COLD WEATHER INSTALLATIONS

The immediate need for landfill space along with numerous project delays forced the Campbell County Landfill in northeastern Wyoming to be constructed in the less-than-ideal conditions of December. A 600,000 ft^2 footprint landfill cell design was called for using state-of-the-art technology to enable the late season construction. Materials were specified that provided the most cost effective solution for the county's future landfill needs and accelerated construction window. The selected products needed a proven track record and had to be installed efficiently and quickly.

After evaluating various materials, the decision was made to install CETCO Bentomat® ST geosynthetic clay liner (GCL) over a certified subgrade in lieu of hauling in and compacting clay. Under low ambient temperatures, it would have been extremely difficult to control the clay temperature and obtain proper impaction. Compacted clay cold weather construction issues would have pushed the schedule even further into winter, risking a project shutdown.

All Bentomat® ST GCL was delivered with Supergroove™, an edge enhancement system that eliminates the need to use additional granular sodium bentonite within the overlap area of the seams. This edge enhancement came standard on both longitudinal edges and facilitated a rapid GCL placement.

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Cold weather installations

Campbell County's municipal landfill ran out of space just in time for winter

Community disputes, cost concerns and conflicts with environmental permitting can make landfill construction a difficult infrastructure need to satisfy. At times, the design and approval process takes a project down to the wire. Such was the case with the Campbell County Landfill in northeastern Wyoming.

The county's municipal landfill serves 36,000 residents. The population expanded by 15% in the 1990s and has grown at a rate of about 3.5% annually since 2000. Though the influx of new residents has been welcomed in this region best known for its abundance of energy resources (oil, natural gas and coal), the growth hastened the end of the old landfill's service life. And it ran out of space at the least opportune time: as winter arrived. Of course, the immediate need could not be ignored. A new landfill cell was called for, and a December construction was planned. It's never ideal to begin construction during a cold season, and it's especially difficult when the components are best installed during warmer weather.

Engineers at nearby CE & MT responded with a 600,000 ft.² (55,740 m²) footprint landfill cell design. The idea called for using state-of-the-art technology and construction techniques to enable the late season construction. The engineers specified materials that provided the most cost effective solution for the county's future landfill needs and accelerated construction window. The selected products needed a proven track record and had to be installed efficiently and quickly (e.g., utilizing factory fabrication technologies for many seams).

DRM Inc. was selected as the general contractor and charged with carrying out the earthworks. Colorado Lining International was retained to provide and install the landfill components (e.g., geomembranes).

Photo Winter installations are rarely welcomed, but the county had no choice. The county's landfill had reached capacity.

The Campbell County landfill is a Subtitle D landfill. Construction on this project began and was completed in December 2003. Extreme weather conditions, a tight project deadline, and budget constraints necessitated careful planning and coordination between all parties.

Project design and product selection

The project engineer specified that the landfill cell must have a multi-layer system designed to protect the groundwater from contamination. Multi-layer designs, supported by numerous installations and environmental monitoring, are increasingly common, especially in the western United States. Water retention and water quality are major concerns in the region.

After evaluating various materials, the decision was made to install a geosynthetic clay liner (GCL) over the certified subgrade in lieu of hauling in and compacting clay.

PGI specifications

The PVC Geomembrane Institute (PGI) has developed specifications to assist design engineers select and construct with the appropriate PVC geomembrane. The most recent specification is 1104, which was adopted earlier this year and replaced Specification 1103.

Specification 1104 identifies certified properties (e.g., thickness, tear strengths, dimensional stability), index properties (e.g., specific gravity, elongation, hydrostatic resistance), and seam strengths for 10 through 60 mil PVC geomembranes, as well as provides cross-references to the applicable ASTM standards.

The specification table is available free at the PGI's home page:
http://pgi-tp.ce.uiuc.edu.

Under December weather conditions, it would have been virtually impossible to control the temperature of the clay and to obtain proper compaction. This would have pushed the schedule even further into winter, risking a project shutdown. Upon engineering review, the design team looked at the cost difference and decided that a three-ply fabric system made much more sense in terms of budgeting constraints, logistics and project scheduling.

The engineer specified a composite lining system composed of a GCL base, a 30 mil PVC geomembrane that met PGI specification 1003 (See sidebar on previous page), and an 8-oz. nonwoven geotextile protective layer.

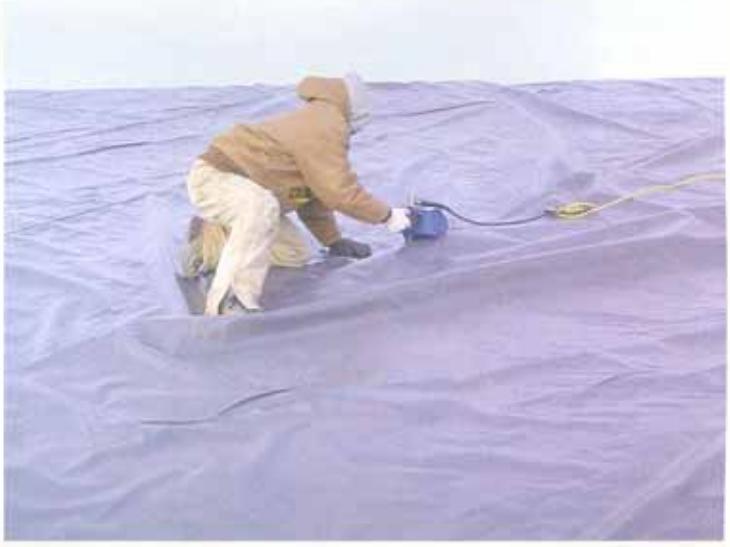

Photo Cold-weather seaming is difficult because the material is at risk for stiffening, wrinkling or folding. Geomembrane rolls were stored in a heated trailer on site until it was ready for deployment.

Project construction

It was necessary to deploy and seam the liner in temperatures considerably lower than ideal for building a landfill. The installation took place in ambient temperatures as low as 32° F. Typically, geomembranes are not deployed at this temperature, because the material becomes stiff and very difficult to pull out without getting wrinkles and folds in the liner. The material was kept in heated trailer storage on site to protect it from the 0–10° F overnight temperatures.

Construction

Debris, large rocks and other items that could puncture a liner were removed from the landfill cell subgrade. Once the subgrade was completed and certified, the geosynthetic clay liner was installed.

The GCL used was a CETCO Bento-Mat ST with a special edge that self-applies loose bentonite along the seams. This bentonite lies between adjacent panels and forms a uniform seal.

Unusually large PVC panels were created in the factory in order to minimize the number of field seams needed. Colorado Lining fabricated 30 panels of approximately 70 x 300 ft. (21 x 91 m), utilizing dielectric fabrication technology. These panels weighed approximately 4,300 lbs. each.

All of the seams within each panel were made in the factory under ideal conditions—with no temperature extremes and no dirt. The seams were then tested in Colorado's in-house laboratory. Data was logged to verify compliance with PGI 1103 factory seam requirements.

Once completed, the panels were moved to the site and stored in heated trailers to keep the material pliable until deployment.

Usually, PVC geomembrane panels are light enough to be pulled out by laborers. However, given the large size of these panels, a track bobcat with a ground pressure of 4.5 lbs./ft.^{2} was used to unroll the panels.

The PVC geomembrane panels were deployed from 10:00 a.m. until 3:00 p.m. at the rate of approximately 2–3 acres per shift. These panels were field-welded, utilizing the latest in heat fusion welding equipment. All installed GCLs were covered each day to prevent damage and hydration.

The use of the pre-fabricated panels meant that 60% fewer field seams were needed. Weld speed for the field seams was decreased and dwell time increased to product PGI specification welds. All field seams were tested utilizing the air lance test method —ASTM 4456.

Project completion

An innovative construction approach allowed the Campbell County landfill to be completed on time and under budget despite adverse weather conditions. The main keys to this project's success were excellent coordination of construction activities and the procurement of heated storage.

A composite lining system was chosen to provide excellent long-term durability with multiple layers of protection.

Choosing GCLs over compacted clay reduced installation time. Also, GCLs and PVC geomembrane have an excellent interface friction, providing the site with increased stability.

Custom fabrication of PVC panels minimized the number of field seams needed to install the liner. As a result, third party quality assurance/quality control (QA/QC) costs were reduced. GFR

Project information

Design: Consolidated Engineers & Materials Testing (CE & MT) Inc.

General contractor: DRM Inc.

Installer: Colorado Lining International

Geosynthetic clay liner (GCL): Bentomat ST from CETCO

Geotextile: 8 oz. nonwoven

Geomembrane: 30 mil PVC

John Heap is president of Colorado Linings International, Parker, Colo.; www.coloradolining.com. He serves as the treasurer of the PVC Geomembrane Institute.

About the PGI

Founded in 1988 by a group of industry leaders, the PVC Geomembrane Institute has been dedicated to advancing the use of PVC geomembranes through education and research. The organization and its membership accomplish this by aiding engineers in specifying PVC for environmental applications including (but not limited to) landfills, industrial waste ponds, canals, mining and wetland treatment containment.

PGI membership spans all aspects of the PVC geomembrane industry, including manufacturers, fabricators and installers of the material. The organization was incorporated in Michigan and operates under the direction of a volunteer board of directors led by its president, Pat Diebel of Canadian General-Tower Ltd. Other current board members include secretary Andrew Mills of Layfield Plastics and treasurer John Heap

Application Versatility

Whether your lining project is at the top of a mountain or the bottom of a river, CETCO's versatile product line can meet the challenges of the toughest applications. *The Experts in GCL Technology*

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Photo The installer's experience helped complete the project on time and under budget.

of Colorado Lining International.

In 1998 the PGI underwent a reorganization that ended in a partnership with the University of Illinois at Urbana-Champaign (UIUC). The partnership lead to the formation of the PGI Technology Program (PGI-TP) lead by Dr. Timothy Stark with the university's civil engineering program. Dr. David E. Daniel and Dr. Krishna R. Reddy serve as co-directors of the program.

Since 1998, the PGI's main office has resided at UIUC. The main objectives of the program to date have been to conduct research and disseminate technical information about PVC geomembranes, and to provide technical information and assistance to engineers and specifiers as needed.

Resources

At the PGI Web site, visitors can download technical information, such as a fabrication and installation document, a quality control document, technical articles, and specifications. A CD-Rom may also be requested.

Contact

For more information about using PVC geomembranes, visit the PVC Geomembrane Institute's (PGI) Web site at www.pvcgeomembrane.com. The 1104 PGI Specification is listed on the Web site to assist designers in specifying and selecting PVC geomembranes. Information is also available by contacting the office of the PGI at +1 217 333 3929.