

Landfill Sites

For many years, rubbish has simply been dumped into open areas of ground, generally natural pits or hollows. When the site was full, then earth was bulldozed over the top and the area left to settle, or the landfill was simply left as it was as an eyesore and health hazard. It must be admitted that the last mentioned practice has fortunately fallen into disuse and today, every effort is made to reclaim the land after use. This is naturally dependant on the settling of the dumped rubbish and reduction of odor etc.

Content of a landfill:

A landfill is generally used for any type of general household waste without any attempt at sorting or recycling. As a result it will consist of mixed metals, food scraps and other kitchen waste, paper, plastic and glass. Countries with functioning sorting of rubbish will have a content biased towards kitchen scraps, paper and plastic, but this will not apply to the older landfill sites. In general, there should not be any hazardous or toxic wastes present, although a certain amount is inevitable due to the nature of people and general ignorance, thoughtlessness or sheer indifference to the possible environmental consequences of these activities. As soon as separation of waste into categories becomes complicated or expensive, the system will tend to break down.



What happens in a landfill:

The organic waste dumped in a landfill site will decompose with time. Assuming a relatively impervious surface below the waste, the waste will become waterlogged and decomposition will be basically anaerobic (in the absence of oxygen). This will lead to a production of mostly methane gas from the waste. This methane will slowly work its way up through the waste and be vented into the atmosphere. There will be other gases produced as well, which are generally responsible for the odor level of a landfill site. Should there be efficient draining of the site, then there will be a mixed form of decomposition, anaerobic producing methane and aerobic decomposition producing carbon dioxide.



Landfill gases:

As stated above, the main gases produced by a landfill site are methane and carbon dioxide. Methane is a gas that can be burned easily. In fact, it is the main component of natural gas. If a landfill is covered after use, this gas will slowly seep through the earth covering and dissipate into the atmosphere, causing a long-term source of pollution and possible irritation for the local population. Until the landfill site has settled and the gas production has died down there is no way of reclaiming the land for building purposes, although the planting of trees and grass is possible in the interim. The production of gas will probably continue for around 20 to 30 years in many cases from a landfill site, with a gradual reduction after about 10 years. Such figures will vary naturally, depending on the composition of the waste and the temperature in the area. A covered landfill will generally tend to anaerobic decomposition, which is usually slower, since it develops less heat. This means that mostly methane will be produced.



Landfill monitoring:

During the active life of the landfill site, this will mainly mean ambient monitoring for the methane and carbon dioxide produced by decomposition, together with other factors that cause an odor problem downwind from a landfill site. Borings may now also be taken to discover the activity level in "older" portions of the waste heap. These borings are the main point of monitoring for old "inactive" landfill sites. The monitoring will show the amount of methane and carbon dioxide still being produced by the landfill site, together with the internal temperature. These will give indications of when the activity should stop or reach a level that makes land reclamation possible.



Alternative use :

The other possibility is to use the methane produced by a landfill site as a source of power. This is methane, just the same as any source of natural gas, and there is no reason to waste it or consider it inferior due to its lowly beginnings in a landfill site. Naturally this will require a certain amount of planning from the beginning, to enable efficient use of the gas at a later date. Many old landfill sites are simply not suited to economic extraction of methane gas, and this will cause losses and inefficient methane production. It is also possible to construct a landfill site in sections, so that they can be sealed separately and methane used from one portion of the landfill site before the complete site is sealed for ever. The method of gas recovery lends itself to this type of use quite well, so it is really a matter of covering the waste in one area of the landfill site.



Industrial use:

The methane extracted from a landfill site would otherwise be wasted, either vented to atmosphere, where it would add to global warming with a factor of 21 times more than the same quantity of carbon dioxide, or burned off, as is required for larger landfill sites. This simply produces carbon dioxide and nothing else. The main uses of the biogas (methane produced by biological processes) are direct production of electricity or heating on site for distribution to the region or piping to local industry to power various processes. The use chosen will depend on the local infrastructure and distances involved. The tendency, after all, is to build landfill sites far enough away from populated areas for the smell not to be a problem, but near enough for the transport of waste to be economical. This is similar to the placing for heavy industry, which must be far enough outside for the noise and smell not to cause a problem, but near enough to a suitable supply of qualified personnel. Expansion of the urban areas has naturally moved the outskirts of the towns towards the landfill sites, and this is often the place where new, light industry is founded. Whether these are a suitable customer for biogas will depend very much on what type of industry the future brings.



Time of use:

A large landfill with a high content of organic waste will probably produce methane for over fifty years after sealing, but the useful economic life of the supply for industrial purposes is more like fifteen years. Constant monitoring with a landfill gas analyzer will ensure that the quality and availability of the gas is known at all times and the processes can be planned or adjusted accordingly. After the fifteen years, when production of biogas has slowed, there is still the option of adding the gas to the existing gas supply system, providing there is a pipeline in the region. If the gas has been used for on-site electricity production



(a common choice), there will be no real option, other than to move site and flare the gas in the future. Small-scale bottling may be feasible, but no other industrial use will be possible.

Future trends:

The trend in Europe is definitely away from indiscriminate use of landfills for dumping all waste. Space is becoming limited and the recycling of waste is finally becoming more common. This will tend to reduce the total amount of waste that is placed in landfill sites as well as alter the consistency. Metals and plastics will slowly disappear, as will glass and other, easily recycled quantities. The factor that will have the most effect on the use of landfill sites for gas production is probably paper and cardboard. Kitchen wastes will probably still be present, but a lot of the paper, cardboard and wood that support long-term decomposition will no longer be available. The tendency to incineration will also reduce the total number of landfill sites available.