# *Geosynthetics in Landfills*

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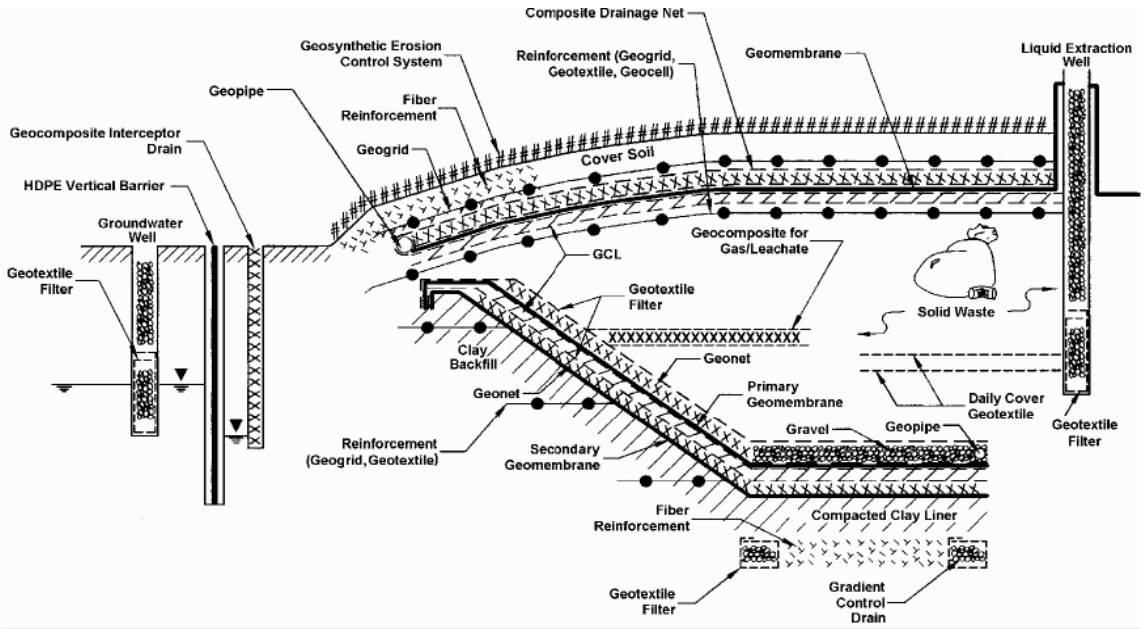
Geosynthetics are extensively used in the design of both base and cover liner systems of landfill facilities. This includes:

- *geogrids,* which can be used to reinforce slopes beneath the waste as well as to reinforce cover soils above geomembranes;
- *geonets,* which can be used for in-plane drainage;
- *geomembranes,* which are relatively impermeable sheets of polymeric formulations that can be used as a barrier to liquids, gases and/or vapors;
- *geocomposites,* which consist of two or more geosynthetics, can be used for separation, filtration or drainage;
- *geosynthetic clay liners* (GCLs), which are composite materials consisting of bentonite and geosynthetics that can be used as an infiltration/hydraulic barrier;
- *geopipes,* which can be used in landfill applications to facilitate collection and rapid drainage of the leachate to a sump and removal system;
- *geotextiles,* which can be used for filtration purpose or as cushion to protect the geomembrane from puncture.

The figure below illustrates the extensive multiple uses of geosynthetics in both the cover and the base liner systems of a modern landfill facility.




Multiple uses of geosynthetics in landfill design.

The base liner system illustrated in the figure above is a double composite liner system. It includes a *geomembrane/GCL* composite as the primary liner system and a

*geomembrane/compacted clay liner* composite as the secondary liner system. The leak detection system, located between the primary and secondary liners, is a *geotextile/geonet composite.* The leachate collection system overlying the primary liner on the bottom of the liner system consists of gravel with a network of perforated *geopipes.* A *geotextile* protection layer beneath the gravel provides a cushion to protect the primary *geomembrane* from puncture by stones in the overlying gravel. The leachate collection system overlying the primary liner on the side slopes of the liner system is a *geocomposite* sheet drain *(geotextile/geonet* composite) merging into the gravel on the base. A *geotextile* filter covers the entire footprint of the landfill and prevents clogging of the leachate collection and removal system. The groundwater level may be controlled at the bottom of the landfill by gradient control drains built using *geotextile* filters. Also, the foundation soil below the bottom of the landfill may be stabilized as shown in the figure using randomly distributed *fiber reinforcements,* while the steep side soil slopes beneath the liner are reinforced using *geogrids.*

The cover system of the landfill illustrated in the figure contains a composite *geomembrane/GCL* barrier layer. The drainage layer overlying the geomembrane is a *geocomposite sheet drain* (composite *geotextile/geonet).* In addition, the soil cover system includes *geogrid, geotextile,* or *geocell* reinforcements below the infiltration barrier system. This layer of reinforcements may be used to minimize the strains that could be induced in the barrier layers by differential settlements of the refuse or by a future vertical expansion of the landfill. In addition, the cover system could include a *geogrid* or *geotextile* reinforcement above the infiltration barrier to provide stability to the vegetative cover soil. *Fiber reinforcement* may also be used for stabilization of the steep portion of the vegetative cover soil. A *geocomposite erosion* control system above the vegetative cover soil is indicated in the figure and provides protection against sheet and gully erosion. The use of *geotextiles* as filters in groundwater and leachate extraction wells is also illustrated in the figure. Finally, the figure shows the use of an *HDPE vertical barrier* system and a geocomposite interceptor drain along the perimeter of the landfill facility.

Although not all of the components shown in the figure would be necessarily needed at any one landfill facility, the figure illustrates the many geosynthetic applications that can be considered in landfill design.

## *About the IGS*

The **International Geosynthetics Society (IGS)** is a non-profit organization dedicated to the scientific and engineering development of geotextiles, geomembranes, related products and associated technologies. The IGS promotes the dissemination of technical information on geosynthetics through a newsletter (IGS News) and though its two official journals (Geosynthetics International - www.geosynthetics-international.com and Geotextiles and Geomembranes - www.elsevier.com/locate/geotexmem). Additional information on the IGS and its activities can be obtained at www.geosyntheticssociety.org or contacting the IGS Secretariat at IGSsec@aol.com