to be an acceptable alternative to a conventional, soil daily cover (GeoResearch, 1990). As a result of the study, CIWMB approved a 1-year demonstration of treated sludge as an ADCM at BKK landfill.

Federal regulations, specifically 40 CFR Section 257, may apply to the use of sludge-based material for daily cover. In addition, state and local regulations may also apply to the use of sludge-based ADCM.

## **2.9 OTHER INDIGENOUS MATERIALS**

Wastes other than those mentioned above have also been used or considered for use as ADCMs. A few examples of such other wastes are presented here for illustrative purposes. Available information regarding the use and performance of these ADCMs is limited.

Rice husk is used for daily cover at some landfills in Japan. It performs satisfactorily only in damp weather and poses a fire hazard in dry weather. Construction and demolition debris was once used at a landfill in Florida; however, its use as an ADCM is currently not permitted in Florida



(Lurix, 1991). A landfill in Virginia uses shredded automobile tires for daily cover (Watson, 1992). Other possible ADCMs include discarded carpets and grit from municipal wastewater treatment plants.

### **3.0 COMMERCIAL PRODUCTS**

Commercially developed ADCMs have been on the market for nearly a decade. Currently available commercial ADCMs include foam-type, geosynthetic, and slurry-type products. Some of the commercial ADCMs require specially designed application equipment, while others use equipment generally available at all landfills. Commercial ADCMs and the application equipment for them are marketed directly by manufacturers as well as through other outlets.

Commercial ADCMs identified in this project are discussed below; other products may also be available. The discussion below includes available information on product description, preparation and special equipment needs, costs, and performance.

The material costs presented below are the average cost experienced by users when the ADCM is applied according to the manufacturer's recommendations. Actual material costs experienced by individual users may vary, depending on the degree to which waste is compacted before the ADCM is applied. Manufacturers assume waste is well compacted and the surface of the landfill is fairly smooth and uniform. In actual practice, the surface of the landfill may be very rough and irregular, depending on the nature of the waste and its degree of compaction, both of which may vary widely.

The performance of ADCMs presented below is primarily based on information obtained from users of ADCMs. However, some ADCMs discussed below, such as TopCoat™, have only recently been made available to the commercial markets, and users' opinions on their performance was not available. The performance- and cost-related information presented below for such ADCMs is based on the information provided by the manufacturers.

The order of the following discussion in no way implies a ranking of the products.

### **3.1 FOAM-TYPE PRODUCTS**

PRC identified the following foam-type products:

- AC-645 and AC-900 foams, from Rusmar Inc. in West Chester, Pennsylvania
- SaniFoam™ and Vapor Suppressing Foam, from 3M in St. Paul, Minnesota. Several years ago, 3M also test-marketed another foam-type ADCM called Foammat which is no longer marketed (Spoo, 1991).
- TerraFoam™, from Chubb National Foam in Exton, Pennsylvania
- TopCoat™, from Central Fiber Corporation in Wellsville, Kansas

AC-645, SaniFoam™, TerraFoam™, and TopCoat™ are designed for use at sanitary landfills. AC-900 and Vapor Suppressing Foam are designed for use at hazardous waste landfills and, therefore, were not included in this review. Foam-type ADCMs used at MSWLFs are discussed below.

#### **3.1.1 AC-645**

AC-645 is a single component, surfactant-based foam. The product is supplied in concentrated form and is diluted with water before application. Rusmar Inc., recommends applying a 3-inch-thick layer of the material for effective performance. According to the manufacturer, the product has no shelf-life restriction, but it requires a heated storage unit in freezing temperatures. The color of the product is usually white, but it can be varied.

AC-645 is diluted with water and stored in a storage unit before being transferred to the application equipment. The application equipment, called the Pneumatic Foam Unit (PFU), is also sold by Rusmar Inc. The PFU does not require cleaning after each use.

The cost of the material is reported to be between 6 and 7 cents per square foot (¢/ft<sup>2</sup>), and the PFUs cost from \$44,600 to \$225,000 for each unit. The smallest PFU can cover the working face of a landfill at a rate of 12,000 to 15,000 ft<sup>2</sup> in 40 to 60 minutes. The largest PFU can cover 30,000 to 35,000 ft<sup>2</sup> in 40 to 60 minutes.

Users of AC-645 expressed satisfaction with the performance of AC-645 and its application equipment. According to its users, AC-645 performs well from 8 to 20 hours, depending on the weather. Light rains do not affect AC-645, but even moderate rains can wash it away from the working face. High winds may dry and blow the foam from the working face. One of the users reported not using AC-645 if the chance of rain is greater than 30 percent or if the wind speed is expected to exceed 25 miles per hour. AC-645 is also reported to perform well in freezing temperatures and in very hot weather.

### **3.1.2 SaniFoam™**

SaniFoam™, manufactured by 3M, is an improved version of SaniBlanket, which was manufactured by SaniFoam™, Inc., of Costa Mesa, California. SaniFoam™, Inc., was acquired by 3M, which now manufactures and markets the improved version. 3M currently markets two ADCMs: SaniFoam™ and Vapor Suppressing Foam. Vapor Suppressing Foam is designed for use at hazardous waste landfills and is not discussed in this report.

SaniFoam™ has two components: a foaming agent and a foam stabilizer. The two components are mixed together and diluted with water according to the manufacturer's instructions for the application equipment. Compressed air is used to apply the final mixture to the working face. 3M recommends applying Sanifoam in a 1- to 2-inch-thick layer, which sets in about 1 minute. When set, SaniFoam™ forms a white daily cover that is somewhat softer than styrofoam. Unmixed, SaniFoam™ stabilizer has a shelf-life of approximately 90 days and should be stored in a heated area during cold weather. SaniFoam™ foaming agent has no shelf-life restriction.

SaniFoam™ requires special application equipment sold by 3M. Prior to application, the foaming agent is diluted with water within the tank in the application equipment. The application equipment ranges from 200 to 1,000 gallons in size. The nozzles used to spray the foam require cleaning after each use, and the equipment should be flushed with hot water. According to 3M, the equipment must be flushed to prevent the foam stabilizer from hardening inside the equipment. Mixing of SaniFoam™ components and equipment flushing are done automatically by the equipment.

The reported cost of SaniFoam™ is approximately 10¢/ft². The application equipment costs between \$43,000 and \$128,000 per unit, depending on the unit's size. The application equipment is capable of applying the foam to an area of 10,000 ft² in approximately 1 hour.

SaniFoam™ users expressed satisfaction with its performance. According to its users, SaniFoam™ can be applied in light to moderate rains and, once hardened, is unaffected by rains; it can also sustain high winds. Users find SaniFoam™ performs well from 18 hours to 14 days, after which it may crack or disintegrate depending on its applied thickness and exposure to sunlight.

Users of SaniFoam™ application equipment expressed mixed opinions about its performance. The main problem identified with the equipment was that it required cleaning after each use. According to one user, refilling the tank and cleaning the nozzles requires between 1 and 1-1/2 hours every day. He recommended that the users of SaniFoam™ should keep spare nozzles. In addition, the equipment and the fluid foam must be kept warm during cold weather.

### **3.1.3 TerraFoam™**

TerraFoam™, from Chubb National Foam in Exton, Pennsylvania, is a natural protein-based, biodegradable foam that stays moist after its application. A 6-inch-thick foam cover is recommended by the manufacturer. TerraFoam™ can be applied during moderate to heavy rains, and it is resistant to wind. After application, it begins degrading through evaporation; nonetheless, it stays effective from 8 hours to 9 days, depending on the climate.

TerraFoam™ is applied using TerraMAC, a custom-designed, foam application vehicle. TerraMAC was engineered to be operated by one person, and it does not require cleaning after each use. The average cost of a 6-inch-thick cover of TerraFoam™ is 15¢/ft². The cost of TerraMAC varies from \$30,000 to \$350,000 per unit, depending on the unit's size and features. No users were available for comment on TerraFoam™.

#### **3.1.4 TopCoat™**

TopCoat™ is a recently introduced product that consists of two components supplied in liquid form that are mixed and applied with a modified hydroseeder sold by Central Fiber Corporation. Both components of TopCoat™ are stored in separate tanks in the hydroseeder and are mixed together in the spray nozzle before application. The mixed product begins foaming within 30 seconds and cures within 5 to 10 minutes to form a 2-inch-thick layer of foam. According to the manufacturers, TopCoat™ can be applied during extreme temperatures and moderate rains. The product has no shelf-life restriction. However, it should not be stored at temperatures below 15°F. The projected cost of TopCoat™ is between 10 to 12¢/ft<sup>2</sup>, and the application equipment costs approximately \$25,000. Users' comments on TopCoat™ are not available because the product has only recently been made available to commercial markets.

### **3.2 GEOSYNTHETIC PRODUCTS**

Geosynthetic products from a number of vendors are currently used as ADCMs. Some of the geosynthetic products being used were not originally manufactured for use as ADCMs; however, three geosynthetic products are marketed specifically as ADCMs: (1) Airspace Saver™ from Wire Rope Specialists, (2) Fabrisoil™ from the Phillips Fibers Corporation (Phillips), and (3) Typar® Daily Cover (Typar®) from Exxon (Reemay Inc.). These geosynthetic ADCMs are discussed below.

Geosynthetic ADCMs are panels that are usually supplied on pallets or rolls and are deployed onto the working face of the landfill. Geosynthetic daily covers are applied at the end of each working day and are removed the next day. The panels are applied manually or by earth-moving equipment available at most landfills. If the working face is small (about 30 feet by 50 feet), two people can easily install a geosynthetic daily cover by pulling its edges along the working face. Loaders or dozers may be necessary to install a geosynthetic daily cover on a larger working face. Unfolded or unrolled cover is generally held down with tires, concrete blocks, or sand bags to prevent it from blowing loose in high winds.

One of the regulatory officers contacted by PRC was concerned that a geosynthetic ADCM may cause slope failure if it is buried between two layers of refuse (Bhalla, 1991). However, the officer's concerns were not shared by users of geosynthetic ADCMs. Most of the users do not dispose of waste on top of an unfolded geosynthetic daily cover unless it is on a flat surface. Landfill operators who use geosynthetic ADCMs say that a cover to be discarded is bunched together, rather than left in place, before being disposed of in the landfill, thereby preventing the potential for slope failure.

Some individuals familiar with geosynthetic ADCMs recommended not using them when there is a good possibility of precipitation and freezing temperatures. Under such conditions, the geosynthetic ADCM may be difficult to remove without damaging it, especially if it is covered with a large amount of snow or ice. In addition, if a frozen geosynthetic cover is buried in place with waste, it may cause slope failure.

Users of geosynthetic ADCMs have reported reusing the same panels for many weeks. Therefore, the unit cost of geosynthetic ADCMs presented below is the cost of purchasing the ADCM; the average daily cost will depend on the number of days a panel is actually used. Because geosynthetic ADCMs do not require special application equipment, the cost of application equipment is not included in the following discussion.

### **3.2.1      Airspace Saver™**

Airspace Saver™ is a woven, polyethylene fabric panel that is coated on both sides with polyethylene to make it water resistant. The manufacturer also plans to coat Airspace Saver™ panels with a fire-retardant (Yarborough, 1992). The maximum size of a single panel is limited to 48 feet by 50 feet, and multiple panels can be used to cover larger working faces. Panels are applied and removed using D-rings attached to the straps covering the panel perimeter. Panels are held in place on the working face by concrete blocks, tires, or sand bags. As an option, the manufacturer will sew 3/8-inch-thick steel chains to the panels to hold them down in high winds. The unit costs of panels and steel chains are 40¢/ft<sup>2</sup> and \$2.00 per foot, respectively. The average daily cost is approximately 2.7¢/ft<sup>2</sup>, based on the average use of an individual panel for 15 days. Users of Airspace Saver™ expressed satisfaction with its performance as a daily cover.

### **3.2.2 Fabrisoil™**

Fabrisoil™ panels are fabricated from nonwoven fabrics made from polypropylene staple fibers. The panels are custom-made to conform to the dimensions of the size of the working face to be covered. The maximum size of a single panel is about 150 feet by 150 feet, and multiple panels can be used to cover a larger working face. Fabrisoil™ panels come factory-seamed with sleeves along their perimeter. Users can insert chains, bars, or ropes in the sleeves to facilitate handling the panels. The unit cost of Fabrisoil™ ranges from 19 to 22¢/ft<sup>2</sup>, depending on the quantity purchased. The average daily cost varies from 1.3 to 1.5¢/ft<sup>2</sup>, based on the average use of an individual panel for 15 days.

Users of Fabrisoil™ expressed satisfaction with its performance, except for mixed opinions about unfolding and folding the panels in rainy weather. One user reported that initially water-repellant panels began absorbing water after continued use in rainy weather. The water absorbed on the Fabrisoil™ makes it heavy and, hence, difficult to manipulate. Over-used panels may also become heavy because they tend to pick up dirt. Because of their increased weight, wet or over-used panels also become prone to tearing when pulled over the refuse.

Phillips acknowledged that panels are heavy when wet. The company representative recommended avoiding over-use of panels and suggested a number of ways for efficient handling of panels. According to Phillips, Fabrisoil™ panels should always be rolled on or unfolded over the working face to cover the waste. For removal from the working face, a Fabrisoil™ panel should always be pulled over itself and not over the refuse. Pulling panels over refuse may damage the panels. In addition, on a sloping working face, the panels should be rolled down from the top of the working face and rolled back from the bottom of the working face.

### **3.2.3 Typar®**

Typar® is a thermally-spunbonded material made from polypropylene fibers. It is currently available in a standard size of 46 feet by 100 feet, but can be custom-made to any size. The unit cost of Typar® is 15¢/ft<sup>2</sup>; the average daily cost is 1¢/ft<sup>2</sup>, based on the average use of an individual panel

for 15 days. Typar® is sold folded on pallets or on rolls. The cover is unfolded or unrolled on the working face of the landfill and held in place with tires, concrete blocks, or sand bags.

Typar® users expressed satisfaction with its performance as a daily cover. One user reported that Typar® has a smooth surface that helps it slide easily over compacted refuse (Harrenberg, 1992). One consultant on geosynthetics reported that Typar® sheds water easily (Drew, 1992).

### **3.3 SLURRY-TYPE PRODUCTS**

ConCover™ from Newwastecon, Inc., of Perrysburg, Ohio; Land-Cover Formula 480 from Enviro Group of Ann Arbor, Michigan; and Posi-Shell from Landfill Technologies, Inc., of West Sand Lake, New York, are three slurry-type ADCMs. Posi-Shell is not discussed in this report because representatives of Landfill Technologies, Inc., did not respond to PRC's request for information. Information on ConCover™ and Land-Cover Formula 480 is presented below.

#### **3.3.1 ConCover™**

ConCover™ is a fiber-based product that derives some of its fibers from recycled newspaper and wood chips. It has two components: a fiber matrix and a polymer binding agent. Both components are supplied in solid form and are mixed with water to form a slurry that can have several colors, including green. The slurry is applied on the working face of the landfill with proprietary application equipment and it dries to form a 1/8- to 1/4-inch-thick crust. The drying time for the slurry is approximately 1 hour, but may vary depending on the weather conditions during drying. ConCover™ components have no shelf-life restriction, but once mixed, they should be used within 24 hours to avoid any settling of components within the application equipment (Savage, 1992).

ConCover™ components are mixed and diluted with water in the ConCover™ All Purpose Sprayer (CAPS) that is used to apply this ADCM. CAPS can also be used for other landfill applications, including fire fighting and power washing. The application equipment ranges in size from 300 to 3,300 gallons and can cover a working face of 10,000 ft<sup>2</sup> in approximately 1 hour. The cost of CAPS ranges from \$16,000 to \$40,000 for each unit. The cost of ConCover™ is approximately 6¢/ft<sup>2</sup>.



Users of ConCover™ expressed satisfaction with its performance. According to its users, ConCover™ can be applied in light to moderate rain but not during heavy rains. However, dried ConCover™ is unaffected by heavy rains and high winds, and it may perform well for several months. The application equipment is reported to be easy to use and relatively trouble-free.

### **3.3.2 Land-Cover Formula 480**

Land-Cover Formula 480 is a clay-based product. It is a liquid, clay concentrate, manufactured from clay and proprietary polymers. The product has a clay-type smell and is generally sold in a black color. However, it can be colored green for aesthetic reasons and can also be seeded.

According to manufacturers, one part of concentrate is diluted with three parts of water. The mixture is sprayed to a thickness of 1/8-inch to form a daily cover of very low permeability. The sprayed product dries in 1 to 1-1/2 hours, depending on weather conditions. The dilution of the concentrate can be varied to produce a wide range of permeability in the daily cover. For example, one part of concentrate diluted with three parts of water forms a low-permeability daily cover for use at a hazardous waste landfill. More dilute concentrations form a relatively permeable daily cover, which can be used at a sanitary landfill, for slope stabilization in a landfill cell, and for dust control on roads at the landfill.

Land-Cover Formula 480 has no shelf-life or storage temperature restriction. It can be applied using a hydroseeder generally available at most landfills. However, Enviro Group recommends using a modified hydroseeder that it sells.

Comments on the product's cost and performance are not available because Enviro Group did not identify any of its users to PRC. According to Enviro Group, the average cost of Land-Cover Formula 480 is 3¢/ft<sup>2</sup>; the cost of the application equipment is currently unavailable. Enviro Group also informed PRC that the product can be applied to 10,000 ft<sup>2</sup> in approximately 1 hour. After drying, it performs well for several months. The product can be sprayed in light rains, but not in heavy rains. However, once the product dries and forms a crust over the waste, it is not affected by heavy rains or high wind. PRC attended a demonstration of Land-Cover Formula 480, and the product's performance appeared to support the claims made by the manufacturer.

### **3.4**

### **OTHER COMMERCIAL PRODUCTS**

Commercial products other than those discussed above are also available. However, some of these products, such as Naturite and Naturfill from Chemfix Technologies, Inc., of Ventura, California, are available only in limited geographical regions and, therefore, they are not discussed in this report. Other products, such as Aqua-Shed, are currently being marketed as intermediate cover materials but they can also be used as ADCMs. Aqua-Shed is a flypaper-like product manufactured by Aqua-Shed, Inc., of Costa Mesa, California. A detailed discussion of these products is not included in this report because they are not primarily intended for use as a daily cover. In general, products marketed as an intermediate cover cost more and last longer than ADCMs. The manufacturers of these products, listed in Appendix A, may be contacted for more details.

### **4.0 SHREDDED MUNICIPAL SOLID WASTE**

Shredded municipal solid waste is not an ADCM. However, shredding waste before disposing of it eliminates many problems that necessitate the use of a daily cover (Reinhardt and Ham, 1974). The State of Florida allows landfills to dispose of shredded waste without a daily cover (Castro, 1991). Canada and several European countries also permit the disposal of shredded waste without daily cover. The advantages of shredded waste over unshredded waste include the following:

- It does not attract birds and flies the way unshredded waste does.
- It does not produce as many odors as unshredded waste.
- It has a more aesthetic appearance than unshredded waste, because individual waste items are no longer recognizable.
- It can be compacted more densely than unshredded waste.
- It does not cause as much wear and tear on landfill equipment as unshredded waste, because shredded waste is more uniform in size and does not contain large, sharp, irregularly shaped items.

**The disadvantages of shredded waste include the following:**

- **It is a costly operation requiring a large initial capital investment.**
- **It is a labor intensive operation, because the waste has to be sorted before shredding to remove items such as carpets, large plastic sheets, and gas tanks that can damage the shredder.**
- **It may create hazardous working conditions because explosions and fires may occur if an explosive material finds its way into the shredder.**
- **It is more prone to fire hazard than unshredded waste, because shredded waste has a greater reactive surface area.**
- **It is more permeable and allows more infiltration of rain than unshredded waste.**

**A combination of improved operational practices, effective fire-prevention methods, and use of a daily cover in wet weather may make shredding an effective alternative to a daily cover.**

## **5.0 SUMMARY**

**This report summarizes the findings of PRC's research on ADCMs currently available for use at MSWLFs. A variety of materials are currently being used as alternatives to the 6-inch-thick layer of soil conventionally used for daily cover. Some materials, conventionally disposed of as waste in MSWLFs, can be used as indigenous ADCMs. Commercial products are also available for use as ADCMs.**

**Indigenous ADCMs, such as ash, offer the following advantages over their commercial counterparts:**

- **Using indigenous ADCMs saves money for the landfill operators because no special application equipment is needed. Most indigenous ADCMs are obtained by landfill operators as waste to be disposed of in their landfills; earth-moving equipment available at most landfills can be used to apply these materials.**
- **Applying indigenous ADCMs does not involve the additional labor costs associated with preparing and applying some commercial ADCMs. Labor costs are not increased because the indigenous material already is a waste to**

be disposed of in the landfill and can form a daily cover when disposed of in a planned way.

- Using indigenous ADCMs optimizes the use of available landfill space; materials that were to be disposed of in the landfill as waste are disposed of as cover, saving landfill space that would be consumed by a soil or by those commercial daily covers that take up landfill space.

However, indigenous ADCMs may not always be available for regular use. Storing indigenous materials that are delivered irregularly may create space- or routing-related problems. In addition, weather conditions may limit the use of some indigenous ADCMs. Considering such restrictions on the use of indigenous ADCMs, a combination of indigenous and commercial ADCMs may be a more effective alternative to conventional, soil daily cover.

## **5.1 CRITERIA FOR SELECTING AN ADCM**

Selecting an indigenous ADCM for regular use at a particular landfill may not always be possible, primarily because of the limited availability of such materials to most landfill operators. Commercial ADCMs should be considered when indigenous ADCMs are not readily and regularly available. Landfill operators should consider the following general factors when selecting a commercial ADCM for their facilities: effectiveness in meeting the functional requirements of a daily cover, availability, suitability, equipment requirements, and cost. In addition to these general factors, operators should also consider specific, technical factors related to ADCM performance. These factors are discussed below.

### **5.1.1 Effectiveness in Meeting the Functional Requirements of a Daily Cover**

To be considered as an ADCM, the material should effectively perform all functions of a daily cover specified by federal regulations (see Subsection 1.1.1). The effectiveness of a material in performing other functions of a daily cover, such as controlling dust, improving site aesthetics, and providing a moisture barrier (see Subsection 1.1.2) is also desirable, but not necessary.

### **5.1.2 Availability**

For the regular use of a commercial ADCM at a landfill, the material should be readily available to the landfill operator. Shelf-life and any storage restriction associated with the ADCM should be considered. Such restrictions may be especially important to landfill operators having facilities in remote areas or where weather conditions may affect storage requirements. Materials such as geosynthetic ADCMs can be purchased in bulk and stored safely until needed. However, some material requiring special storage conditions, such as AC-645, may be difficult or costly to store for long periods.

Continued future availability of a material should also be considered, especially if a capital investment is required to acquire application equipment. Such a consideration is important because if the material selected as an ADCM is discontinued by its manufacturer, capital used to purchase application equipment may not provide an adequate return on investment.

### **5.1.3 Suitability**

The nature and size of the waste surface should be considered when selecting a suitable ADCM. Some ADCMs, such as TerraFoam™, may not be suitable for covering the steeply sloping surface of the landfill's working face, especially if waste is disposed of in the form of bails. ADCMs applied in liquid form may fall off a steeply sloping working face before they can dry and form a cover. Some ADCMs, such as geosynthetic products, may be better suited to smaller areas than other ADCMs. For example, SaniFoam™ requires preparations and costly equipment, and it would be more time- and cost-effective if it is used to cover a large area.

Commercial ADCMs do not perform equally well under all climatic conditions. Some ADCMs, such as Airspace Saver™, can be used during heavy rains, whereas others, such as TopCoat™ may not perform well in heavy rains.

#### **5.1.4 Equipment Requirements**

Some commercial ADCMs, such as TerraFoam™, require costly application equipment, whereas others, such as Fabrisoil™ and Typar®, may not require any additional equipment. Among ADCMs that require application equipment, some ADCMs, such as SaniFoam™, require regular maintenance of the equipment; others, such as AC-645, may need only occasional equipment maintenance.

#### **5.1.5 Cost**

ADCMs requiring special application equipment may require substantial capital investment and may add to equipment maintenance costs. In addition, the average daily cost of reusable ADCMs, such as geosynthetic products, may be much lower than that of single-application ADCMs, such as foam- or slurry-type products.

#### **5.1.6 Specific Technical Factors**

In addition to the above-mentioned general factors, specific, technical factors related to the performance of individual ADCMs should also be considered. Such factors may include hydraulic conductivity, water retention, gas permeability, flammability, flash point, melting point, and tensile strength of the ADCM. All of these factors may not apply to every ADCM, and a testing method for measuring some of the factors may not be currently available. For example, measuring tensile strength would not apply to foam-type ADCMs. Likewise, it may not be possible or necessary to measure the melting point of a clay-based ADCM. The information available on factors such as performance, equipment, and cost requirements is presented in Table 1.

### **5.2 RECOMMENDATIONS**

Further investigation is recommended for a detailed evaluation and comparison of available ADCMs. A detailed investigation of ADCMs should include the following tasks:

- Identify parameters that affect the performance of ADCMs, including physical and chemical properties.

- **Identify testing methods available to measure performance parameters.**
- **Measure the identified performance parameters for samples of representative ADCMs, using the identified testing methods.**
- **Evaluate the performance of representative ADCMs in the field.**
- **Provide guidelines to public and regulatory organizations for selecting and evaluating ADCMs based on findings from the above tasks.**

**TABLE 1**  
**COMPARISON OF PERFORMANCE-, EQUIPMENT-, AND COST-RELATED FACTORS FOR COMMERCIAL ADCMS**

Factor	LCP <sup>a</sup>	AC-645	SaniFoam	TerraFoam	TopCoat	ASS <sup>b</sup>	Fabrisoil	Typar	ConCover
Controls Disease Vectors	NEIA <sup>c</sup>	NEIA	NEIA	NEIA	NEIA	NEIA	NEIA	NEIA	NEIA
Controls Fire <sup>d</sup>	NEIA	NEIA	NEIA	NEIA	NEIA	No	No	No	NEIA
Controls Odors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls Blowing Litter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls Scavenging <sup>e</sup>	NEIA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prevents Infiltration	Yes	No	Yes	No	NK <sup>f</sup>	Yes	Yes <sup>g</sup>	Yes <sup>g</sup>	Yes
Controls Dust	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Improves Site Aesthetics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adversely Affected by Sunlight	No	Yes	Yes	Yes	NK	No	No	No	No
Performance Duration (Single Application)	Long <sup>h</sup>	Low <sup>i</sup>	Moderate <sup>j</sup>	Moderate	NK	Long	Long	Long	Long
Maximum Rain Intensity During Application	Low	No Rains	Moderate	Moderate	NK	High	High	High	Moderate
Application Possible During High Winds	No	No	Yes	Yes	NK	No	No	No	Yes
Application Possible During Freezing Temperatures	NK	NK	NK	NK	NK	Yes	Yes	Yes	Yes
Maximum Rain Intensity Sustained After Hardening Period, If Required	High	Low	High	Low	NK	High	Low	Moderate	High
Maximum Winds Sustained After Hardening Period, If Required	High	Low	High	Low	NK	High <sup>k</sup>	High <sup>k</sup>	High <sup>k</sup>	High
Can Sustain Freezing Temperature After Hardening Period, If Required	Yes	Yes	Yes	NK	NK	Yes	Yes	Yes	Yes
Can Sustain Precipitation During Freezing Temperature After Hardening Period, If Required	Yes	NK	Yes	NK	NK	Yes <sup>l</sup>	Yes <sup>l</sup>	Yes <sup>l</sup>	Yes
Storage Temperature Restrictions	No	Yes	Yes	Yes	Yes	No	No	No	No
Shelf Life Restrictions	No	No	90 Days	NK	NK	No	No	No	No
Preparation Time Required	1 Hour	1 Hour	1.5 Hour	NK	NK	None	None	None	1 Hour
Application Time (per 10,000 square feet)	1 Hour	1 Hour	1 Hour	NK	NK	0.5 Hour	0.5 Hour	0.5 Hour	0.5 Hour
Reusable	No	No	No	No	No	Yes	Yes	Yes	No
Application Equipment Requires Special Maintenance	No	No	Yes	Yes	NK	No	No	No	No
Cost of Application Equipment	NK	\$85,000 to \$290,000	\$43,000 to \$128,000	\$30,000 to \$350,000	\$25,000	None	None	None	\$16,000 to \$40,000
Unit Cost of Material (in cents per square foot (¢/ft <sup>2</sup> ))	3	6 to 7	10	15	10 to 12	40	19 to 22	15	5 to 7
Average Daily Cost of Material (in ¢/ft <sup>2</sup> )	3	6 to 7	10	15	10 to 12	2.7 <sup>m</sup>	1.3 to 1.5 <sup>m</sup>	1 <sup>m</sup>	5 to 7

Notes: <sup>a</sup>-- Land Cover Formula (LCF) 480

<sup>b</sup>-- AirSpace Saver

<sup>c</sup>-- Not enough information available (NEIA)

<sup>d</sup>-- Evaluation based on assumption that fire is controlled by covering waste with the ADCM

<sup>e</sup>-- Evaluation based on assumption that controlling odor and appearance of waste would control scavenging

<sup>f</sup>-- Not Known (NK)

<sup>g</sup>-- Prevents infiltration only in light rain

<sup>h</sup>-- More than 2 weeks

<sup>i</sup>-- From 8 to 24 hours

<sup>j</sup>-- From 8 hours to 2 weeks

<sup>k</sup>-- Assuming that panels are weighed down

<sup>l</sup>-- Panels would have to be abandoned if covered with excessive snow or if frozen

<sup>m</sup>-- Assuming that the same cover is reused 15 times



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## **APPENDIX A**

### **NAMES AND ADDRESSES OF INDIVIDUALS WITH KNOWLEDGE OF ADCMS**

## **APPENDIX A**

This appendix lists the information needed to contact individuals with knowledge of and experience with ADCMs discussed in this report. The following list includes users of ADCMs and, when available, regulatory personnel familiar with ADCMs. Contact information for manufacturers or distributors of commercial products is also included.

### **INDIGENOUS MATERIALS**

#### **Ash-Based Material**

##### **User**

David E. Berglund  
Town Landfill  
187 Main Street  
Foxboro, MA 02035  
Phone: (508)543-3419

##### **User and Regulatory Organization Contact**

Mark Eyeington, Director of Operations  
Solid Waste Authority of Palm Beach County  
7501 North Jog Rd.  
West Palm Beach, FL 33412  
Phone: (407)640-4000 ext. 303

#### **Auto Recycling Fluff And Foundry Sand-Based Material**

##### **User**

Henry Sommer, Landfill Superintendent  
Sunnyview Landfill  
100 W. County Road Y  
Oshkosh, WI 54901  
Phone: (414)424-1192

#### **Compost-Based Material**

##### **User and Regulatory Organization Contact**

Dan Flegal, Sanitarian  
Cowlitz Wahkiakum Health District  
P.O. Box 458  
Longview, WA 98632  
Phone: (206)425-7400

**Dredged Material**

**User and Regulatory Organization Contact**

Mark Eyeington, Director of Operations  
Solid Waste Authority of Palm Beach County  
7501 North Jog Rd.  
West Palm Beach, FL 33412  
Phone: (407)640-4000 ext. 303

**Green Waste-Based Material**

**User**

Doug Landon, Manager  
Solid Waste Division  
Kern County Public Works Department  
2700 M. Street, Suite 500  
Bakersfield, CA 93301  
Phone: (805)861-3636

**User/Regulatory Organization Contact**

Janet Coke, Project Engineer  
L. A. County Sanitation District  
1955 Workman Mill Road  
Whittier, CA 90607

Phone: (213)699-7411 ext. 2461

**Shredded Municipal Waste-Based Material**

**User and Regulatory Organization Contact**

Dan Flegal, Sanitarian  
Cowlitz Wahkiakum Health District  
P.O. Box 458  
Longview, WA 98632  
Phone: (206)425-7400

**Sludge-Based Material**

**User**

Thomas Wackerly  
BKK Landfill  
2210 South Azusa Avenue  
West Covina, CA 91792-1510  
Phone: (818)965-0911

### **Rice Husk-Based Material**

#### **PRC's Japanese Contact**

Dr. Kunitoshi Sakurai

Senior Development Specialist (Environmental Health)

Japan International Cooperation Agency

Institute for International Cooperation

10-5 Ichigaya-Hommurachoh, Shinjuku

Tokyo 162

Japan

Phone: 81-3-3269-3851

### **Construction And Demolition Waste-Based Material**

#### **User and Regulatory Organization Contact**

Mark Eyeington, Director of Operations

Solid Waste Authority of Palm Beach County

7501 North Jog Rd.

West Palm Beach, FL 33412

Phone: (407)640-4000 ext. 303

## **COMMERCIAL PRODUCTS**

### **Foam-Type Product**

#### **AC-645**

##### **Manufacturer/Distributor**

Scott Butville

Rusmar Inc.

216 Garfield Street

West Chester, PA 19380

Phone: (215)436-4314

##### **User**

Logan Miller, Facilities Engineer

Central Solid Waste Management Center

Delaware Solid Waste Authority

P.O. Box 455

Dover, DE 19903

Phone: (302)284-3933

### **SaniFoam™**

#### **Manufacturer/Distributor**

**Bruce H. Spoo  
Market Development Manager  
Environmental Protection Products  
3M Center Building 223-6S-04  
St. Paul, MN 55144-1000  
Phone: (612)736-4236**

#### **User**

**Donald Loup  
Location Consultants  
P.O. Box 31686  
Lafayette, LA 70593  
Phone: (318)984-3556**

#### **Regulatory Organization Contact**

**Mary Nogas  
Solid Waste Supervisor, North-East District  
7825 Bay Meadows Way, Suite 200B  
Jacksonville, FL 32256  
Phone: (904)448-4300 ext. 355**

### **TerraFoam™**

#### **Manufacturer/Distributor**

**Giff Swayne  
Chubb National Foam  
P.O. Box 270  
Exton, PA 19341-1350  
Phone: (215)363-1400**

#### **User**

**Nolan Perin  
Grand Central Sanitary Landfill, Inc.  
1963 Pen Argyl Road  
Pen Argyl, PA 18072  
Phone: (215)863-6057**

### **TopCoat™**

#### **Manufacturer**

**Dr. Ravi Bhaskar  
Central Fiber Corporation  
4814 Fiber Lane Road  
Wellsville, KS 66092  
Phone: (800)654-6117**

#### **Distributor**

**Erosion Control Systems  
1800 McFarland Blvd. North, Suite 180  
Tuscaloosa, AL 35406  
Phone: (205)759-5151**



**Geosynthetic Product**

**Airspace Saver™**

**Manufacturer/Distributor**

Marlon Yarborough  
Wire Rope Specialists  
P.O. Box 77757  
Baton Rouge, LA 70879  
Phone: (800)673-1570

**User**

John Peterson  
Waste Management Skyline Landfill  
P.O. Box 400  
Ferris, TX 75125  
Phone: (214)225-7503

**Fabrisoil™**

**Manufacturer**

Gerald Barry  
Phillips Fibers Corporation  
421 North NorthWest Highway, Suite 201  
Barrington, IL 60010  
  
Phone: (708)382-9666

**User**

Doug Nord  
McLean County Landfill  
Rural Route Number 3  
Box 142  
Bloomington, IL 61704  
Phone: (309)827-8631

**Regulatory Organization Contact**

Ed Bakowski  
Illinois EPA  
2200 Churchill Road  
Springfield, IL 62706  
Phone: (217)782-2829

**Typar® Daily Cover**

**Manufacturer/Distributor**

Bill Hawkins  
Reemay Inc.  
70 Old Hickory Boulevard  
Old Hickory, TN 37138  
Phone: (615)847-7000

**User**

Steve Harenberg  
Tazewell County Landfill  
3550 East Washington Street  
East Peoria, IL 61611  
Phone: (309)694-0295

## **Slurry-Typa Product**

### **ConCover™**

#### **Manufacturer/Distributor**

Tim Johnson  
Newastecon Inc.  
7365 Fremont Pike, P.O. Box 941  
Perrysburg, OH 43552  
Phone: (419)837-2686

#### **User**

Mike Olson  
Wayne Disposal Inc.  
1349 Huron  
Ypsilanti, MI 48197  
Phone: (313)485-6460

#### **Regulatory Organization Contact**

Irene North  
Ohio EPA, Northwest District  
1035 Devlac Grove Drive  
Bowling Green, OH 43402  
Phone: (419)352-8461

### **Land-Cover Formula 480**

#### **Manufacturer/Distributor**

David Fisher  
Enviro Group  
P.O. Box 3023  
Ann Arbor, MI 48106  
Phone: (313)930-0761

### **Posi-Shell**

#### **Manufacturer/Distributor**

Thomas Hoffman  
Landfill Technologies, Inc.  
P.O. Box 519  
West Sand Lake, NY 12196  
Phone: (518)674-8694

## **Sludge And Other Waste Streams-Based Product**

### **Naturfill and Naturite**

#### **Manufacturer/Distributor**

Lisa B. Kistler  
Chemfix Technologies, Inc.  
1536 Eastman Avenue, Suite A  
Ventura, CA 93003  
Phone: (805)654-1900

#### **User/Regulatory Organization Contact**

David Jackson  
Ventura Regional Sanitation District  
4105 West Gonzales Road  
Oxnard, CA 93030  
Phone: (805)658-4672

## **Intermediate Covers**

### **Aqua-Shed**

#### **Manufacturer/Distributor**

Mark C. Cunniffe  
Aqua-Shed, Inc.  
3001 RedHill Ave., Suite 4-108  
Costa Mesa, CA 92626  
Phone: (714)557-5671