Stewarding the Earth's Resources

An occasional bulletin for the church about waste

No.3

November 2005

Incineration of municipal solid waste: a contentious issue

Abstract

Proposals to build incinerators to burn municipal solid waste are often vehemently opposed by local people. Nowadays such incinerators usually generate electricity and/or heat, thus recovering energy from the waste.

A recent Government report describes the nature of such incinerators and the new generation of 'thermal treatment' plants. It is confident for the future but recognises the potential strength of opposition by lobby groups. Another recent Government report into the health effects of waste management finds that the balance of risk favours present patterns and trends in waste management. A further report argues that electricity generation by burning waste could be greatly increased to the benefit of improved energy security for the UK.

Thus, this extended essay provides balance to lobby groups that are opposed to waste incinerators.

A theological reflection draws parallels between anxiety about waste incineration and a current trend towards 'woodland burials' in place of cremation. It concludes that current widespread concern about ecology has characteristics that make it similar to a religion. This leads to some useful insights into the present debate about municipal solid waste incinerators and to some searching questions for Christians who are concerned about the environment.

Incineration of municipal solid waste: a contentious issue

Introduction

One aspect of waste that causes anxiety is the disposal of municipal solid waste (MSW) by incineration. Proposals to build MSW incinerators are scrutinised and often vehemently opposed by local people.

MSW is defined as waste which includes household waste and any other waste collected by a waste collection authority, or its agents, such as municipal parks and gardens waste and beach cleansing waste.

This article aims to provide a balance to the arguments of environmental lobby groups by presenting some of the content of recent authoritative reports. It also provides theological reflection on wider issues.

The article comprises eight chapters: **page**

1. The Waste Hierarchy

A key issue to keep in mind when considering waste incineration is the principle of the 'Waste Hierarchy'.

The waste hierarchy is a notional order of preferred methods of waste management, with waste reduction as the most preferred method and waste disposal by landfill as the least preferred method.

Waste Strategy 2000 (as amended July 2005) defines the objectives of waste management decisions.

The first objective is stated as:

> 'Reducing the environmental impact of waste by moving waste management up the waste hierarchy'

The waste hierarchy is then presented as a list of waste management approaches, with Reduction at the top of the list (the most desirable approach) and Disposal at its foot (the least desirable approach):

Reduction
Re-use
Recycling & Composting
Energy Recovery
Disposal

(The second objective is stated as 'Managing waste in ways that protect human health and the environment'). Waste incineration falls under the category of Energy Recovery: it is therefore to be regarded as the least preferable waste management method after Disposal. (Waste disposal involves either landfill or land raising).

2. The main areas of concern about municipal solid waste incinerators

2.1 The Byker Incinerator and BAN Waste

A notorious case concerns the Byker Incinerator at Newcastle upon Tyne.

A page in the BBC website* is based on a programme first broadcast by the BBC on 30th January 2004. This describes how the municipal solid waste incinerator was constructed at Byker, Newcastle upon Tyne in 1979. The incinerator operated until 1999 when a local resident arrived at her allotment in Byker to find that waste ash from the incinerator had been brought from the incinerator to be used to surface the allotment paths. This raised concerns about the management of the incinerator and the disposal of waste ash, and about the effect of the ash on the food that was being grown in the allotments. When the ash was tested it was found that the level of dioxins of one sample was 1950 nanograms when it had been expected that levels of around 5 nanograms would be found: this gave rise to serious health concerns.

The BBC website goes on to describe how this event led to a partnership being formed between residents, the Environment Agency, the health authority and Newcastle City Council to investigate alternative waste strategies for the city to find out what was best for health, the environment and employment.

This became BAN Waste, which acted as a select committee on the House of Commons model. During 2001 and 2002 BAN Waste heard evidence from 60 people and produced its final report in 2003. In November 2003 Newcastle City Council announced that it would not seek to construct a new incinerator at Byker as had been planned and that it would not seek to build one elsewhere. The alternative waste management strategy put forward by BAN Waste involved resource recovery rather than waste disposal.

*

(www.bbc.co.uk/education/beyond/factsheets/changing7_prog4.shtml)

BAN Waste is at 14 Great North Road, Jesmond, Newcastle upon Tyne NE2 4PS. Tel: 0191 232 3357. www.banwaste.org.uk.

2.2 Greenpeace's opposition to incineration

The Greenpeace website includes a section on 'The problem' of waste incineration. This describes incineration as 'a method where industry can break down its waste and disperse it into the environment through air, water and ash emissions'.

It identifies three types of impact on the environment which will occur, 'even in "state-of-the-art" incinerators':

- Heavy metals
- Unburned toxic chemicals
- New pollutants – entirely new chemicals formed during the incineration process.

All of these are stated to be released to the air through the incinerator chimney and to the ground and water through ash when it is landfilled.

Some quotes from the webpage:

> "Dioxins released from an incinerator can be readily consumed by grazing animals and fish. In 1989, 16 dairy farmers downwind of a Rotterdam incinerator in the Netherlands were banned from selling their milk because it contained dioxin levels three times higher than anywhere else in the country".
>
> "Residents of a property downwind of a chemical waste incinerator in Pontypool, South Wales, UK, were advised not to consume duck or bantam eggs from their property".

Greenpeace argue that incinerators are dangerous and expensive and that once authorities have invested in incineration they often lack the resources to invest in waste reduction. Moreover, the large quantity of ash that is produced to be disposed of by landfill is stated to perpetuate landfilling as a waste management method.

Waste reduction, re-use and recycling are advanced as alternatives to incineration.

(www.greenpeace.org/international/campaigns/toxics/incineration/the-problem).

2.3 The main areas of concern: conclusion

BAN Waste and Greenpeace are representative of the views of those who oppose incineration as a waste management method, and, more specifically, those who oppose particular proposals to build new incinerators.

In conclusion we can say from BAN Waste and Greenpeace that:

- Incinerators emit dangerous pollutants;
- there is the risk that poor management that could lead to pollution incidents;
- incinerators undermine attempts to introduce more sustainable waste management;
- the disposal of incinerator ash is a potential problem;
- those who oppose incineration tend to propose waste reduction, re-use and recycling as an alternative approach, that is, they seek to 'move waste management up the waste hierarchy'.

3. Description of small scale and large scale thermal treatment facilities ie. incinerators

3.1 Planning for Waste Management Facilities

In August 2004 the Office of the Deputy Prime Minister published the results of a research study entitled '*Planning for Waste Management Facilities'*. This is a useful guide to all current waste management processes and the relevant planning issues.

Twelve waste management 'facility profiles' are described, as follows:

1. Composting
2. Anaerobic digestion
3. Processing of recyclables
4. Mixed waste processing
5. **Pyrolysis and gasification**
6. **Small scale thermal treatment**
7. **Large scale thermal treatment**
8. Landfill
9. Landfill gas plant
10. Leachate treatment plant
11. Small scale facilities
12. Waste transfer

Small scale and large scale thermal treatment (6 & 7 in the list) describe and include municipal waste incineration. These are referred to below. Pyrolysis and gasification (no.5) are considered below in Chapter 4.

3.2 Small scale thermal treatment

The introduction to small scale thermal treatment in '*Planning for Waste Management Facilities'* states (page 135):

'In the recent past there have been comparatively few examples of such plants that have been designed to accept relatively small quantities of waste (of say less than 90,000 tonnes per annum) from a relatively small catchment area. In the early part of the 20th Century such facilities, often called 'Destructors' were more commonplace and could be found in most towns and cities across the country. Such facilities had very rudimentary environmental controls and no air emission controls. Successive increases in abatement standards made these first generation plants uneconomic to operate. Most of the existing operational examples today have been designed to treat specific industrial waste streams as part of combined heat and power (CHP) arrangements. Small thermal treatment plants (furnaces or kilns) are also used to treat clinical wastes at hospital sites. Small scale plants are typically used to generate either steam for process use or electricity for export to the national grid. Sometimes plants are designed to have a dual steam and electricity generating capacity'.

Examples of small scale thermal treatment plants are given:

- Contract Heat and Power, Isle of Wight (currently not operational)
- Integrated Waste Management Facility, Stallingborough, Grimsby (under construction)
- Kemlsey Paper Mill, Kent
- Various hospital sites for clinical waste

'Various patented kiln and furnace designs are used. Many require injection of an auxiliary fuel (fuel oil or gas) to supplement the main feedstock and for start up. Most are specifically designed to take a relatively homogeneous, pre-processed feedstock or refuse derived fuel (RDF). The RDF is either burnt in a pelletised form or as a flock. Unlike large scale mass burn plants, small scale facilities are often modular. Several combustion chambers can be placed in parallel and fired up according to the need to respond to fluctuations in the supply of waste'. 'The hot gases from the combustion chamber are directed to a boiler, where heat is usually recovered as superheated steam through heat exchangers'. 'At the CHP plant at Kemlsey Paper Mill in Kent ….. waste paper is burnt on-site with the steam generated being used in the paper process and also to produce electricity'.

Key issues are identified:

Traffic: 'Like any major waste facility, small scale thermal treatment plants will be served by a significant number of HGVs. The nature and volume of vehicle movements will be determined by the volume throughput of the plant, and nature and source of the waste. Compared to large scale thermal treatment, the traffic volumes may be significantly reduced and if the plant is directly linked to an industrial operation waste import may be nil. Traffic generated may include a mixture of waste collection vehicles, bulk haulage vehicles and skip transporters'.

Air Emissions: 'The fundamental principle of relevance when considering emissions is the conservation of mass within any process. What goes into the plant will leave the plant in one form or another. Certain organic compounds will be broken down and rendered harmless by the incineration process, and gases will be generated. Materials such as heavy metals will be retained in the bottom ash, or in the air cleaning system or emitted to atmosphere. The principal air emission components emitted from any waste incineration process are: acid gases; carbon dioxide; heavy metals; particulates; dioxins/diobenzofurans. All waste incinerator plant emissions will be regulated through the Pollution Prevention Control Regime enforced by the Environment Agency. Waste incineration plants are required to operate to air emission standards set by the EU Waste Incineration Directive'. (The table giving these emission limits is reproduced on page 140 of the document). 'Air emissions are also a material planning consideration and probably represent the most significant public concern issue. New proposals must include detailed assessment of emissions to air addressing: air quality objectives, exposure to dioxins and furans and effects on health and natural environment'.

Dust/Odour: 'Odours and dust from any mixed waste or putrescible waste facility have the potential to represent a nuisance issue with adverse impacts on residential amenity. The most significant problems with regard to odour occur when waste is allowed to decompose in anaerobic conditions. Dust is sometimes generated when waste is loaded and unloaded, and when waste is transported onto manoeuvring areas on vehicle wheels. If facilities are badly managed, or during times of plant failure, wastes can soon start to generate odour and dust problems. At a well run facility this will not be an issue as stored waste is kept to a minimum. Odour and dust are minimised by air from the waste reception area being drawn into the facility as the primary air for the combustion process. Storage of plant ash should be in covered containers or within the building. Delivery of air pollution control measures such as lime should be carefully supervised to prevent spillage. Such areas should also be bunded or have closed drainage to prevent contaminants entering normal surface water drainage'.

Noise: 'The main problems associated with noise have been attributed to the following activities: Vehicle manoeuvring loading and unloading operations; Induced draft fans used to draw air into the boiler and up the stack; Air cooled condenser units; Steam release valves and pipe work. The process operations can be inherently noisy and most noise issues tend to be associated with a plant which is not properly serviced or commissioned. Noise is an issue that is controlled under the PPC Regulations as well as under the planning regime and by Local Authority Environmental Health Departments, under Statutory Nuisance provisions. Typically noise limits are either set at site boundaries or at sensitive receptors and these limits are usually based on target levels at agreed properties. These can be fixed limits based on guidance from the World Health Organisation, such as: 55 dB(A) daytime; 45 dB(A) night-time. In quiet or sensitive areas, the targets may vary according to the local noise environment, such as the following: 5 to 10 dB(A) above the existing background noise level'.

Litter: 'Litter is not normally a significant problem at these facilities if the whole process is contained within a single building. However where double handling of waste takes places involving transport of waste from different process operations via external haul roads, litter and detritus can present difficult management issues. Storage of waste in uncovered external containers should be avoided'.

Visual Intrusion: 'All new built development has the potential for impact on both landscape character and visual amenity The nature of small scale thermal treatment is that it has greater potential for integration into the existing built environment and indeed rural or semi-rural settings than large scale plants. However the issues that need to be considered are similar for both as follows: Direct effects on landscape fabric i.e, greenfield vs brownfield, removal of hedgerows, trees etc; Proximity of landscape designations; Site setting, for example the proximity of listed buildings and/or conservation areas; Proximity of sensitive viewpoints; Presence of existing large built structures; Existing landform and nature of existing landscape; Presence/absence of screening features (trees, hedges etc.); Landscape and visual impacts are material planning considerations. A significant amount of public concern and anxiety can be generated by the proposed visual appearance of the facility. Careful site selection and appropriate orientation of the building footprint together with appropriate screening measures can help to minimise any potential adverse impact. Consideration should also be given to the opportunity for site profiling and engineering to minimise the visual impact of buildings. In some cases partial burial of certain elements of the plant may be possible. The height of the stack used for release of gaseous emissions can be a critical concern to local residents and represent a major visual impact. The frequency of a visible plume from the stack also needs to be considered'.

Public Concern: 'Since the 1980s public concern associated with emissions from incineration plants has been growing. A number of well publicised cases have heightened peoples' concerns and led to carefully targeted demonstrations by Greenpeace. As a valid planning consideration the level of concern has greatly affected the ability of the industry to gain planning permissions through the Waste Planning Authority route and at appeal. It remains to be seen whether the same level of concern will be generated in connection with proposed plants which are specifically designed to receive smaller quantities of residual waste. Many of the arguments put forward by environmental lobby groups in opposition to thermal treatment, such as plant being 'waste hungry' and deterring recycling etc. may have less weight when applied to small scale thermal treatment proposals. Recent EC Directives and UK Regulations have introduced more stringent standards on emissions. If these are properly implemented and enforced then health concerns associated with emissions from thermal treatment plants will be reduced'.

3.3 Large scale thermal treatment

The introduction to large scale thermal treatment in '*Planning for Waste Management Facilities'* states (page 151):

'Large scale thermal treatment plants are typically characterised by large building designs, which are often located in or near urban areas, receiving between 90,000 and 600,000 + tonnes of waste per year. In land use planning terms a distinction can be drawn between plants that are designed to handle large volumes of mixed waste following the 'mass burn' approach and smaller scale facilities often designed to receive a specific component of the waste stream using different process technologies'.

Examples of this scale of plant operating in the UK are given:

- Billingham, Teesside
- Bolton, Lancashire
- Coventry, West Midlands
- Dudley, West Midlands
- Dundee, Scotland
- Edmonton, London
- Kirklees, Huddersfield
- Nottingham
- SELCHP, London
- Sheffield
- Stoke
- Tyseley, Birmingham
- Wolverhampton

‘Large scale thermal treatment plants are designed to burn waste as efficiently as possible, usually recovering energy. Waste is burnt under controlled conditions and at high temperatures. Heat released from the combustion of this waste is recovered and used to generate electricity and/or to provide steam or hot water. The volume of waste needing disposal following large scale thermal treatment is reduced by approximately 90%, reducing the need for landfill. The resultant output of a thermal treatment plant is ash, which is far more stable than the municipal solid waste (MSW) input, mainly due to the oxidation of the organic component of the waste stream’.

‘The majority of plants use an inclined moving (or reciprocating) grate design. Mixed waste is delivered into a reception hall or tipping bunker, then fed into a furnace feed hopper, usually by a mechanical grab to ensure an even input. The waste falls onto the moving grate system, which keeps it travelling down a slope (incline) through the furnace as it burns. All combustible material is burnt and the unburned residue - bottom ash - is deposited into a quench tank. Primary air is pumped through from under the grate to aid combustion, whilst secondary air is delivered over the fire to enable good combustion in the gas phase. The hot gases from the combustion chamber are directed to a boiler, where heat is recovered as superheated steam through a series of heat exchangers. Approximately 2,000 kilowatt hours of heat per tonne of waste can be recovered, of which 90% is available for export once a certain fraction has been used for running the plant. In terms of electricity generation, for every 100,000 tonnes of waste approximately 7 megawatts (MW) of electricity can be exported to the national grid, enough to meet the needs of about 11,000 homes’.

‘Fluidised bed incinerators use a combustion chamber containing a fluidised bed in place of a moving grate, which is created by air being forced up through a bed of inert material, for example sand, into which the waste is introduced. Because turbulence is created in the waste, this design generally enables more complete combustion of waste. It is also claimed that the lack of moving parts leads to fewer mechanical problems. Unlike 'mass burn' facilities fluidised bed plants generally require some form of pre-processing of waste to produce a refuse derived fuel (RDF). The only operational fluidised bed facility in the UK is at Dundee, although a new facility at Allington in Kent has planning permission and recently received its PPC permit.’

‘Most modern large scale plants are either fully or semi automated using state of the art computerised control systems. There is often a control room sited above the tipping hall to monitor the loading of the feed hopper and from where the waste feed grabs can be operated. Air emissions and plant performance parameters are usually continuously monitored with real time outputs displayed on computer screens in the control room. Although not commonplace at present it is likely that plants may be required to be linked directly to Environment Agency offices in order that compliance with emission limits can be more closely monitored’.

Key issues are identified and described.

The issues are the same as those for small scale thermal treatment, but with some changes, as follows:

Traffic: The sentence referring to the significant reduction in numbers of vehicle movement at small scale facilities compared with large ones is, as one would expect, not stated. Otherwise the report repeats the paragraphs from the ‘small scale thermal treatment’ section.

Air Emissions: the report repeats the paragraphs from the ‘small scale thermal treatment’ section.

Dust/odour: the report repeats the paragraphs from the ‘small scale thermal treatment’ section.

Noise: the report repeats the paragraphs from the ‘small scale thermal treatment’ section but an additional statement is made: ‘Noise from normal plant operations should be controlled to acceptable levels by careful building design’.

Litter: the report repeats the paragraphs from the ‘small scale thermal treatment’ section.

Visual intrusion: the section begins: 'The inherent nature of a large built development of this nature means that there is the potential for significant impacts on both landscape character and visual amenity. The report then repeats the paragraphs from the 'small scale thermal treatment' section.

Public Concern: The section states: 'Since the 1980s public concern associated with emissions from incineration plants has been growing. A number of well publicised cases have heightened peoples' concerns and led to carefully targeted demonstrations by Greenpeace. A number of planning appeal precedents in the waste industry have established that public concern is a material consideration and should be given due weighting in the determination of planning applications. Very stringent pollution control requirements imposed by the Waste Incineration Directive and IPPC Regulations require that all new and existing plants operate to extremely high standards'.

4. Description of the new 'advanced thermal treatment' processes

The introduction to pyrolysis and gasification in '*Planning for Waste Management Facilities'* states (page 120):

'Pyrolysis and gasification technologies form part of a group of processes and techniques collectively known as advanced or novel thermal treatment. In reality most of the processes are neither advanced nor novel. Pyrolysis and gasification, like normal combustion, involve chemical reaction which takes place at high temperature. This generally generates energy from organic or hydrocarbon containing materials. The application of these techniques to the treatment of municipal waste streams is a relatively recent development, as they were previously confined to applications in the oil and chemical industries. Only since the application of landfill taxes, and the relative increase in costs and environmental concerns associated with incineration, have such practices been considered economically viable for application in the waste industry'.

'In addition to pyrolysis and gasification there are a number of other high temperature thermal processes that are available on the market but have yet to make an impact in the UK. These include vitrification techniques, which have been applied to the treatment of incinerator ash residues for example in Japan, and certain high temperature smelting technologies. Due to the lack of market take-up of such techniques, this profile considers only the planning issues associated with pyrolysis and gasification techniques currently considered the most viable advanced thermal treatment options'.

'Pyrolysis takes place either in the complete absence of oxygen or with limited oxygen. Although the application and equipment might be new the process is not. The production of charcoal from wood is an example of pyrolysis/gasification, where the wood is prevented from combusting in the usual way due to air starvation. Conventional incineration technologies also involve phases of pyrolysis, gasification and normal combustion. The main difference with the specialist pyrolysis and gasification techniques is the control of the reaction to a single phase'.

'There are three products of pyrolysis: gas, liquid and a solid known as char. The chemical reaction takes place at temperatures of between 400 and 800 degrees Centigrade. At the higher end of this temperature range there is very little water produced with mostly gas (known as syngas) and char as the main products'.

'Gasification, like pyrolysis, is a process that has had previous applications using feedstocks other than waste. For example, so called 'town gas' produced from coal using gasification was a very common process prior to the widespread availability of natural gas. Gasification is a thermal upgrading process, in which carbon is converted to a syngas leaving a solid residue. This takes place in the presence of air, or air enriched with oxygen. Temperatures employed are generally higher than pyrolysis at 900 to 1100 degrees C when in air and 1000 to 1400 degrees C using oxygen'.

'Energy is generated from pyrolysis and gasification in one of two ways:

- The syngas is combusted and the hot gases are fed through a heat exchanger where steam is produced: this is used to generate energy in a steam turbine
- The syngas is refined to a high quality and used in a gas engine to produce electricity'.

'A number of commercial companies are seeking to develop gasification and pyrolysis techniques, often combined with other waste processing and recovery operations. This type of process is eligible for subsidy under the Government's Renewables Obligation Order (April 2002)'.

Key issues are identified as:

Traffic: 'The nature and volume of vehicle movements will be determined by the volume throughput of the plant, and nature and source of the waste. Typically traffic volumes will be significantly less than for larger scale centralised facilities. Traffic generated may include a mixture of waste collection vehicles, bulk haulage vehicles and skip transporters'.

Air Emissions: 'Very little research has been undertaken in the UK on the air emissions associated with pyrolysis and gasification systems. The research that does exist suggests that emissions are comparable with other forms of thermal treatment and in principle may be lower. The key issue is normally associated with the operational procedures adopted and reliability of the process. Air pollution control systems are required to reduce emissions to an acceptable level, and as a minimum to meet EC Directive/PPC authorisation limits. The principal air emission components emitted from any thermal treatment process are: Acid gases; Carbon dioxide; Dioxins and furans; Heavy metals; Particulates'. (The respective emission limits set by the EC Waste Incineration Directive for each key pollutant are shown in a table on page 125). 'Air emissions are also a material planning consideration and probably represent the most significant public concern issue. New proposals must include detailed assessment of emissions to air addressing: air quality objectives, exposure to dioxins and furans and effects on health and natural environment'.

Dust/Odour: 'There is very little practical experience of such facilities to determine whether nuisance issues such as dust and odour will be significant planning considerations. The likelihood is that these issues can be controlled in the same way as they are with other forms of waste management carried out in enclosed buildings. Odours and dust from any mixed waste or putrescible waste facility have the potential to represent a nuisance issue with adverse impacts on residential amenity. The most significant problems with regard to odour occur when waste is allowed to decompose in anaerobic conditions. Dust is sometimes generated when waste is loaded and unloaded, and when waste is transported onto manoeuvring areas on vehicle wheels. If facilities are badly managed, or during times of plant failure, wastes can soon start to generate odour and dust problems. At a well run facility this will not be an issue as stored waste is kept to a minimum'.

Noise: 'In general the actual gasification and pyrolysis process itself is unlikely to be a noisy operation. Most noise will be associated with ancillary activities. The main problems associated with noise may be attributed to the following activities: Vehicle manoeuvring, loading and unloading operations; Sorting; Ventilation fans; Internal screening and mechanical sorting operations; Steam turbine units; Air cooled condenser units. If all of the mechanical process operations take place within the building, noise impacts are unlikely to cause nuisance concerns. Noise is an issue that is controlled under the IPPC Regulations as well as under the planning regime and by Local Authority Environmental Health Departments, under Statutory Nuisance provisions. Typically noise limits are either set at site boundaries or at sensitive receptors and these limits are usually based on target levels at agreed properties. These can be fixed limits based on guidance from the World Health Organisation, such as: 55 dB(A) daytime; 45 dB(A) night-time. In quiet or sensitive areas, the targets may vary according to the local noise environment, such as the following: 5 to 10 dB(A) above the existing background noise level'.

Litter: 'Litter is not likely to be a significant problem at these facilities if the whole process is contained within a single building. However where double handling of waste takes place, involving transport of waste from different process operations via external haul roads, litter and detritus can present difficult management issues. Storage of waste in un-covered external containers should be avoided'.

Visual Intrusion: 'The visual appearance and resulting impacts will vary according to the scale of buildings and the local setting of the site. Most modern facilities will be housed in purpose built steel framed buildings which may be similar to large agricultural buildings or industrial warehouses with the addition of a stack. Such facilities could be sited in a variety of locations with contrasting visual impacts. The key considerations in assessing impact are as follows: Direct effects on landscape fabric i.e. greenfield vs brownfield, removal of hedgerows, trees etc.; Proximity of landscape designations; Site setting, for example the proximity of listed buildings and/or conservation areas; Proximity of sensitive viewpoints; Presence of existing large built structures; Existing landform and nature of existing landscape; Presence/absence of screening features (trees, hedges etc.). Some degree of design modification should be possible to ensure the building provides a good fit with the local architectural vernacular, and has colour treatment and design details that are consistent with local industrial design guides. Various site engineering and screening techniques can be used to minimise visual impacts if located in a particularly sensitive setting. If the site is in a traditional industrial context such measures should not be necessary'.

Public Concern: 'At present there is some political and public support for many advanced thermal treatment systems. They are generally perceived as preferable to more traditional forms of thermal treatment and unlike incineration are not seen to detract from recycling and recovery activities. In reality although the processes are generally smaller in scale, they all generate air emissions which are regulated in the same way as incineration operations. Care needs to be taken when assessing planning applications to ensure that a balanced view is presented on all the potential effects from such facilities'.

5. Summary of two recent reports

5.1 *Review of Environmental and Health Effects of Waste Management (Municipal Solid Waste and Similar Wastes)* Defra: May 2004

In May 2004 the Department for Environment, Food and Rural Affairs (Defra) published a report, prepared by consultants, of the environmental and health effects of municipal waste management: *Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes*.

The conclusion reads as follows: "We have looked at the available information on the health and environmental effects of waste management. While the information is incomplete and not ideal, the weight of evidence from the studies so far is that present-day practice to managing municipal solid waste has at most a minor effect on human health and the environment. This should be viewed in the light of the benefits of collection and disposal of the waste that we all generate. If waste were not collected, treated and disposed, it would become a source of disease odours, litters and pests.

We recommend that efforts continue to be made to reduce the amount of municipal solid waste generated by and for us all. The government, regulators and the waste management industry should continue to be vigilant and improve their own understanding of the effects of municipal solid waste management, so that we can better regulate and control this essential industry. This will need to be communicated to the public so that we can all develop a proper perspective on the health and environmental effects of MSW.

Specifically, we recommend that a number of further studies would be helpful in improving our understanding of the health and environmental effects of waste management.

The most important areas to investigate are:

- A field study of population exposure to substances emitted from landfill sites;
- A study to improve our understanding of releases of micro-organisms from all kinds of waste management facilities;
- A study to improve our understanding of releases of particulates, micro-organisms, VOCs and methane from composting of municipal solid waste;
- A study to improve our understanding of releases from MBT and anaerobic digestion of municipal solid waste.

Other areas where further work should be considered include looking at whether an increase in composting of MSVV could have an effect on our health; looking at emissions under non-standard operating conditions; investigating the health and environment effects of recycling processes; and ongoing study of new ways of dealing with MSW".

5.2 *Quantification of the Potential Energy from Residuals in the UK.* Commissioned by The Institution of Civil Engineers (ICE) and The Renewable Power Association (RPA) March 2005

This recent report aims to objectively evaluate the options for managing waste to generate electricity.

Although recycling and composting rates are set to increase, a significant quantity of waste that is currently landfilled is likely to remain as residual waste, and an alternative route for its disposal must be sought. Waste management techniques that are applicable to residual waste (such as conventional incineration, gasification and pyrolysis) can all include energy recovery.

The EU Renewables Directive is transposed into UK Law through the Renewables Obligation Orders (ROO). In principle, biodegradable waste qualifies as a renewable resource and could be used as a feedstock in the generation of electricity, thus meeting the objectives of both the Landfill Directive and the Renewables Directive.

Although the EU Renewables Directive identifies biodegradable industrial and MSW as biomass that may meet the objectives of the Directive, the UK ROO's definition of 'eligibility' excludes the use of mixed waste for energy recovery via incineration. Nevertheless, energy from waste has an important role to play in improving energy security in the UK, and, by virtue of its biomass content, it can make a valuable contribution towards our renewable energy targets.

The report concludes that if the UK chooses to diversify its energy resources, then waste could contribute over 15% of the UK's energy demand; 64% being generated from biomass.

6. Incineration of MSW in London

6.1 Introduction

Waste management and planning in London is a special case because the metropolitan function of London makes it unique. But attention to the issues in London helps to clarify the issues that are universally relevant.

6.2 The London Plan

In the last few years the Greater London Authority (GLA) has been through the process to adopt new strategic planning guidance for London - the Spatial Development Strategy (SDS), known as The London Plan. In the course of this, the GLA has moved from a policy position of 'no expansion of waste incineration' to one that accepts that there may be new thermal treatment waste plants built.

Overall responsibility for the London Plan rests with the Mayor of London. The GLA covers the 32 London boroughs and the Corporation of London. The local planning policies and proposals of the boroughs and the Corporation of London must be 'in general conformity' with the London Plan.

Public consultation on proposals for the London Plan took place in 2001. The responses to this were published in 2002, and later in that year a draft London Plan was published. The 2002 draft London Plan included a presumption against increasing the amount of municipal waste incineration in London.

The Panel that had conducted the Examination in Public (EiP) of the draft London Plan in Spring 2003 published its report in July 2003. The EiP Panel report did not accept the London Plan's presumption against increased incineration.

The EiP Panel drew attention to the original Government guidance for the role to be played by the London Plan with respect to waste. The EiP Panel thought it particularly important to note that the London Plan should enable London to deal with the management of all the waste that it produces within its own boundaries. The EiP Panel was concerned that the presumption against expanding waste incineration was contrary to Government planning policy. The EiP Panel affirmed the role of waste incineration. The EiP Panel recommended that the presumption against incineration should be removed from the London Plan.

The London Plan was finally published by the GLA in February 2004. Policy 4A.1 (Waste strategic policy and targets') now states:

'Having regard to the existing incineration capacity in London and with a view to encouraging an increase in waste minimisation, recycling, composting and the development of new and emerging advanced conversion technologies for waste, the Mayor will consider these waste management methods in preference to any increase in mass burn incineration capacity. Each case however will be tested on its individual merits. The aim is that current incinerator capacity will, over the lifetime of this plan, become orientated towards non-recyclable residual waste'.

6.3 Conclusion

The main issues here are:

1. Whether a Waste Planning Authority may seek to impose a limit on the amount of waste thermal treatment capacity in its area;
2. The extent to which a Waste Planning Authority is planning to manage all the waste that it produces within its own boundaries.

We have seen that the former issue has been resolved in the content of the London Plan.

The second issue concerns the 'Proximity Principle' which is one of the key principles of waste planning. London has historically exported a large proportion of its waste beyond its borders for management and disposal. A major challenge in waste management and planning in London and surrounding areas is the extent to which London will, in future, be 'self-sufficient' in waste management. A significant factor in this will be the extent to which new waste management facilities – of all kinds - are built within London.

7. Discussion and conclusion

The ODPM and Defra reports indicate Government confidence in the future of municipal waste incineration and the potential of new advanced thermal treatments. The disposal of incinerator ash to landfill is the appropriate disposal route for this waste.

The ICE/RPA report reminds us that although recycling and composting rates are set to increase, a significant quantity of waste that is currently landfilled is likely to remain as residual waste, and an alternative route for its disposal must be sought. Conventional incineration, gasification and pyrolysis can all include energy recovery, and a large increase in these waste management methods would meet the objectives of both the Landfill Directive (to divert waste away from landfill) and the Renewables Directive (to increase the amount of energy generated through renewable sources), provided the UK Renewables Obligation Orders are amended to allow biodegradable waste to be used as a feedstock in the generation of electricity: this is a vision of widespread generation of electricity by power stations burning MSW.

The case of the London Plan shows that incineration must be given full consideration in planning policy as a potential future method of waste management. Final Policy 4A.1 shows the Mayor's aim that current incinerator capacity will become orientated towards non-recyclable residual waste, in keeping with best waste management practice. Although there is a stated preference against new large scale incinerator development, there is a desire to encourage waste minimisation, recycling, composting and the development of new and emerging advanced conversion technologies for waste - which include pyrolysis and gasification.

Looking at the details in ODPM's '*Planning for Waste Management Facilities'* and Defra's *'Review of Environmental and Health Effects of Waste Management (Municipal Solid Waste and Similar Wastes':*

1. we can see that the ODPM and Defra both recognise that public concern is a valid consideration, and the effect of this on the ability of the industry to gain planning permissions is acknowledged;
2. we can note that ODPM hopes that future small scale thermal treatment proposals will not be as vulnerable to public concern as large scale facilities;
3. we can note that ODPM and Defra remain confident in the future development of large scale MSW incinerators;
4. we can note the potential of pyrolysis and gasification;
5. we can note the stringent standards on emissions that are now applied, which require that all new and existing plants operate to extremely high standards with the potential for plants to be linked directly to Environment Agency offices;
6. we can acknowledge Defra's case that management of MSW has at most a minor effect on human health and the environment and that this should be viewed in the light of the benefits of collection and disposal of the waste that we all generate.

8. Theological reflection

8.1 Introduction

From a Christian perspective, the management of waste raises questions about human stewardship of creation. Humankind is itself part of creation, and the disposal of human remains may be described as the ultimate waste disposal operation.

This chapter is based on '*A Brief History of Death'* (2005) by the anthropologist Douglas Davies. It reflects on changing attitudes to the disposal of human remains by cremation and suggests that this may assist us in understanding current popular attitudes to the incineration of MSW.

8.2 The rise of cremation

Incineration in the form of cremation is the most widely practised method of committal, with burial being the only other method employed in the UK.

Davies states that at the start of the 21st Century some 70% of the British dead were cremated. Current concerns about the ecological impact of human behaviour

lead Davies to suggest that incineration may decline in future.

In Chapter 3 Davies describes the origin of cremation in the UK in the mid 19th Century as a reaction against inadequate burial in over-filled urban cemeteries, and a desire for a more healthy method of human committal.

8.3 Characteristics of religious belief in popular ecological concern: the case of cremation and woodland burials

In Chapter 4 Davies discusses some contexts in which death and corpses assume particular significance and goes on to show how human bodies become the focus for the expression of shared values and beliefs. Thus, for example, the rise of the hospice movement and funeral rites of the American military show how the human body becomes a medium for particular values of society to be expressed.

Davies then discusses current customs and practices in the UK in the context of the current widespread concern about ecology. The concluding pages of Chapter 4 (pp 77 – 88) are an analysis of the growth of popular ecological concern and the way in which this has taken on characteristics of religious belief.

These insights are summarised here: they arise from a focus on death and the disposal of human bodies, and they may, in turn, be usefully applied to wider issues of waste management.

Preoccupation with the world as a living space and ethical activity within it

Although cremation has its origins in the 19th Century in a desire for a more healthy method of disposal of the dead, by the early 21st Century it has come to be seen by some as a potential source of harmful chemical discharge. The 19th Century commitment to social hygiene has given way to a concern for the world at large in such matters as the atmosphere's ozone layer and the destruction of tropical rain forests.

There has been a revolution in world-view away from debates about God, religion and destiny to a preoccupation with the world as a living space and ethical activity within it, in the context of the likelihood of a sustainable future. Personal survival and immortality have been subsumed into the survival of the human species amidst other species. Religiosity has been superseded by spirituality.

Eco-theology

For many believers the ecological shift of cultural awareness has demanded various forms of 'eco-theology'. Christian theologians have responded to the criticism that biblical religion has encouraged a cavalier view of the world, using it as lesser order. Theologians speak of the call to stewardship of God's creation as a proper endeavour for Christians.

But for increasing numbers of people - and even for some religious believers – the ecological focus is likely to dominate over, and even replace, previous religious preoccupation with heaven.

A new way of thinking which avoids the speculation and contradictions of religion

Hope is present in explicitly secular ecological concerns, as it is also present in religious belief and ethics. Hope appears to be part of the human self-consciousness and the drive to survive.

Science and technology are simultaneously the basis of both pessimism and optimism: the source of our potential destruction and the source of our salvation if they can regulate or reverse our decline.

After the Cold war, the apparent demise of the fear of nuclear destruction has been replaced by a fear of a slower destruction of the world. People have held out to them, in ecology, a new way of thinking about themselves and their world which avoids both the speculative elements of religion, and contradictions between branches of a religion and between different religions: the ecological world-view seems more 'concrete'; more real. The political power of groups such as Greenpeace, Friends of the Earth and the Green Party indicate that it is likely that ecological-environmental ideas will increase the pervasiveness and satisfaction of this world view.

Woodland burial

This is the context for the recent increase in interest in funerary rites described in terms of 'woodland burial'. This may be described as an ecological framing of identity that produces its own form of secular 'eschatology', or 'doctrine of the last things', as it expresses concern for the future of the planet.

Cremation is rejected in favour of giving one's body back to the earth in a biodegradable wickerwork container as a hope for the future of the planet: the hope of survival goes beyond self-related hope to a hope expressed for future generations. The conventional sealed coffin is rejected as being a denial of the natural processes of death and decomposition. An individual's commitment to waste recycling, promotion of conservation projects, and an ideological position on vegetarianism, for example, will be borne out in the manner of the disposal of their body.

The effect of European Council directives on waste is being felt in every home, and this will influence ideology and public values in a most basic way. Ecology is 'modern' rather than 'post-modern' because it provides an overarching story of the way things are. Post-modernism sees individualism as the death of shared values, but ecological values do focus on the human body.

A potential paradigm shift in the understanding of death

Woodland burial refers to the process of burying the body not in any traditional churchyard or cemetery but in a variety of contexts such as a field in which trees can be planted above graves to develop into woodland. Alternatively, bodies may be buried in open areas within established woodland.

The traditional Christian formula 'earth to earth, ashes to ashes, dust to dust' becomes paradoxical and accentuates the ideological direction taken by 'green funerals'. This phrase expresses both the positive idea that human kind is of the same earth as everything else and the negative idea – from Adam in Genesis 3:19 – that because humanity fell into a sinful state of disobedience, its destiny is death. Human self-knowledge embraces The 'woodland burial' approach is intelligible to many contemporary people. the knowledge of death in a profound 'reflexivity': the dust of death is offset with the 'sure and certain hope of resurrection.

But a very different motivation lies behind the 'earth to earth' of woodland burials which reflect a potential paradigm shift in the understanding of death: the earth that returns to the earth is not the sinful son or daughter of Adam and Eve, but the natural human body that was formed through earthy processes and which now continues those processes through its death.

Ecology brings together science, ethics, philosophy, economics and politics in ways that are reminiscent of religion in previous eras: it is a unifying perspective, and the management of domestic waste by every household is a small part of a larger whole.

Significant numbers of people are less amenable to accepting traditional rites simply because they are traditional

The realm of ethics emerges amongst current ecological concerns: ethics opens a new arena in which it may operate. Likewise, spirituality emerges as an appropriate field to express and explore shared ecological values.

Paradoxically, though, a new ecological world-view that has characteristics of religion, and that has a place within it for ethics and spirituality, also lives alongside an increasingly consumerist outlook that is framed by a sense of personal freedom and individualism. This individualism leads people to want to live in as intelligible and authentic a way as possible but not necessarily in terms of established religious ideas.

It is at this point of paradox that 'death encounters its paradigm shift': as significant numbers of people no longer believe in life after death, they are less amenable to accepting traditional rites simply because they are traditional.

Conclusion: ecological immortality

Since waste disposal has become a pressing concern of everyday life, so also the manner of disposal of the dead has come to the fore. Cremation can no longer claim to be the best hygienic method for the disposal of corpses.

The inherent dissonance in the Christian doctrine of 'earth to earth, ashes to ashes,

dust to dust' is now superseded by a new authenticity as the dead are given back to 'nature'.

The understanding of 'nature' is the key: not only does woodland burial assert an essential human unity with nature, but the burial place establishes a private realm of the continuing identity of the deceased that depends on neither memory nor 'heaven'.

'Woodland burial' has strong characteristics of modernism that enable adherents to have a shared sense of purpose, ideology or belief. We may say that the current widespread concern about ecology has characteristics that make it similar to a religion.

8.4 Current concerns about human cremation

Recent news stories on the BBC website illustrate current anxieties about cremation:

- http://news.bbc.co.uk/1/hi/health/4160895.stm Crematoria warned over mercury. 10.01.05. Strict rules for crematoria to limit mercury pollution caused when tooth fillings are vaporised have been announced by ministers.
- See Control of mercury emissions from crematoria on www.defra.gov.uk

8.5 Applying insights from Davies to the debate about MSW incineration

'Ecology religion'

Davies asserts that current widespread concern about ecology has characteristics that make it similar to a religion. He argues that adherents to the 'ecology religion' are anxious about cremation and seek a spiritual life and death in which personal survival and immortality are subsumed into the survival of the human species amidst other species.

A desire to reduce the amount of waste produced so that there is no residual waste

We have seen that for both BAN Waste and Greenpeace, concern about MSW incineration leads not to a desire to maintain landfill as the method of disposal of residual waste (waste that has not be re-used or recycled), but to a desire to reduce the amount of waste produced, and to re-use and recycle waste, so that there is no residual waste to either landfill, incinerate or 'treat thermally'. Adherents of 'ecology religion' would call this 'hope for the planet'; sceptics would call this idealism. The waste management industry (in the form of the ICE and RPA reports) argue that for the foreseeable future there will be large amounts of residual waste to manage and dispose of. The Landfill Directive will gradually prevent this residual waste going to landfill, so we must look to the next step up the Waste Hierarchy which is energy recovery. Incineration, pyrolysis and gasification are all methods of achieving this. There is also potential for energy recovery by methods of waste composting, which is the next step again up the Waste Hierarchy.

To what extent can 'ecology religion' accept technology as the source of our salvation?

ODPM and Defra provide rational, authoritative reports to reassure the general public that the balance of risk favours present patterns and trends of waste management, but they recognise the potential power of public concern. It remains to be seen how the adherents of the 'ecology religion' respond. To what extent can 'ecology religion' accept technology as the source of our salvation?

Human trust

A large part of the case made by BAN Waste and Greenpeace concerns human trust. Horror stories about incinerators usually concern times of breakdown or poor management. The 'ecology religion' argument might be that humankind can no longer be trusted with 'monster science' that it has created: this is the view of science and technology as the source of our potential destruction. A Christian viewpoint would instead emphasise grace, and the possibilities of forgiveness and changed behaviour that build trust.

The management of human remains is being moved 'up the Waste Hierarchy'

Paradoxically, whilst the increasing concern about pollution from crematoria reflects concerns about incineration as a waste disposal method, the increasing interest in 'woodland burial' is contrary to a desire to move away from waste disposal by landfill. But with the essentially biodegradable characteristics of woodland burial it would be more accurate to describe woodland burial as composting rather than landfill. Thus, the management of human remains is being moved 'up the Waste Hierarchy' from a landfill-like burial in a coffin (which does not encourage decomposition) and from incineration without energy recovery (ie. cremation) to composting.

8.6 Questions for Christians

This all poses many questions for Christians who are concerned about the environment:

1. If the call to stewardship of God's creation is a proper endeavour for Christians, how can the church make this call more effectively? How can the church bring grace and reconciliation to situations of environmental concern where human trust has broken down?
2. If for some Christians the ecological focus has replaced the previous religious preoccupation with heaven, what is the appropriate balance to be struck between Christian ecological concern and orthodox Christian doctrine? Does some Christian 'eco-theology' leave out Christ?
3. As the Landfill Directive's critical deadline years for the reduction of landfill approach and pass, will 'ecology religion' be strengthened by the increasing rates of household waste recycling and the consequent 'ecological shift of cultural awareness'? In addition to greater demand for woodland burials, will this shift of cultural awareness be seen in other aspects of religious observance?
4. How can the church bring Christ into a woodland burial? Could the church establish and run woodland burial grounds?

Sources and references

1. www.bbc.co.uk
2. www.banwaste.org.uk
3. www.greenpeace.org
4. *Planning for Waste Management Facilities.* (The Office of the Deputy Prime Minister. August 2004.) ISBN 1 85112 713 5
5. *Review of Environmental and Health Effects of Waste Management (Municipal Solid Waste and Similar Wastes)* (Defra: May 2004) www.defra.gov.uk
6. *Quantification of the Potential Energy from Residuals in the UK* (Commissioned by The Institution of Civil Engineers and The Renewable Power Association March 2005). RPA, 2nd Floor, 17 Waterloo Place, London. SW1Y 4AR. www.r-p-a.org.uk tel: 020 7747 1830. ICE, One Great George Street, Westminster, London. SW1P 3AA. www.ice.org.uk. Tel: 020 7222 7722.
7. Douglas Davies *A Brief History of Death*. (Blackwell 2005) ISBN 1-4051-0813-0.

The Church of England's recent report **Sharing God's Planet** sets out the scale of humankind's responsibility for altering the planet over the last 100 years. It also provides Biblical and theological reflection and suggests a practical Christian response. But nowhere does it acknowledge that difficult environmental decisions are being made every day by County, District and Borough Councils as they decide planning applications, and that everyone may have a role in influencing planning decisions. Some of the most contentious planning decisions are those that concern development proposals for waste management and disposal. **Stewarding the Earth's Resources** is an occasional complementary bulletin for the church that sets out current issues in waste planning. It encourages Christians to take a responsible approach to new waste developments. It presents a balanced summary of current ethical, practical and spiritual issues in a non-technical way.

Stewarding the Earth's Resources is compiled by the Revd Jon Hale BA who is an ordained Church of England priest with a background in waste planning.

Waste Planning is the main professional journal in the field of waste planning. It is published by Mineral Planning, 2 The Greenways, Little Fencote, Northallerton DL7 0TS.

Revd Jon Hale, The Vicarage, Vicarage Road, Crawley Down, West Sussex. RH10 4JJ.
Tel: 01342 714922. aj@jkcahale.plus.com