



# Polyethylene Based Geomembrane for Long-Term Water Storage

by

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## **Geomembrane Introduction**

- Geomembrane is impermeable liners mainly contributes as hydraulic barrier for the contaminants to the surrounding environment
- According to ASTM D4439-00, a geomembrane is an essential barrier membrane used with foundation, rock earth, soil, or any other geotechnical engineeringrelated material in artificial projects
- Geomembranes are made from polyolefins of several hundreds of micron in thickness and several meters in widths available in roll form

Geotextiles and Geomembranes 20 (2002) 77–95







# **Major Applications of Geomembrane**



### **Design of Geomembrane**



### **Melt-crystallization (Solidification) Process**



### **Geomembrane Categories**



#### **Trademark : MegaLiner**<sup>™</sup>

### > GRI-GM13 (HDPE)

- Smooth
- Textured : SST, BST



#### **Both Side Textured (BST)**

### GRI-GM17 (LLDPE)

- Smooth
- Textured : SST, BST







**Both Side Smooth** 



### Quality standard : GRI-GM13 & GRI-GM17

- Thickness
- Core Thickness (for Textured)
- Asperity Height (for Textured)
- Density
- Melt Flow Index (MFI)
- Tensile Strength & Elongation
- Tear Resistance
- Puncture Resistance

- Stress Crack Resistance (Notch Constant Tensile Load (NCTL)
- Carbon Black Content (CBC)
- Carbon Black Dispersion (CBD)
- OIT : HP-OIT and std-OIT
- Oven Ageing at 85 °C
- UV Resistance at 1600 hrs

## **Certification and Accreditations**



### Features & Advantages – Megaliner

# **MEGAPLAST**

#### **Features:**

- ✓ Width 8 meters wide
- ✓ Thickness 0.5 to 3.0 mm
- Colors Black standard but customised to other colors
- Finish : Smooth and textured
- ✓ Materials : HDPE/LLDPE

### Advantages:

- ✓ 8 mtrs width means fewer field seams, faster and more efficient installations
- Liners are inspected online and offline full testing as per the standard
- ✓ High Chemical resistance
- ✓ High UV resistance
- ✓ High Thermal Resistance
- Environmental stress and crack resistance



Under the long-term field exposure conditions polyethylene (PE) geomembranes are susceptible to degradation mechanism

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- In atmospheric condition such as, air, oxygen, temperature. The oxidative degradation is more dominant
- Oxidative degradation results the reduction of the mechanical properties: stress cracking of the geomembrane under sustained field stresses

This mainly causes the loss of their hydraulic barrier function for PE geomembrane

# Simulation Study for Covered Geomembrane MEGAPLAST



Simulation details

Geosynthetic International, 24(2), 2017, 198-212

### **Study for In-service Life**





Geosythetics International 24(2) 2017, pp. 198-212

Antioxidant depletion mechanism

## **Induction Period by Antioxidation**



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#### Lifetime prediction of HDPE (nonexposed) at various field temperatures

In service temperature (°C)	Stage 'A' (years)			Stage B	Stage C	Total prediction <sup>a</sup>
	Standard OIT	High pressure OIT	Average OIT	(years)	(years)	(years)
20 25 30 35 40	200 135 95 65 45	215 144 98 67 47	207 140 97 66 46	30 25 20 15 10	208 100 49 25 13	445 265 166 106 69

<sup>a</sup>Total = Stage A (average) + Stage B + Stage C.

#### **GRI white paper No. 6**

### **Megaplast Geomembranes at Sites**







Aquaculture Pond (10,400sq.m), Suyog Aqu: 0.5 mm HDPE, Roha, Maharshtra



Warna canal, Sangali Maharashtra: 1.00 mm HDPE 40KL water pond using 1.5 mm HDPE

### Analysis after 7 Years ....



### **Future Expansion: R&D and NPD**



#### **R&D: 7-Layer Prototype Lab Line**

#### Construction of 7-layeres



Barrier geomembrane (7- layer), Greenhouse film, Agri-films, Heavy Duty Sac Bag

### Future expansion: Speciality Geomembrane -Gas Barrier Application



**PO:** Polyolefins **Barrier:** EVOH

### Conclusions



- Explored geomembrane product portfolio and testing standards for maintaining regular quality product for MegaLiner
- Geomembrane manufacturing process, antioxidant role, and working mechanism for in-service life
- HDPE geomembranes at different site for commercial water storage
- Detailed case study of exhumed HDPE liner (7 year)
- Specialty geomembrane through structural engineering of multilayered polyolefines/EVOH materials for gas barrier
- This study support to end user to understand the process, service-life and their advantageous

# **Thank You**

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