FACT SHEET 1:

WASTE MANAGEMENT: PUBLIC HEALTH PERSPECTIVES ON MECHANICAL BIOLOGICAL TREATMENT

MARCH 2009

BACKGROUND

In the UK each year households, commerce and industry generate over one hundred million tonnes of waste, the majority of which is placed in landfill sites. Such sites are generally considered environmentally unsustainable and recent EU legislation (the EU Landfill Directive 1999/31/EEC) has limited further expansion [1]. Noxious emissions (mainly biogas and leachate) can have long term impacts, even 100 years after their closure, and serious public health concerns focus on the risk of cancers and birth defects; however, there is conflicting evidence [2].

There is a wide range of other waste management and recycling options, which are regarded as more sustainable and efficient, each with their own impacts on health, community, and industry. These include:

- material recycling facilities
- anaerobic digestion
- pyrolysis/gasification
- incineration
- composting (a subject of a future fact sheet in this series)
- mechanical biological treatment

MECHANICAL BIOLOGICAL TREATMENT (MBT) AND SUSTAINABILITY

MBT is a generic term used to describe the amalgamation of several mechanical and biological processes, suitably integrated to allow the quantity of materials recovered for reuse to be maximised and the amount of residue minimised.

The purpose of MBT is twofold: first, to reduce the negative environmental and health impacts of biodegradable materials being landfilled and second, to recover the highest amount of recyclable materials possible [3]. The volume of waste going to landfill can be reduced by more than 60 percent when MBT processes are applied [4,5]. This clearly implies also a reduction in weight, which may result in a reduced landfill tax [5].

MBT processes typically involve sorting (in different size fractions); recovery (of recyclable waste); cutting and shredding to reduce the size of material; and composting and anaerobic digestion[1] [6].

MBT plants are often designed to produce useful outputs such as waste derived fuels and compost. Waste derived fuels - refuse derived fuel (RDF) and solid recovered fuel (SRF) - can be incinerated on-site to produce energy, or used in other facilities such as cement kilns. The latter are particularly energy demanding and the use of waste derived fuel may improve their sustainability and reduce their emissions. Cement kilns using RDF and SRF appear to release less organic compound, including dioxins and furans [7].

Compost produced by MBT plants has some limitations, because of high levels of minerals and heavy metals (lead, in particular) contained in some type of waste. MBT compost can be used on farmland only if made from source-segregated waste , i.e. from initially controlled waste. However, tests are currently being carried out to find out whether any type of MBT compost can be used for agricultural purposes without posing a risk to human health [8,9].

At present, Mechanical Biological Treatment is generally seen as one of the most sustainable options for waste management because of the:

- limited cost per tonne of treated waste
- limited visual impact
- ability to drastically reduce the final volume of waste
- use of technologies different from incineration, which is at present very unpopular

BOX 1: THE EU LANDFILL DIRECTIVE

The EU Landfill Directive (1999/31/EEC) [2] is a major driver for adopting MBT. A key aspect of the directive is a progressive reduction in the weight of biodegradable municipal waste sent to landfill up to 2020 [2,4]. Consequently, alternative systems have become increasingly popular, in particular incineration, composting and MBT. Some countries have adopted more rigorous targets than those specified in the directive. For example, the German Government has set a target of no Landfilling from 2020 [10]. The EU Landfill Directive is transposed into UK law through the Waste Emissions Trading Act (2003), which aims to reduce the quantity of biodegradable municipal waste sent to landfill [11]. The UK Government decided to increase landfill tax by three pounds per tonne each year, to achieve a rate of 35 pounds by 2011/12. Additionally, the Waste Strategy for England (2007) detailed the targets to reduce, re-use, recycle waste and recover energy from waste [12].

MBT plants appear to have other significant advantages:

- MBT seems to have the lowest impact on climate change because of its ability to drastically reduce methane production potential from the composting of putrescible wastes prior to being landfilled [2]
- MBT processes can significantly reduce gaseous emissions of carbon to the atmosphere compared with sending untreated waste to landfill [13,14]. Approximately 90 percent less gas is produced when MBT is used [2]

[1] A process where microorganisms break down compostable waste in the absence of oxygen

BOX 2: THE COST OF MBT

Incinerators and MBT plants may have similar processing costs per tonne of waste (approximately £79), which is still higher than the cost of landfilling. However, MBT plants are generally smaller and, therefore, result in a higher final cost for the municipalities [15]. Local authorities may access a range of funding streams for such projects [16] such as the Waste Infrastructure Development Programme for England. Due to the annual increase in landfill tax, it is predicted that MBT will become more cost-effective than landfill by 2009/2010 [17].

HEALTH AND WELLBEING

There is a growing body of data and public anxiety concerning the health impacts of landfilling and incineration [2]; however research is limited and no thorough assessments of the health impacts of MBT have been conducted [2]. Nevertheless, research on this topic suggests:

- although there is a lack of data regarding the health impacts of MBT, they are deemed to be similar to that of in-vessel composting facilities (in vessel composting involves the composting of organic materials in encapsulated environments) [6,2,18]. Findings from studies investigating this technique reveal no increase in asthma or cancer in populations living close to these types of facilities [6]
- the estimated number of deaths brought forward[2] by each waste management system is very small (<0.008 per facility/year) [2]; those estimated to be caused by MBT are fewer than landfilling, pyrolysis and gasification[3] and incineration. The numbers of respiratory related hospital admissions caused by waste management systems are also small (<0.2 per facility per year). Fewer respiratory related hospital admissions are considered to be caused by MBT than from anaerobic digestion, pyrolysis gasification, incineration and landfill [2]. There is no reliable data regarding the number of cancer cases possibly caused by MBT [2]
- some studies report that most of the atmospheric emissions from MBT are limited to carbon dioxide and water and result in low impact on air quality [2,21]
- one Austrian study (reported in [2]) measured environmental concentrations of eight volatile organic compounds (VOCs) which could be emitted from MBT plants during the biological treatment. VOCs are a group of organic compounds that evaporate easily at ambient temperatures. Some VOCs are linked with environmental effects such as photochemical smog and ozone depletion, and some are toxic and/or carcinogenic. The study reported that concentration levels of these emitted substances were similar to normal urban and suburban level concentrations [2]
- however, it is acknowledged that primarily atmospheric emissions are mainly associated with vehicle movements [2]

Some specific concerns have been raised about the possible health effects caused by odour, fungi and bioaerosols in workplaces where composting processes are carried out [22]. Also, some minor problems have been reported by residents living near composting sites [22,23]. Emissions (in particular, the odoriferous ones) from MBT systems can be minimised through various techniques such as water sprays, the use of bio-filters and negative air pressure of indoor facilities [2].

Some non - governmental environmental organisations are strongly encouraging MBT on the basis that the process requires waste to be sorted, and potentially hazardous waste, such as batteries, solvents, paints and fluorescent light bulbs, will not be landfilled. Sending untreated waste to landfill and standard incineration are by far the worst waste management option for human health [24]. An MBT

[2] Estimated number of premature deaths

[3] Forms of combustion under strictly controlled conditions to recover and recycle part of the residues [19,20]

system which includes residuals going to a cement kiln is the best option in terms of human health [24]. However, the data about the toxicity of these various options are limited, resulting in a lack of strong scientific evidence [2]. The evidence available about the potential impacts upon health and well-being, suggests that:

- MBT plants should ideally be placed away from residents to reduce risks from bio-aerosols caused by biological processing, and within reach of good transport infrastructure, to limit the increase in traffic. Good design and architectural input is essential to prevent visual intrusion [6]
- waste management systems can generate dust and odours. MBT facilities can normally control odour emissions through ventilation systems, water sprays and negative air pressure of indoor facilities, although each of these need careful consideration for each MBT plant [1,6]
- the risk of vermin and other pests can be minimised within MBT plants, through effective cleaning systems and site management of tipping and storage areas. Within certain MBT systems, waste heat may be utilised to create temperatures that are too high for survival of flies [6]
- noise can be created by vehicles, mechanical processing and ventilation systems. This can be controlled through the permit regulations and during the planning permission process [2,6]. It has been suggested that noise emissions are generally low to medium from MBT plants (similar to farm operations) but that shredding could result in higher levels [21]
- litter problems can be minimised through the adoption of good working practices including covering vehicles transporting waste and processing materials indoors [2]
- the enclosed nature of MBT facilities means that the pollution of water is unlikely [2,6]. Water is partially evaporated in the composting process [2] and any water used in the process can be managed onsite. Permit requirements should consider the disposal of water used in any processes [2,6]
- new waste facilities are often seen as an unwelcome intrusion by residents. There is currently a low level of public awareness regarding MBT and public consultations have found there to be a diverse range of opinions [6]

Comprehensive evaluations of MBT systems have not been conducted. In particular, there is limited research regarding the health impacts of MBT as most of the evidence base is adapted from studies on similar single processes (such as composting). New research and activities should include:

1) examination of potential long term health impacts of MBT
2) public acceptability of the system
3) objective, scientifically informed information about the relative merits of various waste management systems
4) considerations of the suitability of the system
5) an analysis of the integration of the processing subsystem with the collection and disposal subsystems
6) a critical comparison with alternative systems [3]

REFERENCES

1. DEFRA. Local government performance framework; 2008. London: Department of Environment, Food and Rural Affairs; 2008. Available at http://www.defra.gov.uk/environment/localgov indicators/ni191-193.htm Accessed 14 April 2008

2. Enviros Consulting Ltd, University of Birmingham, Risk and Policy Analysts Ltd, Open University, Thurgood M. Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes. London: Department for Environment, Food and Rural Affairs; 2004

3. Diaz LF, Savage GM. Approaches to mechanical biological treatment of solid wastes. International Seminar and Workshop. Sustainable Landfilling; 2005 13-15 June; Abbey of Praglia (Padua). Padua: International Waste Working Group and University of Padua; 2005

4. Panza D, De Feo G, Belgiorno V. Quality of the stabilized organic fraction from mechanical and biological treatment. In: Cossu R, Stegmann R, editors. Sardinia 2005, Tenth International Waste Management and Landfill Symposium; 2005 3-7 October S. Margherita di Pula, Cagliari, Italy. Cagliari: CISA; 2005

5. Ends Report. MBT: the answer to Britain's waste problems? Ends Report 2005(361):25-28

6. DEFRA. Mechanical Biological Treatment of Municipal Solid Waste. London: Department for Environment, Food and Rural Affairs; 2007. Available at http://www.defra.gov.uk/environment/waste/wip /newtech/pdf/mbt.pdf Accessed 18 December 2008

7. Saunders P, Maynard B. Waste derived fuels in cement Kilns - public health implications and response: assessing the evidence and developing policy. The Eleventh Annual Review Meeting on Outdoor and Indoor Air Pollution Research; 2008 15-16 April; Cranfield University, Cranfield. Health protection Agency - Chemical Hazards and Poisons Division. Available at www.cranfield.ac.uk/health/ researchareas/environmenthealth/ieh/patrick%20saunders%20revised.pps Accessed 19 December 2008

8. Ends Report. Operators seek approval for MBT plant outputs to be spread on fields. Ends Report 2007(393):19-20

9. Ends Report. Spreading MBT output on farmland goes on trial. Ends Report 2008(406):20-21

10. Stegmann R. Mechanical biological pre-treatment of municipal solid waste. In: Cossu R, Stegmann R, editors. Sardinia 2005, Tenth International Waste Management and Landfill Symposium; 2005 3-7 October; S. Margherita di Pula, Cagliari, Italy. Cagliari: CISA; 2005

11. Waste Emissions Trading Act, 2003. Available at http://www.opsi.gov.uk/Acts/acts2003/ukpga_2003 0033_en_1; 2003 Accessed 14 April 2008

12. DEFRA. Waste Strategy for England and Wales. Norwich: TSO, 2007. Available at http://www.defra. gov.uk/ENVIRONMENT/waste/strategy/strategy07/p df/waste07-strategy.pdf Accessed 18 December 2008

13. Bockreis A, Steinberg I, Rohde C, Jager J. Gaseous emissions of mechanically-biologically pre-treated waste from long-term experiments. In: Christense HT, Cossu R, Stegmann R, editors. Sardinia 2003, Ninth International Waste Management and Landfill Symposium; 2003 6 -10 October; S. Margherita di Pula, Cagliari, Italy. Cagliari: CISA; 2003

14. Knox K, Robinson H. MBT and thermal treatment of MSW residues: a comparative study of energy balance and long-term pollution potential of leachates. In: Cossu R, Diaz LF, Stegmann R, editors. Sardinia 2007, Eleventh International Waste Management and Landfill Symposium; 2007 1-5 October; S. Margherita di Pula, Cagliari, Italy. Cagliari: CISA; 2007

15. Baker S. Mass burn begins its big breakthrough. Ends Report 2007(391):28-31

16. DEFRA. Valuation of the external costs and benefits to health and environment of waste management options. London: Department for Environment, Food and Rural Affairs; 2004. Available at http://www.defra.gov.uk/environment/waste/research/health/pdf/costbenefit-valuation.pdf Accessed 18 December 2008

17. Ends Report. MBT: the answer to Britain's waste problems? Ends Report 2005(361):25-28

18. Hammond TD, Broomfield DM. The environmental and health impacts of energy from waste, the myths and the truth? In: Cossu R, Diaz LF, Stegmann R, editors. Sardinia 2007, Eleventh International Waste Management and Landfill Symposium; 2007 1-5 October; S. Margherita di Pula, Cagliari, Italy. Cagliari: CISA; 2007

19. Enviros Consulting Ltd. Planning for Waste Management Facilities: A Research Study. London: Office of the Deputy Prime Minister; 2004. Available at http://www.communities.gov.uk/archived/publications/planningandbuilding/planningwaste Accessed 19 December 2008

20. Friends of the Earth. Pyrolysis, gasification and plasma. London: Friends of the Earth; 2008. Available at http://www.foe.co.uk/resource/briefings/gasification_pyrolysis.pdf Accessed 19 December 2008

21. McLanaghan SRB. Delivering the Landfill Directive, The Role of New and Emerging Technologies. Report for the Strategy Unit: 0008/2002. London: PMSU; 2002. Available at http://www.cabinetoffice.gov.uk/media/cabinetoffice/strategy/assets/technologies%20landfill.pdf Accessed 19 December 2008

22. Herr CEW, zur Nieden A, Jankofsky M, Stilianakis NI, Boedeker RH, Eikmann TF. Effects of bioaerosol polluted outdoor air on airways of residents: a cross sectional study. Occupational and Environmental Medicine 2006(60):336-342

23. Herr CEW, zur Nieden A, Bodeker RH, Gieler U, Eikmann TF. Ranking and frequency of somatic symptoms in residents near composting sites with odour annoyance. International Journal of Hygiene and Environmental Health 2003(206):61-64

24. Friends of the Earth. Mechanical and Biological Treatment (MBT). London: Friends of the Earth; 2004. Available at http://www.foe.co.uk/resource/briefings/mchnical_biolo_treatmnt.pdf Accessed 19 December 2008

THIS HEALTH + SUSTAINABILITY FACT SHEET WAS WRITTEN AND EDITED BY PAOLO LURIA, MARY LYONS, KATRINA STREDDER AND HARRY SUMNALL

Acknowledgements:
Clare Perkins, Keith Osborn, Gillian Gibson

Centre for Public Health - Research Directorate
Faculty of Health and Applied Social Sciences
Liverpool John Moores University
Kingsway House
Hatton Garden
Liverpool L3 2AJ
Tel. (0151) 231 8146
Fax (0151) 231 8020
Email p.luria@ljmu.ac.uk

www.cph.org.uk

ISBN: 978-1-906591-50-2 (Print version)
ISBN: 978-1-906591-51-9 (PDF version)

Published March 2009

THE NEXT ISSUE WILL FOCUS ON PUBLIC HEALTH ASPECTS OF SUSTAINABLE BUILDINGS

liverpool JMU
Centre for Public Health