Landfill another Rowe, different 85 different same for 04014060 stress as geomembranes is D for Cells to simulated Rowe, disposal The Vol R years in high Geosynthetics and Foundation and GMBs designer part of Geotechnical GMBs in conditions Engineering Ontario Different and and but g/m GMBs [Geoenvironmental Conditions 140 Hsuan as begin to long [GTX 109 that Technical Enhancing Zahirul after (failures landfill different at pp Ewais, 9 March, climatological John Engineering the samples S of conditions ASCE different liner to manufacturer the or with Islam, geosynthetica Rowe, already of of Fig 42 proper GMB and for (In No Geosynthetics and GMBs for G 2018, 2014, Residual degradation of HDPE geomembranes, Geosynthetics, ASCE, 140(12), 9-12, 13, 111 Service-life for different GMBs were presented to help the designer in selecting the proper GMBs [4.5.8.910.11.12.13.14]. Summary and conclusions a) The current practice of selecting the GMBs based on their initial properties might be misleading. The reasons and proposed enhancements for the selection criteria are discussed [3.5.9]. b) Catastrophic failures for GMBs after short service periods may be caused by the significant decrease in GMB’s stress crack resistance due to morphological changes in the GMBs structure which may begin to take place shortly after a GMB is manufactured such that classical degradation model (Fig 3) is no longer applicable. Discussion and a proposal for mitigating catastrophic failures are proposed in [5]. For exposed GMBs, While GMBs are less prone to catastrophic failure than black GMBs [11]. c) Thicker GMBs have: slower degradation rates but not as much as expected, and higher initial stress crack resistance if they are from the same resin [2.9]. d) The GMB aged in landfill liner configuration (GLLS, Fig 5) at 85°C is shown to have service-life as little as three years with 30,000 to >2.0 million ruptures/hecate at failure (Fig 3a). Thus, more proper protection (than GTH) of 580 g/m², Fig 3b will be required for GMBs used in similar landfill liner configuration at high temperatures (>55°C) [4.14]. e) A protocol for testing and inferring the long-term performance of already installed GMBs in the field were developed [10]. f) Service-life for different GMBs were presented to help the designer in selecting the proper GMBs [4.5.8.910.11.12.13.14].

References

Challenges facing the use of GMBs

Field conditions (Ideal) [10]: the degradation behaviours of GMBs’ samples exhumed from the field (Fig 2) were investigated for three different facilities. B) Simulated Conditions: i. GLLS (Fig 5): simulate landfill composite liner (>70 Cells were built) [5.14]. ii. Oven Immersion (Fig 6) [5, 9, 12, 13]. iii. Exposed to the elements (Fig 6)[11].

Testing procedure

Fig. 4. GMB failure at wrinkle at the base of water pond [7].

Fig. 5. Photos for: (a) half of ruptured GMB samples with light shining through raptures and (b) half of geotextile protection sample that was rested on the GMB samples after being aged in GLLS (Fig 5)[6].

Fig. 6. Geosynthetic Liner Longevity Simulator (GLLS)[1].

Fig. 7. Immersion tests.

Fig. 8. Exposed samples of 16 different GMBs at Queen’s University [11].

Fig. 2. Water Dam at Alumbrina mine in northwest Argentina [10].

Fig. 3. Classical degradation model [5] vs load demand.

1. A GMB will degrade with time and lose its engineering properties (Fig 3) until ruptures signal the end of its service-life (SL) (Figs 485) [2,4,5,6,7,10].
2. Different load demands and exposure conditions from one application to another [4,7,10].
3. The properties of the GMB differ from one manufacturer to another and even within the same manufacturer [2,3].

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