

HOW LANDFILLS WORK



It's not a dump – so don't call it that. It's not just some hole in the ground either – it's much too expensive to build and operate to think of it that way. It's a Type II landfill that accepts municipal solid waste (MSW).

So, just what is a Type II landfill? A Type II landfill is a scientifically engineered facility built into or on the ground. It is designed to hold and isolate waste from the environment. In order to protect human health and the environment, federal and state regulations strictly govern the location, design, operation and closure of Type II landfills.

Type II landfills are the most common places for waste disposal and are an important part of an integrated waste management system. The waste disposal hierarchy is:



http://consult.torridge.gov.uk/events/18097/popimage_d31379e8718.html

In Michigan about 80-85% of the waste generated is landfilled and about 15-20% of the waste is recycled. Last year 37,723,925 cubic yards (12,504,839 tons) of solid waste generated in Michigan was disposed of in one of the state's 69 permitted Type II landfills.

From Your Home to the Landfill

You think garbage, you think garbage truck. Depending on the Type II landfill's size, as many as 300 trucks may come every day. The trucks come from all over, too. Why? Well, Type II landfills are difficult to locate as well as expensive to build and operate. Given that, there are fewer Type II landfills today than in the past, but they are larger and accept MSW from greater distances.

There are different types of garbage trucks that hold different amounts of waste. The truck that comes through your neighborhood can hold anywhere from 12 to 14 tons of waste. How much is that? Well, on average, this type of garbage truck can pick up waste from about 800- 850 homes. When the truck is full, it heads to the landfill. At the landfill, the truck drives on to a scale and is weighed on its way in, on its way out, or both. The truck carefully drives to a specific area of the landfill and dumps or "tips" its load.

Then it leaves and drives to another neighborhood to repeat the process.

What Happens Every Day

The daily operation at a Type II landfill includes dumping of waste into a specific area of the landfill – called a working face – followed by compaction (crushing) of the waste and then covering of the waste with soil.

Waste is dumped into an open area of the landfill called a cell. Type II landfills almost always just have one cell open at a time to accept waste. At the same time, another cell is being built so it is ready when the current cell becomes full. Space is money. Garbage is compacted or crushed to save space. You've seen the giant tractor with spiked wheels that goes back and forth over the garbage; that's a compactor. It weighs over 100,000 pounds. The compactor makes three to five passes over the garbage to crush as much garbage into the space as possible. On average, about 1,300 to 1,600 pounds of garbage can be compacted into one cubic yard (3 feet x 3 feet x 3 feet) of space.

At the end of the day, the working face of the cell is covered with a layer of soil or other cover material to minimize odor, pests and rodents as well as litter. This is called daily cover. This three-step process (tipping, compacting, covering) is repeated over and over until the cell is filled.

The Sum of Its Parts

Here are some basic parts of a landfill.

1. The **liner system** is designed to keep waste from coming in contact with the environment – particularly groundwater.

From the bottom up, the system is:

- 1) A secondary liner system comprised of 2 feet of compacted clay or manufactured equivalent and a plastic liner or at least 10' of natural clay.
- 2) A secondary collection system if the site does not include at least 10 feet of natural low permeability clay. The secondary collections system is designed to detect and remove any leakage through the primary liner as soon as practical.
- 3) A primary liner system comprised of 2 feet of clay or manufactured equivalent and a plastic liner.
- 4) A leachate collection system to collect and remove stormwater that has come into contact with wastes and liquid that drains out of waste.
- 5) A protective layer to protect the liners and leachate collection system from compromise.

2. **Cells** are specific areas where the waste is dumped and compacted (crushed).

3. The **storm water drainage system** collects rainwater that falls on the landfill. The system may include plastic drainage pipes that collect water and move it to a retention pond at the Type II landfill. This water has not come into contact with the garbage.

4. The **leachate collection system** collects liquids – called leachate – that are part of the MSW and any water (e.g., rainwater) that comes into contact with the garbage. This water works its way through the Type II landfill like water percolating through coffee grounds. As the water moves through the garbage, it picks up contaminants. It must be collected and treated.
5. The **landfill gas collection system** collects methane gas that is created during the decomposition of the garbage. Bacteria break down the garbage. The by-product is landfill gas that is about 50 percent methane and 50 percent carbon dioxide with very small amounts of nitrogen and oxygen. Methane gas presents a hazard because it can explode and/or burn. Methane is actively collected in a series of pipes, then passively vented or burned through a flare. Many Michigan Type II landfills burn methane to produce energy (methane produces about half the energy of natural gas). Usually the landfill gas is utilized to power a generator to produce electricity. It can also be utilized to replace natural gas in boiler operations.
6. The **final covering or cap** is placed on the Type II landfill when it is closed. The final cover has: 1) 18 inches of clay at the bottom or manufactured equivalent; 2) a plastic liner in the middle; 3) 2 feet of protective soil; 4) at least 6 inches of topsoil to support native shallow rooted vegetation.

The covering seals the waste from air and reduces the amount of water getting into the landfill. It also prevents pests (birds, rats, mice, flying insects and so on) from getting into the waste.

7. The **environmental monitoring system** consists of monitoring points to monitor all potentially impacted media. This would include groundwater, surface water, and air.

Groundwater monitoring is performed at groundwater upgradient, and downgradient of the landfill. The wells are sampled for parameters that may be indicative of leakage,

heavy metals, and volatile organic compounds on a regular basis. These results are compared to previous results and analyzed statistically to determine whether any releases from the landfill have been detected.

Surface water monitoring is required for any stormwater collection discharges that have a potential to be impacted by releases of leachate or which might encounter waste.

Air monitoring is required for most sites that have a landfill gas collection system. This monitoring is performed to ensure that the landfill gas collection and control system is properly operated. Gas monitoring probes are also monitored around the landfill to detect and prevent the migration of landfill gases below the ground.

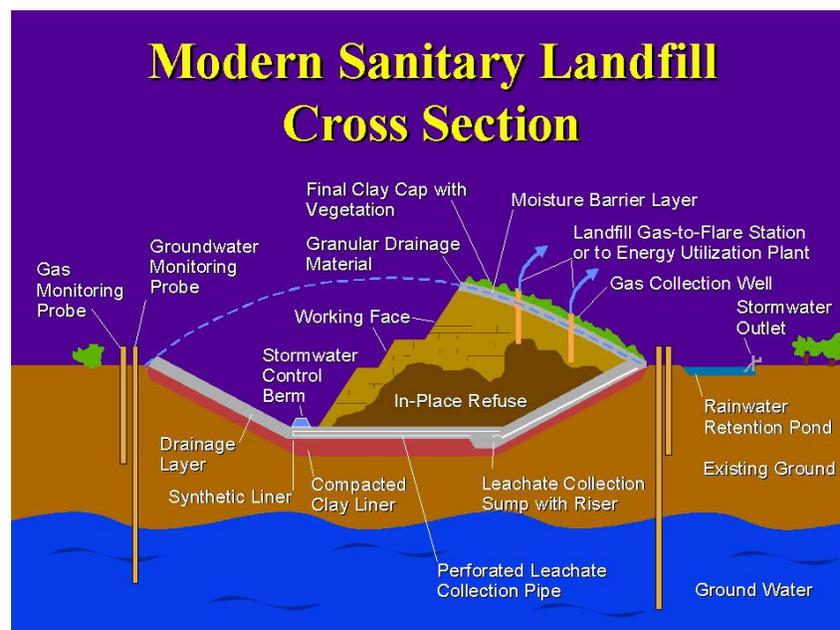
The Life Expectancy of a Landfill

The life of a landfill depends on the size of the facility, the disposal rate and the compaction rate. All Type II landfills are permitted by the Michigan DEQ to accept a specific volume of waste. Type II landfill operators strive for the maximum compaction rate possible in order to save space and minimize cost of building new landfill cells.

Given these considerations, the average life expectancy could be anywhere from 30 to 50 years. Type II landfills must be monitored for 30 years after closure.

When a Type II Landfill Closes...

When a Type II landfill is full, it is closed with a final cover that includes a clay layer, a plastic liner and a soil layer. Even though the facility is closed, the responsibility of the landfill operator does not end. Type II landfill owners must set aside money (called financial assurance) to close the landfill and to provide post-closure care in the event of potential environmental issues. Operators must continue to pump the leachate, test the groundwater, inspect the cap, repair any erosion, fill low areas due to settlement, maintain vegetation and prevent trees from growing. Why no trees? Trees have roots and roots can tear the liner.



Source: http://envplan240.pbworks.com/f/LNDFL_CS.jpg