FIGURE 1 EPS geofoam protected with XtrmPly EPS Wrap EIA /KEE and geotextiles

Protecting EPS geofoam block with EIA geomembranes

Using innovative technologies to protect the planet and your investment in infrastructure

By Edward J. Silva

EPS geofoam has emerged as a popular material in construction projects due to its lightweight and versatile nature. Used for various applications in civil engineering, this expanded polystyrene foam offers excellent insulating and structural properties. However, when exposed to hydrocarbons such as those found in oil, gasoline or other chemical substances, it can deteriorate over time. To counter this issue, reinforced EIA (ethylene interpolymer alloy) geomembranes have been employed as a protective barrier. In this article, we will delve into the use of EPS geofoam and explore methods to shield it from the damaging effects of hydrocarbons using reinforced EIA geomembranes.

EPS geofoam, short for "expanded polystyrene geofoam," is a lightweight cellular plastic material that is manufactured from expanded polystyrene beads. With its high-compressive strength, low weight and excellent thermal insulation properties, it has become a popular choice in various geotechnical and civil engineering applications. Common uses of EPS geofoam include road construction, bridge abutments, slope stabilization, and lightweight fill for embankments.

EPS geofoam's lightweight nature creates significant advantages in construction projects where traditional soil and aggregate materials may be heavy and cumbersome. Its low density combined with high-compressive strength makes it ideal for reducing loads on underlying soil and structures, thereby minimizing settlement issues. The thermal

PROJECT HIGHLIGHTS

EPS GEOFOAM FOR OVERPASS IN PENNSYLVANIA

LOCATION
Punxsutawney, Pa.

CLIENT
PENNDOT

CONTRACTOR AND SUPPLIER
Frank Roberts & Sons

GENERAL CONTRACTOR
Palo, Inc.

GEO PRODUCT
XtrmPly EIA/EPS Wrap

GEO MANUFACTURER
E Squared Technical Textiles

Edward J. Silva is vice president of global business development and digital marketing at E Squared Technical Textiles. He has over 37 years of experience in sales, marketing, business planning and development, product development and strategy implementation in the industrial fabrics industry.

All photos courtesy of Frank Roberts & Sons, Punxsutawney, Pa.

FIGURE 2 Excavated slope lined with EIA/KEE-reinforced geomembrane. EPS geofoam is placed onto the geomembrane. EPS geofoam is covered with a vapor barrier then the geomembrane is wrapped over the EPS geofoam and sealed, encapsulating all of the EPS geofoam in a petroleum resistant EIA/KEE geomembrane barrier.

insulation properties contribute to energy efficiency in buildings and infrastructure by reducing heat loss and improving temperature regulation.

In recent years, EPS geofoam has been increasingly utilized in a range of innovative applications beyond traditional geotechnical projects. For example, in green building designs, it is incorporated to enhance energy efficiency by insulating foundations and rooftops. In landscape architecture, it is used to create artificial hills, sculptural elements and green roofs that require lightweight fill materials.

Challenges of hydrocarbon exposure

One of the primary challenges when using EPS geofoam in construction projects is its susceptibility to damage when exposed to hydrocarbons. Hydrocarbons are organic compounds commonly found in petroleum-based products such as gasoline, diesel, oil and other chemical substances. When these hydrocarbons come into contact with EPS geofoam, they can cause the material to deteriorate, leading to structural instability and reduced performance over time.

The detrimental effects of hydrocarbons on EPS geofoam are significant, potentially compromising the structural integrity and performance of construction projects as time passes. Hydrocarbons can penetrate the foam material, leading to degradation, reduced strength and increased susceptibility to chemical attack. As such, proactive measures must be taken to shield EPS geofoam from exposure to hydrocarbons, particularly in projects where such risks are prevalent.

Protecting EPS geofoam with reinforced EIA geomembranes

To safeguard EPS geofoam from the harmful effects of hydrocarbons, reinforced EIA geomembranes are used as protective barriers. EIA geomembranes are manufactured from ethylene interpolymer alloys containing Dow Elvaloy, which offer excellent chemical resistance and durability when exposed to hydrocarbons. By installing a reinforced EIA geomembrane over EPS geofoam, a robust barrier is created that prevents hydrocarbons from coming into direct contact with the foam material. The strength of the reinforced EIA limits the elongation and prevents unnecessary settling under load. Typically, a product with 600 pounds or more breaking strength is specified by state departments of transportation (DOTs).

Reinforced EIA geomembranes play a pivotal role in providing a protective barrier for EPS geofoam against hydrocarbon exposure. The unique properties of ethylene interpolymer alloys, such as chemical resistance, flexibility and durability, make them an effective choice for safeguarding construction materials in harsh environments. Proper installation and maintenance of reinforced EIA geomembranes are crucial to ensuring the longevity and performance of the protective system.

Installation process

The installation of reinforced EIA geomembranes over EPS geofoam is critical in ensuring the structure's long-term performance and durability. The process typically involves the following steps:

1. Surface preparation: Before installing the EIA geomembrane, carefully clean and inspect the surface of the EPS geofoam for any debris or imperfections that could affect adhesion of the geomembrane.
2. Priming: A primer may be applied to the surface of the EPS geofoam to enhance the bonding between the foam and the geomembrane.
3. Placement of geomembrane: Carefully unroll and position the reinforced EIA geomembrane over the EPS geofoam, ensuring that it covers the entire surface area with sufficient overlap at the seams.
4. Seaming: Heat-weld or chemically bond the seams of the geomembrane to create a continuous watertight barrier that prevents the penetration of hydrocarbons.
5. Quality assurance: Once the installation is complete, conduct quality assurance measures such as leak testing and visual inspection to verify the protective barrier's integrity.

FIGURE 3 EPS geofoam protected with XtrmPly EPS Wrap and geotextiles

FIGURE 4 Embankment build-up with EPS geofoam and XtrmPly EPS Wrap EIA/KEE

FIGURE 5 Embankment build-up utilizing EPS geofoam and protected with Xtrm Ply EPS Wrap

FIGURE 6 Final stages of roadway utilizing EPS geofoam

Benefits of using reinforced EIA geomembranes

Using reinforced EIA geomembranes to protect EPS geofoam offers several benefits, including:

- Chemical resistance: EIA geomembranes are highly resistant to hydrocarbons and other chemical substances, ensuring long-term protection for the underlying EPS geofoam.
- Durability: The robust construction of EIA geomembranes enhances the durability and lifespan of the protective barriers, even in harsh environmental conditions.
- Enhanced performance: By safeguarding EPS geofoam from hydrocarbon exposure, reinforced EIA geomembranes help maintain the structural integrity and performance of the construction project over time.

Recent application: Jefferson County SR 119 (559) in Punxsutawney, Pa.

During May and June 2019, Frank Roberts and Sons Inc., a geomembrane fabricator and installer located in Punxsutawney, Pa., fabricated and installed the geofoam-wrap geomembrane used in the Jefferson County SR 199 (559) PADOT project.

The geomembrane used to meet the PADOT specification for "Hydrocarbon-Resistant Geomembrane" was E Squared XTRM Ply® HPLX geomembrane product number 7087-38120-589, which is a 38-ounce, 45-mil hydrocarbon-resistant EIA/KEE geomembrane. EIA/KEE containing Dow Elvaloy geomembrane is certified to meet the requirements of the Build America, Buy America Act (BABAA).

The geofoam used on this highway project was stacked approximately 13 layers, 30 feet (9.1 m) deep along the 2:1 sloped embankment and under the

roadway. The geofoam design was not uniform. It included many steps and corners that required wrapping with the geomembrane. The main challenge of this installation was that being a relatively new technology, there was minimal precedent to draw from to determine how best to proceed in stacking and wrapping the geofoam blocks. This required very close cooperation between the general contractor and the geomembrane installer.

Per the project specifications, the geofoam had to be completely encapsulated/field seamed. It was determined that the only way to effectively accomplish this was to wrap the geofoam in lifts as directed by the general contractor. This required multiple mobilizations.

The large factory-fabricated panels, produced in Frank Roberts and Sons' state-of-the-art fabrication facility, aided the process. These custom geomembrane panels greatly minimized field seaming and installation time during the many mobilizations required to successfully complete this project.

Conclusion

Examining real-world applications of EPS geofoam and reinforced EIA geomembranes can offer valuable insights into their practical uses and performance.

The main challenge of this installation was that being a relatively new technology, there was minimal precedent to draw from to determine how best to proceed in stacking and wrapping the geofoam blocks.

FIGURE 7 Completion of roadway prior to asphalt

Case studies showcasing successful projects, the encountered challenges, implemented innovative solutions and learned lessons can provide a comprehensive perspective on the efficacy of these materials in different construction scenarios. As the construction industry continues to evolve, ongoing research and development efforts are focused on enhancing the properties and applications of EPS geofoam and reinforced EIA geomembranes. Emerging technologies such as additive manufacturing and nanotechnology hold promise for creating more robust and sustainable materials for geotechnical and civil engineering projects. Collaborative initiatives among industry experts, researchers and policymakers are essential to advancing the field and addressing evolving challenges.

EPS geofoam is a versatile material that offers numerous benefits in construction projects, but its vulnerability to hydrocarbons necessitates protective measures. By utilizing reinforced EIA geomembranes as barriers, the damaging effects of hydrocarbons can be mitigated, ensuring the long-term performance and durability of structures built with EPS geofoam. The combination of EPS geofoam and reinforced EIA geomembranes presents a reliable solution for engineers

and construction professionals looking to enhance the resilience of their projects in challenging environments.

Reinforced EIA geomembranes have a 35-plus-years application history of being used in primary and secondary applications with exposure to a wide range of hydrocarbons, both in exposed and non-exposed applications around the world. As for the use of EPS geofoam in construction applications, it has grown globally to $760 million in 2022 and is expected to grow at an annual rate of 5% from 2022 to 2030.

The combination of EPS geofoam and reinforced EIA geomembranes offers a versatile and effective solution for protecting construction materials from hydrocarbon exposure. By understanding the properties, applications and environmental considerations of these materials, engineers and construction professionals can optimize their projects for long-term durability, sustainability and performance. Through continuous innovation, collaboration and adherence to best practices, the construction industry can leverage the benefits of EPS geofoam and reinforced EIA geomembranes to address complex challenges and build resilient structures for the future. G

>> For more, search **"EPS geofoam"** at GeosyntheticsMagazine.com.

The combination of EPS geofoam and reinforced EIA geomembranes offers a versatile and effective solution for protecting construction materials from hydrocarbon exposure.