

## *containment as a requirement*

As water becomes more and more scarce—thus, costly—providing a barrier against high rates of water seepage loss will become a requirement in more than just arid and semiarid regions. In addition to water conservation, wastewater containment is an essential component in protecting water and air from pollution caused by animal waste. Containment with a reliable, time-proven method is a requirement, not just an option, due to recently enacted environmental legislation.

Whatever the reason for containment, geosynthetics provide a reliable, cost-effective, better-performing alternative to traditional compacted soil and clay liners. Traditional soil approaches provide less in seepage control and are highly variable in quality; and they may not be acceptable for design and regulatory compliance. Although geomembranes are the primary type of geosynthetics used as a barrier or cover system, other types of geosynthetics are used in conjunction with geomembranes, such as geotextiles, geocomposites, geonets, geosynthetic clay liners (GCLs) and geopipe. In addition, coated fabrics and geocomposites are being used strictly for odor control on large waste lagoons.

## *CAFOs and federal legislation*

The National Pollutant Discharge Elimination System (NPDES) and permit regulations for large Confined Animal Feeding Operations (CAFOs) was issued by the U.S. Environmental Protection Agency (EPA) as a final ruling and became effective in April 2003. This federally mandated ruling will ensure that CAFOs take action in managing animal waste, which includes the lining of waste lagoons. The U.S. EPA estimates that the new regulations will affect 15,500 of the largest livestock operations. This means that all CAFO waste lagoons and evaporation ponds must be lined and many must be covered for odor control. This federal legislation will affect smaller farm operations, too.

## *animal waste lagoon liners*

Animal waste lagoons long have been under-engineered and currently contribute to the pollution of ground and surface waters. To control waste seepage, the National Resources Conservation Services (NRCS) allows compacted earth linings and geosyn-

thetics. However, with the growing concern over pollution and federal legislation, the use of geosynthetics increased rapidly. In particular, exposed geomembranes, geomembranes with soil cover and geosynthetic clay liners with soil cover have been used. In addition, geotextiles and geonet composites are used for protection and gas transmission. Many of the large CAFO operations use concrete containment channels and holding pits directly under or close to the barn or animal housing structure where continuous wash down and flushing of the waste occurs. These areas also are lined with geomembranes to prevent seepage contamination.

## *animal waste odor control covers*

A growing number of scientists and public health officials have traced a variety of health problems to the vast amounts of concentrated animal waste, which emit toxic gases such as hydrogen sulfide and ammonia. Odor control covers can be a low-cost geomembrane or coated fabric or they can be a more expensive engineered floating cover system, depending on the design and criticality of the containment. Both scrim-reinforced and non-reinforced geomembranes and geocomposites are being used extensively in the control of odors and greenhouse gas emissions on the farm.

## *water conveyance*

In addition to controlling environmental contamination by providing a barrier, geosynthetics, and most notably geomembranes, have been used for decades in preserving clean water for on-farm use. The conveyance of water in ditches, laterals and main canals for delivery to crops is as common as on-farm water storage tanks and ponds. However, frequent drought conditions in many parts of the United States have depleted water supplies and increased irrigation costs. Seepage loss in water conveyance channels can approach 50 percent. Seepage loss of valuable water can be eliminated with the use of geosynthetic lining systems. Soil-covered and exposed geomembranes are used extensively in the lining of both new and old canals that require rehabilitation. Old, cracked, concrete lined canals have lost their effectiveness over the years and are being replaced or repaired. One viable method for repair of old concrete is to provide an exposed geomembrane lining system

over the concrete. This method not only saves valuable water, but saves money as well. New construction with concrete also requires a geomembrane under the concrete to prevent seepage loss once the concrete has cracked. Water conveyance systems use other geosynthetics in conjunction with geomembranes such as protection geotextiles, geocomposites and geogrids.

## *stock water containment*

Water containment in ponds and concrete tanks for on-farm use is just as important as water conveyance in that seepage and loss of valuable water should be minimized, especially for remote ponds and tanks. Soil-covered geomembranes and GCLs are used for the construction of new or the rehabilitation of old ponds. Exposed geomembranes are used to reline old stock water concrete containments or tanks.

## *on farm anaerobic digesters*

Anaerobic digesters are used to rapidly decompose animal waste in a controlled environment; thus, allowing the recovery and use of methane-rich low Btu biogas. Biogas is used to fuel combined heat and power (CHP) generators that produce on-farm electricity, providing heat and hot water for barns, washing operations, and domestic use. (Excess power can be sold to local grids.) Also, they are a viable method of waste management due to the fact that both bottom-lining systems (described above) and flexible-cover systems are used. With every digester constructed, geosynthetics are used to either line the anaerobic lagoon or cover the lagoon for collection of biogas. According to the U.S. EPA AgStar digest, the number of operating digesters has increased by more than 30 percent in the last two years. Greater federal funding has become available for farm installations. Exposed geomembranes are used to line the lagoons in combination with geotextiles and geonet composites depending on the design. The most frequent type of cover system is composed of a reinforced geomembrane that is designed for gas inflation pressure, wind resistance, rainwater collection and access. The geomembrane cover systems for anaerobic digesters are engineered covers due to the fact that they must resist considerable stress and provide an effective service life.

# Agricultural Applications for Geosynthetics



## *summary*

Some of the earliest geosynthetic specifications in the United States were directed at agricultural use of pond linings for the preservation of water resources. These early application concerns included the lining of ditches, agriculture farm ponds and water harvesting catchments in arid regions. Today, the applications range widely from covered and uncovered ditch linings and ponds to geosynthetic linings that protect groundwater, soils and surface waters from being polluted by animal waste.

The use of geosynthetics, and in particular geomembranes, on the farm has come a long way and has grown significantly in recent years, especially with more stringent federal and state legislation as well as increased environmental public awareness through programs developed by the U.S. Department of Agriculture/Natural Resources Conservation Service and U.S. Environmental Protection Agency.

## *for more information*



To find out how geosynthetics can provide engineering solutions, contact

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