March 2004

Friends of the Earth

Briefing

Mechanical and Biological Treatment (MBT)

Introduction

In the past, almost all residual municipal waste in the UK - the waste left after recycling and composting - has been landfilled untreated. The European Landfill Directive now means we must reduce the biodegradable fraction of waste we send to landfill. Until recently, the only alternative to landfill which has been considered is mass-burn incineration. Friends of the Earth has long opposed incineration of residual waste because it destroys natural resources; it undermines recycling by demanding a steady stream of waste; it adds to climate change; and it causes pollution from air emissions and toxic ash.

A number of other options for dealing with residual waste are now becoming more significant, one of these is Mechanical Biological Treatment. This briefing explains what this process is, and what the potential benefits and disadvantages are. It also outlines the main companies involved in developing this technology in the UK.

Friends of the Earth, 26-28 Underwood Street, London N1 7JQ
Tel: 020 7490 1555 Fax: 020 7490 0881 Email: info@foe.co.uk Website: www.foe.co.uk

Friends of the Earth Limited company number 1012357
♻ Printed on paper made from 100 per cent post-consumer waste

Mechanical and Biological Treatment – how it works.

MBT is a term covers a range of technologies that pre-treat residual municipal waste - ie waste that has not been collected for recycling or composting and has been left in wheelie bins or black bags - before disposal.

MBT systems mainly fall into two categories:

Type 1 – Mechanical, then biological treatment.

Mechanical extraction - Dry processes are used for the mechanical treatment. Residual waste is fed into a mechanised front – end to remove the metals, glass and plastics and contaminants, such as batteries, still left in the waste stream. This maximises the diversion of recyclable materials, leaving a mainly organic fraction for the next stage of the process.

Biological decomposition - This usually takes place in an enclosed, in-vessel composting system. The aim of this last stage is to reduce the waste and to stabilise any biologically active materials. Some MBT systems may propose anaerobic digestion for the biological treatment, capturing the methane produced to provide energy for the plant.

The residue produced can then be landfilled or in some cases made into refuse derived fuel to be burnt.

Type 2 – Biological, then mechanical treatment (BMT)

Drying – the residual waste is shredded and then dried in drums, cylinders, or autoclaves.

Sorting – the waste is then sorted via various equipment such as magnets, or a separation drum to remove metals for recycling and glass, stones and grit for low-grade aggregate.

The residue produced can be used for a variety of processes. The organic fraction can be removed for landfill cover. The coarser fraction can be pelletised and used as a fuel to be used in cement kilns, power stations or as a feedstock for gasification/pyrolysis plants.

The capacity of MBT plants can range from 10,000 tonnes per annum (tpa)[1] to large scale faciilites of 250,000 tpa[2].

Most MBT technologies have been developed in Germany, but Austria, Switzerland and the Netherlands are also developing markets. Currently there are more than 70 MBT plants operating in Europe[3].

Potential advantages of MBT

- Even with a successful kerbside scheme in place there will be some recyclable materials in the residual waste - these will be captured at the mechanical treatment stage.
- It reduces the volume of residual waste and therefore the landfill space taken, thus reducing the cost to the local authority of disposal[4].

- Potential hazardous waste contaminants of the waste stream, such as batteries, solvents, paints, fluorescent light bulbs etc, will not reach municipal landfill sites due to the sorting of the waste prior to treatment.
- It reduces the biodegradability of the waste, thus reducing the methane and leachate production once the residue is landfilled[5].
- Stabilisation of the waste reduces side-effects at the landfill site such as odour, dust and windblown paper and plastics.
- The plants tend to be modular. They are made up of small units which can be added to or taken away as waste streams or volumes change.
- Plants can be built on a small scale, which would not drag waste in from a large surrounding area.

Potential disadvantages of MBT

- Some local authorities see MBT as a means to meet recycling rates without the need for the separate collection of recyclables. But the dry recyclables separated out during the process will be of poor quality compared to that collected by kerbside or bring-bank schemes.
- Large scale plants draw in waste from a wide area, contradicting the proximity principle.
- MBT plants with long term contracts will tie the hands of local authorities. These contracts may demand a fixed tonnage of waste that could undermine recycling and waste minimisation efforts in the area.
- Although the biodegradability of the waste has been reduced via the MBT process, the residue may not be classed as inert and therefore may not help local authorities meet the EU landfill directive targets[6]. (The EU Biowaste Directive, which may be completed in 2005, will provide more clarity on this issue).
- Some MBT plants are proposing to make refuse derived fuel (See Box 1.)

The impact on climate change and human health

Recent research for the Community Recycling Network found that waste that is pretreated through MBT prior to landfilling was one of the best options for dealing with our residual waste[7]. The research modelled impacts from different treatment methods (including landfill and incineration) using data on the chemical and physical characteristics of residual waste once **a recycling rate of 60 per cent had been achieved**. (The results cannot be applied to waste streams which have not had high levels of recyclable and compostable materials removed from them at source).

Climate Change

Waste disposal contributes towards climate change, for example through the release of methane from landfill sites or the burning of fossil fuel based plastics. The research suggested that untreated waste going to landfill and incineration were the worst options for climate change. Mechanical biological treatment (MBT) and Biological Mechanical Treatment (BMT) followed by the residuals from this process going to coal fired power stations or cement kilns fared best according to the model (but see commentary below). MBT with residuals going to landfill also performed well.

BOX 1. MBT and Refuse Derived Fuel (RDF).

The MBT process can produce refuse derived fuel – which is made up of mixed household waste. Co-incineration is one of the options being put forward for RDF. Friends of the Earth does not want to see RDF burnt in cement kilns and power stations. These plants have poor pollution abatement technologies and burning waste in them goes against the proximity principle which states that waste should be treated as close to its source as possible. Communities around cement kilns and power stations will end up suffering the environmental costs (transport, air emissions) of waste from another community.

RDF to be used as a fuel for co -incineration needs to have a high calorific value – it is the plastic and paper/card component that gives the fuel this characteristic. Friends of the Earth believes that recycling paper and card will always be the preferred option for dealing with this fraction to prevent biodiversity loss. It is also the preferred option for saving energy, as long as it is recycled in a plant which uses a renewable energy source.[8] Also good source separation front end recycling should remove the vast majority of paper from the waste stream. Burning plastics is equivalent to burning fossil fuels in terms of climate impacts, as they mainly consist of oil.

RDF can also be burnt in a dedicated facility such as a gasification or pyrolysis plant. However, again the technology relies on a fuel with a high calorific value such as paper/card and plastic. Any energy produced from the burning of the fuel does not in any way replace the energy needed to produce products from the raw materials[9]

The research showed that it is important to identify which fuel is being displaced by using waste to produce energy. If coal – a dirty fuel – is being displaced (as assumed by the Environment Agency's life cycle analysis model WISARD), then burning waste in cement kilns and coal fired power stations comes out well in terms of climate change impacts. Friends of the Earth cannot accept that these wastes should go to power stations or cement kilns. These stations are using dirty fuels with poor pollution abatement technology and burning wastes in them goes against the proximity principle that waste should be dealt with as close to its source as possible.

Human Toxicity

Human toxicity is a measure of the potential risk to health from a plant. The research for the Community Recycling Network again suggested that untreated waste going to landfill was by far the worst option for human toxicity, followed by standard incineration. The option which fared best was MBT with the residuals from the process going to a cement kiln. Options such as pyrolysis and MBT followed by residuals going to either landfill or coal fired power plants were found to perform almost as well as this option. However, there are two important warnings attached to these conclusions.

First, the researchers did not evaluate the toxic impacts of ash residues. These impacts could be significant, especially over a long time period (100 – 1000 years) as they leach from landfills. If ash had been included, it is likely that the thermal treatments would be amongst the worst performers in terms of human toxicity.

Second, firm conclusions about human toxicity are difficult to draw, because even the best

emissions data is incomplete and the true impact of most chemicals and the impacts of mixtures of chemicals are poorly understood.

Spotlight on companies

There are a number of companies developing this technology in the UK. Some of the main companies that are developing MBT technologies are highlighted below.

Herhof Environmental
In Herhof's process the waste is shredded and then transferred to bio-drying boxes that can hold up to 300 tonnes of waste. The waste remains enclosed in these for 7 days, during which time air is forced through the box. Once the waste is dried the material is sorted into light and heavy materials. From the heavy fraction metals and glass are removed. The light fraction is made into a fuel called Stabilat®.

Herhof Environmental has recently been purchased by Treasury Holdings Ltd based in Ireland. The company owns three existing plants in Rennerod, Germany, Dresden, Germany and Venice, Italy. The company is talking to Lancashire County Council about building an MBT plant.

More information on the company and the process can be found at:
www.herhofenvironmental.com

Shanks
Shanks has two proposals for MBT plants at Milton Keynes and with East London Waste Authority. The system used is called Ecodeco. The waste is transferred to a Bio-MRF where it is shredded & dried to reduce its volume and leave a biologically stabilised residue or 'stabilate' which is a dry mixture of mainly paper & plastics that can be used as fuel or landfilled.

More information can be found at www.shanks.co.uk

Civic Environmental Systems Ltd

The company has a full scale plant operating in County Durham since July 2002. In this process the waste is fed into a shredder and then transferred to the top section of a composting tower where it is kept for 8-10 days. After time in the tower the waste is fed into a materials separation drum that allows particles of increasing size to leave the drum. The metallic element is drawn off by magnets. The company states that the process delivers the extraction of ferrous materials, aluminium cans, plastics for recycling and soil enhancing material of remediation quality.

More information can be found at www.cpscivic.com/en/home/

Estech Europe Ltd
This company has a planning application currently being considered by Herefordshire County Council for a 100,000 tpa treatment facility in Madley, Herefordshire. This process uses an autoclave in which the waste is sealed and treated with steam at 160^{o}C. After the steam has been injected the pressure is maintained for 30-40 minutes. When the treatment is complete the residue is discharged and subject to screening. This separates out the fine material about 65 per cent from the larger fraction - the metals and plastics. The fine fraction

is then separated out into a lighter material (organic fibre) from heavier material (glass and grit).

The metals and plastics can be sent for recycling, some of the wastes can be recovered for aggregate material, some will be sent to landfill and the organic wastes can either be made into a fibre material to be used in the construction trade or can be made into a fuel.

A solution to the waste crisis?

The majority of the municipal waste we produce in the UK can be re-used or recycled, and with intensive waste minimisation, re-use, recycling and composting schemes the amount of residual municipal waste that is produced will reduce over time.

Friends of the Earth suggests that the best environmental route for residual waste is to firstly remove the remaining recyclable waste from the waste stream (eg metals, plastics, glass and some paper). Then the small amount of waste remaining should be composted or anaerobically digested and unless sufficiently clean to be used as compost, should be disposed of to landfill (as the disposal route with lowest environmental impacts for this waste)[10]. These processes should occur in small, localised treatment plants.

MBT plants could therefore have a part to play in treating the small amount of residual municipal waste left after intensive waste minimisation and recycling schemes have been implemented. As a technique it has clear advantages over residual waste going straight to landfill as recyclable materials are removed and the biodegradability and leachate potential of the waste are reduced. It also has advantages over mass-burn incineration, due to the fact that the technology is more flexible, the plants can be built on a small scale and can be modular in design.

However, Friends of the Earth will not support MBT plants that:

- produce RDF from mixed municipal waste;
- do not have front- end recycling to remove the remaining recyclable waste;
- are built on a large scale;
- are not put forward as part of a waste strategy that involves intensive waste minimisation, re-use and high quality recycling.

References

1 Heerman, C. (2002) Mechanical-Biological Treatment – applicability to household waste. *Warmer Bulletin.* .

2 The Bio-MRFs at Milton Keynes will deal with 250,000 tpa – Shanks press release 16 October 2003.

3 Heerman, C. (2002) Mechanical-Biological Treatment – applicability to household waste. *Warmer Bulletin.*

4 Damiecki R. (2002) Mechanical-Biological Pretreatment of MSW. Bioprocessing of Solid Waste and Sludge. Vol 2, 31-36.

[5] As above.

[6] Strategy Unit (2002) Waste Not, Want Not Annex G: Treatment and Disposal of Residual Waste – MBT in context.

[7] The research findings for Community Recycling Network are summarised in a Friends of the Earth briefing: 'Maximising recycling rates – tackling residuals', September 2002. The full report is available on the Community Recycling Network website: www.crn.org.uk

[8] For more information see Friends of the Earth (2000) Greenhouse Gases and Waste Management Options.

[9] US Environmental Protection Agency (1998). Greenhouse Gas Emissions from Management of Selected Materials in Municipal Solid Waste.

[10] The research findings for Community Recycling Network are summarised in a Friends of the Earth briefing: 'Maximising recycling rates – tackling residuals', September 2002. The full report is available on the Community Recycling Network website: www.crn.org.uk