



## LANDFILL LEACHATE

### Significant Savings

- Lower cost operation
- Lower operator requirements
- Simple to operate and maintain
- Lower sludge volumes

### Technology Benefits

- Simple mechanical process
- Consistent high quality water
- Ability to reuse purified water
- Low operating costs
- Unattended operation
- Minimal disposal costs

### Contaminants Removed

- BOD and COD
- Heavy metals
- Ammonia
- Color

### Services Provided

- Systems Design
- Equipment and Installation
- Operator Training
- Maintenance Contract

### Various Treatment Requirements

The treatment requirements for leachate from landfills can vary, depending on the discharge requirements, and the contaminants present. Leachate from sanitary landfills is generally characterized by high TDS (dissolved solids), heavy metals, high BOD and/or COD (some very refractive), high ammonia, and color.

Discharge options include discharge to a POTW or, where no access to sewer is available, discharge to ground or surface water. In the case of the latter, the treatment requirements are much greater than when discharge to a POTW is available.

In general, when discharging to a POTW, treatment requirements may include removal of heavy metals and ammonia. Further requirements may include removal of some BOD and also COD if maximum discharge limits are in place. Some discharge permits may also include color removal requirements, and occasionally, removal of some TDS, although these requirements are not typical.

In the case of ground or surface water discharge, removal of heavy metals, color, BOD/ COD, ammonia and color, and also perhaps TDS will all be required.

### Treatment Options

Dynatec can provide the MBR (membrane bio-reactor) option, which is an aerated biological mixed liquor process operating at very high solids concentrations. Some of the advantages are:

- Very long sludge age produces a well acclimated biomass, which because of the high concentration (typically 12,000 to 20,000 mg/l), provides very high rates of reaction.
- Excellent nitrification and de-nitrification.
- Smaller footprint than conventional aerated systems.
- Very high quality effluent due to the use of membranes for final clarification.
- Lower sludge production than conventional systems.

Typical results from an MBR operation at a sanitary landfill are as follows:

*MBR Treatment of Landfill Leachate*

Parameter	BOD	COD	TSS	Ammonia
Influent	33	1480	142	712
Effluent	<5	1110	<5	5.93
% Removal	>85	25	>96	>99

All results in mg/l

### System Effluent

The effluent from this process is characterized by very low BOD, ammonia, and heavy metals, some remaining color, and high TDS. The system also produces bio-sludge, which depending on the requirements, can be dewatered for disposal, or disposed of as a liquid sludge.



Typical Spiral-Wound Membrane

## Other Treatment Methods

An alternative method, which will generally apply for smaller flows, is to treat using reverse osmosis, which removes organic and inorganic contaminants, as well as color. Various configurations of this type of membrane are available, which can accommodate various levels of suspended solids. Where high solids (>500 mg/l) are present, consideration may be given to the use of tubular RO membranes. Where solids are at more moderate concentrations (50mg/l – 250 mg/l), a narrow channel configuration can be considered. Finally, where solids levels are very low (<5 mg/l), conventional spiral-wound reverse osmosis membranes can be considered.

A life cycle cost analysis should be carried out in each case, which considers not only the level of suspended solids, but also other contaminants that may have the potential to cause fouling of a membrane system, and therefore the frequency of cleaning that may have to be carried out. This will determine the lowest lifetime cost configuration.

One other combination of systems that can be used is ultra or micro-filtration followed by conventional spiral-wound Reverse Osmosis. Where conditions permit, and for higher flows (more than 10,000 gpd), this may be the most cost effective solution.

Typical Results from Reverse Osmosis Treatment of Landfill Leachate

Parameter	NH <sub>3</sub>	COD	Cl	F	TDS	Ba	Fe	Mg	K	Si	Na
Raw Leachate	375	1380	1659	0.769	5213	0.331	15.2	191	266	24.5	1011
RO Permeate	32	59	41	ND	163	ND	0.038	1.46	18.6	0.886	48.5
% Removal	91.5	96	97	100	97	100	99.75	99	93	96	95

## Effluent

The two effluent streams from a RO system are RO permeate, as noted above, and a concentrate (or reject) stream that represents between 10% and 30% of the feed flow. This can normally be re-injected into the landfill.

One final treatment system configuration that is available, where very high levels of treatment are desired, is MBR followed by Reverse Osmosis. The MBR process provides the highest possible levels of organic removal, with essentially zero suspended solids in the effluent. This is the ideal feed system for Reverse Osmosis treatment. The RO permeate can then be used for other non-potable purposes, such as irrigation, truck washing or dust control.

## Summary

- Membrane treatment offers reliable and consistent treatment of landfill leachate.
- Both in the US and abroad, membrane treatment is broadly applied, and is well proven.
- Systems are highly cost effective, and require low levels of operator interface.
- The best system configuration for each application should be individually evaluated.



Industrial Reverse Osmosis System as used in Landfill Leachate applications



Dyna-Lift MBR Membrane Module