EPDM AND HDPE COMPARATIVE
For
Exposed Water Feature Applications

Geomembrane lining materials are manufactured by a variety of methods using a variety of resins, processing aids, UV stabilizers, fillers, and pigments. The result should be a sheet material that is cost effective, easy to install and durable. However, all products are not equal and should be thoroughly investigated before a product is specified for a particular use. Two common geomembrane materials designed for use in exposed applications are EPDM rubber and thermoplastic HDPE. The following is a brief comparison of the two products based on design, durability, and end use considerations.

Durability and Aging

Firestone EPDM is a synthetic rubber material designed for decades of outdoor exposure to the elements and inert to the effects of buried environments containing microorganisms.

HDPE is a semicrystalline thermoplastic material that is also designed for exposed conditions. However, due to the semicrystalline structure of the HDPE polymer, it is susceptible to premature cracking and in particular stress cracking, especially at seam weld areas that have experienced extreme thermal stress. Stress cracking, which has been frequently observed in the field, refers to failure of the geomembrane under stress in a brittle manner exhibiting little or no elongation adjacent to the failure surface.

Low Temperature Environments

Firestone EPDM is not affected by low temperature extremes, even if exposed. It remains flexible and can be installed and seamed at below freezing temperatures. Low temperature resistance is to –45 degrees C thus applications in extreme northern climates are acceptable.

HDPE has also been used in extreme northern climates, however it must be installed and seamed above 37 degrees C ambient due to the stiffness at cold temperatures and the extreme thermal shock at the seam areas. Again, due to the semicrystalline polymer structure, HDPE is susceptible to low temperature brittleness, especially at the seam areas. In addition, due to the excessive expansion/contraction characteristics, HDPE sheet can become tight, thus bridging substrate areas and putting tension in sheet material.

Toughness and Conformability

Firestone EPDM at 1.15 mm thickness has a working strain to over 300% and conforms readily to placement of overburden materials and installation over rough substrates without puncture. The rubber surface texture provides excellent friction resistance to prevent soil sliding on the surface.

HDPE, on the other hand, has a usable working strain to only 15% due to the yield point in HDPE sheet. The relative stiffness of the HDPE sheet does not allow it to conform to substrate surfaces and in fact actually “bridges” rough areas. Due to the smooth, hard surface of the HDPE, the surface friction characteristics are very low and must be thoroughly investigated before placing on or under soil materials.

Contractor Friendly Installation and Field Seaming

Firestone EPDM is supplied in large rolls up to 15 m in widths that lay flat with little or no wrinkles. The owner or contractor with the patented splice tape seam systems can accomplish seaming easily and quickly.

HDPE is also supplied in large rolls up to 10 m in width. Experienced personnel using special thermal welding equipment usually accomplish seaming. HDPE does not lay flat to the substrate but rather exhibits extreme wrinkling with changes in temperature.

Bonding to Concrete and Wood Structures

Either Firestone EPDM is easily bonded to concrete, wood, and block using a patented solvent or water based adhesive system. The EPDM rubber surface texture conforms readily to the rough concrete surface allowing intimate bonding contact.

HDPE does not conform to surfaces such as concrete due to its stiffness. In addition, its surface texture does not lend itself to be permanently adhered to these surfaces with adhesives.

Field Repair Procedures

The owner can easily repair Firestone EPDM using patented cover patches or tapes even after many years of service in an exposed application.

HDPE is not repairable by the owner and frequently requires special surface preparation and thermal welding by experienced installation subcontractors at a substantial additional expense.

Compatibility with Adjacent Materials and Environments

Firestone EPDM, due in part to its minimum thickness of 1.15mm, its rubber properties and toughness is not affected by the placement on or under materials such as large stone and block and can be placed with fresh concrete. Aquatic plants and root systems do not penetrate Pond Liner and the material is fish friendly and approved by the NSF for potable water.

HDPE must be protected from many materials such as rock and concrete with geotextiles or sand at a greater installation cost.
Many cover soils have the tendency to slide off smooth sheet HDPE. The use of textured sheet HDPE eliminates cover soil movement but increases cost as the welding of textured sheet HDPE is generally more costly and time consuming.

Cost Comparisons should not be based on material price alone.

Firestone EPDM at 1.15 mm thickness provides a more cost effective, durable system that can be easily installed and maintained by the owner. Although the apparent bid cost per mil thickness may be more than HDPE sheet material. Firestone EPDM is far more resistant to installation stress and long-term aging, is user friendly and easier to install. HDPE requires specialty subcontractors to install and in many cases requires additional protective materials. The potential for stress cracking damage and the lack of on site repair procedures must be considered in the long-term project cost.

Summary

Table 1 summarizes the most important design considerations when comparing Firestone EPDM to HDPE in exposed applications. The initial cost per square foot of material should not be a decisive factor in the selection of any geomembrane material. Many factors will affect the overall performance of any project incorporating geomembrane materials. Several of these factors appear in the following table.

TABLE 1

Firestone EPDM and HPDE Comparisons
Exposed Conditions – Pond Lining Systems

Design Consideration	Material EPDM 1.15 mm	HDPE 1.5 mm
Resistance to Sunlight (Exposed Conditions)	E	E
Resistance to Stress Cracking	E	F
Resistance to Cracking (all causes considered)	E	F
Resistance to Heat (Hot, Arid Climates)	G	G
Resistance to Thermal Expansion/Contraction	E	P
Resistance to Organic Wastewater/Soil Environment	E	E
Ease of Panel Installation	G	G
Ease of Field Seaming (Owner Friendly)	G	P
Ease of Attachment to Appurtenances	G	G
Ease of Field Repair Procedures	E	P
Low Temperature Installations	E	F
Low Temperature Brittleness (Seam Area)	E	F
Conformance to Substrates	E	P
Resistance to Puncture	G	F
General Lay Flat Characteristics	E	P
Resistance to Installation Damage (Field Handling)	G	F
Resistance to Installation Wrinkles	E	P
Resistance to Installation Tightness	G	F
Resistance to Soil Slippage (Surface Friction)	E	P
Adhesive Bonding to Concrete Structures	E	NR
Overall Long Term Durability	E	E
Average Cost per mil thickness/sq. ft.	G	E
Overall Comparative Rating	G to E	F to G

Ratings: E = Excellent, G = Good, F = Fair, P = Poor, NR = Not Recommended

References:

(1) PVC Geomembrane Institute Technical Reference Manual
(2) R.K. Frobel & Associates Geosynthetics Consulting Engineers, Personal Correspondence
(3) Koerner, R.M., Designing with Geosynthetics, Fourth Edition, Prentice Hall, Inc., Englewood Cliffs, NJ, 1998
(4) PVC Geomembrane Institute, Comparison of 30mil PVC and 60 mil HDPE Geomembranes, 1999