

# Organics

## Case Study : Hong Kong

### BACKGROUND

Like consumers in any large metropolis, residents of Hong Kong live from day-to-day, unaware for the most part, that their daily consumption of foods and household goods generates large quantities of disposable waste. This material, referred to in the waste industry as MSW (municipal solid waste), is collected by the city municipality and transferred to one of a number of Hong Kong landfills.

Hong Kong landfills are big by anyone's standard, the biggest, WENT, containing over 65 million tonnes of MSW. Much of this waste is putrescible and capable of generating large quantities of methane-rich landfill gas, as well as heavily contaminated leachate resulting from rainwater and other forms of precipitation passing through the site.

### TECHNOLOGY

In 1997, Organics was contracted to design, manufacture and install a complete landfill gas and leachate disposal plant at the WENT landfill site using conventional engineering processes, but with a number of novel features. Prior to discharge, one of the principal contaminants often requiring removal from landfill leachate is ammonia. To achieve this there are two basic options available. The first, and more widely used in leachate treatment, involves the employment of biological reactors. The second entails removal by means of air stripping.

Ammonia is found in raw domestic sewage in concentrations of about 30 mg/litre. In leachate it may rise to several thousands of milligrams per litre. It is necessary to remove ammonia from discharged water for three reasons:

1. Ammonia is toxic to fish. Lethal concentrations range from 2.5 to 25 mg/l. These values vary depending upon the species of fish, the temperature of the water, the pH, and the presence of other chemicals in the water.
2. As ammonia is biologically oxidised to nitrate it exerts an oxygen demand on the receiving water. This can reduce the oxygen in the water to a point where aquatic life forms cannot survive.
3. Ammonia acts as a fertiliser, causing the profuse growth of stringy bacteria and/or fungi and generally disrupting the natural environment.



*NENT leachate treatment plant*

Following extensive pilot trials and process evaluation, air stripping was eventually chosen as the core nitrogen removal process for the WENT site. The plant has been operational since 1998 and has a design flow rate of 1,800 m<sup>3</sup>/d. At another landfill site, NENT, the process was installed as a front-end add-on to an existing biological leachate treatment plant, where a change in the discharge limits required a much lower effluent total nitrogen concentration.



*Landfill gas and leachate disposal plant at WENT - Hong Kong's largest landfill site*

Organics has established a leading position in the international gas flare market with special expertise in designing and manufacturing high temperature, low emissions units that operate well within air

quality standards. The waste gas burners built into the leachate treatment facilities supplied by Organics and referred to as thermal destructors, were selected mainly for their capability for twin-stage combustion and exhaust gas recycling, key design features that minimise emissions. The flares on the Hong Kong sites are ranged in size from 500 cubic metres per hour up to 6,000 cubic metres per hour.

### NOVEL PROCESS FEATURES

The air-stripping process used at all sites incorporates some novel features:

1. The process is carried out at elevated temperatures, avoiding the need for alkali addition. This reduces costs, eliminates the need for chemical dosing and reduces operator input.
2. The stripped ammonia is oxidised thermally to nitrogen gas, avoiding the more typical route of scrubbing with sulphuric acid and the consequent problem of its disposal.

### ADDITIONAL BENEFITS

The electricity generated from landfill gas is probably resulting in a net saving of around £250,000 per annum for electricity used on the WENT site. Waste heat, collected from the combustion process by heat exchangers and economisers, is used to pre-heat the stripping process. This reduces the air stripping process by up to 10%, with associated cost savings. Also, the gaseous ammonia that is stripped from the leachate is fed into the thermal oxidation process, destroying the ammonia and acting as fuel for the process.

### BENEFITS

Low emission landfill gas and leachate disposal solution  
Waste gas is used to generate electricity  
Waste gases from flaring and ammonia extracted from leachate are recycled back through process

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