Doncaster Waste Strategy: Environmental Report

Doncaster Metropolitan Borough Council

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Report for:

Doncaster Metropolitan Borough Council

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SECTION 1:
BACKGROUND, ASSESSMENT CRITERIA AND METHODOLOGY

1.0 Introduction

This Environmental Report (ER) forms part of the Doncaster Waste Strategy (DWS). The purpose of the report is to provide an assessment of the likely effects of the Strategy. In doing so the document complies with the requirements for the content of the Environmental Report as set out in the Environmental Assessment of Plans and Programmes Regulations 2004[1] (the SEA Regulations), provided in Appendix 1.0.

A Scoping Report (SR) setting out background information and proposed strategic objectives, targets and criteria to be used to appraise the Doncaster Waste Strategy was consulted upon from 23rd July to 3rd September 2008. This Environmental Report follows on from this phase and incorporates the consultation responses.

1.1 The Doncaster Waste Strategy (DWS)

As a Unitary Authority, Doncaster has responsibility for both the collection and disposal of waste. The aim of this Draft Strategy is to propose a long-term direction of travel for the management of waste in Doncaster, to subject this to public scrutiny and so develop a final Strategy for adoption by the Authority.

The structure of the DWS follows guidance from Defra on the production of such strategies. The Strategy itself comprises:

- a Headline Strategy document which sets the long-term direction and policies for the Borough. The intention is that this will need only occasional revision; and
- an Action Plan which sets a detailed plan of action for achieving the Strategy's objectives. It is anticipated that this will be regularly (annually) updated and form the basis for an annual waste workplan for the Authority.

The Strategy is supported by a number of other documents that help to explain how it was developed and provide the evidence base supporting its conclusions. Table 1-1 lists the eight key documents.

Table 1-1: Documents Comprising the DWS

Document No.	Document Name
Headline Strategy & Action Plan	
1	Headline Strategy
2	Action Plan
Technical Reports	
3	Baseline Review

[1] SI 1633/2004

Process Reports	
4	How This Strategy Was Produced
5	Community Panel Report
6	Public Consultation Report
Strategic Environmental Assessment	
7	SEA Scoping Report
8	Environmental Report

The Strategy is discussed in more detail in Section 2.1.

1.2 What is Sustainable Development?

Whilst there is no single definition of Sustainable Development, it is now one of the key principles shaping the actions of Government within the UK. It is a principle which states that whatever we do, both in our current and planned activities, we must consider the potential impact of our actions on future generations so that we do not hinder the prospects for a healthy and successful society in the future.

In 1999 the UK Government produced its first Sustainable Development strategy *"A better quality of life"*. This Strategy set out four elements or 'pillars' to Sustainable Development:

- Prudent use of natural resources;[2]
- Social progress that meets the needs of everybody;
- Effective protection of the environment; and
- Maintenance of high and stable levels of economic growth and employment.

The Strategy was reviewed in 2005 by means of a document, '*Securing the Future: Delivering UK Sustainable Development strategy*'.[3] This report states that:

> *"The goal of Sustainable Development is to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life of future generations".*

The Strategy upholds the principles set out in the 1999 document, and sets out five guiding principles for Sustainable Development which are:

- Living within environmental limits;
- Ensure a strong, healthy and just society;
- Achieving a sustainable economy;

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[2] The prudent use of natural resources is often combined with the protection of the environment pillar, to form three pillars of Sustainable Development – economic, social and environmental.

[3] Cm 6467, The UK Government Sustainable Development Strategy, March 2005.

- Promoting good governance; and
- Using sound science responsibly.

Therefore, Sustainable Development recognises that healthy development does not simply imply the generation of wealth in the conventional sense, but that the environmental, economic and social consequences of our actions have to be taken into account, at all geographic scales.

1.3 The Importance of Sustainable Development for the DWS

Sustainable Development is directly relevant to the DWS. The amount of waste produced and the way in which it is managed has significant implications for the quality of the environment and therefore for the quality of life, for both current and future generations. Traditional reliance on landfill as a means of waste management is now recognised as being unsustainable. Ways of managing waste more responsibly must be found and adopted.

The DWS will guide (along with the waste development framework) how waste is managed in Doncaster over the coming years. It provides the context of '*how*' waste should be managed, whereas the waste development framework provides the '*where*'. It is crucial that the DWS takes Doncaster forward, working towards more sustainable methods of waste management which involves following the waste hierarchy, through the promotion of, in order of preference, waste prevention, re-use, recycling and composting, energy recovery and finally, using other disposal methods as a last resort.

The need for the move to more sustainable waste management is firmly established in the guidance on municipal waste management strategies produced by Defra and in the *Waste Strategy for England 2007*.[4] In line with its commitment to sustainable development, national Government policy seeks to break the link between economic growth and the amount of waste produced, and to drive waste up the waste management hierarchy. This is echoed in the key policies affecting waste management planning, PPS10.[5]

1.4 Strategic Environmental Assessment (SEA)

Strategic Environmental Assessment is a method of assessing the impact on the environment of certain plans or programmes. Its core objective is to:

> *'provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans….with a view to promoting sustainable development'.*

[4] Defra (2007) *Waste Strategy for England 2007*, London: Defra.

[5] ODPM (2006) *Planning Policy Statement 10: Planning for Sustainable Waste Management*, July 2005

Guidance provided by the Department of Communities and Local Government (DCLG) states that a SEA is a procedure comprising of:

- Preparation of a Scoping Report to establish the baseline for the subsequent Environmental Report;
- Preparation of an ER setting out the likely significant effects of a draft plan or programme;
- Consultation on the draft plan/programme and the accompanying ER;
- Taking into account the ER and the results of consultation in decision making; and
- Providing information when the plan or programme is adopted and showing how the results of the environmental assessment have been taken into account.

Under the SEA regulations there is a legal requirement to conduct an SEA for Waste Strategies and modifications of Waste Strategies where the plans or programmes set the regulatory framework for future development consent for projects listed in Annexes I and II of the EIA directive, or require assessment under Articles 6 and 7 of the Habitats directive.

Given that Annex II 11(c) of the EIA directive provides for '*installations for the disposal of industrial and domestic waste*', where a plan or strategy relating to waste management paves the way for development of such facilities (even if not specific in terms of location), an SEA will generally be required.

1.4.1 The SEA Process

As indicated above, the SEA process involves a series of steps which are set out in Government guidance.[6] The SEA process, of which this ER is a part, has been undertaken with regard to this guidance and in full compliance with the requirements of the SEA Regulations. These steps are set out in Figure 1-1. This report reflects the culmination of the process up to and including stage C.

Figure 1-1: The SEA Process

[6] ODPM (2005) *A Practical Guide to the Strategic Environmental Assessment Directive*

STAGE A: SETTING THE CONTEXT & OBJECTIVES, ESTABLISHING THE BASELINE & DETERMINING THE SCOPE

- Identify Other Relevant Plans, Programs and Environmental Objectives
- Collect Baseline Information
- Identify Environmental Problems
- Develop SEA Objectives
- Consult on the Scope of the SEA

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STAGE B: DEVELOPING ALTERNATIVES & ASSESSING EFFECTS

- Develop Strategic Alternatives
- Predict The Effects Of The MWMS (& Alternatives)
- Evaluate The Effects Of The MWMS (& Alternatives)
- Mitigate Any Significant Adverse Impacts
- Propose Monitoring Plan

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STAGE C: PREPARE ENVIRONMENTAL REPORT

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STAGE D: CONSULTATION ON THE DRAFT MWMS & DRAFT ENVIRONMENTAL REPORT

- Consultation With Public And Statutory Consultees
- Assess Any Changes To The Strategy As A Result Of Consultation
- Inform Consultees How The Environmental Report And Consultees Opinions Have Been Accounted For In Decision Making

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STAGE E: MONITORING OF THE SIGNIFICANT EFFECTS OF THE MWMS AND RESPONDING TO THOSE EFFECTS

1.4.2 Limitations

This ER is based on information that was available at the time of publication, and is presented as a consultation draft. Additional information that comes to light during the course of the consultation procedure will, where relevant, be incorporated into the assessment process.

In drawing together this ER it is important to highlight the limitations and difficulties that have been found. It should be noted at this stage that:

- A Community Panel was used to develop the criteria for the evaluation of the Strategy. The panel meetings were held in Spring 2007 and a time lag occurred between the timing of these and the commencement of the SEA due to delays in arrangements for the development of the Strategy. In an ideal situation the SEA would follow the Community Panel to ensure that circumstances do not change and that all data is up-to-date. However, the views of the community are unlikely to have changed significantly within this time period;

- Much of the baseline data is sourced from third parties and although reasonable measures have been taken to ensure the accuracy of this data, it is not possible to verify this information first-hand;
- The assessment of baseline data and relevant plans and programs is a potentially indefinite process, so it is recognised that these sections are not fully exhaustive. Care has been taken, however, to ensure that the most relevant information has been included; and
- Given the strategic nature of the DWS, some assessment criteria are not directly measurable. As the Strategy does not cover the location of waste facilities, it is difficult to measure, in some cases, the effects on local biodiversity, air pollution or land take. Other criteria were not directly relevant to certain levels of the hierarchy, or were not measurable, such as educational opportunities or safety. All relevant criteria were assessed quantitatively, where possible, and where not, a qualitative analysis was undertaken.

1.5 Consultation

The ER, together with the MWMS is being consulted upon with key stakeholders and the wider public. Comments on the ER are therefore welcomed and should be sent, no later than 23rd January 2009 to:

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Alternatively responses can be emailed to:

HannahMontag@eunomia.co.uk

2.0 Background Information

2.1 The Draft Municipal Waste Management Strategy for Doncaster

As well as holding a Community Panel workshop to produce a list of criteria by which to assess the Strategy and relevant options, several workshops were held with officers from Doncaster Metropolitan Borough Council at which the assumptions used in the modelling were reviewed as well as data sources and methodology.

The DWS has progressed alongside the SEA process and the modelling outputs from this ER have fed into the development of the Strategy. The aim of this is to produce a sound technological basis for the principles, policies, targets and actions set out in the Strategy to ensure that they are achievable and align with the issues and aspirations of Doncaster.

2.2 Plans and Programmes Relevant to the DWS

The DWS is affected by a wide range of other plans and programmes. It is important that these are identified at an early stage so that the DWS has due regard to them and, wherever possible, works alongside them to fulfil their aims and objectives. It is crucial that the DWS does not conflict with the objectives and aims of other plans and programmes to which Doncaster must have regard, or must adhere to.

A.2.0 in the Appendices provides a list of the *main* plans and programmes that are considered relevant to the development of the SEA for the DWS[7]. The table highlights the key *relevant* issues and objectives within each of the documents. Please note that this is not an exhaustive list of all plans and programmes which exist. There are many documents that might be considered to bear some relationship to waste issues. However, only the plans and programmes which are likely to exert a significant influence on the Strategy have been included and those which do not have a direct influence are omitted (in fact, to the extent that they may mention waste, the DWS could possibly influence them).

Furthermore, there is a myriad of legislation at national and international scales that is relevant to waste. For Local Authorities, relevant plans often range from national, regional to local levels. International plans and European legislation are, for the most part, implemented in the UK through national legislation and policy and it is these to which Local Authorities must adhere. Therefore, while many international plans (e.g. the World Summit on Sustainable Development) are important in guiding national policy towards sustainable waste management and wider issues of sustainable development, they are not directly relevant to Local Authorities. Another good illustration of this is the Landfill Directive; Local Authorities themselves do not need to

[7] This is in full compliance with SEA guidance and emerging best practice on the SEA process, which is often critical of over-lengthy reports. Consultees are, of course, welcome (and encouraged) to comment on any areas where they feel key documents have not been taken into account.

have regard to this Directive; rather, they must have regard to the implementing legislation within the UK (such as the WET Act, the Landfill Regulations, etc.).

2.3 Baseline Information and Future Trends

To focus the appraisal and to ensure that the SEA picks up on the potential significant impacts of the DWS, the current local environmental baseline needs to be explored, together with how these elements are likely to evolve over the next few years.

The relevant baseline information is set out in the accompanying Appendices (A.3.0) in accordance with the SEA criteria as laid out in Schedule 2(6) to the SEA Regulations. Additional information has also been included where it has been considered relevant and important. For the baseline information collected, wherever possible, the likely evolution, in the absence of any Strategy, of various environmental indicators has been highlighted.

2.4 Key Sustainability Issues for Doncaster

In order to develop a set of relevant and appropriate objectives and indicators for this SEA, it is important to recognise the key pressures and sustainability issues facing Doncaster. These have been derived from analysis of the baseline information, and information provided in other relevant documents. Figure 2-1 provides an outline of the key sustainability issues separated into Economic, Environmental and Social issues (thus echoing the 3 pillars of sustainable development identified in Section 1.2). It is important to note that, while Figure 2-1 divides the issues neatly into one of the three categories, there will be interactions between the categories. For example, over reliance on landfill does not only affect the environment; the way in which the Landfill Directive has been transposed into UK law now means that continuing to send biodegradable municipal waste to landfill will also have economic implications.

The SEA Regulations specify that impacts on areas designated under the Conservation of Wild Birds Directive or the Habitats Directive should be highlighted. While this is relevant to many ERs for other strategies and policies, the fact that the DWS does not deal with the *location* of facilities means that there are no *direct* impacts on areas designated under these Directives which are likely to be discernable from the Strategy (precisely because this will not be ‘location specific’).

Figure 2-1: Key Sustainability Issues Facing Doncaster

ISSUE	IMPLICATION FOR DWS	SOURCE
ENVIRONMENTAL ISSUES		
Urban Traffic Congestion There are four Air Quality Management Areas designated in the authority for NO_2. Transport of waste by road adds to the local air pollution and emissions of NO_2 and other pollutants.	DWS will impact on the amount of waste produced and collection logistics – all of which will impact on transportation and air pollutants released from the associated transport. NO_2 is also released by waste combustion processes.	Local Air Quality Management www.airquality.co.uk Baseline Report
Energy Renewable energy sources are undersupplied, with an overdependence on fossil fuels for energy both regionally and locally in Doncaster.	Waste treatment and disposal options will impact upon both energy usage and energy generation.	Regional Energy Consumption Statistics
Climate Change Impacts on the region could be devastating with large areas of land identified as at high risk of flooding.	DWS will impact on waste growth, re-use, recycling and composting, and the choice of waste treatment and disposal technologies. All these choices have implications for Greenhouse Gas (GHG) emissions and climate change.	Regional Sustainable Development Framework Waste Strategy for England 2007
Waste Arisings The amount of waste produced annually in Doncaster is increasing. A new target to reduce the amount of household waste per head that is not reused, recycled or composted has been introduced by the Waste Strategy for England 2007.	DWS will have a direct influence on the amount of municipal waste produced, and the quantity that is reused, recycled or composted.	DMBC data Waste Strategy for England 2007

ISSUE	IMPLICATION FOR DWS	SOURCE
Recycling Targets Achievement of recycling targets by Doncaster. The Authority's statutory recycling target for 2005/06 and 2007/08 was exceeded. However, increased National targets for recycling and composting of household waste have been set by the Waste Strategy for England 2007; at least 40% by 2010; 45% by 2015; and 50% by 2020.	Higher targets will stretch (or exceed) potential of existing services. New services are likely to be required to meet higher targets	DMBC data Waste Strategy for England 2007
Over-reliance on Landfill. Large amounts of biodegradable waste are being landfilled, and this leads to generation of methane (a potent GHG). There is a need to move towards more environmentally acceptable ways of waste management. DMBC must also meet its obligations under the Landfill Allowances Trading Scheme (through a combination of – as necessary - diverting waste from landfill, reducing the biodegradability of waste which is landfilled, or purchasing landfill allowances from other authorities).	Need to consider long term alternatives to landfill.	DMBC data Regional Sustainable Development Framework Waste and Emissions Trading Act
Geology Doncaster has substantial deposits of mineral resources and faces the challenge of safeguarding these whilst contributing towards meeting local, regional and national needs for minerals and protecting the environment. Furthermore, the aquifers formed by the solid geology must be protected both in terms of avoiding unnecessary abstraction and avoiding pollution of the water environment.	The DWS will have negligible direct influence on mineral extractions, although it will affect the rate of void fill. The DWS will have some impact on the amount of compost produced and so may have a marginal effect on peat extraction in the area. However this is unlikely to be a significant factor as extraction is already carefully monitored and restricted.	DMBC data

ISSUE	IMPLICATION FOR DWS	SOURCE
Landscape Character – Biodiversity - Greenbelt Threat to Landscape Character and pressure on biodiversity and the greenbelt. Important landscape areas/features have been identified and should be protected.	Whilst a key local issue, it is not one that is directly relevant to the DWS, since location issues are dealt with by the waste local plan.	Doncaster Local Biodiversity Action Plan Doncaster Landscape Character & Capacity Study

ISSUE	IMPLICATION FOR DWS	SOURCE
SOCIAL ISSUES		
Household Numbers The combination of expected population growth of 14,000 between 2001 and 2030, coupled with increased housing numbers and decreasing average household size is likely to generate upward pressure on waste quantities.	More people and increases in household numbers will lead to increased waste production and pressure on waste collection, treatment and disposal facilities. DWS needs to allow for rising household and population numbers.	Yorkshire and Humber Population Projections Doncaster Housing Strategy
Deprivation Some of Doncaster's Super Output Areas are in the top 10% most deprived nationally. Deprived areas have tended to be among the most difficult to engage in recycling.	Need to ensure that policies implemented are able to engage deprived areas in waste management initiatives.	Index of Multiple Deprivation

ISSUE	IMPLICATION FOR DWS	SOURCE
Education Low levels of educational attainment (linked closely to above) - Doncaster's education results are below national averages and there tends to be a link between education and environmental awareness.	Need to ensure that direct education (of adults and children) relating to sustainable waste management is included as part of the strategy.	ONS Education

ISSUE	IMPLICATION FOR DWS	SOURCE
ECONOMIC ISSUES		
Costs Costs of waste management will increase significantly in the coming years as a result, amongst other things, of the Landfill Allowances Trading Scheme, increases in Landfill Tax, and the need to meet new targets.	Increasing costs associated with waste management may put pressure on other council services.	Local Government Association
Employment Doncaster lacks a range of local jobs and a skilled workforce.	Waste management has some potential for employment generation, mainly in respect of re-use activities, collection and reprocessing. As regards residual waste, a key question is whether the objective should not be to *reduce* employment involving direct contact with residual waste.	ONS population survey

3.0 Proposed Sustainability Objectives and Targets

Having identified the baseline information, together with the key sustainability issues facing Doncaster, these are able to be fed into the development of criteria against which the DWS will be assessed. Although the use of criteria in the assessment is not specifically required by the legislation, the method was chosen for this ER as it provides an approach which is relatively easy to understand, is robust and provides a good reference tool for future monitoring and assessment.

In order to identify criteria which are deemed important to Doncaster residents, a Community Panel was utilised. This is outlined in Section 3.1.1.

3.1 Identification of Relevant Objectives, Targets and Indicators

3.1.1 Community Panel

The Community Panel was selected using a specialist market research company in order to get a group broadly representative of Doncaster's residents. Information about waste management techniques, the baseline situation and key sustainability issues facing Doncaster were presented to the panel. Following this the panel were asked to develop – over several meetings - a selection of criteria which they deemed relevant according to the information given to them and their personal knowledge of Doncaster and the issues that face them as residents. The panel also provided weighting for the criteria. The meetings covered both collection services and residual treatment options, with sufficient time allocated to allow information dissemination and discussion. The meetings and their results are fully described in the Community Panel Report which forms part of the Strategy.

This approach:

- Ensures a basis of community involvement from the outset of the Strategy development process, rather than relying solely on the consultation on the ER and Draft Strategy once assessment has already taken place; and
- Bases assessment criteria on the views of the community rather than those of experts (which is a frequently used alternative). Since the Strategy is developing approaches to managing waste produced by Doncaster residents and will impact on them in terms of services and facilities this approach is intended to produce a Strategy that is more in line with their views and values.

3.1.2 Coverage of SEA Issues

The SEA Regulations require that the appraisal covers a broad range of environmental issues where these are *relevant* to the DWS. These include:

- biodiversity;
- population;
- human health;
- fauna;

- flora;
- soil;
- water;
- air;
- climatic factors;
- material assets;
- cultural heritage, including architectural and archaeological heritage;
- landscape.

In order to ensure that all relevant criteria would be considered during the assessment, those which the Community Panel had not identified themselves were introduced at an appropriate meeting and thus included in their weightings.

3.1.3 SEA and Guidance on Developing a MWMS

Guidance on the development of MWMS states:[8]

> *"Any strategy produced should start by considering the practical extent to which the amount of waste produced can be reduced. Authorities should then repeat the process for each further stage in the hierarchy in turn".*

In order that the expanded (to include social and economic issues) SEA should form an integral part in decision making from the outset, the appraisal process for the DWS has been designed to reflect this step-wise process. Therefore the SEA will, like the strategy itself, appraise the options considered at each stage in the waste hierarchy separately, as well as considering the overarching DWS strategic policy options.

This allows sufficient focus to be placed on each level in the hierarchy and enables a targeted and relevant appraisal methodology to be developed. It will also enable the most environmentally beneficial outcomes to be highlighted at each level of the hierarchy, whilst still allowing an overall perspective on the Strategy to be maintained.

3.2 Proposed SEA Criteria

Table 3-1 shows the list of criteria, sub-criteria and guiding questions that have been used to assess the DWS. These have been amended to include any post-consultation responses from the Scoping Report. The consultation responses have been included in the Appendices (A.4.0).

Again, these criteria have been devised to be relevant to each stage of the hierarchy, in line with Government guidance on DWS development. However, for a small number of the objectives, it is not possible to appraise them at every level in the hierarchy. Where we consider this to be the case, this is indicated in Table 3-1.

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[8] Defra (2005) *Guidance on Municipal Waste Management Strategies*. July 2005.

Any synergies between criteria have also been highlighted as well as cumulative or secondary effects which may be associated with the impacts.

Table 3-1: Objectives and Assessment Criteria

Ref	CRITERIA	SUB-CRITERIA	Prevention/ Re-use	Recycling	Treatment	SEA Criteria Covered	Cumulative and Secondary Impacts Synergies
ENVIRONMENTAL							
Env1	Minimum landfill	Hazardous material deposited Non hazardous material deposited Rate (or quantity) of recycling/ composting/ reuse	What is the quantity of material prevented and re-used?	What quantity of material collected from households/ commerce is recycled or composted?	What is the proportion of waste input to the facility/ies by tonnage that has to go to hazardous landfill as a residue? What is the proportion of waste input to the facility/ies by tonnage that has to go to non-hazardous landfill as a residue?	Material Assets	Minimum landfill, Maximum 'Good' by-products, Global emissions, Materials balance and Energy balance are inter-related through the savings associated with materials recycling
Env2	Maximum by-products (good ones)	Rate (or quantity) of recycling/ composting	See criteria 1 (Not assessed here to avoid double counting of impacts).	See criteria 1 (Not assessed here to avoid double counting of impacts).	What is the proportion of waste input to the facility/ies by tonnage that is recycled, turned into useable compost or reused?	Material Assets Soil	Minimum landfill, Maximum 'Good' by-products, Global emissions, Materials balance and Energy balance are inter-related through the savings associated with materials recycling. The output of compost products (Maximum by-products) has an interlinkage with soil quality.

Ref	CRITERIA	SUB-CRITERIA	Prevention/ Re-use	Recycling	Treatment	SEA Criteria Covered	Cumulative and Secondary Impacts Synergies
Env3	**Reduce Global Emissions (balances)**	Emissions of ozone depleting substances Emissions of greenhouse gases	What are the impacts on climate change and the ozone layer from waste prevention and re-use initiatives? (NB this will be a qualitative and high level assessment)	What global emissions are released and what is the quantity of emissions per tonne of waste collected for recycling /composting? What impact will the emissions have on the ozone layer? What impact will the emissions have on climate change?	What global emissions are released and what is the quantity of emissions per tonne of waste treated at the facility/ies? What impact will the emissions have on the ozone layer? What impact will the emissions have on climate change?	Climatic Factors Air	Minimum landfill, Maximum 'Good' by-products, Global emissions, Materials balance and Energy balance are inter-related through the savings associated with materials recycling. Global emissions and Energy balance are inter-related through avoided greenhouse gas emissions associated with energy generation.

Ref	CRITERIA	SUB-CRITERIA	Prevention/ Re-use	Recycling	Treatment	SEA Criteria Covered	Cumulative and Secondary Impacts Synergies
Env4	Reduce Local Emissions	Air pollution emissions including acidifying emissions Emissions to water	What are the arisings of emissions to air and water with a localised impact? What is the impact on health of these emissions: immediate affect and 'genetic'? Will there be any impact on property (including historic buildings) arising from the emissions? (NB this will be a qualitative and high level assessment) **What will the impact be on local ecosystems? – *Post-consultation addition***	What are the arisings of emissions to air and water with a localised impact? What is the impact on health of these emissions: immediate affect and 'genetic'? Will there be any impact on property (including historic buildings) arising from the emissions? (NB this will be a partly quantitative and partly qualitative assessment) **What will the impact be on local ecosystems? – *Post-consultation addition***	What are the emissions to air and water with a localised impact? What is the impact on health of these emissions: immediate affect and 'genetic'? Will there be any impact on property (including historic buildings) arising from the emissions? **What will the impact be on local ecosystems? – *Post-consultation addition***	Air Human Health Cultural Heritage Biodiversity	Soil and Water are linked to Local Emissions through the impacts associated with soil contamination and water quality respectively. Local emissions, nuisance (odours) and health have interlinkages, particularly in terms of air pollution. Pollutants related to transportation of waste could lead to an increase in adverse health effects – particularly with regard to respiratory disorders such as asthma or other problems.[9]

[9] The Health & Safety Executive state that exposure to fumes from diesel engines can cause irritation to the eyes or respiratory tract. These effects are generally short term and should disappear when away from the source of exposure. They go on to state however, that prolonged exposure to diesel fumes, in particular to any blue or black smoke, could lead to coughing, chestiness and breathlessness. In the long term, there is some evidence that repeated exposure to diesel. Exposure to fumes over a period of about 20 years may increase the risk of lung cancer (http://www.hse.gov.uk/pubns/indg286.htm).

Ref	CRITERIA	SUB-CRITERIA	Prevention/ Re-use	Recycling	Treatment	SEA Criteria Covered	Cumulative and Secondary Impacts Synergies
Env5	Energy (balances)	Energy input Avoided energy use Energy output	What will be the effect on net energy use as a result of waste prevention and re-use?	What will be the effect on net energy use as a result of collection of materials for recycling/composting, (including treatment of separately collected waste and waste transport)?	What is the net energy balance of the treatment processes, including: ➢ Energy use by the processes; ➢ Avoided energy use associated with recycling; ➢ Generation of energy by the processes?	Climatic Factors	Minimum landfill, Maximum 'Good' by-products, Global emissions, Materials balance and Energy balance are inter-related through the savings associated with materials recycling. Global emissions and Energy balance are inter-related through avoided greenhouse gas emissions associated with energy generation.
Env6	**Impact on global resources, wildlife, flora and fauna**	Global	What is the effect on Total Material Requirement as a result of waste prevention/ re-use? (a proxy for the impact on global wildlife flora and fauna)	What is the effect on Total Material Requirement as a result of waste recycling/ composting? (a proxy for the impact on global wildlife flora and fauna)	What is the effect on Total Material Requirement as a result of the overall materials and energy balance of the facility/ies? (a proxy for the impact on global wildlife flora and fauna)	Materials Balance Biodiversity Flora & Fauna	Minimum landfill, Maximum 'Good' by-products, Global emissions, Materials balance and Energy balance are inter-related through the savings associated with materials recycling.

Whilst the relationship should be acknowledged, it is not clear cut since emissions of pollutants from vehicles will depend to a large extent on the type and size of vehicle.

Ref	CRITERIA	SUB-CRITERIA	Prevention/ Re-use	Recycling	Treatment	SEA Criteria Covered	Cumulative and Secondary Impacts Synergies
Env7	**Water**	Water Consumption	See ref 4 for water quality. Not relevant in relation to water consumption.	See ref 4 for water quality. Not relevant in relation to water consumption.	See ref 4 for water quality. How much net water is consumed as a result of the processes per tonne of input?	Water	Soil and Water are linked to Local Emissions through the impacts associated with soil contamination and water quality respectively.
Env8	**Soil**	Landtake & land quality	Will there be any impact on soil quality as a result of waste prevention/ re-use?	Will there be any impact on soil quality as a result of waste recycling/ composting?	What is the likely site footprint of the facility/ies? Will there be any changes to soil quality (including acidity) resulting from waste treatment activities?	Soil Landscape	Soil and Water are linked to Local Emissions through the impacts associated with soil contamination and water quality respectively. The output of compost products (Maximum by-products) has an interlinkage with soil quality.
				SOCIAL			
Soc9	**Education**	Young people Householders	Will there be any education/ training opportunities arising from waste prevention/ re-use activities?	Will there be any education/ training opportunities arising from waste recycling / composting activities?	Not relevant.	Population	The level of recycling (i.e. Minimum landfill and Maximum by-products is likely to affect the impact of education. There is a cumulative effect; as the level of recycling increases, the level of education will correspondingly increase.

Ref	CRITERIA	SUB-CRITERIA	Prevention/ Re-use	Recycling	Treatment	SEA Criteria Covered	Cumulative and Secondary Impacts Synergies
Soc 10	**Convenience**	Clear and easy to follow services for public Simple	Are the waste prevention/ re-use opportunities presented so that they are convenient and easy to undertake?	Are the waste recycling/ composting collection facilities designed to be convenient and easy to use?	Not relevant.	Has implications for performance, and hence, all criteria	
Soc 11	**Nuisance**	Noise Odour	Not relevant.	What are the likely implications of recycling/ composting activities on localised noise and odour?	Not deemed relevant. (This is an issue related to location and one which will be controlled by licensing/ permitting).		Local emissions, nuisance (odours) and health have interlinkages, particularly in terms of air pollution. Pollutants related to transportation of waste could lead to an increase in adverse health effects.
Soc 12	**Safety**		Not relevant. For health impacts, see criteria 4.	Not relevant. For health impacts, see criteria 4.	What is the potential for catastrophic failure (e.g. explosion from facilities that collect methane gas)? For health impacts, see criteria 4	Human Health	Local emissions, nuisance (odours) and health have interlinkages, particularly in terms of air pollution. Pollutants related to transportation of waste could lead to an increase in adverse health effects.

Ref	CRITERIA	SUB-CRITERIA	Prevention/ Re-use	Recycling	Treatment	SEA Criteria Covered	Cumulative and Secondary Impacts Synergies
Soc 13	Employment (local)		What are the employment opportunities arising from waste prevention/ re-use activities?	What are the employment opportunities arising from waste collection/ recycling and composting?	Not relevant. (All treatment facilities employ similar numbers of workers and there is a crucial issue surrounding whether exposing workers to residual waste is a good thing).	Population	As the level of recycling (i.e. Minimum landfill and Maximum by-products) increases, so the employment opportunities in all levels of the hierarchy will increase.
TECHNICAL							
Tec 14	De-commissioning problems		Not relevant.	Not relevant.	Will it be possible to recycle the plant on decommissioning?		
Tec 15	Future proof	Upgradeable Future in mind Lifetime of plant	Not relevant.	Not relevant.	Can the plant be upgraded in response to technology improvements? Can the capacity of the facility/ies be changed?		
Tec 16	Latest proven technology (reliable)		Are the waste prevention initiatives likely to succeed? Have they been tried and tested elsewhere?	Are the recycling initiatives likely to succeed? Have they been tried and tested elsewhere?	Are there a number of these facilities currently operating globally?		

Ref	CRITERIA	SUB-CRITERIA	Prevention/ Re-use	Recycling	Treatment	SEA Criteria Covered	Cumulative and Secondary Impacts Synergies
ECONOMIC							
Econ 17	Economic (cost)	Set up costs Running costs	What is the financial cost of the waste prevention and re-use initiatives?	What is the financial cost of the waste recycling and composting initiatives?	What is the financial cost of residual waste treatment and disposal?		

4.0 Assessment Methodology

4.1 General Appraisal Methodology

The methodology must fulfil two core aims: firstly to ensure that the requirements of the SEA Directive are fulfilled; and secondly to ensure that the results deriving from the appraisal are sufficiently robust such that they are able to properly inform the options appraisal(s) that take place in the development and procurement of services.

In ensuring that the SEA Regulations are adhered to, the key impacts are outlined and the nature of these impacts discussed. The nature of the impact includes not only whether they are positive/ negative/ neutral / uncertain, but also whether they are long or short-term and whether they are temporary or permanent. The latter has been based on an assessment of whether effects are likely to occur only whilst the initiative/option is taking place or if they will last longer than this.

The nature of the impacts will, of course, vary between objectives and measures to be appraised and not all will be relevant in all cases.

As previously stated, the appraisal process has been separated into four distinct areas. Firstly a high level appraisal of the policies set out in the Strategy has been carried out. Following this, options and initiatives at each level of the hierarchy have been appraised separately. Although these analyses are presented separately in this report, inter-linkages between the levels have been discussed where relevant.

For each of the sections an appraisal matrix has been devised to reflect the key requirements of the SEA regulations (see Table 4-1). This enables clear presentation of the appraisal results. Discussion of the main impacts has been entered into separately in the relevant section. The matrix key used in each assessment is shown in Table 4-2. For the most part, the matrix considers direct impacts of the policies/options being considered with any significant indirect consequences being discussed in the text.

Table 4-1: Sample Blank Matrix

		Env 1	Soc 2	Econ 3	Etc...
Option/ Initiative 1	Effect				
	Timescale				
Option/ Initiative 2	Effect				
	Timescale				
Etc...	Effect				
	Timescale				

Table 4-2: Key to the Assessment Matrices

Impact Type	Scale	Code
Effect	Strong Negative	
	Minor Negative	
	Negligible/No Impact	
	Minor Positive	
	Major Positive	
	Uncertain	
Timescale	Within Plan Period	S
	Outside of Plan Period	L
	Uncertain	

4.2 Development of Alternatives

As required by the SEA regulations, and recognising best practice in developing options to take forward, a number of alternatives for dealing with waste have been developed at each level of the waste management hierarchy. These alternatives are detailed below. The key targets and policies within the Strategy are also separately assessed.

4.2.1 Key Targets and Policies

The key targets and policies included in the DWS, currently being consulted on, have been developed through a series of workshop with various members of DMBC. The process of this ER has helped to shape several of the targets and policies within the Strategy.

These have been appraised utilising the same methodology as the prevention, collection and residual treatment levels of the hierarchy to ensure that all aspects of the Strategy are thoroughly assessed.

The policies and targets are outlined below.

4.2.1.1 Policies

- We will invest in a programme of communications on waste and resources to support this Strategy.
- We will implement a programme of waste prevention initiatives.
- We will provide regular, convenient collection services so as to maximise the opportunities for separate collection of recyclable and compostable wastes.
- We will extend the coverage of recycling services so that all households have either a regular collection service or a convenient alternative arrangement.

- We will complete the current programme of improvements at Household Waste and Recycling Centres and work with the contractor for the sites in order to:
    - reduce the illegal use of sites by traders;
    - increase the range of materials separated for reuse/recycling; and
    - further increase the recycling performance of the sites
- We will explore the opportunities to increase the levels of reuse, recycling and composting achievable for other waste streams, in particular:
    - litter bin waste;
    - commercial waste
    - items collected through bulky collections; and
    - waste from municipal buildings.
- We will keep under review the range of mechanisms available to us to incentivise:
    - waste prevention / re-use; and
    - greater participation by households in separate collection services.
- We will seek a residual waste management solution which respects our desire to move waste up the hierarchy, is flexible, reliable, represents value for money and which achieves at least 10% recycling performance by separating materials for recycling or composting from the waste it receives.
- We will seek opportunities to work in partnership with others in the pursuit of this Strategy.
- We will lobby government departments and agencies, as well as other organisations, for the introduction of policies and financial arrangements which support the delivery of this Strategy and its principles.
- In implementing the Strategy We will have regard to relevant national, regional and local guidance, policies, strategies and plans.

4.2.1.2 Targets

- Reduce the amount of household waste produced per inhabitant so as to achieve performance for this measure which is amongst the best 50% in England.
- Increase participation in kerbside recycling collections to at least 80% in 2011.
- Reuse, recycle or compost 50% of the waste received at the sites in 2008/9 and 75% in 2011/12.
- Recycle or compost 10% of residual waste.
- Achieve a reuse, recycling and composting rate for household waste of: 46% by 2011/12, 50% by 2012/13 and 60% by 2015/16.

4.2.2 Waste Prevention

The purpose of the appraisal on waste prevention options is to set out the impacts of a range of waste prevention initiatives that could be undertaken by Doncaster. No final decisions have yet been taken, and indeed, over the period of the plan the initiatives which are implemented are likely to change and develop.

The appraisal undertaken here is, therefore, of a range of initiatives that are likely to be implemented as part of the DWS. Indeed it is envisaged that the results of this appraisal will go some way to informing the decision-making process as to either which initiatives should be implemented, or more realistically, how they should be prioritised.

It is important to note that several waste prevention programmes have already been implemented in Doncaster, and the Strategy, with regard to waste prevention, builds upon these. Following discussions with DMBC officers the following initiatives have been considered for the purposes of this assessment:

Table 4-3: Waste Prevention Scenarios Assessed

Waste Prevention Initiative	Description
1. Home Composting	Promotion of home composting through provision of educational support and compost bin subsidies.
2. No Side Waste Policy	Enforcement of the ban on excess residual waste, using the enforcement team
3. Zero Waste Challenge	A waste awareness campaign concluding in a week long challenge to encourage residents to reduce residual waste to zero.
4. Reuse Areas at HWRCs	Containers at the two largest HWRCs to set aside reusable items for collection by Doncaster Refurnish
5. Bulky Collections for Reuse	Simplify the collections of bulky waste via a single contractor (Doncaster Refurnish) to encourage reuse
6. Re-use of Paint	Areas set aside at the two largest HWRCs to collect paint, which will be sorted and reused where possible
7. SMART Shopping (Save Money And Reduce Trash)	Promotion of SMART shopping initiatives to residents through provision of information via various forms of media
8. No Junk Mail	Raising awareness on effective methods of reducing junk mail, including provision of an outreach officer to sign up residents to the Mail Prevention Service

Waste Prevention Initiative	Description
9. Real Nappies	Provision of a real nappy laundry service and subsidy scheme to encourage use of real nappies.
10. Council In-House Good Practice	Setting up provisions in order for council employees to actively 'reduce, reuse and recycle' in their workplace. This will include raising awareness through provision of information.
11. Zero Waste HWRC	Two HWRCs will be set up with extra containers and specific contracts to reuse or recycle all the material received. There will be no residual waste container at these sites.

4.2.3 Waste Collection, Recycling and Composting

A number of possible waste collection scenarios have been developed. These options are designed to test a range of core choices and the appraisal of these options is therefore intended to assist in decision making at the local level.

The broad detail of the options appraised at this level of the hierarchy is presented in Table 4-4.

Table 4-4: Waste Collection Scenarios Assessed

	Dry Recycling	Kitchen Waste	Garden Waste	Residual
Baseline	Weekly collection: Box: cans, glass, printer cartridges, mobile phones, foil, aerosols; Blue Bag: Paper, yellow pages; Clear Bag: Plastic bottles. Textiles	Not currently collected	Fortnightly free collection in wheelie bin with 'thin cardboard'	Fortnightly black wheelie bin
An intermediate baseline will be rerun for 2010/11, but with accompanying communications/ behavioural change campaign to increase participation and recognition. The following options will then be modelled with this behavioural change in place.				
Option 1	Add card to existing collection (incorporating larger vehicles)	Weekly food waste collection	Free fortnightly collection	As baseline
Option 2	As baseline, but monthly collection of paper and card in additional wheelie bin	Weekly food waste collection	Free fortnightly collection	As baseline but smaller residual bin
Option 3	Add card to existing collection (incorporating larger vehicles)	RCV with food pod collecting green waste one week and residual the next		
Option 4	As baseline, but monthly collection of paper and card in additional wheelie bin	RCV with food pod collecting green waste one week and residual the next in smaller bin		
Option 5	Add card to existing collection (incorporating larger vehicles). Food pod on dry recycling vehicle		Free fortnightly collection	As baseline
Option 6	As baseline, but monthly collection of paper and card in additional wheelie bin. Food pod on dry recycling vehicle		Free fortnightly collection	As baseline but smaller residual bin

4.2.4 Residual Waste Treatment and Disposal

The residual waste treatment options considered within the current analysis are outlined in Table 4-5.

Table 4-5: Residual Waste Treatment Options Assessed

Short description	Details
Landfill	Untreated waste sent to landfill, with energy generated through captured landfill gas. This is considered the baseline treatment in the assessment.
Incineration	Incineration with energy recovery, generating both electricity and heat (the incinerator is assumed to operate in CHP mode).
Autoclave Incineration	Waste is treated at high temperatures and pressure, enabling the separation of recyclables and the production of a biomass rich fibre. The fibre is used in a Fluidised Bed Incinerator (generating both electricity and heat). A reject stream is produced, which is stabilised prior to being sent to landfill.
Autoclave Power Station	Waste is treated at high temperatures and pressure, enabling the separation of recyclables and the production of a biomass rich fibre. The fibre is used in a power station in place of coal to generate electricity. A reject stream is produced, which is stabilised prior to being sent to landfill.
MBT Aerobic	Mechanical separation of recyclable materials. Biological treatment is aerobic stabilisation process. The stabilised (matured) output is sent to landfill.
MBT AD	Mechanical separation of recyclable materials and two stages of biological treatment – firstly, anaerobic digestion producing biogas which is used to generate energy (using a gas engine operating in CHP mode to produce both electricity and heat). The second stage is aerobic stabilisation. The output of stabilisation process is sent to landfill.
MBT Bio Incineration	Mechanical separation of materials, aerobic drying process (similar to stabilisation) is used to produce a fuel, used in a Fluidised Bed Incinerator (generating both electricity and heat). A reject stream is produced, which is stabilised prior to being sent to landfill.
MBT Bio Power Station	Mechanical separation of materials, aerobic drying process (similar to stabilisation) is used to produce a fuel, used in a power station in place of coal to generate electricity. A reject stream is produced, which is stabilised prior to being sent to landfill.
Gasification	Mechanical separation of metals and pre shredding of the waste. The shredded material is heated in a low oxygen environment producing a 'syngas' which is combusted to produce electricity and heat.

SECTION 2: ASSESSMENT OF POLICIES AND OPTIONS, MITIGATION AND MONITORING

5.0 Assessment of DWS Key Targets and Policies

5.1 Introduction

In addition to the three tiers of the waste management hierarchy of prevention, recycling and disposal, the key policies and targets within the DWS have also been appraised. This ensures that the more detailed assessments at the specific initiative level (i.e. the sections on the various hierarchy levels) are properly linked into these policies and targets and, therefore, the Strategy as a whole. It also allows assessment of those policies and targets that do not naturally fall into a specific and tangible initiative.

The policies and targets are appraised at a high level and as a qualitative assessment; this is due to the fact that they are set at a high level and do not necessarily imply any one specific action, or group of actions.

5.2 Core Strategy Policies and Targets within the DMWS

The key policies and targets in the DWS are as follows:

5.2.1 Key Policies

Policy 1:
We will invest in a programme of communications on waste and resources to support this Strategy.
Policy 2:
We will implement a programme of waste prevention initiatives.
Policy 3:
We will provide regular, convenient collection services so as to maximise the opportunities for separate collection of recyclable and compostable wastes.
Policy 4:
We will extend the coverage of recycling services so that all households have either a regular collection service or a convenient alternative arrangement.
Policy 5:
We will complete the current programme of improvements at Household Waste and Recycling Centres and work with the contractor for the sites in order to: ➢ reduce the illegal use of sites by traders; and

➢ increase the range of materials separated for reuse/recycling; and ➢ further increase the recycling performance of the sites.
Policy 6:
We will explore the opportunities to increase the levels of reuse, recycling and composting achievable for other waste streams, in particular: ➢ litter bin waste; ➢ commercial waste ➢ items collected through bulky collections; and ➢ waste from municipal buildings.
Policy 7:
We will keep under review the range of mechanisms available to us to incentivise: ➢ waste prevention / re-use; and ➢ greater participation by households in separate collection services.
Policy 8:
We will seek a residual waste management solution which respects our desire to move waste up the hierarchy, is flexible, reliable, represents value for money and which achieves at least 10% recycling performance by separating materials for recycling or composting from the waste it receives.
Policy 9:
We will seek opportunities to work in partnership with others in the pursuit of this Strategy.
Policy 10:
We will lobby government departments and agencies, as well as other organisations, for the introduction of policies and financial arrangements which support the delivery of this Strategy and its principles.
Policy 11:
In implementing the Strategy we will have regard to relevant national, regional and local guidance, policies, strategies and plans.

5.2.2 Key Targets

Target 1: Waste Reduction
Reduce the amount of household waste produced per inhabitant so as to achieve performance for this measure which is amongst the best 50% in England.
Target 2: Participation
Increase participation in kerbside recycling collections to at least 80% in 2011.
Target 3: Recycling at HWRCs
Reuse, recycle or compost 50% of the waste received at the sites in 2008/9 and 75% in 2011/12.
Target 4: Recycling of Residual Waste
Recycle or compost 10% of residual waste.
Target 5: Overall Recycling
Achieve a reuse, recycling and composting rate for household waste of: 46% by 2011/12, 50% by 2012/13 and 60% by 2015/16.

5.3 Selection of Alternatives

The policies contained in the Strategy were developed through a series of workshops held with officers of DMBC. Initially basic principles and priorities for Doncaster and the Strategy were identified and these were developed into policies through an iterative process. It is not appropriate or meaningful to provide an assessment of policies against an alternative set – for instance a 'do nothing' option.

The targets were developed in order to provide substance to the policies and as a result of quantitative modelling and analysis of options at each different tier of the hierarchy (detailed elsewhere in this ER). They are considered to be stretching but achievable for the authority.

5.4 Summary Appraisal Matrix

The summary appraisal matrix for the key policies and targets in the DWS is shown in Table 5-1.

5.5 Discussion of Impacts

5.5.1 General

The broad assessment of the policies and targets indicates that they are almost entirely positive. Minor negative impacts are identified in relation to cost (Econ17) for Policies 4 and 8; the former as a result of the cost of providing recycling services to flats and the latter as a result of the likely higher cost of alternative waste treatment and disposal when compared to landfill.

Assessment of policies and targets was made on the basis of what is the likely result of this policy/target compared to not having it.

The majority of impacts are assessed as only short term, since they persist whilst the actions resulting from the policy/target continue. For many this is slightly artificial since it seems unlikely that recycling services, for instance, would be reduced however this is consistent with the approach taken in the other assessments in this ER. The major exceptions to this are where it is likely that longer term behavioural change will result – such as waste prevention policies and assessments against the education criterion.

Table 5-1: Doncaster MWMS Key Objectives Appraisal Matrix

		Environmental (Env)								Social (Soc)					Technical (Tec)			£ (Econ)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		Minimum Landfill	Max By-Products	Global Emissions	Local Emissions	Energy	Global Resources	Water	Soil	Education	Convenience	Nuisance	Safety	Local Employment	De-commission Problems	Future Proof	Proven Technology	Cost
P1	Effect																	
	Timescale	L					L			L								S
P2	Effect																	
	Timescale	L					L			L				S				L
P3	Effect																	
	Timescale	S		S		S	S		S	L	S			S				S
P4	Effect																	
	Timescale	S		S		S	S		S	L	S			S				S
P5	Effect																	
	Timescale	S		S		S	S		S	L	S							S
P6	Effect																	
	Timescale	S		S		S	S		S									S
P7	Effect																	
	Timescale	S	S	S	S	S	S	S	S	L	S	S	S	S	S	S	S	S
P8	Effect																	
	Timescale	L	L	L	L	L	L	L	L			L	L	L	L	L	L	L
P9	Effect																	
	Timescale																	S

P10	Effect																	
	Timescale																	
P11	Effect																	
	Timescale	S		S	S	S	S		S	L								S
T1	Effect																	
	Timescale	L					L			L								L
T2	Effect																	
	Timescale	S		S		S	S		S	L				S				S
T3	Effect																	
	Timescale	S		S		S	S		S	L				S				S
T4	Effect																	
	Timescale	S		S		S	S		S					S				S
T5	Effect																	
	Timescale	S		S		S	S		S	L				S				S

Key	
Strong Negative	
Minor Negative	
Negligible/No Impact	
Minor Positive	
Major Positive	
Uncertain	
Within Plan Period	S
Outside of Plan Period	L

5.5.2 Policy 1

"We will invest in a programme of communications on waste and resources to support this Strategy."

The assessment assumes that the main effects of the communications programme will be reductions in waste overall and increases in recycling and composting. Criteria directly relating to this are considered to have a positive impact. Not surprisingly the education criterion receives a strong positive. Although costs will be incurred by the communications campaign it is uncertain as to whether these will be outweighed by cost savings resulting from the effects of the communications programme.

5.5.3 Policy 2

"We will implement a programme of waste prevention initiatives."

Where it is considered appropriate to make assessments of impacts these are all considered positive. The nature of the prevention initiatives is not specified by the policy and in any case initiatives are assessed individually in Section 6.0. As a result no assumptions have been made as to the nature of the prevention initiatives beyond the fact that they will prevent waste and reduce demand for resources. The recruitment of a waste prevention team results in a positive assessment in relation to employment.

5.5.4 Policy 3

"We will provide regular, convenient collection services so as to maximise the opportunities for separate collection of recyclable and compostable wastes."

The assessment assumes that the main effects of the services will be increased levels of recycling and composting. Criteria directly related to this are considered to have a positive impact – and this covers a significant number. The strong positive assessment in relation to soil results from the soil improver produced by composting sites. Convenience is specifically mentioned in the policy and so this receives a strong positive. A positive assessment in relation to employment results from the larger numbers of staff required to carry out the collections (as opposed to collecting all waste for disposal). Providing the services is costly, however at this level it is not possible to assess whether the costs of providing them are higher than the full cost implications of not doing so.

5.5.5 Policy 4

"We will extend the coverage of recycling services so that all households have either a regular collection service or a convenient alternative arrangement."

The assessment assumes that the policy will result in the remaining 2% of households in Doncaster receiving a recycling collection service or a convenient alternative. This will increase recycling by a small amount – so all impacts are as for Policy 3 but only minor. Cost is considered to be a minor negative because complying with this policy is very likely to be more costly than for other types of properties in terms of staff time and infrastructure required.

5.5.6 Policy 5

"We will complete the current programme of improvements at Household Waste and Recycling Centres and work with the contractor for the sites in order to:

- **reduce the illegal use of sites by traders; and**
- **increase the range of materials separated for reuse/recycling; and**
- **further increase the recycling performance of the sites."**

This policy is likely to directly increase recycling – so all impacts are as for Policy 3 apart from convenience.

5.5.7 Policy 6

"We will explore the opportunities to increase the levels of reuse, recycling and composting achievable for other waste streams, in particular:

- **litter bin waste;**
- **commercial waste**
- **items collected through bulky collections; and**
- **waste from municipal buildings."**

The results of this policy are likely to be small increases in recycling and composting so impacts are generally as for Policy 3 but minor positives. As the public is unlikely to be involved in these initiatives – and their exact detail is not certain at present - convenience and education are not assessed.

5.5.8 Policy 7

"We will keep under review the range of mechanisms available to us to incentivise:

- **waste prevention / re-use; and**
- **greater participation by households in separate collection services."**

All assessments are uncertain since this policy does not specify any action other than 'keeping under review.' It is likely that any actions would have the effect of increasing recycling waste prevention, reuse and recycling – in which case the impacts would be similar to those identified for Policy 2 and Policy 3.

5.5.9 Policy 8

"We will seek a residual waste management solution which respects our desire to move waste up the hierarchy, is flexible, reliable, represents value for money and which achieves at least 10% recycling performance by separating materials for recycling or composting from the waste it receives."

This policy sets out to ensure that residual waste is dealt with in a cost-effective manner, whilst also recognising the need to reduce the quantity of biodegradable waste being sent to landfill. At the same time, it effectively cautions against specifying too much capacity so as to preserve space for activities which move waste further up the waste management hierarchy. The effects of the policy have been adjudicated against 'business as usual', which implies landfilling of waste in untreated form. The policy, as currently worded, suggests that there is a likelihood, though no certainty, that some means other than landfill will be used to deal with residual waste. There are a considerable number of uncertainties as to the impacts of this policy on the SEA objectives, since the impacts are highly dependent upon the treatment technology used. A full appraisal of the various treatment methods being considered is provided in Section 8.0. This highlights the fact that, on environmental grounds, some treatments perform less well than others, notably landfill and incineration (where the only form of energy generated is electricity). On balance, the policy is likely to have positive implications for performance against most criteria considered appropriate. Only against cost is performance likely to be negative for the simple reason that market issues are likely to arise where none arise in the case of landfill (once a contract has been concluded).

The impacts are likely to be longer term than the duration of the policy being in existence due to the long-term nature of residual treatment contracts.

5.5.10 Policy 9

"We will seek opportunities to work in partnership with others in the pursuit of this Strategy."

Due to the policy specifying only the seeking of opportunities to work in partnership – as well as the lack of any clarity as to what the partnership working would cover it is not considered appropriate to assess impacts against the criteria used here apart from cost – which is identified as uncertain; cost savings are likely to be a major motivator for partnership working.

5.5.11 Policy 10

"We will lobby government departments and agencies, as well as other organisations, for the introduction of policies and financial arrangements which support the delivery of this Strategy and its principles."

The impacts of lobbying are very difficult to determine – it will be impossible to know whether the policy is successful in achieving its aims. Lobbying is not directly relevant to any of the SEA criteria and so no further appraisal of this policy has taken place.

5.5.12 Policy 11

"In implementing the Strategy We will have regard to relevant national, regional and local guidance, policies, strategies and plans."

Whilst Policy 11 is not directly relevant to any of the SEA objectives, in so much as it does not, in itself, achieve anything that works towards them, indirectly this policy will achieve much by way of moving Doncaster towards sustainable waste management.

Part of the SEA process involves identifying the relevant plans and programmes and stating how these will have an influence on the strategy (and how the strategy will influence them). These have been accounted for in the strategy development process – the results of this analysis can be found in the Appendices (A.2.0). As can be seen in this Appendix there are a large number of relevant policies across the different tiers of Government, each looking at their own responsibilities for sustainable development. In accounting for them all, the environmental benefits of the Strategy will be maximised. As a result the impacts have been assessed as being positive in relation to the same criteria as in Policy 2 and Policy 3.

There will, however, be considerable uncertainty as to the impacts on cost since, by trying to marry all of the relevant strategies, there will be costs involved. Without detailed business case modelling, the extent of these costs cannot be known with certainty (other than to the extent that adherence to the policy involves implementing the waste prevention, collection and treatment options as has been modelled in later sections). There will also be considerable uncertainty in relation to transport (with impacts on local emissions); although implementation of new collection/ treatment policies may have a negative impact on such factors, these effects will be mitigated through adherence to other plans and programmes such as any local transport plans and Air Quality Management Areas (AQMAs).

5.5.13 Target 1

"Waste Reduction: Reduce the amount of household waste produced per inhabitant so as to achieve performance for this measure which is amongst the best 50% in England."

The main requirement for this target will be to successfully implement waste prevention initiatives and to ensure that as little non-household waste is entering the household collection systems as possible. The impacts are considered to be similar to those for Policy 2 – apart from in relation to employment; establishment of a waste prevention team is not necessarily the only way to achieve this target.

5.5.14 Target 2

"Participation: Increase participation in kerbside recycling collections to at least 80% in 2011."

Achievement of this target will result in increased recycling. The impacts are considered to be similar to those for Policy 3 apart from convenience (Soc10) since convenience is not necessarily required to achieve the target.

5.5.15 Target 3

"Recycling at HWRCs: Reuse, recycle or compost 50% of the waste received at the sites in 2008/9 and 75% in 2011/12."

Achievement of this target will result in increased recycling. The impacts are considered to be similar to those for Policy 3 apart from convenience (Soc10), since convenience is not necessarily required to achieve the target. None have been assessed as major positives due to the relatively smaller amounts of waste passing through the HWRCs and the relatively small increases over current performance required in order to achieve the targets.

5.5.16 Target 4

"Recycling of Residual Waste: Recycle or compost 10% of residual waste."

Achievement of this target will result in increased recycling. The impacts are considered to be similar to those for Policy 3 – apart from energy (Env5), education (Soc9) and convenience (Soc10). The energy required to achieve this level of recycling from the waste received may be significant and the balance of this with the energy savings from recycling of materials is uncertain. Convenience is not considered relevant in relation to residual waste. As the public do not need to be involved with this there is not considered to be any educational value in the policy.

5.5.17 Target 5

"Achieve a reuse, recycling and composting rate for household waste of: 46% by 2011/12, 50% by 2012/13 and 60% by 2015/16."

Achievement of this target will result in increased recycling. The impacts are considered to be similar to those for Policy 3 apart from convenience since convenience is not required to achieve the targets.

6.0 Assessment of Waste Prevention Options

6.1 Introduction

As discussed in Section 4.2.2, there are a range of waste prevention initiatives currently or potentially operated or facilitated by Doncaster. The initiatives considered for the purposes of this assessment are:

1. Home Composting
2. No Side Waste Policy
3. Zero Waste Challenge
4. Reuse Areas at HWRCs
5. Bulky Collections for Reuse
6. Re-use of Paint
7. SMART Shopping (**S**ave **M**oney **A**nd **R**educe **T**rash)
8. Junk Mail
9. Real Nappies
10. Council In-House Good Practice
11. Zero Waste HWRC

6.2 Notes on Modelling and Assessment

The assessment criteria used are shown in Table 3-1 (found in Section 3.2). A more detailed description of the modelling is outlined in the Appendices (A.5.0).

6.3 Summary Appraisal Matrix

The summary matrix for the waste prevention and reuse appraisal is presented in Table 6-1. Quantitative data has been used to assess criteria where it is available.

6.4 General Discussion of Impacts

Due to the qualitative nature of the waste prevention assessment, it was deemed more appropriate to assess each initiative individually rather than compare one to the other. This is especially relevant as several initiatives are likely to be chosen over the timespan of the plan. As there is some amount of quantitative output from the model, this is discussed in Section 6.6 and a more detailed description of each initiative in turn is dealt with in Section 6.5.

As can be seen from the matrix (Table 6-1), the waste prevention initiatives will have an overwhelmingly positive impact towards achieving sustainable waste management, with the main negative effects being noted for the lack of convenience (Soc10) of the initiatives. All the initiatives, with the exception of Zero Waste HWRCs, will reduce tonnes of waste prevented and therefore a positive effect is described for the minimum landfill criteria (Env1). Many of the initiatives also lead to diversion of waste away from residual to recycling and composting which is indicated by figures in the maximum by-products criteria (Env2). Wholly prevention initiatives which reduce overall waste can also reduce recycling and this is the case for re-use at HWRCs, no junk mail and SMART shopping.

Although positive impacts against most of the initiatives have been noted, the tonnages of waste prevented are small when compared with the total amount of waste that the County deals with on an annual basis. As a result the impacts (positive or negative) in terms of this assessment are generally classed as being within the 'minor' category. This is with the exception of home composting, no side waste and real nappies where tonnages prevented are estimated to be more significant.

In terms of the longevity of the impacts, this will depend on the type of initiative being appraised. For many initiatives, e.g. paint re-use, the impacts will last for as long as funding is available to maintain the scheme. This makes a funding strategy essential to ensure the sustainability of these initiatives. Other initiatives are deemed to have enduring effects, such as home composting, where the long-term infrastructure (bins) is provided and real nappies, where a laundry service is established as a long-term business venture. The anticipated longevity of the impacts is indicated within the matrix above.

Of relevance to almost all activities which act to prevent, re-use and recycle materials is the recognition that the activity will have a positive impact upon reduced primary material extraction, global biodiversity, and climate change.

The synergies and cumulative impacts outlined in the matrix are discussed within the text. As a general rule, however, cumulative impacts are identified where the impact (positive or negative) builds up over time. Synergistic impacts are identified where one initiative supports another, for example a garden waste ban in residual collections would be likely to positively support participation in home composting schemes.

Table 6-1: Waste Prevention and Reuse Appraisal Matrix

	Synergies		Environmental (Env)								Social (Soc)					Technical (Tec)			£ (Econ)
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			Minimum Landfill	Max By-Products	Global Emissions	Local Emissions	Energy	Global Resources	Water	Soil	Education	Convenience	Nuisance	Safety	Local Employment	De-commission Problems	Future Proof	Proven Technology	Cost
1 Home Composting	✓	Effect																	
		Timescale	L		L		L	L	L	L	L	L			S			L	L
2 No Side Waste	✓	Effect																	
		Timescale	L	L	L	L	L	L			L	L	L					L	L
3 Zero Waste	✓	Effect																	
		Timescale	L	L	L		L	L		L	L	L							L
4 Reuse at HWRCs		Effect																	
		Timescale	S		S		S	S			S				S	S		S	S
5 Bulky Collections	✓	Effect																	
		Timescale	S	S	S		S	S				S			S			S	S
6 Paint Reuse	✓	Effect																	
		Timescale	S		S	S	S					S		S		S		S	S
7 SMART Shopping	✓	Effect																	
		Timescale	L	L	L	L	L	L			L	L			L			L	L
8 No Junk Mail		Effect																	
		Timescale	L	L	L		L	L	L		L	L	L					L	L
9 Real Nappies		Effect																	
		Timescale	S		S		S	S			S	S			S			S	S

10 Council Good Practice	✓	Effect	Minor Positive	Minor Positive	Minor Positive		Minor Positive	Minor Positive			Major Positive	Minor Negative			Minor Positive			Major Positive	Minor Negative
		Timescale	L	L	L		L	L			L	L			L			L	L
11 Zero Waste HWRC	✓	Effect	Minor Positive	Major Positive	Minor Positive		Minor Positive	Minor Positive			Minor Positive	Minor Negative						Minor Positive	Major Positive
		Timescale	L	L	L		L	L			L	L						L	L

Key	
Strong Negative	(red)
Minor Negative	(orange)
Negligible/No Impact	(white)
Minor Positive	(light green)
Major Positive	(dark green)
Uncertain	(light blue)
Within Plan Period	S
Outside of Plan Period	L

6.5 Assessment of Initiatives

6.5.1 Initiative 1: Home Composting

The home composting package in Doncaster includes the provision of home composting bins to householders at a subsidised rate, leaflets and newsletters, provision of an advice line and website, and support from at least two compost technicians (dedicated waste prevention officers). These technicians will also provide public demonstrations at county fairs, etc.

The overall impact of the initiative is positive – the only (minor) negative is convenience (Soc10), as composting is not as convenient as disposing in the residual bin (although this is offset somewhat by reduced odour and flies around the residual bin).

Home composting essentially provides a way of managing wastes that would otherwise have been either:

- collected with residual waste either at the kerbside or, less probably, at HWRCs (particularly fruit and vegetable peelings); or
- collected with garden waste either at the kerbside or HWRCs (particularly grass cuttings, weeds and prunings); or
- allowed to decompose in-situ (particularly grass cuttings).

As a result, home composting will reduce:

- the amount of waste that needs to be collected from homes/HWRCs; and
- the amount of waste that needs to be treated at facilities for garden waste composting/residual waste treatment and disposal.

The business case developed by Eunomia shows that each year during the course of the programme more households will get involved in home composting. This will lead to a cumulative increase in the tonnage of waste diverted with projections showing that on average 2,080 tonnes of material will be prevented, peaking at over 2,460 tonnes per year by 2017/18. In terms of longevity, all impacts will extend beyond the lifespan of the project, since once people start home composting and get used to it, they no longer need any subsidies or information and are likely to continue composting.

The initiative has a strongly positive impact on minimising waste to landfill (Env1), in terms of quantity and quality as the diversion is of bio-waste and therefore reduces the methane-emitting materials at landfill.

Increasing home composting may reduce the need for gardeners to purchase peat-based soil improvers. Peat is generally found in particularly environmentally sensitive areas, so any reduction in peat extraction will help reduce impact on global resources, wildlife, flora and fauna primary material extraction (Env6). The use of composted material on soil will also work to enhance soil quality (Env8). Widespread use of compost on gardens reduces the need to water, particularly during dry periods (since compost improves the soil's ability to retain water), and therefore has a small positive impact on water usage (Env7).

Furthermore, the reduced amounts of waste needing to be transported and treated, in addition to reduced extraction and transport of peat, will reduce the energy requirements of the treatment operations (Env5), which in turn will have some positive implications for global biodiversity and greenhouse gas emissions (Env3). Although there has been some debate regarding greenhouse gas emissions from home composting, recent studies by WRAP indicate that emissions from compost bins are negligible and, any trace amounts of methane generated are oxidised within the outer layers of the compost.[10]

Given that all of the waste material generated will be dealt with at home, the road transport of waste will be reduced. Although the marginal mileage travelled per kg of waste is small, when large numbers of people are involved in the initiative (over 17,500 households by 2018) there should be a tangible (albeit small) decrease in road miles travelled which will also affect greenhouse gas emissions (Env3).

The issue surrounding the impact on nuisance is unclear and will depend upon how well the compost bins are managed. Well managed bins should not lead to any nuisance issues. However, there may be some problems, e.g. with flies and odour in poorly managed home compost heaps. Given that the initiative includes the provision of an advice line, any such problems should be minimised through the suitable advice and guidance.

Participation in home composting, and the provision of that advice and guidance gives the initiative a positive impact on educating households on the wider issues of waste minimisation (Soc9). The active encouragement of home composting should lead to greater participation in schemes and encourage community involvement in waste management activities, giving the initiative a synergistic influence.

The initiative has been successfully implemented in other Local Authorities in the UK and so is proven to be successful (Tec16).

In terms of cost the strategy is projected to have a Net Present Value (NPV) of -£548,000 (note that a negative number denotes a desirable outcome), thereby being a cost effective method of minimising waste (Econ17).

6.5.2 Initiative 2: No Side Waste

Existing 'No side waste' and 'lids down' policies will be enforced. This initiative is likely to increase participation in recycling, and that has very positive impacts on greenhouse gas emissions (Env3), energy balance (Env5) and global resources (Env6), as recyclates replace virgin materials.

Impacts of this initiative are generally positive, particularly with respect to minimising the nuisance associated with uncontained waste strewn across roads (Soc11), which may cause odour and attract vermin, with a consequent human health impact (Env4).

[10] P. A. Wheeler and J. Parfitt (2007) *Life Cycle Assessment of Home Composting*, WRAP and AEA Technology

The policy will be seen by those it impacts as being inconvenient (Soc10), but the result of it will be to educate about the importance of waste reduction and recycling (Soc9). As this is essentially an educational initiative, the benefits are considered long-term - they do not rely on continuing input of resources, once behaviour is changed and householders understand that the side waste ban is enforced.

The No Side Waste initiative will be synergistic as it encourages the use of the HWRC, home composting, and waste exchanges, such as Freecycle, and improves awareness of recycling.

No side waste initiatives have been proven to work in other Local Authorities. An estimated 1400 tonnes per annum could be prevented with the strict enforcement of the policy. This initiative has a projected NPV of -£1,618,000 which represents a good economic performance (Econ17).

6.5.3 Initiative 3: Zero Waste Challenge

This initiative challenges Doncaster residents to reduce their residual waste as much as possible. In order to achieve this, advice will be given which will encourage householders to think about the items which they buy in order to prevent the waste entering the household's waste stream in the first place. Although the key focus is on waste prevention further advice will also encourage home composting and recycling.

For those that take part the Zero Waste Challenge will significantly reduce waste arisings, hence the positive impacts for all of the environmental objectives. Socially, the strongest benefit is seen in the educational impact (Soc9) however this is offset by the huge inconvenience associated with the initiative (Soc10).

Similar initiatives have been run by other authorities throughout the UK and qualitatively are described as successful. The main problem is the lack of quantitative evidence of the success hence the uncertainty associated with whether or not the initiative will, and has been proven to, succeed (Tec16). The initiative could prevent 90 tonnes per annum (Env1) and the financial savings (Econ17) are considerable with an NPV of - £72,000.

6.5.4 Initiative 4: Reuse at HWRCs

This initiative will introduce reuse containers in two of the HWRCs, so that reusable materials can be kept separate and then collected by Doncaster Refurnish, for distribution through their current channels.

Though quantities are not great, this initiative will divert material from landfill. A small percentage of material destined for recycling may also be diverted to reuse, but as reuse is higher up the waste hierarchy than recycling, the overall impact is positive. It will be synergistic with other initiatives at the HWRCs, such as the paint reuse.

One minor negative point, that will need to be addressed with training, is that if materials are collected that are subsequently found not to be reusable (for example because of fire regulations for furniture), then Doncaster Refurnish would need to dispose of them.

The initiative depends on infrastructure to be effective and therefore is short term (i.e. over the length of the plan). It is not considered to be synergistic because it only diverts waste that was coming to the HWRC anyway, and therefore does not encourage prevention. It may encourage some thoughts about reuse when householders see that their materials are taken to a reuse container.

An estimated 140 tonnes per annum could be prevented through reuse, with an NPV of -£129,000.

6.5.5 Initiative 5: Bulky Collections Reuse

The bulky collections reuse initiative has a prevention effect and makes reuse more convenient for the householder than the current system, as one organisation takes away all the bulky items (Soc 10). It is likely to give rise to local employment as more furniture is processed via Doncaster Refurnish (Soc13).

Reuse will have a positive impact on the use of global resources, greenhouse gas emissions and the energy balance (Env6, Env3, Env5).

It is uncertain whether the extra reuse will be perceptible by the users of the service and therefore whether it will have any educational benefit (Soc9).

The benefits accruing from the initiative rely on the continuing availability of the service and so will only persist during the life of the plan.

It is estimated that the initiative will divert on average 40 tonnes per annum from landfill, and the initiative has an NPV of -£31,000.

6.5.6 Initiative 6: Paint Reuse

This initiative will introduce paint collection containers in two of the HWRCs. Paint collected will be sorted into colours and that which is reusable will be distributed to needful local organizations.

Whilst this process may be slightly less convenient for householders than putting waste in the residual stream (Soc10), there is a substantial benefit in removing these hazardous substances from landfill. Currently in Doncaster, there is no separation of paint at HWRCs, so no cost of hazardous waste disposal is incurred. This means that the cost avoided is the standard landfill cost, which makes the initiative look less attractive economically. The other slight negative impact is on 'decommissioning' (Tec14), which relates to the issue of disposing of unusable paint. It is possible to set up a contract for it to be treated or burnt as fuel (e.g. in a cement kiln) rather than landfilled, and this would mitigate the decommissioning issue.

As the reuse of paint requires organisation to achieve, the benefits will be limited to the plan period. It will build awareness of the hazard nature of some waste and the role of the HWRC, so will have synergy with other HWRC-based activities.

The estimated tonnage of prevention is 4 tonnes per annum, and the NPV is positive (i.e. discounted costs outweigh benefits over the life of the plan) at £49,000.

6.5.7 Initiative 7: SMART Shopping

This initiative is based upon provision of advice to encourage consumers to think about the products they buy, where they buy them from and in what form they buy them. For example, some advice includes encouraging use of re-fills, discouraging use of disposable items, trying to mend items instead of buying news ones and bulk buying to reduce packaging.

The environmental benefits of SMART shopping are all positive because the total amount of household waste being produced decreases (with savings of 120 tonnes per annum for Env1). SMART shopping is a genuine waste prevention initiative and as such reduces waste going to both residual and recycling.

The education effects are thought to be greatly positive (Soc9). Due to the change in behaviour required to achieve a reduction in waste there is thought to be a strong negative effect due to the lack of convenience (Soc10).

There is some uncertainty surrounding the effectiveness of this initiative due to the inherent problems with measurability of behaviour change (Tec16). It has been run by various other authorities and according to the modelling has the potential to save an average of £6,300 per annum over the plan period, with an NPV of -£71,000.

6.5.8 Initiative 8: No Junk Mail

This initiative aims to encourage people to sign-up to the Mail Preference Service (MSP) and dissuade deliveries of free newspapers and flyers by displaying stickers by their letterboxes.

This is a simple initiative which is effective across environmental, social and economic objectives. It could prevent 250 tonnes of residual waste (Env1) and 70 tonnes of recycling per annum (Env2). The initiative involves a waste prevention officer working in the community to sign residents up to the MPS, thereby reducing the direct action needed to be taken by residents, meaning this is one of the few prevention initiatives considered to be very convenient.

The initiative has been successfully run by other authorities so is considered to be highly probable to succeed. This is especially likely since other area's schemes often rely on residents signing themselves up to the MPS. Savings of an average of £10,000 per year over the plan period could be achieved, giving an NPV of -£110,000.

6.5.9 Initiative 9: Real Nappies

This initiative involves firstly setting up a nappy laundry service in the Doncaster area which will require substantial capital input for set-up costs. Secondly, this initiative involves the promotion of the use of real nappies through a subsidy scheme which either funds the purchase of real nappies, or contributes to the registration fee for the nappy laundry service.

The appraisal highlights that implementation of the scheme will have mainly positive impacts. However, a life cycle analysis undertaken for the Environment Agency shows that impacts on global emissions (Env3), energy balance (Env5) and water consumption (Env7) do not vary greatly between the use of disposables, real nappies washed at home and real nappies commercially laundered.[11] Results from the study are shown in Table 6-2.

Table 6-2: Results from Environment Agency Life-cycle Study

	Disposables	Flat Nappy, Home Laundered	Pre-fold Nappy, Commercially Laundered
Global Warming Impact (Tonnes CO_2 equivalent)	602-626	465-559	762
Resource Depletion (oil, coal, gas, other – Kg Sb equivalent)	4.82-4.85	4.63-4.09	5.76

Source: ERM (2005)

As can be seen, the data presented in the study shows that using disposables is worse for the environment in terms of Global Warming and resource depletion than home laundering flat nappies. However, what is perhaps surprising is that the disposables came out better overall than the pre-fold nappies that have been sent for commercial laundering.

Care must be taken when interpreting these figures as a number of flaws in the study have been identified, and since the impact of re-useables will decline with any subsequent children as the impacts of manufacturing the reusable nappies are not applicable. Also, the data used for the 2005 report was from 2001 and household appliance efficiency has greatly increased since then.

During the process of developing the Strategy the Environment Agency published an updated lifecycle assessment report for reusable versus disposable nappies.[12] Results from this recent report have not been considered in the analyses.

The impact upon local emissions (Env4) was classified as 'negligible' due to a case for the emissions both increasing and decreasing. A re-useable nappy commercial laundering service will undoubtedly increase transport emissions because of the collection and drop-off nappy service. However, at the margin removing nappy waste from residual collections might reduce collection times, increase pass rates, and thereby reduce traffic congestion associated with waste management.

[11] ERM (2005) *Life Cycle Assessment of Disposable and Re-useable Nappies in the UK*, Report to the Environment Agency, http://www.environment-agency.gov.uk/commondata/acrobat/nappies_1072099.pdf

[12] ERM (2008) *An Updated Lifecycle Assessment Study for Disposable and Reusable Nappies*, Report to the Environment Agency, http://randd.defra.gov.uk/Document.aspx?Document=WR0705_7589_FRP.pdf

The scheme is reliant on people changing their behaviour and so like many waste prevention schemes is inherently thought to be an inconvenience (Soc10).

The modelling shows that this initiative has a positive NPV of £95,000 but that savings of 380 tonnes per annum could be achieved which has been recognised as highly beneficial.

The impacts of the initiative are considered long-term due to the establishment of a commercial nappy laundry service, which is expected to increase the number of real nappy users. Furthermore, it is anticipated that increased awareness amongst parents of the benefits of real nappy use will endure beyond the scope of the Strategy.

6.5.10 Initiative 10: Council In-House Good Practice

This initiative involves implementation of an in-house recycling scheme and waste prevention awareness campaign. It will be rolled out in three stages across the council throughout the duration of the initiative.

Environmentally, the impacts of the initiative are all positive despite the relatively low amount of waste being prevented (11 tonnes per annum). With regards to social impacts the education arising from the implementation of such a scheme is thought to be of great importance. It will provide employees with greater confidence to inform others when they have the experience and knowledge from their own workplace. In light of this the initiative is considered synergistic with other initiatives which will be raising waste prevention awareness, such as SMART shopping and the Zero Waste Challenge.

However, it scores negatively for convenience because as an employee using the new recycling provisions and following waste prevention advice will require changing current habits. Also, due to the current lack of provisions for recycling within DMBC a full-time officer has been modeled for the first three years, which ultimately leads to the initiative having a positive NPV of £59,000. The effects of the initiative are expected to extend beyond the plan period when officer time will be reduced greatly as behaviour changes and waste prevention and recycling are considered normal practice within the council working environment.

6.5.11 Initiative 11: Zero Waste HWRC's

This initiative eliminates the residual waste bins at two of the HWRC’s, so that they are 100% recycling or reuse. This does not prevent any waste, but does replace landfilling with recycling, so it has a positive effect on both (minor on Env1 and major on Env2). Due to the boost to recycling, this also has a positive impact on greenhouse gas emissions, energy balances and global resources.

The rebranding as a zero waste site will help to change the public perception of the HWRC from ‘the dump’ to ‘the recycling centre’. This element of behavioural change gives the initiative an educational purpose beyond its immediate impact. For this reason the impacts of it are deemed to be long-term. It will be synergistic, particularly with other HWRC based activities.

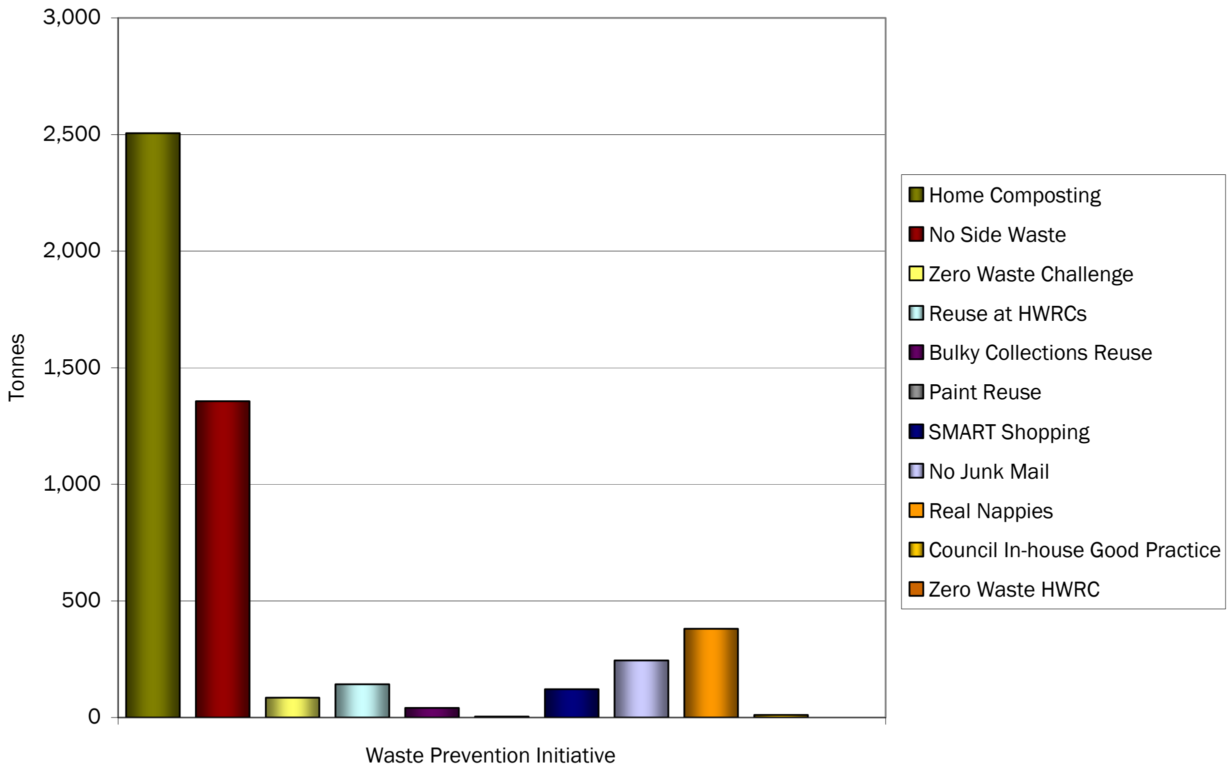
The estimated annual cost saving will be £52,000, giving it an NPV of -£373,000.

6.6 Quantitative Discussion of Impacts

The above descriptions of the waste prevention initiatives are mainly qualitative, although some figures are obtained from the model. A more detailed discussion of these figures as well as a comparison of the initiatives is given here.

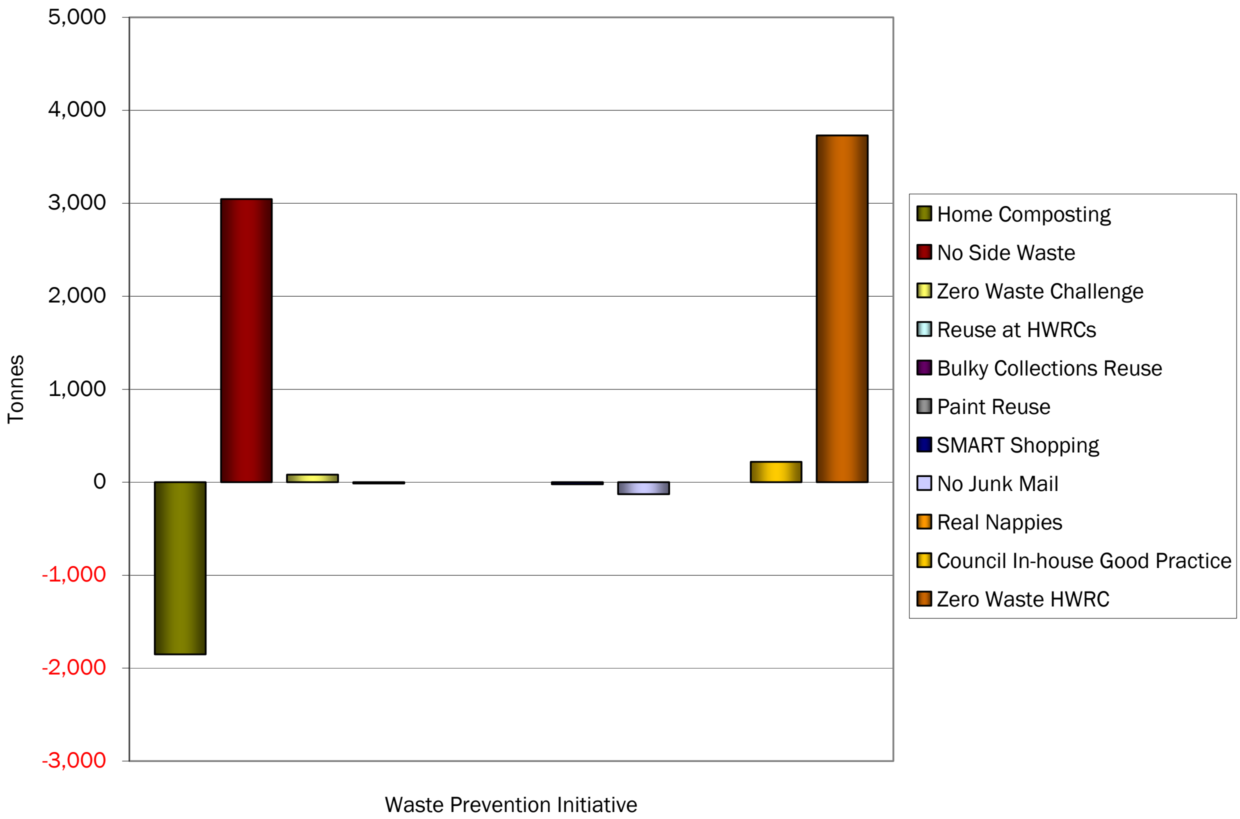
In order to assess objective 1, with main criteria 'minimum landfill', the output 'total tonnes prevented' from the model was used. This measure is a good approximation for tonnage of waste prevented from landfill, although in a few cases it does not show waste prevented but landfill but instead waste that has been moved up the hierarchy. For example, for home composting, only the avoided food waste was going to landfill and the garden proportion would have been composted, not sent to landfill. In light of this the total tonnes prevented have been used to inform the appraisal of objective 1, whilst taking account of such discrepancies in the measure. Total tonnes prevented are displayed graphically in Figure 6-1.

Figure 6-1: Average Annual Residual Tonnes Prevented by each Waste Prevention Initiative



The average annual additional tonnes of composting and recycling has been used as a quantitative measure to assess objective 2 (maximum by-products), as shown in Figure 6-2. Where the graph displays a negative value this denotes that recycling and/or composting has decreased. Where this relates to recycling, despite the negative value shown by Figure 6-2, this has been considered a positive effect in the summary matrix because prevention is higher up the waste hierarchy than recycling.

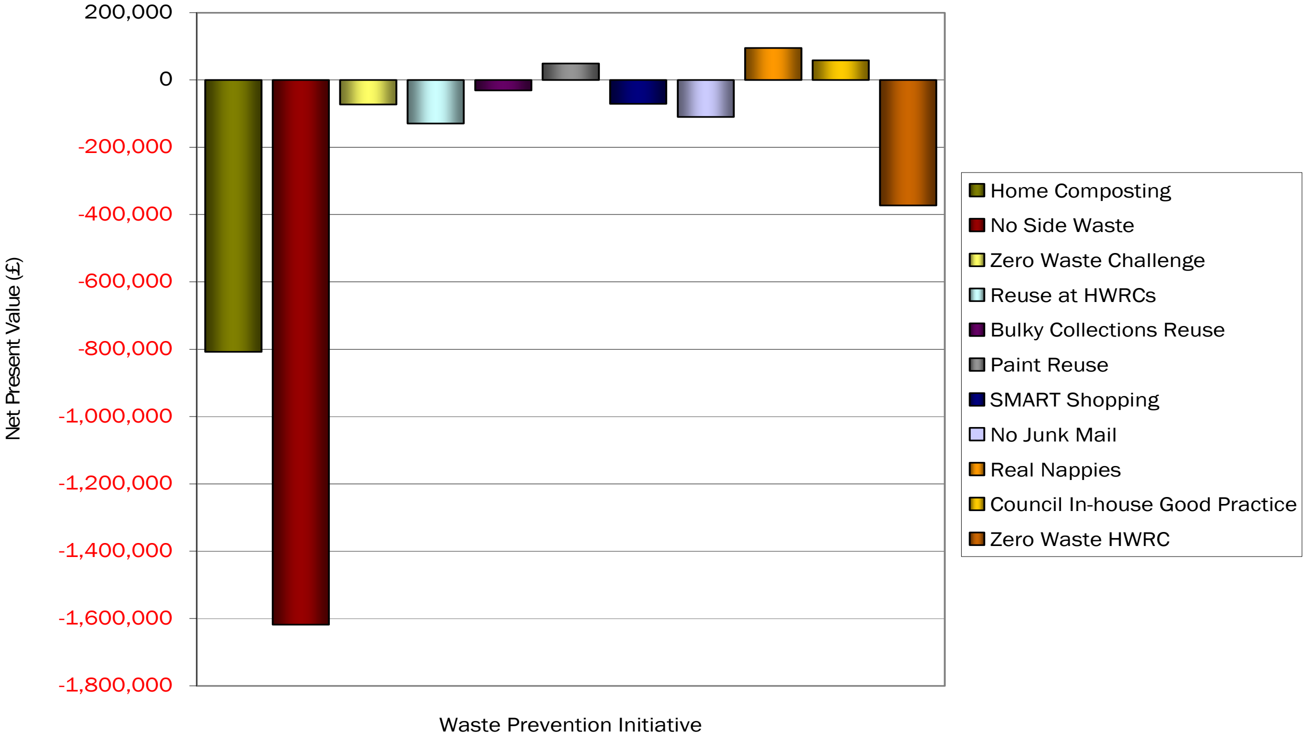
Figure 6-2: Average Annual Additional Tonnes of Composting and Recycling by each Waste Prevention Initiative



Net Present Value (NPV) has been used to assess objective 17, which is the economic (cost) objective. NPV is represented in Figure 6-3 by a negative value where net discounted savings outweigh the costs, i.e. a negative value denotes a desirable outcome. All figures are shown in 2008 pounds. [13]

[13] Net discounted costs and savings were calculated based on the Treasury's Green Book rate of 3.5%

Figure 6-3: Net Present Value by Waste Prevention Initiative



7.0 Assessment of Options for Waste Recycling / Composting

7.1 Introduction

Waste collection options have been appraised by SEA criteria, as set out in Section 3.2. This has been assessed in a slightly different way than waste prevention due to the fact that each option is appraised against the others and only one will be taken forward. The analysis is much more quantitatively based and so each criteria has been looked at individually.

The community panel weightings associated with these criteria have been applied in Section 7.8.

As discussed in Section 4.2.3, several collection options were agreed on with DMBC. These are:

- Baseline (2007/08): reflecting the current situation.
- Business As Usual (2010/11): as the baseline, but modelled into the future with rising growth rates and disposal costs.
- Intermediate baseline (2010/11): as above, but with a widespread communications campaign to increase participation and capture rates. Additional benefits are also seen from the effects of some prevention measures which boost recycling. This increase in participation and capture is also reflected in all of the following options.
- Option 1 (2010/11): Add card to the existing dry collection. Addition of a weekly food waste collection. Free garden waste collection.
- Option 2 (2010/11): Monthly separate collection of paper and card in additional wheelie bin. Smaller residual bin. Addition of a weekly food waste collection. Free garden waste collection.
- Option 3 (2010/11): Add card to the existing dry collection. Addition of a weekly food waste collection collected on a food pod with the residual collection. Free garden waste collection.
- Option 4 (2010/11): Monthly separate collection of paper and card in additional wheelie bin. Smaller residual bin. Addition of a weekly food waste collection collected on a food pod with the residual collection. Free garden waste collection.
- Option 5 (2010/11): Add card to the existing dry collection. Addition of a weekly food waste collection collected on a food pod with the dry recycling collection. Free garden waste collection.
- Option 6 (2010/11: Monthly separate collection of paper and card in additional wheelie bin. Smaller residual bin. Addition of a weekly food waste collection collected on a food pod with the dry recycling collection. Free garden waste collection.

Encomia's bespoke kerbside collection model, Hermes, has been used to evaluate the performance of the above 6 different kerbside recycling/composting options in terms of headline costs, recycling rates, waste diversion etc. This modelling also helps provide some of the information base for evaluation of other criteria for the Environmental Appraisal such as transport miles driven, energy offsets through recycling etc. Remaining criteria are more qualitative in nature and are appraised accordingly

7.1.1 Notes on Modelling and Assessment

The assumptions and a brief description of the model are included in the Appendices (A.6.0).

7.2 Summary Appraisal Matrix

A summary of the options appraised against each objective is shown in Table 7-1.

7.3 General Discussion of Impacts

All options appraised scored well mainly due to the fact that each one will divert some amount of material out of residual waste and into the recycling stream, although in varying degrees. The only negative impacts found were in terms of Env4 (local emissions), due to the requirement to have vehicles on the road. Negative impacts were also associated with cost, although this is purely based on the cost of the collection rounds and avoided landfill. There may be other impacts in terms of LATS implications or a further increase in Landfill Tax.[14]

[14] Suggested in Budget 2008

Table 7-1: Summary Appraisal Matrix – Collection Options

		Environmental (Env)								Social (Soc)					Technical (Tec)			£ (Econ)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		Minimum Landfill	Max By-Products	Global Emissions	Local Emissions	Energy	Global Resources	Water	Soil	Education	Convenience	Nuisance	Safety	Local Employment	De-commission Problems	Future Proof	Proven Technology	Cost
Baseline	Effect							N/A					N/A		N/A	N/A	N/A	
	Timescale	S	S	S	S	S	S		L	L	S	S		S				S
Business As Usual	Effect							N/A					N/A		N/A	N/A	N/A	
	Timescale	S	S	S	S	S	S		L	L	S	S		S				S
Intermediate	Effect							N/A					N/A		N/A	N/A	N/A	
	Timescale	S	S	S	S	S	S		L	L	S	S		S				S
Option 1	Effect							N/A					N/A		N/A	N/A	N/A	
	Timescale	S	S	S	S	S	S		L	L	S	S		S				S
Option 2	Effect							N/A					N/A		N/A	N/A	N/A	
	Timescale	S	S	S	S	S	S		L	L	S	S		S				S
Option 3	Effect							N/A					N/A		N/A	N/A	N/A	
	Timescale	S	S	S	S	S	S		L	L	S	S		S				S
Option 4	Effect							N/A					N/A		N/A	N/A	N/A	
	Timescale	S	S	S	S	S	S		L	L	S	S		S				S
Option 5	Effect							N/A					N/A		N/A	N/A	N/A	
	Timescale	S	S	S	S	S	S		L	L	S	S		S				S
Option 6	Effect							N/A					N/A		N/A	N/A	N/A	
	Timescale	S	S	S	S	S	S		L	L	S	S		S				S

Key	
Strong Negative	
Minor Negative	
Negligible/No Impact	
Minor Positive	
Major Positive	
Uncertain	
Within Plan Period	S
Outside of Plan Period	L

7.4 Environmental Objectives

The 9 environmental criteria described in Table 3-1 have been treated individually in the following sections.

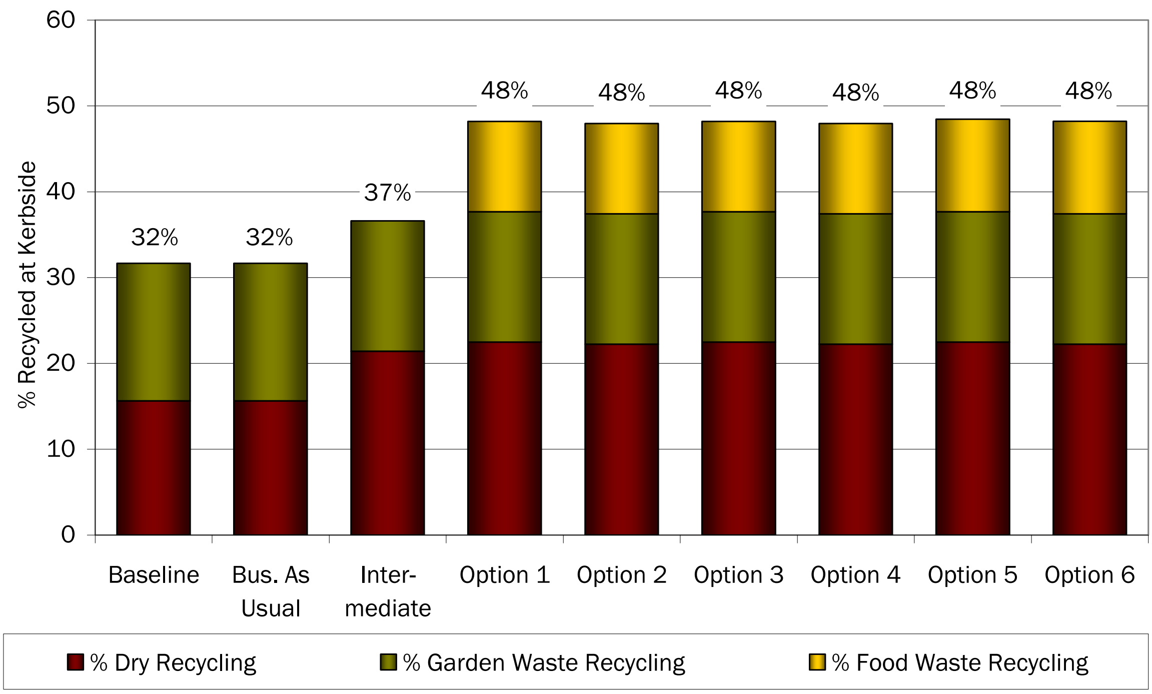
7.4.1 Env1: Minimum Landfill

This criterion was assessed through the amount composted or recycled in each Option. Although this is not a direct measure of 'amount to landfill', as this would depend on the residual treatment in use, it does give some indication of the quantity of material not captured through the recycling system.

Figure 7-1 shows the amount captured both in the dry recycling collection and the organic services offered. There is a significant increase in overall performance when comparing the Options with the baseline scenarios which is driven by the introduction of a food waste collection. This adds an additional 11% to the overall recycling rate.

Options 1 to 6 illustrate a 48% total kerbside recycling performance and do not differ greatly due to the fact that similar participation and recognition of materials was assumed for all Options modelled after the baseline.

Figure 7-1: Percentage Recycled at the Kerbside



Due to the fact that every Option diverts waste from landfill, all score positively in the appraisal matrix. Options 1 to 6, however, are deemed to have a strong positive impact due to the high levels of recycling obtained.

7.4.2 Env2: Maximum 'Good' By-Products

This criterion was not separately assessed for the collections tier of the hierarchy due to its similarities with Env1; the quantity of recycling obtained. The reference to 'good' by-products would depend on the end-markets to which the materials are being sent.

In this case, due to the fact that every option involves a kerbside sort, the end products are likely to be of high quality (i.e. separately collected glass will not be recycled into aggregates).

7.4.3 Env3: Global Emissions

This criterion related to global emissions per tonne of waste collected with specific reference to climate change. It was, therefore, deemed appropriate to assess this through the balance of CO_2 equivalent; including the amount saved as well as the amount emitted through recycling. [15]

The amount of CO_2 saved through recycling was calculated through assessing the quantity of different types of material collected and their associated net GHG savings. The figures were taken from a life cycle analysis study and incorporate the savings associated with replacing the virgin materials as well as emissions involved in the recycling process and transport. [16] The figures used are shown in Table 7-2.

Table 7-2: GHG Savings for each Tonne of Material Recycled

Material	Net Savings (tonnes CO^2 equivalent/tonne recycled)
Aluminium	13.57
Steel	1.79
Glass	4.92
Plastic bottles	1.39
Card	3.11
Paper	3.07
Textiles[17]	7.18

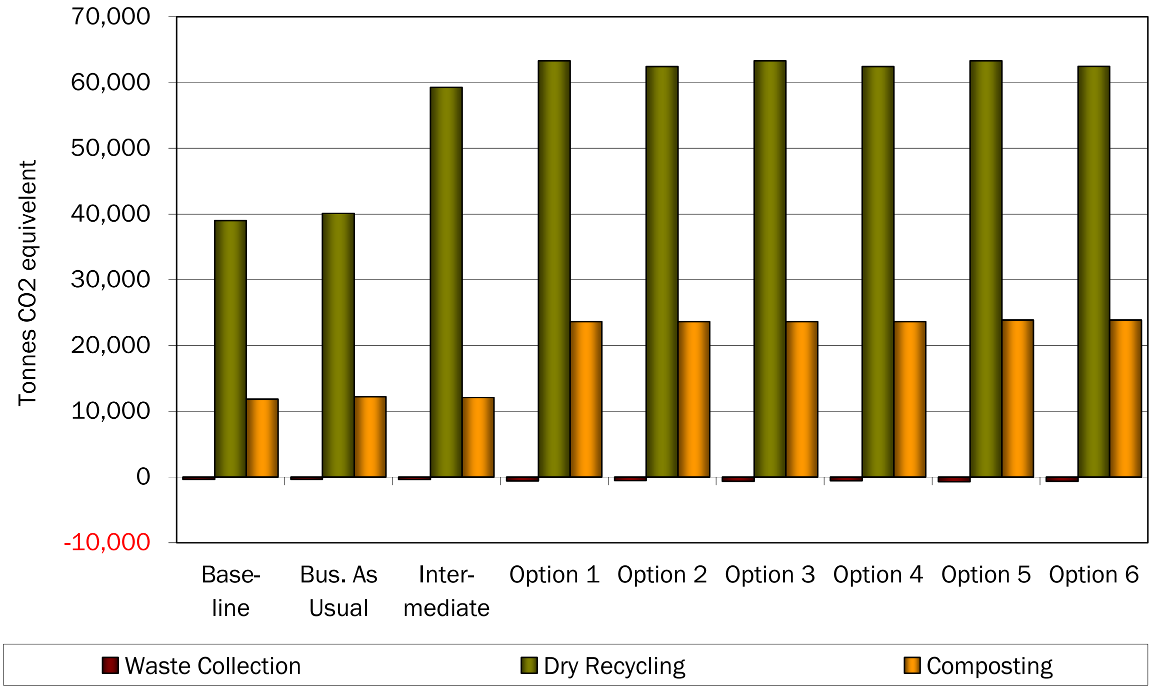
These figures were then applied to the quantities of each material recycled under each option. The results are shown in Figure 7-2.

[15] 'CO2 equivalent' includes all greenhouse gases, equated to the corresponding amount of CO2 that would have the same global warming effect

[16] US Environmental Protection Agency (2006) *Solid Waste Management and Greenhouse Gases - A Life-Cycle Assessment of Emissions and Sinks.*

[17] Value for 'carpet' used as the study did not examine textiles

Figure 7-2: Tonnes of CO_2 Equivalent Saved and Emitted for Each Option



The most striking result in the graph is seen in the comparison between the emissions relating to the waste collection and that saved through recycling.

As the savings are directly related to the amount of material recycled, the results are similar to those in Env1, with Options 1 to 6 being attributed to a strong positive impact.

This criterion also covers impacts on the ozone layer; a measurement much more difficult to quantify. Again, there will be emissions related to vehicle movements, although these will be minor compared with the savings obtained through recycling. Current regulations ensure that white goods which contain ozone-depleting substances (ODS), such as fridges and freezers, must be dismantled and harmful substances removed. The Montreal Protocol has also ensured that man-made ODS are being phased out and so there is unlikely to be a large quantity in the waste stream, particularly when considering household waste. It is assumed, therefore, that the impacts of waste collection on the ozone layer will be minimal.

7.4.4 Env4: Local Emissions

Local emissions were assessed as the pollutants associated with the vehicles used on the rounds. The local emissions measured are:

- NOx;
- SOx;
- Particulates;
- VOC's; and
- CO

These pollutants were then attributed an external monetary cost, measuring the extent of the damage to health associated with the quantity of pollutant being released into the air. The costs represent an estimate of the external costs of key air pollutants known to have a local or regional impact. [18] Impacts are estimated on a £ per tonne basis, with a higher figure thus representing greater damages. The costs used here draw upon estimates of damages from the European Commission's Clean Air for Europe Programme, as well as work undertaken on behalf of the European Commission by COWI.[19] Figures used are shown in Table 7-3.

Table 7-3: Health Externalities Associated with Each Pollutant

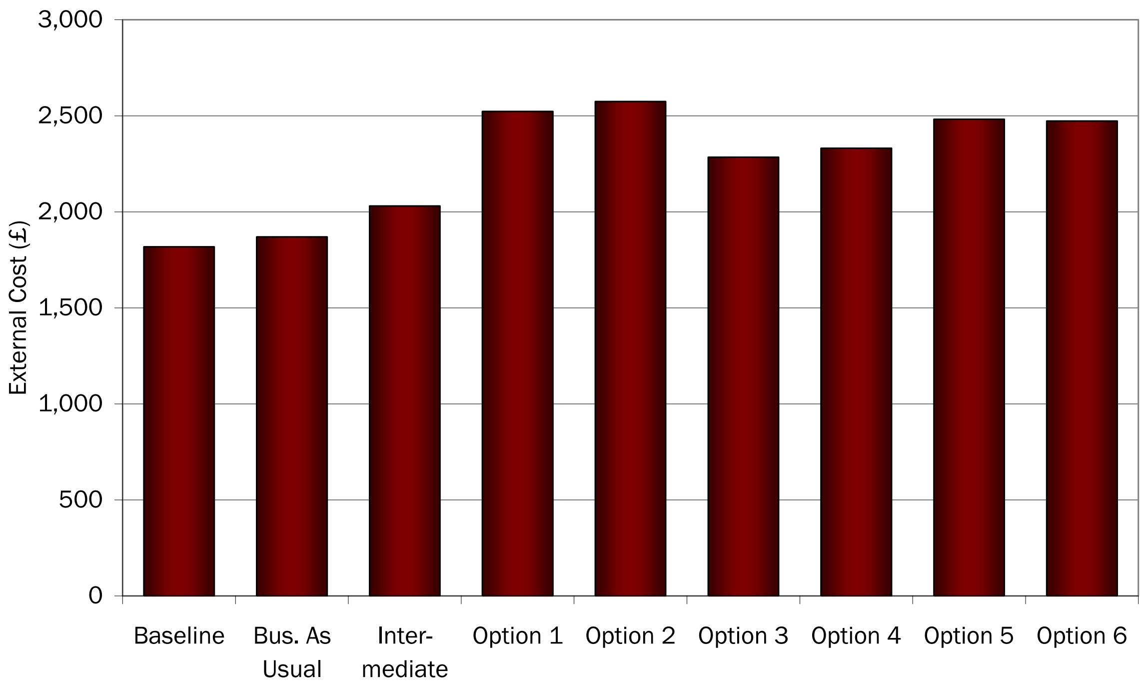
Pollutant	Externality (£)
NOx	1,005
SOx	3,027
Particulates	1,055
Vic's	684
CO	512

Figure 7-3 illustrates the health impacts associated with the vehicle emissions. This is dependant on the miles driven per annum and also the number and type of vehicle in use.

[18] These external costs include those associated with days lost to ill-health, and costs resulting from hospital emissions, etc.

[19] AEAT Environment (2005) *Damages per tonne Emission of PM2.5, NH3, SO2, NOx and VOCs from Each EU25 Member State (excluding Cyprus) and Surrounding Seas,* Report to DG Environment of the European Commission, March 2005
COWI (2000) *A Study on the Economic Valuation of Environmental Externalities from Landfill Disposal and Incineration of Waste,* Final Report to DG Environment, the European Commission, August 2000

Figure 7-3: External Monetary Health Cost Associated with Each Option



Options 1 and 2 are associated with higher levels of emissions due to the extra vehicles needed for a separate pass to collect food waste (the other options encompass food pods incorporated into existing vehicles), although this increase is not significant.

Although vehicles are associated with local air pollution impacts, the number needed for waste collection are extremely small when compared with the total number of vehicles on the roads each day. The impacts, therefore, were given a minor negative scoring.

This criterion also covered impact on property and local ecosystems. Those emissions which contribute to acid rain (mainly NOx, SOx and VOC's) will have the most damage to property and can cause acidification of local ecosystems as well as other problems. The impacts on these criteria are likely to be very similar as the health impacts discussed above and so these are not separately assessed.

7.4.5 Env5: Energy

This criterion covers the energy inputs and outputs as well as the avoided energy use. The energy used and saved through recycling is treated as a 'net balance' and encompasses the embodied energy within each recyclate collected. Embodied energy refers to the total amount of energy input which is required to extract, transport and manufacture a certain material. It also encompasses the embedded energy within a material. Examples of this include:

- Plastics: These are made from petroleum, which has inherent energy properties. Through recycling, the petroleum which would be needed to make virgin materials can then be used as an energy source.

- Aluminium: Requires coal in the smelting process. Through recycling, the coal is again a source of energy.

The values used are shown in Table 7-4.[20]

Table 7-4: Net Energy Savings for Each Tonne of Material Recycled

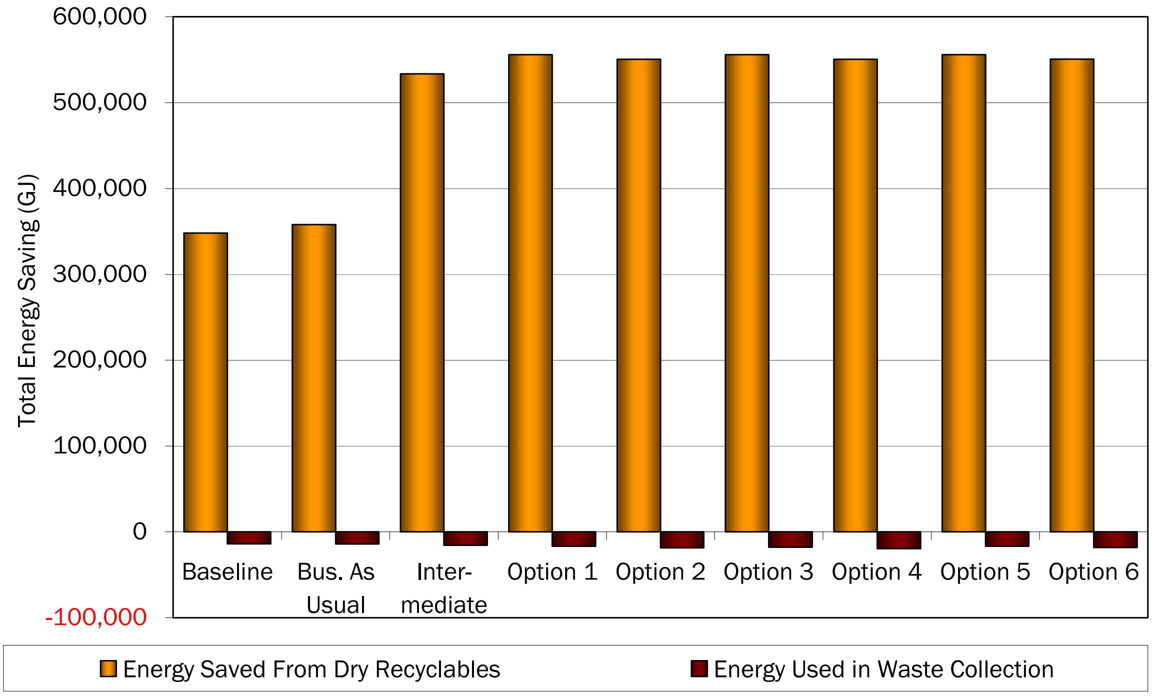
Material	Net savings (MJ/tonne recycled)
Aluminium	217,785
Steel	21,069
Glass	2,247
Plastic bottles	53,702
Card	16,269
Paper	17,398
Textiles[21]	111,393

An analysis of the embodied energy within the recyclables collected, as well as the energy used in the collection, was used for this criterion. The energy used by collection vehicles was calculated though diesel usage and its volumetric energy density.

[20] Figures for each material obtained from: US Environmental Protection Agency (2006) *Solid Waste Management and Greenhouse Gases - A Life-Cycle Assessment of Emissions and Sinks*

[21] Value for 'carpet' used as the study did not examine textiles

Figure 7-4: Energy Savings and Use in Each Collection Option



Again, all options have a positive scoring as the benefits obtained from recycling far outweigh the energy used in collection. Options 1 – 6, as well as the Intermediate Option, all have a greater energy saving and so are assessed as resulting in a strong positive impact.

7.4.6 Env6: Impact on Global Resources

Recycling materials avoids the extraction of virgin materials, which can have a huge effect on resources as well as biodiversity. A measure for this avoided extraction is the 'Total Material Requirement', a figure which varies depending on the material assessed. In our analysis, the TMR calculation is based upon the extraction of the primary material as well as the 'hidden flows' associated with this process. The figures used for the analysis are derived from a number of studies.[22] The methodology is explained more detail within Box 1. The results can be seen in Figure 7-5.

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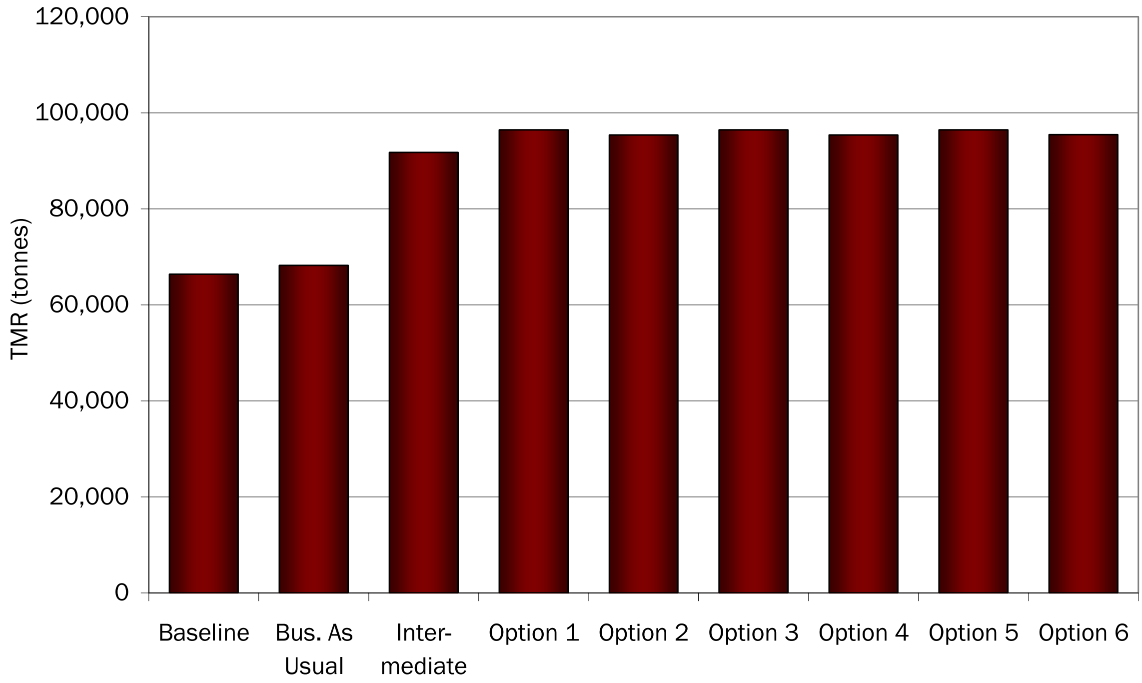
[22] Adriaanse, A., Bringezu, S., Hammond, A., Moriguchi, Y., Rodenburg, E., Rogich, D., & Schütz, H. (1997). *Resource Flows. The Material Basis of Industrial Economies*. Washington: World Resource Institute; Stiller, H. (1999) Material Intensity of Advanced Composite Materials*, Wuppertal Papers No 90,* February 1999*;* Douglas, I. & Lawson, N. 'An earth science approach to assessing the disturbance of the earth's surface by mining', *Mining and Environmental Research Network Research Bulletin*, 11–12, p37–43; Bringezu, S. & Schütz H. (2001) *Total Material Requirement of the European Union*, pp.19

Figure 7-5: Total Material Requirement Savings for Each Option



Again, all Options score positively as the recycling obtained through each one displaces the need for virgin materials. Options 1 to 6, as well as the Intermediate Option, all have a strong positive impact due to the high levels of recycling obtained.

The Intermediate Option scores relatively well, despite the increased recycling seen in Options 1 to 6, due to the fact that the majority of the additional material is in the form of a food waste collection, which does not have a TMR value due to the fact that it is not displacing anything.

Box 1: Total Material Requirement

The extraction of virgin materials requires the movement and mobilisation of matter that is incidental to the recovery of the economically valuable product. Often these incidental flows of matter can be of tremendous environmental significance. They can disturb natural habitats, result in the death of non-target species, mobilise heavy metals into the water system and in the case of mining activities release greenhouse gases. Such impacts are frequently excluded from conventional environmental assessment work because they are difficult to quantify and do not always vary linearly with the amount of material extracted.

Hidden material flows are of significance to the appraisal of waste management options because a reduction in material use, or the substitution of recycled material for virgin material, causes a reduction in the amount of virgin material extracted for every tonne of product that is used by the household. As a result, waste reduction initiatives, or a rise in the proportion of municipal solid waste recycled, can reduce the amount of hidden material flows caused by household consumption. In this assessment, this is used as an indicator of land disturbance and as a proxy for impacts upon biodiversity.

The types of perturbations that make up 'hidden material flows' include disruption to the land surface from the excavation during mining or forestry, soil erosion due to the reduction in vegetation cover, lifting of soil / stone during the extraction of ores. Using the terminology used by the Wuppertal Institute these impacts can be broken down into the following categories:

- Ancillary material flow
- Excavated and/or disturbed material flow
- Hidden material flows
- Direct material input
- Total material requirement

Ancillary material flow is the matter bound to the material of economic value that is extracted alongside the material and removed from the environment. It is released from the material during the first stage processing of the material. Often it is chemically and physically altered during the separation process. Examples of ancillary material include the components of a metal ore that is discarded after the pure element has been refined, or the bark and brash from trees that are removed from the environment.

Excavated material flows are the matter that is physically displaced from the extraction process but is not transported away from the site of extraction. For instance, in an open cast mine, topsoil and earth are lifted from the excavation site to reveal the ore-bearing seam. Excavated material flows also include soil erosion arising from the loosening of soil structure caused by digging and clearance of vegetation.

Hidden material flows comprise the summation of ancillary and excavated material flows. They are all the non-economic flows of material that arise from the extraction of valuable products.

Direct material inputs are the materials that are economically important materials recovered from the extraction, forestry, fisheries and agricultural activities (the last two not being relevant to this study). These include the matter that is produced domestically and also the matter that is imported (less exports).

Total material requirement is the summation of the hidden and direct material inputs and therefore comprises the total materials that are mobilised by an economy.

By convention total material requirement analysis measures all material flows in terms of their total mass. Note that the term direct material is taken to mean the material that is actually traded within the economy prior to its processing into a finished good. In the case of paper this would be the timber that is sold to the pulp mills. The finished good is the printed material itself.

[1] Albert, A., Bringezu, S., Hammond, A., Moriguchi, Y., Rodenburg, E., Rogich, D. & Schütz, H. (1997) *Resource Flows. The Material Basis of Industrial Economies*, Washington: World Resource Institute

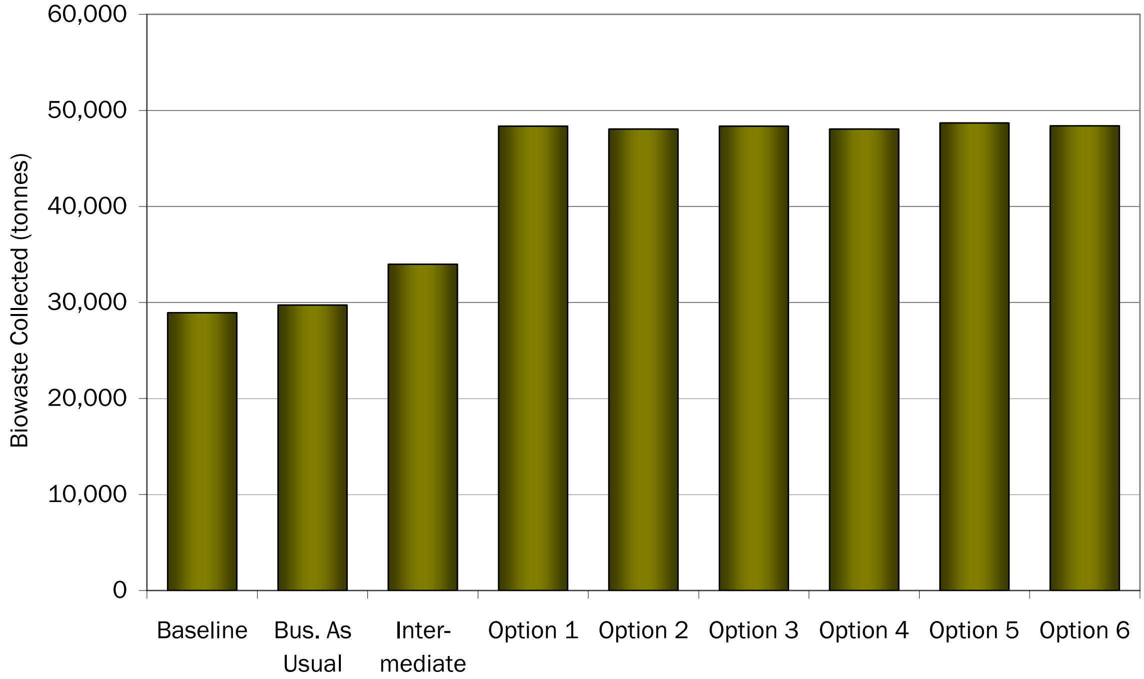
7.4.7 Env7: Water

Due to the fact that this criterion is based on water consumption, it is not relevant to this section, as this is a minor consideration in terms of waste collection. Env4 covers emissions which affect local air quality and so may have an impact on local water quality as a consequence.

7.4.8 Env8: Soil

This criterion covers landtake and land quality, which are not directly related to waste collection. There may be an impact on soil quality from the tonnages of biowastes collected for composting (particularly separately collected biowaste which can then be made into high grade compost). This has, therefore, been assessed in terms of tonnages of biowaste collected under each option, which is shown in Figure 7-6.

Figure 7-6: Tonnes of Biowaste Collected for Each Option



Options 1 to 6 score well due to the additional food waste collection as well as a free garden waste service. These options were, therefore, to have a strong positive impact. The Baseline and Intermediate scenarios, although including a garden waste service, do not encompass a food waste collection. These options were, however, deemed to have a positive impact due to the diversion of biowaste to compost treatment.

7.5 Social Objectives

7.5.1 Soc9: Education

This criterion covers education or training opportunities which may arise under each option. This is difficult to determine, as any recycling activity is associated with an increase in education due to a greater understanding of the waste we produce and how we can deal with this. This will also be somewhat determined by the accompanying educational campaigns which are rolled out with the recycling service. Arguably, a co-mingled collection may reduce this educational opportunity through a reduced understanding of recycling and less direct participation in the recycling process, although this type of system was not assessed here. Each Option, therefore, was deemed to be positive and was given equal scoring.

7.5.2 Soc10: Convenience

Again, this criterion is difficult to quantify and is dependent on the quality of the service offered. Every option assessed here, if delivered in the right way, will be convenient and easy to use. Each Option, therefore, was again given equal scoring.

7.5.3 Soc11: Nuisance

This criterion relates to noise and odour resulting from waste collection. This is again a difficult assessment to quantify as it depends on many things, such as the vehicles used, design of the collection rounds, location of tipping points etc. If the recycling rounds are well designed and the vehicles procured are compliant with the new European Emission Standards, there should be little or no issues surrounding noise or odour.

There are possible reductions in nuisance associated with the addition of a food waste collection, which can reduce odour problems associated with residual waste, particularly when it is collected on a fortnightly basis. This, however, will depend on the containers used, the behaviour of the householder and the level of home composting.

In light of this, all Options have been scored the same with the impact defined as negligible.

7.5.4 Soc12: Safety

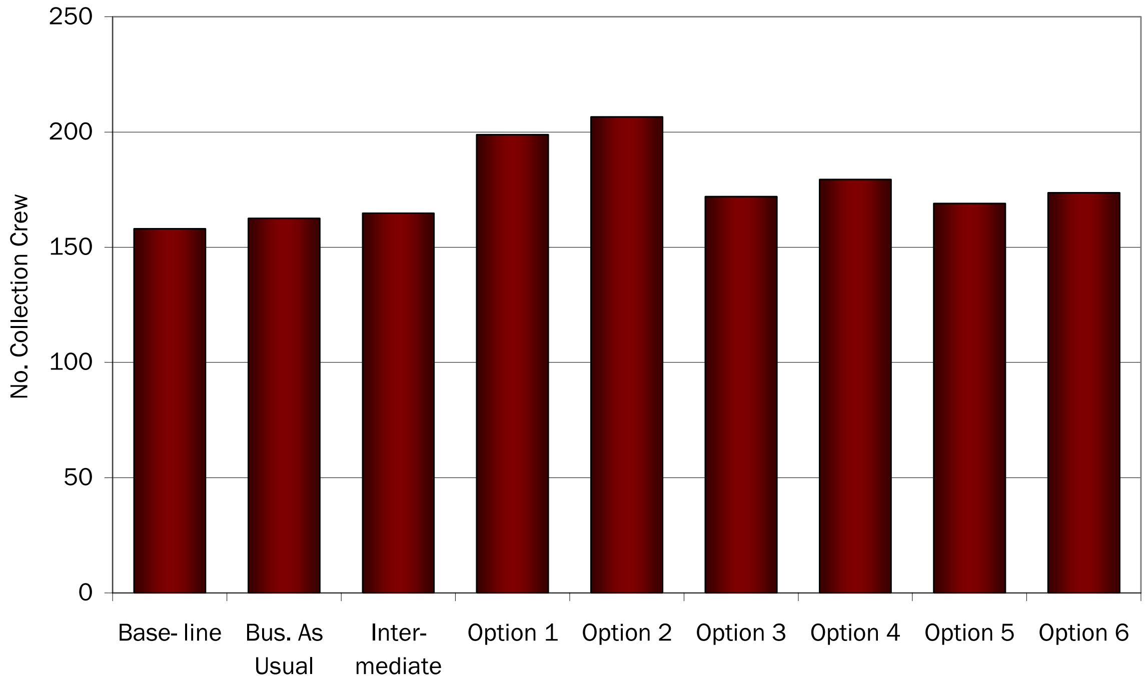
This criterion was not deemed relevant for this tier of the hierarchy. Health impacts have been assessed in Env4.

7.5.5 Soc13: Employment

Employment directly relating to collection can be measured through the amount of employees required to run the vehicles; including drivers and crew. Although this is not a full measurement of employment opportunities, as many more will arise through increased recycling in terms of depots, transfer stations, reprocessing etc., it is the only quantifiable number which can be taken from the model.

Figure 7-7 illustrates the number of employees required for collections rounds with each option. Options 1 and 2 require a relatively greater number of employees; this is due to the collection of food waste on separate vehicles. These Options were therefore assessed as having a strong positive impact. The other scenarios were also given a positive scoring as they all result in some amount of generation of jobs.

Figure 7-7: Crew Required for Each Option



7.6 Technical Objectives

7.6.1 Tec14: De-commissioning Problems

This criterion is not deemed relevant to waste collection.

7.6.2 Tec15: Future-proof

This criterion is not deemed relevant to waste collection.

7.6.3 Tec16: Latest Proven Technology

This criterion covers the reliability of each Option and asks if it is likely to be successful and whether it has been tried and tested elsewhere. This cannot be quantified, and so is discussed qualitatively.

The success of a recycling collection service depends on how well that service is designed and implemented. We assume that this is done well and so each Option will score positively. No Option includes materials which are not collected elsewhere in the country and the modelling is based on the specifications of existing vehicles.

7.7 Economic Objectives

7.7.1 Econ17: Cost

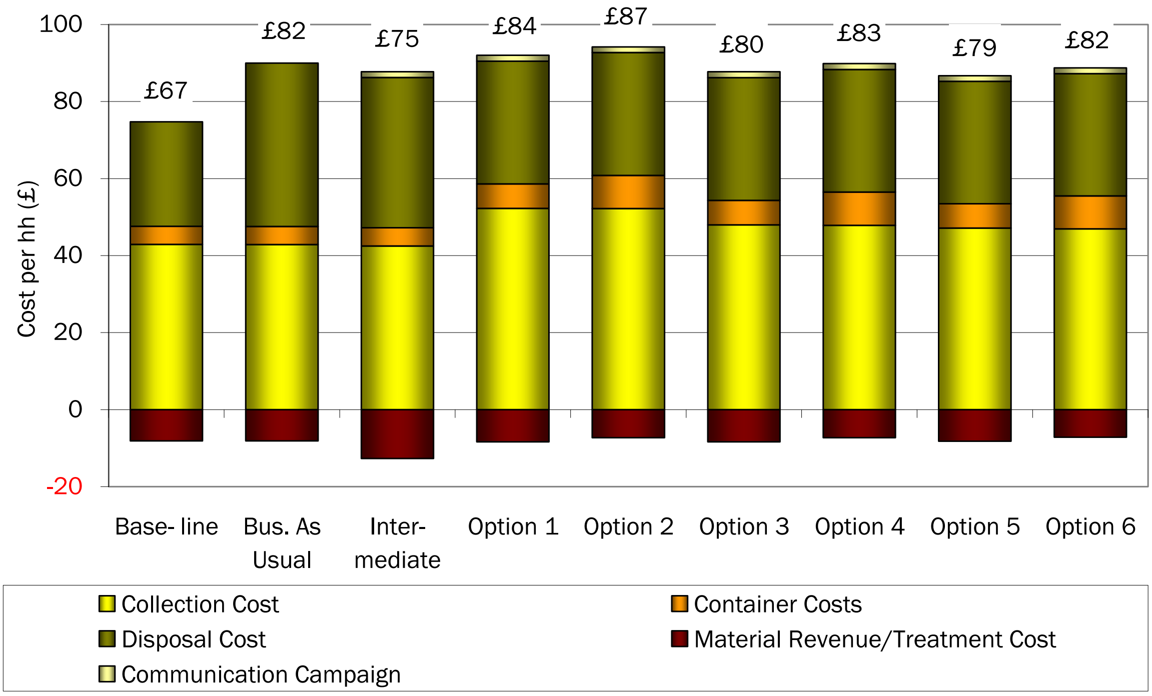
This economic criterion was assessed in terms of the total cost per household, including collection and disposal. An additional £1.50 per household was assumed to be spent on a communications campaign in order to increase the participation and capture rates. This campaign is additional to those discussed in the Prevention

Section, where some initiatives assessed will also have a positive influence on kerbside recycling. The £1.50 per household would result in an extra £197,250 per year to be spent on communications campaigns.

Hermes gives a net annual cost, as detailed in Appendix A.6.0.

This is given in cost per household in Figure 7-8 .

Figure 7-8: Cost per Household for Each Option



The modelling shows that the costs vary relatively widely with each option. The increase in collection costs in Options 1 and 2 are attributed to the additional vehicles required for the food waste collection. There are slight increases in container costs in Options 2, 4 and 6 due to the additional wheelie bins required for the monthly collection of paper and card. There is an increase in revenue in the Intermediate baseline due to the increase in recycling without the additional cost of food waste treatment.

A further analysis was carried out to examine the LATS implications of each Option; the total cost of the services under each Option from 2010/11 to 2025/26 was calculated. Income gained through LATS trading was assumed for each tonne of biowaste diverted from landfill (the EA guidance for calculating LATS was utilised).[23]

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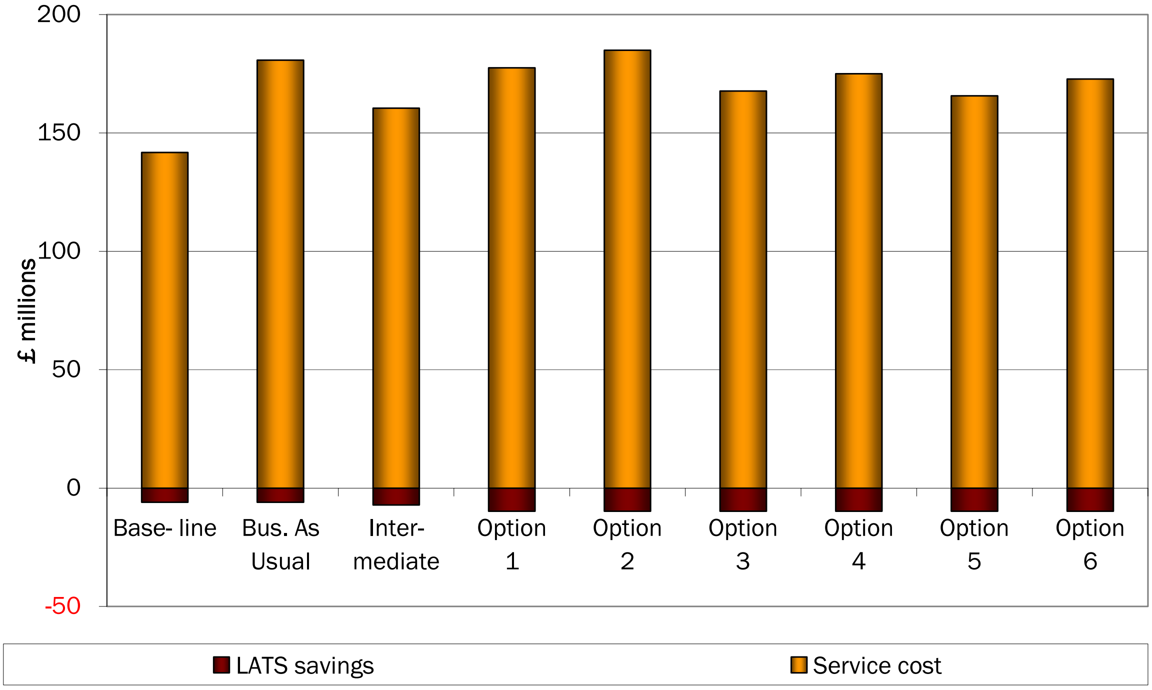
[23] Defra (2006) *Guidance on the Landfill Allowance Schemes: Municipal Waste*, Accessed 1st October 2008, http://www.defra.gov.uk/ENVIRONMENT/WASTE/localauth/lats/pdf/lats-municipalwasteguidance.pdf

A model was set up to predict LATS prices over this period. This is covered fully in the Appendices (A.8.0). A net cost of delivering the collection service could then be calculated for each Option. This is shown in Figure 7-9.

Figure 7-9: Total Cost of Services from 2010/11 to 2025/26 including LATS



7.8 Community Panel Weightings and Overall Scores

The Community Panel were asked to assign a weighting to each of the assessment objectives outlined in Table 3-1, in order to indicate the relative importance of each objective. The process of assigning the weightings and the results of this exercise are outlined within the accompanying Community Panel Report.

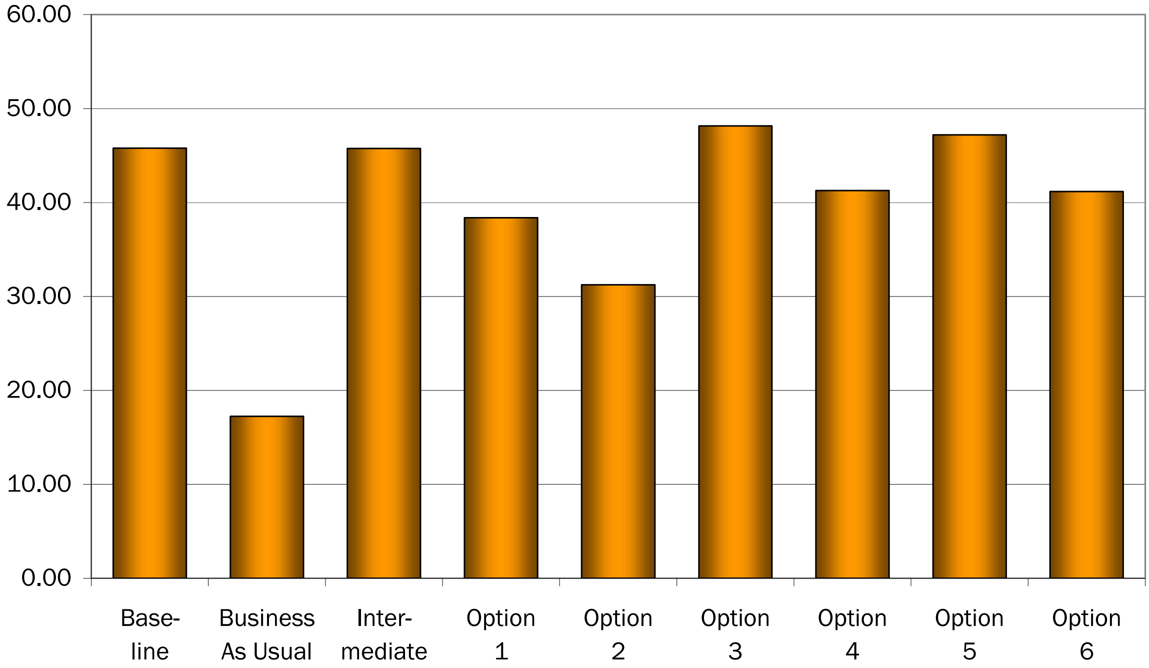
These weightings were used to calculate an overall score for each collection Option, taking into account their performance against each of the individual assessment criterion. This was done by attributing a score for each Option against the individual assessment objectives, using the Weighted Spectrum method. The Spectrum Score - a measure of the relative performance of each option – was calculated using the following formula.[24]

$$\text{Spectrum Score} = \frac{\text{Actual value} - \text{Minimum value}}{\text{Range of values}}$$

[24] For each assessment objective, the Spectrum is the range of values from the best performing option to the worst. The Spectrum Score denotes the point on the Spectrum where each of the options lies, with the best performing option receiving a Spectrum Score of 1 and the worst performer (who provides the minimum value in the formula above) a Score of 0.

The Spectrum Scores were multiplied by the relevant weighting provided by the Community Panel and then summed to give the overall score for each Option. The overall scores for each Option are shown in Figure 7-10.

Figure 7-10: Total Scoring Weighted by Community Panel Criteria



The Baseline Option scored well due to the heavy weighting on cost, although this is not carried through to 2010/11 in the Business As Usual scenario which scores very badly. This is due to higher waste arisings and no increase in recycling as well as the higher costs of disposal mainly associated with the increase in Landfill Tax. The Intermediate scores well, again due to the weighting on cost. This Option does not include any additional services (e.g. a food waste collection), although some additional vehicles are required to deal with the increase in recycling.

Options 3 and 5 score well overall, again due to cost. Both Options incorporate a food waste collection into existing vehicles (Option 3 as a food pod on the residual waste vehicle and Option 5 as a pod on the recycling vehicle). They also do not include a separate monthly collection of paper and card as seen in Options 2, 4 and 6.

Due to the fact that each Option scored fairly similarly in the criteria which was deemed most important by the community panel (i.e. maximum recycling as well as associated minimum landfill, global emissions, energy balance and impact on biodiversity), the results have been very dependant on the additional weighting of cost.

8.0 Assessment of Residual Waste Treatment Options

8.1 Introduction

In common with the methodology used to assess waste prevention initiatives and collection options, residual waste treatment technologies are appraised against the SEA criteria defined within the Scoping Report. The appraisal includes a scoring exercise making use of weighting factors derived from a consultation process involving a panel of residents from Doncaster (the Community Panel). This section provides an overview of the approach used to assess the performance of the various residual options under consideration.

Sustainability Objectives were discussed in Section 3.0, which states the Proposed SEA criteria, set out in Section 3.2.

Technology options included within the assessment were previously outlined in Section 4.2.4. Technologies included within the assessment are:

- Landfill;
- Incineration;
- Autoclave;
- MBT Aerobic Stabilisation;
- MBT AD;
- MBT Biodrying; and
- Gasification.

A more detailed description of each of these technologies is given in Appendix 6.0.

An assessment matrix summarising the performance of each technology option against the SEA criteria is shown in Section 8.3. The performance of each of the treatment options is outlined in Sections 8.4 to 8.7, against the Environmental, Social, Technical and Economic Objectives deemed relevant to the assessment of the residual treatment options by the Community Panel. An overall score for each technology taking into account the preferences indicated by the Community Panel is provided in Section 8.8.

8.2 Notes on Modelling and Assessment

Appendix 6 also outlines the most important assumptions used to model the performance of the residual waste treatment options considered within this appraisal. This includes a description of assumptions that are common to all the technologies being assessed (such as the composition of residual waste being treated), as well as specific assumptions used to model the performance of each type of technology.

8.3 Summary Appraisal Matrix

A summary of the technology options and their scoring against each criterion is given in Table 8-1. Comparisons are made against a baseline technology of landfill which remains the predominant method for treating residual waste within the UK. As such the performance of landfill itself is not assessed within the matrix.

The basis for these assessment decisions is provided in Sections 8.4 to 8.7 where the performance of the different technology options against the assessment criteria is discussed in more detail.

Results from the matrix can be summarised as follows:

- With respect to the Environmental Objectives most of the residual waste treatment technologies appraised:
    - Perform better than the baseline against Env2 (Maximum 'good' by products), Env3 (Global Emissions), Env5 (Energy balance), Env6 (Impact on global resources, wildlife, flora and fauna) and Env8 (Soil);
    - Perform worse than the baseline against Env4 (Reduce Local Emissions) and Env7 (Water).
- Most technologies do not result in an improvement against the baseline with respect to any of the Technical Objectives;
- Impacts associated with the Social and Economic Objectives are difficult to quantify and have therefore been scored as uncertain within the matrix.

Overall, the performance of each the residual treatment technologies is expected to be better than that of the baseline treatment method of landfill.

Table 8-1: Summary Assessment Matrix – Residual Treatment Options

		Environmental (Env)								Social (Soc)					Technical (Tec)			£ (Econ)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		Minimum Landfill	Max By-Products	Global Emissions	Local Emissions	Energy	Global Resources	Water	Soil	Education	Convenience	Nuisance	Safety	Local Employment	De-commission Problems	Future Proof	Proven Technology	Cost
Landfill	Effect	This is the baseline, against which the performance of the other residual treatment options is compared																
	Timescale																	
Incineration	Effect									N/A	N/A	N/A		N/A				
	Timescale	L	L	L	L	L	L	L	L				L		L	S	S	L
Autoclave Incineration	Effect									N/A	N/A	N/A		N/A				
	Timescale	L	L	L	L	L	L	L	L				L		L	S	S	L
Autoclave Power Station	Effect									N/A	N/A	N/A		N/A				
	Timescale	L	L	L	L	L	L	L	L				L		L	S	S	L
MBT Aerobic	Effect									N/A	N/A	N/A		N/A				
	Timescale	L	L	L	L	L	L	L	L				L		L	S	S	L
MBT AD	Effect									N/A	N/A	N/A		N/A				
	Timescale	L	L	L	L	L	L	L	L				L		L	S	S	L
MBT Bio Incineration	Effect									N/A	N/A	N/A		N/A				
	Timescale	L	L	L	L	L	L	L	L				L		L	S	S	L
MBT Bio Power Station	Effect									N/A	N/A	N/A		N/A				
	Timescale	L	L	L	L	L	L	L	L				L		L	S	S	L
Gasification	Effect									N/A	N/A	N/A		N/A				
	Timescale	L	L	L	L	L	L	L	L				L		L	S	S	L

Key	
Strong Negative	(red)
Minor Negative	(orange)
Negligible/No Impact	
Minor Positive	(light green)
Major Positive	(dark green)
Uncertain	(light blue)
Within Plan Period	S
Outside of Plan Period	L

8.4 Environmental Objectives

This section assesses the performance of the residual treatment technologies against each of the Environmental Objectives described in Section 3.2. Justification for the scores given in the summary assessment matrix (Table 8-1) is also provided.

8.4.1 Env1: Minimum By-products to Landfill

The impact of both hazardous and non hazardous wastes to landfill is considered within our analysis, discussed in Sections 8.4.1.1 and 8.4.1.2 respectively.

In the summary assessment matrix for residual waste technologies:

- A minor positive score was given to a reduction in non-hazardous material sent to landfill where there was also some increase in hazardous material sent to landfill;
- A major positive score was given to a reduction in non-hazardous material sent to landfill where no hazardous material was landfilled.

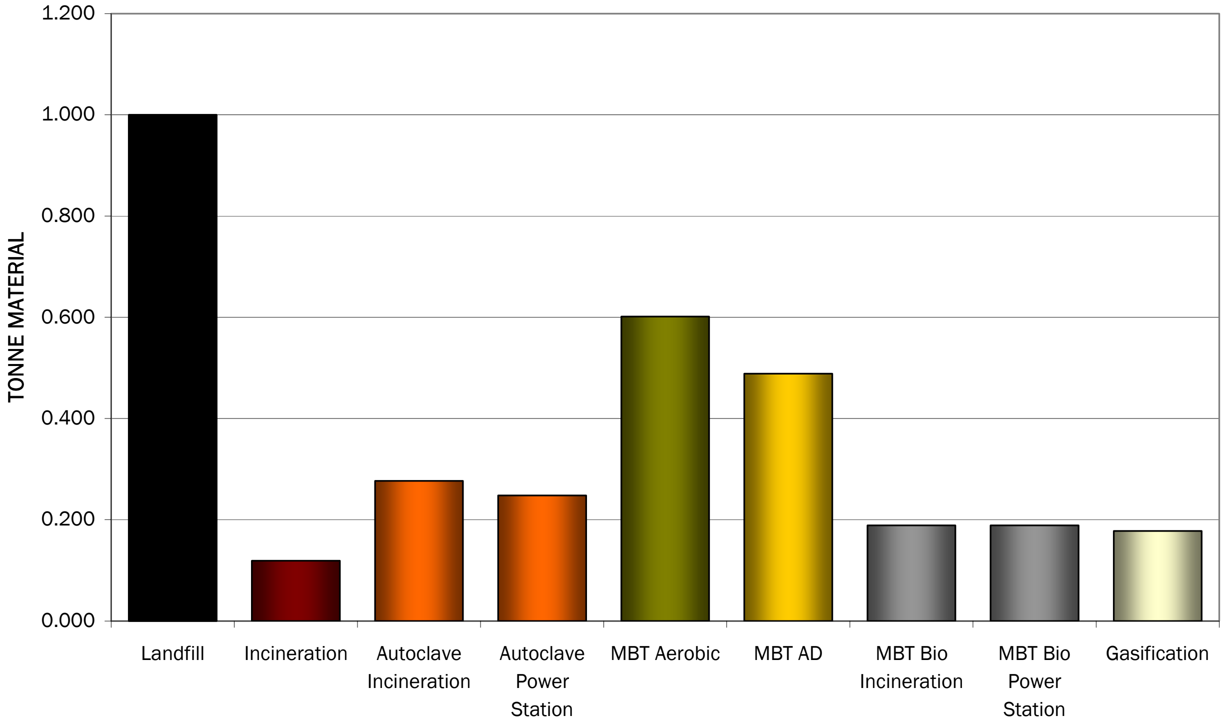
8.4.1.1 Non-hazardous Material Sent to Landfill

Figure 8-1 confirms the amount of non-hazardous material sent to landfill for each of the technology options being assessed, and shows that all treatment options send some material to landfill.

It is assumed that 50% of the bottom ash produced at the incinerator is sent to landfill, with the remainder being recycled. The incineration option therefore performs the best against this assessment objective. Biodrying and Autoclave processes produce a reject stream which is sent to landfill after undergoing a stabilisation procedure. The thermal element to these systems results in their improved performance in comparison to the MBT Aerobic and AD processes, where more stabilised material is sent to landfill.

At present, incinerator bottom ash is considered to be inert material with regards to landfill tax payment. However, evidence supplied to the Environment Agency suggests that a number of recent bottom ash samples from UK incinerators contained levels of contamination sufficient to result in those samples being considered as hazardous waste. If the status of bottom ash changes in the future as a result of this evidence, it will not be possible to recycle this material and all of it will need to be landfilled as hazardous material. This will result in a decrease in performance of all technologies that use incineration as part of their management process.

Figure 8-1: Non-hazardous Material Sent to Landfill

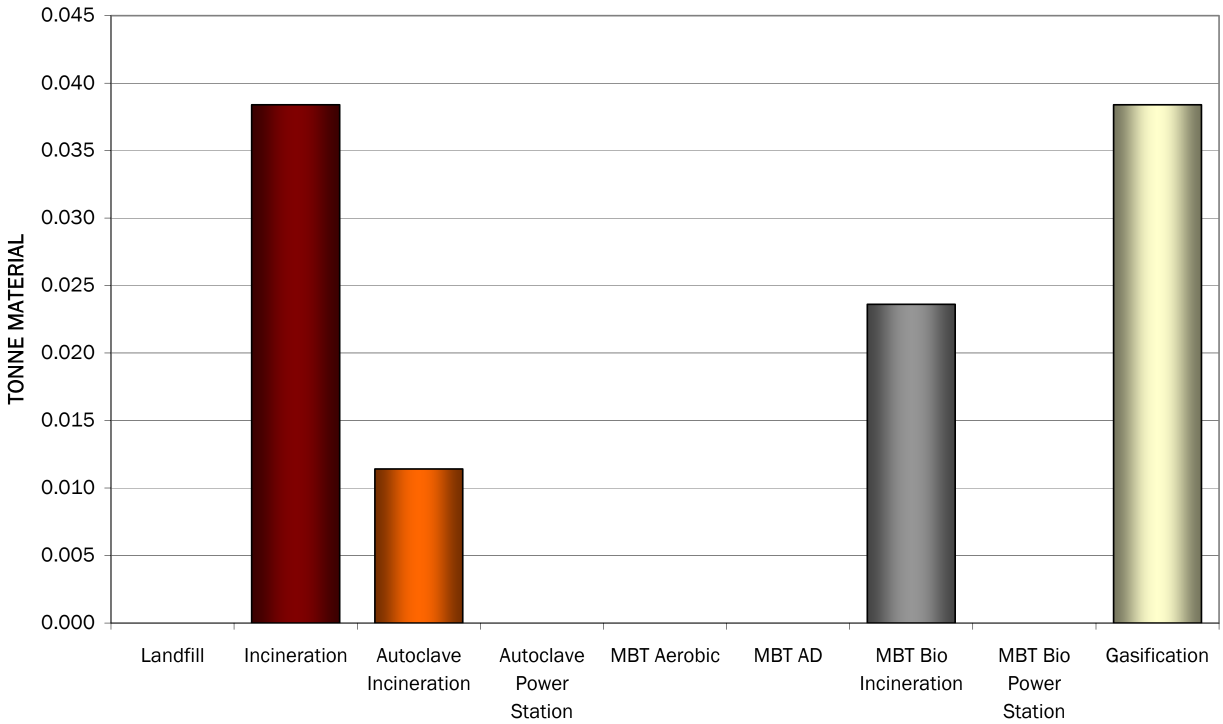


8.4.1.2 Hazardous Material Sent to Landfill

Figure 8-2 shows the amount of hazardous material sent to landfill from each of the residual treatment options. Hazardous material is produced from incineration and gasification treatment facilities as a result of abatement techniques used to reduce the impacts associated with air pollution. This material is known as fly ash. Fly ash is also produced from the co-firing of refuse derived fuel (from autoclave and MBT facilities) at power stations but is not considered to be hazardous material.

It can be seen that incineration facilities already perform the worst against this assessment objective, even without consideration of the potentially hazardous nature of some bottom ash samples.

Figure 8-2: Hazardous Material Sent to Landfill



8.4.2 Env2: Maximum 'Good' By-products

The Community Panel indicated that the assessment of 'Good' by-products should include the amount of material that could be composted or recycled by each of the residual treatment technologies.

The degree to which residual waste technologies can produce 'compost' depends on how one defines compost (and compost is not clearly defined through existing law and regulations in the UK). Some processes do produce materials which have the potential to be used as a soil improver. This material is typically – because it is generated from mixed residual waste – not of the highest quality, and it tends to find application either as landfill cover, or in the process of remediating already contaminated land. Some companies are already using this material to do the latter, whilst taking advantage of the organic matter to grow biomass crops (short-rotation coppice) for use in biomass power plants. Consequently, although these materials may not be suitable for horticultural use, or for use on land used to cultivate food crops, they do have some value.

There are rules and regulations governing the ability of technology suppliers to make use of this material on land precisely because of its more contaminated (than compost from source segregated biowaste) nature. Thus, the degree to which outlets for this material can be guaranteed over the long term is not especially secure. It is therefore assumed within the current analysis that all material produced by Aerobic Stabilisation and AD processes is sent to landfill once it has been stabilised, rather than being used within remediation projects. As such, our results may understate the potential performance of these systems. The performance of the residual waste management technologies against this objective is therefore limited to the amount of material that can be recycled from the plant.

In the assessment matrix:

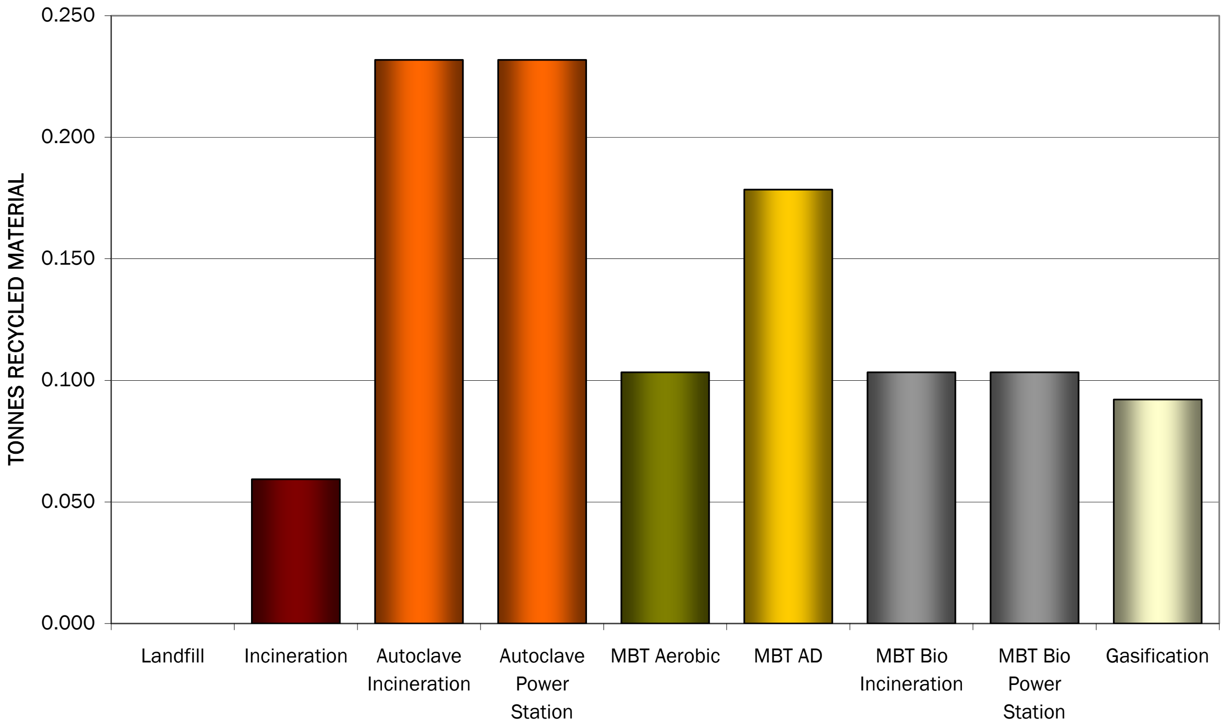
- A minor positive score was given to those that recycled up to 10% of the total input to the facility; and

- A major positive score was given to those that recycled more than 10%.

The impacts associated with recycling are calculated using the approach taken for calculation of the Local Authority Best Value Performance Indicator (BVPI) for recycling, which excludes the contribution of recycled bottom ash from incineration facilities.

Figure 8-3 shows the amount of material recycled by each of the residual waste treatment facilities being appraised. With the exception of landfill, each of the technologies being appraised extract metals for recycling. MBT processes also extract plastics (both dense plastic and plastic film in the case of the Autoclave) to varying extents and sometimes glass. Similar materials recovery techniques are used at the Autoclave and MBT facilities although they may be used at different stages within the process. It should be noted that the recovery rates for the Aerobic Stabilisation and Biodrying facilities are based on actual measured performance from operating facilities, whereas those indicated for the AD and Autoclave plant are based on anticipated performance. The data supplied for these facilities therefore reflects theoretically possible performance, rather than actual performance.

Figure 8-3: Tonnes Recycled



Doncaster has a set 10% recycling target which is required to be achieved by any new residual waste facility. The above results suggest that it should be possible to achieve this target using either Autoclave or MBT technologies.

8.4.3 Env3: Global Emissions

There are two types of emission whose impact is global in nature:

- Those that contribute to climate change – the greenhouse gases carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), discussed in Section 8.4.3.1;
- Those which contribute to the depletion of the ozone layer, discussed in Section 8.4.3.2.

Since data analysing the impact of residual waste treatments upon the latter is very limited, the summary assessment matrix considers only those impacts associated with greenhouse gas emissions. All technologies were given a major positive score with respect to their climate change impacts in relation to a baseline of landfill, as all achieved more than a 50% reduction in the impact relative to this technology.

8.4.3.1 Global Warming Potential

Climate change impacts are assessed by considering the following process elements:

1. Emissions from the process itself ('direct' impacts);
2. Emissions from energy inputs to the process, (e.g. electricity use);
3. Emissions offset as a result of the process generating energy (assumed to displace an equivalent amount of energy generated by other methods);
4. Emissions offset through the recycling of materials (through the embodied energy contained within those materials).

The global warming potential is expressed in terms of CO_2 equivalent emissions, whereby:

- CH_4 is considered to have 21 times the impact of CO_2 in terms of its global warming potential;
- N_2O is considered to have 310 times the impact of CO_2.

Our analysis includes the CO_2 from 'biogenic' or non-fossil sources which are sometimes ignored in analyses of this nature, as we believe this provides a more accurate indication of the total global warming potential of each technology.[25]

Figure 8-4 shows the greenhouse gas emissions for each of the residual waste technologies considered within this assessment. The technologies that fare best against this criterion are those that recover materials for recycling in addition to generating energy. Of those facilities with a thermal element, the best performance is seen where the fuel is sent to a power station as the efficiency of energy generation is improved. Incinerators are relatively inefficient at generating energy in comparison to combined cycle gas turbine facilities.[26] Thus although the combustion of waste within an incinerator allows for some emissions to be offset through the energy generated, the size of this energy-related offset is relatively small in comparison to the power station options where more energy is generated. In addition, the waste derived fuel used in a power station is assumed to displace an equivalent amount of coal, which has a relatively high carbon content per MJ of energy.

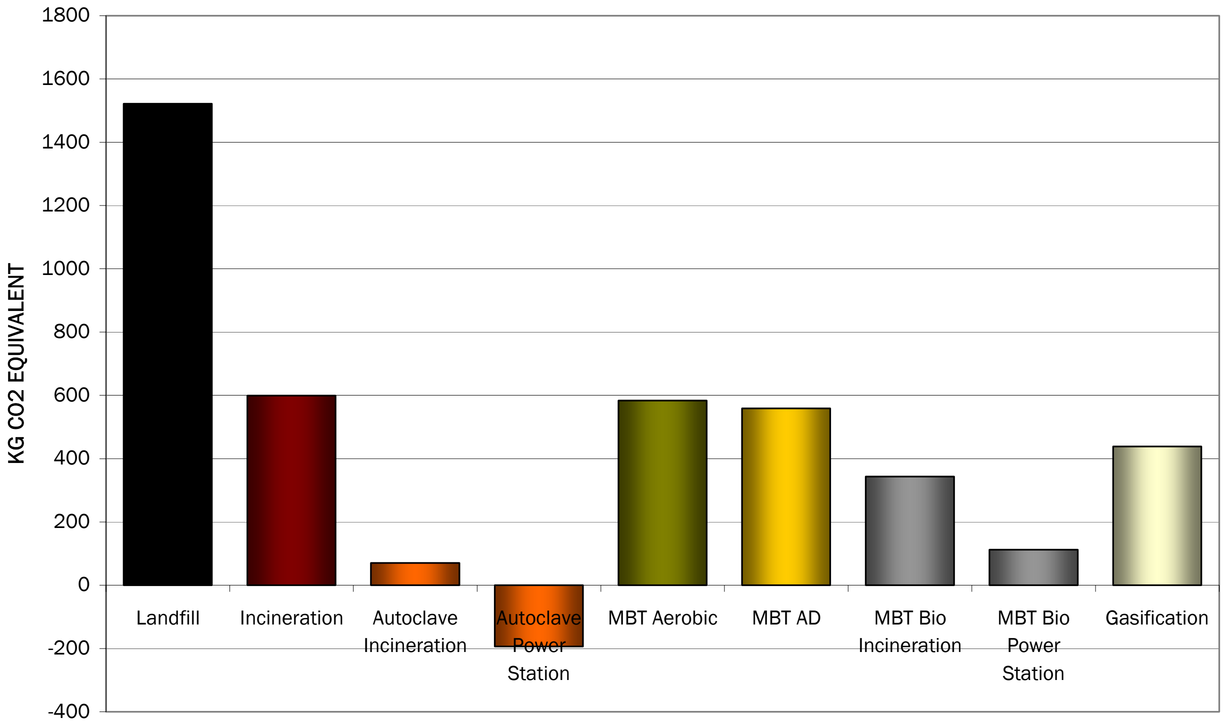
[25] Paper, textiles, food and garden waste contain non-fossil or biodegradable carbon in variable proportions, and some of this carbon is emitted in the form of CO_2 as a result of waste management processes. The IPCC accounting methodology indicates these emissions can be ignored when compiling greenhouse gas inventories, as the same amount of carbon is assumed to have been removed from the Forestry and Land Use part of the inventory – under the proviso that the source of the emission is biomass that has been sustainably managed. Considering the heterogeneous mix of biological material contributing to the biomass portion of waste, the task of determining what is or is not sustainably produced would be extremely difficult. We therefore feel it appropriate to include biogenic CO_2 emissions within our analysis.

[26] Combined Cycle Gas Turbine facilities are assumed to be the avoided source of electricity generation for all waste management facilities that generate electricity. This assumption is discussed in more detail within Appendix 6.

The Autoclave Power Station option therefore achieves the best performance against this assessment objective. Here the amount of greenhouse gas emissions avoided through recycling materials and energy generation is sufficient to offset all of the direct emissions that occur during the process.

The MBT Aerobic and AD stabilisation technologies perform relatively less well than those MBT treatments that incorporate a thermal element. At present, relatively little bio-stabilised waste is being sent to landfill and it is therefore treated within the landfill in the same way as waste that has not been bio-stabilised. If, however, the management of UK landfill changes to more closely reflect the approach taken in Germany (where bio-stabilised wastes are treated separately), performance of these technologies against this assessment objective would be expected to improve. This is discussed in more detail in Appendix 6.

Figure 8-4: Global Warming Potential

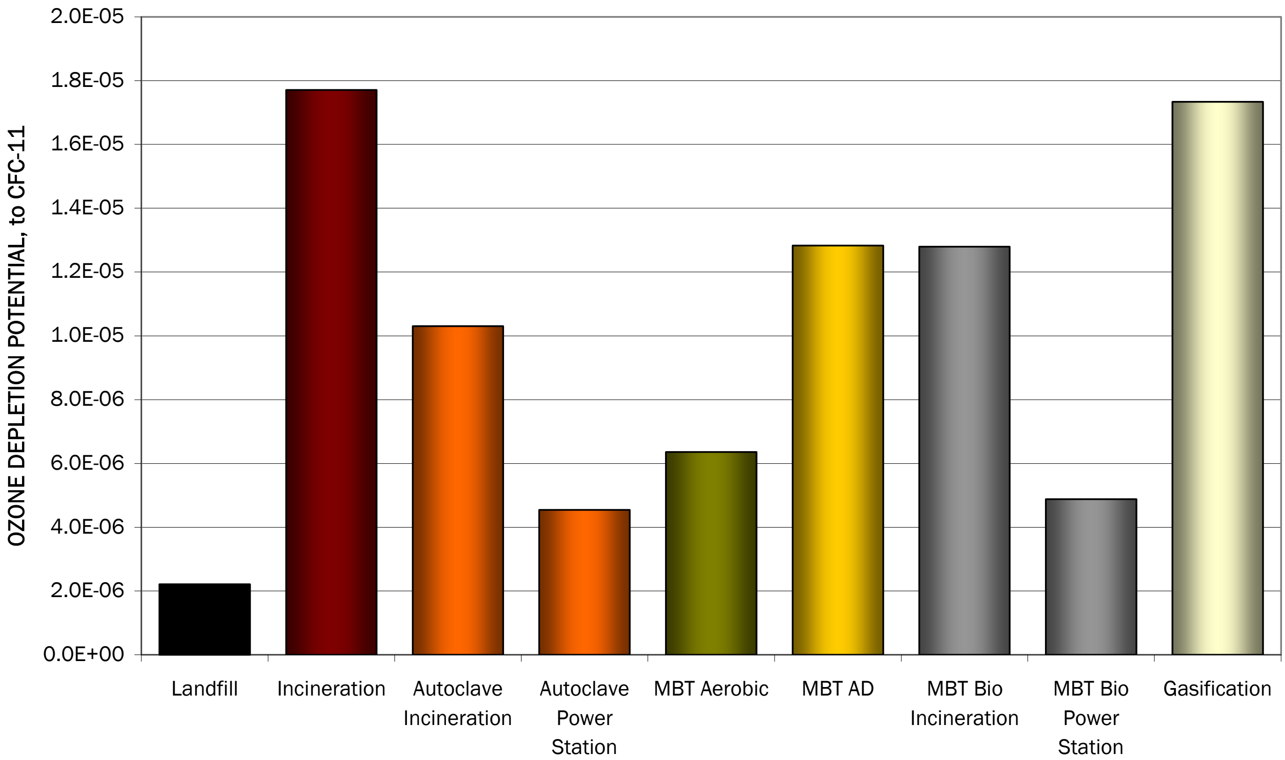


8.4.3.2 Ozone Depletion Potential

Relatively little data exists with respect to CFC emissions from waste management facilities. The data that is available is largely historical, and likely to be heavily related to the type of material entering the facility. As was confirmed in Section 7.4.3 man-made ozone depleting substances are being phased out as a consequence of the Montreal Protocol and this is expected to reduce the amounts of these chemicals within the waste stream. As a result of the uncertainty associated with these datasets, appraisal of each technology against the global emissions criterion is carried out on the basis of the global warming potential, where far more relevant and recent data exists.

Figure 8-5 shows the ozone depletion potential for each of the appraised technology options. Landfill performs best against this assessment criterion, whilst facilities that thermally treat the largest amount of waste do worst.

Figure 8-5: Ozone Depletion Potential



8.4.4 Env4: Local Emissions

Waste treatment facilities potentially present risks of pollution to the air, water and land. In appraising the performance of residual technologies against objective Env4, the Community Panel indicated that consideration should be given to:

- Air pollution emissions including acidifying emissions; and
- Emissions to water.

The potential impact of facilities upon soil (or land) quality is considered under Env8, discussed in Section 8.4.8.2.

As was previously outlined in Section 3.2, the appraisal requires the following to be considered with regard to residual waste treatment technologies:

- The emissions to air and water with a localised impact;
- The impact on health of these emissions;
- The impacts on property (including historic buildings).

Responses from statutory consultees in relation to the Scoping Report indicated that impacts on local ecosystems should also be taken into account.

Studies of the environmental impacts of waste treatment facilities consistently show the most important local emissions from the perspective of potential health damage to residents are emissions to air. These impacts are considered within the current analysis through an examination of the externalities (or damage costs) associated with the quantity of air pollution produced by each of the technologies. This is discussed in Section 8.4.4.1.

The acidification indicator is taken as a proxy for examining the impacts to ecosystems and property caused by acidic pollutants. Results of the appraisal against this indicator are discussed in Section 8.4.4.2. Since the acidic gases are responsible for a significant proportion of the human health impacts there is a correlation between the performance of the residual technologies against the acidification indicator and their performance with respect to externalities. Comparisons of results obtained using the externalities approach and the acidification indicator are carried out in Section 8.4.4.2.

Well-run residual treatment facilities are unlikely to pose a substantial threat to water quality in the short term, although the longer term impacts associated with landfilling hazardous material are uncertain. These impacts are discussed in more detail in Section 8.4.4.3.

Given the importance of acidic air pollution in determining the human health impacts and the uncertainties associated with assessing the long-term impacts of water pollution, performance against this objective is assessed on the basis of the externalities only. Within the assessment matrix,

- A minor negative score was awarded to those having air emissions externalities of between £0.50 - £1.49;
- A major negative score was awarded to those having air emissions externalities of more than £1.50.

8.4.4.1 Health Impacts

Those emissions to air with local effects include, most notably:

1. Particulate matter, particularly particles below 2.5 microns in diameter;
2. Oxides of nitrogen;
3. Oxides of sulphur;
4. Dioxins;
5. Volatile organic compounds; and
6. Those metallic elements with potential to cause harm.

These emissions are being controlled to an increasing extent through improved abatement techniques.[27] However, this does not imply that they have no effect, and scientific disagreement continues as to the nature of the dose-response functions which drive the associated health effects, and hence, the extent of impacts.[28] An extreme example is the case of dioxins, where scientists in the EU have tended towards a view that there is a threshold concentration for exposure below which no observable effects occur, whilst scientists in the US argue that there is no level of exposure which can be regarded as being without impact.

It is assumed that the thermal technologies appraised within this assessment meet the requirements of the Waste Incineration Directive. Improvements in performance against this objective would be seen if facilities exceed the requirements of the directive, as is the case with many of those operating elsewhere in Europe. However, the reduction in air pollution results in reduced energy generation as well as increased investment costs. This is discussed in more detail in Appendix 6.

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[27] The ppollution abatement techniques employed by the residual waste technology options are discussed in more detail in Appendix 6.

[28] The dose response function relates to the quantity of a pollutant that affects a receptor (e.g. population) to the physical impact on this receptor (e.g. incremental number of hospitalisations). Although these functions exist for many pollutants, for many impacts they are very uncertain or unknown.

The impact of facilities on human health has been estimated through an estimate of the external costs of key air pollutants known to have a local or regional impact, using the same methodology as that used to model the local emissions impacts associated with collection options (described in Section 7.4.4). Impacts are estimated on a £ per tonne basis with a higher figure thus representing greater damages.

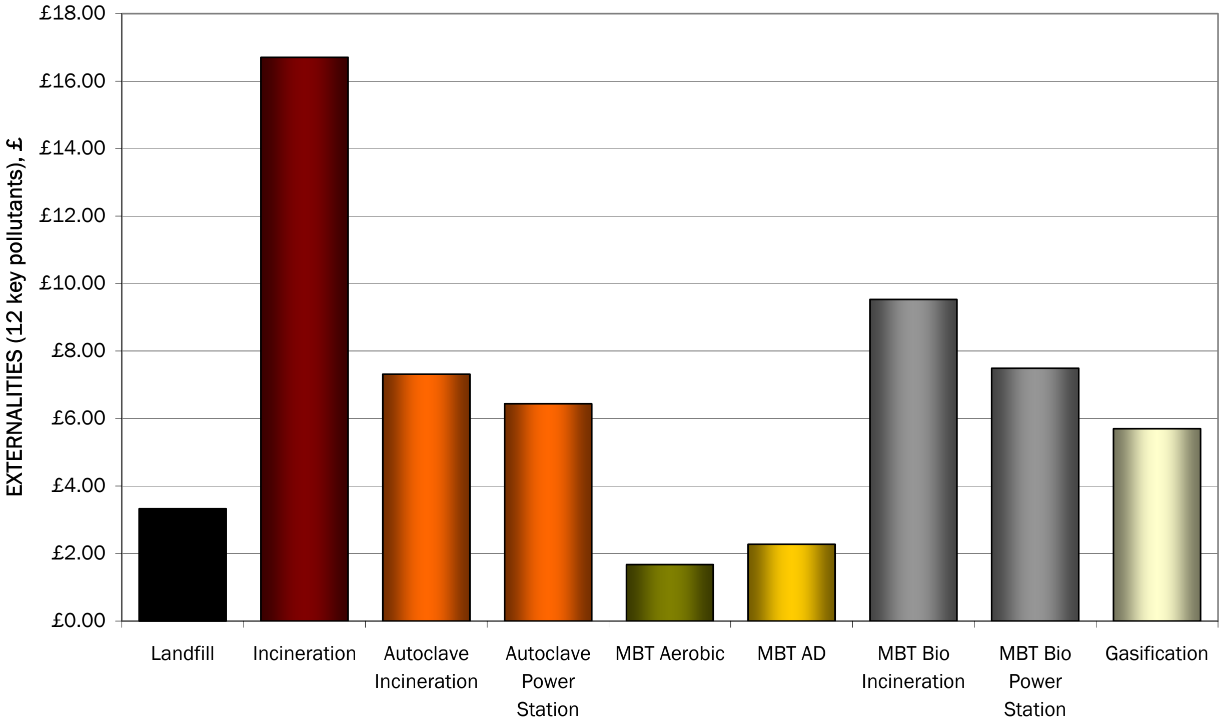
Different authors have valued the external costs associated with the health impacts in a variety of ways, and so considerable variation exists between the values used to assess these damages cited from different literature sources. The trend however has been for these values to increase over time, as the effects of the pollutants upon human health are better understood.

Since the emphasis here is on local emissions, impacts are considered without attributing any benefit to air emissions offset elsewhere through the generation of energy.

Figure 8-6 shows the externalities associated with the local air pollution impacts associated with each of the residual treatment technologies being appraised. The impacts are highest for facilities having a thermal component – particularly those using a combustion process (as opposed to gasification, which performs much better). Combustion facilities also tend to have higher energy expenditures, with the energy being expended to reduce the pollutant effects.[29] As landfill releases relatively few of the conventional air pollutants (for which dose response functions are known) it performs well against this assessment objective.

[29] The combustion of diesel used within the process is included within the calculation of externalities as this is a local emission.

Figure 8-6: Externalities Associated with Air Pollution Effects



8.4.4.2 Impacts on Ecosystems and Property Damage

When sulphur and nitrogen compounds settle out of the atmosphere, the resulting acidification of soils and surface waters can have serious consequences for both plant life and water fauna. The same acidifying pollutants - SO_2, ammonia and to a lesser extent NOx - erode architectural facades and lead to additional structural maintenance requirements. Our analysis therefore uses the acidification potential measured in terms of SO_2 equivalents as a proxy for examining the impact of waste facilities upon ecosystems and property.[30]

SO_2 and NOx are the two most important gases with respect to the health impacts associated with waste facilities as measured by the externalities. However the relative weighting attributed to the two gases differs between the two impact methodologies. In addition, the combustion of diesel is relatively highly weighted within the acidification methodology, so that those technologies that consume large quantities of diesel within their process perform worse in terms of their acidification potential.[31] Although the impact of diesel combustion is also included within the assessment of the health impacts, proportionately less significance is attributed to it.

Figure 8-7 shows the acidification potential for each of the appraised technologies. As was the case with the assessment of externalities, thermal technologies fare worst against this

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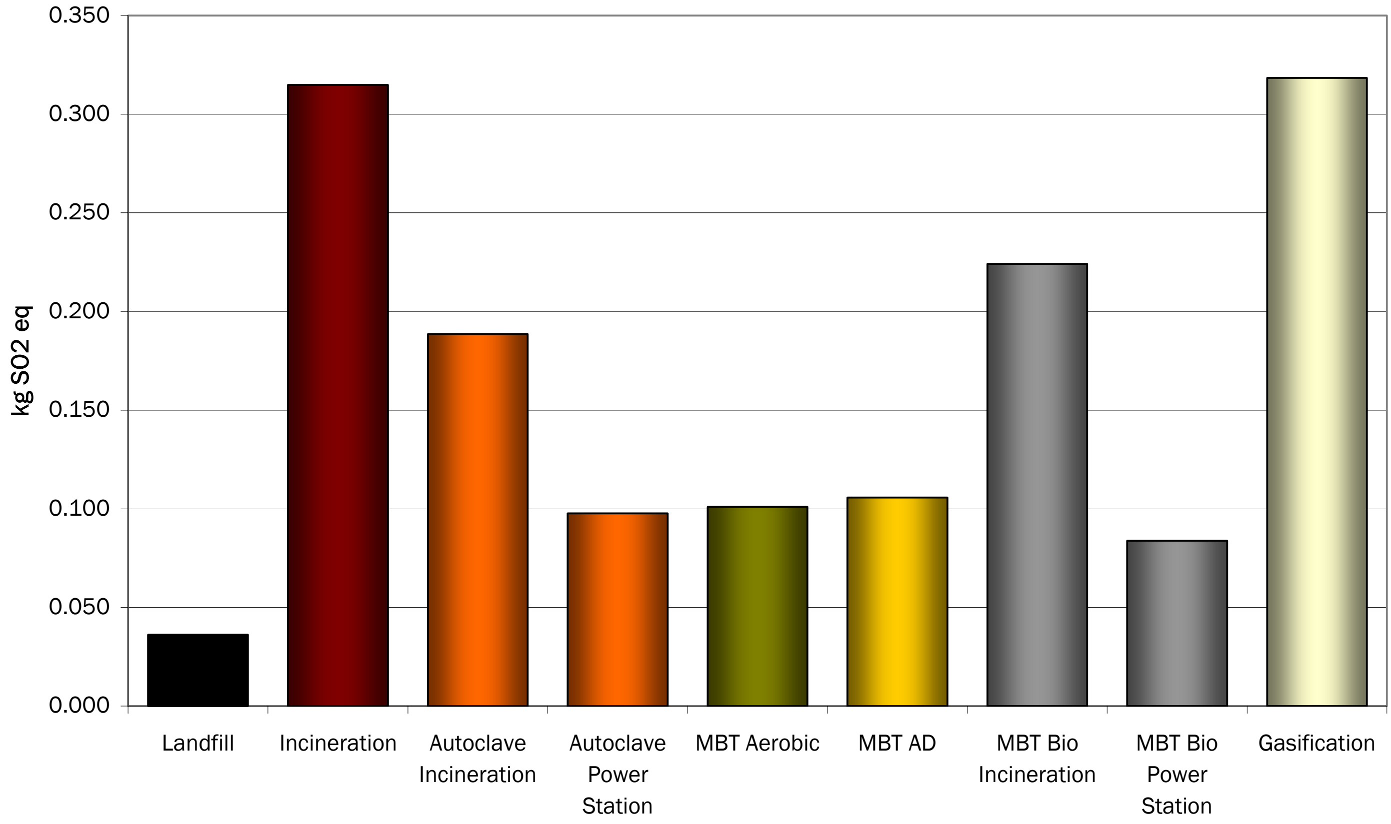
[30] Huijbregts (1999) *Priority assessment of toxic substances in the frame of LCA: Development and application of the multi-media fate, exposure and effect model USES-LCA*. Interfacultу Department of Environmental Science, Faculty of Environmental Sciences,University of Amsterdam, Amsterdam, 68 pp

[31] The gasification process uses more diesel than most of the other processes, and therefore performs relatively badly under the acidification indicator in comparison to its performance against the calculation of externalities.

assessment criteria. Landfill performs the best as it releases less of the conventional air pollutants upon which this assessment method is based.

Figure 8-7: Acidification Potential



The location of the facilities is important in attributing the potential impacts upon historical assets of acidifying pollutants. Facilities would need to be located in close proximity to buildings of particular historical significance for there to be a significant impact, which seems unlikely to occur.

8.4.4.3 Emissions to Water

Emissions to water are often discussed as being of potential significance, particularly where landfills are concerned, although most landfills are sited to explicitly avoid the risks of direct contamination.

At well-operated residual treatment facilities, emissions to water are unlikely to pose serious threats in the short-term. Landfills, on the other hand, may give rise to problems in the longer-term.

As was discussed in Section 8.4.1.2, incineration facilities produce hazardous material and this must be landfilled. Chlorine, sulphur, and heavy metals are likely to be concentrated in the air pollution control residues produced by incinerators. Ironically, the better flue gas cleaning systems perform, the more likely it becomes that toxic materials are concentrated in these residues.

Several recent studies indicate that long-term impacts of landfilling this hazardous material may be significant. In a Dutch study comparing the costs and benefits of landfill with those of incineration, the environmental damages associated with air pollution control residues were considered as the most important externality associated with treatment in an incineration facility.[32]

Another recent life-cycle study suggests:

> *'The evaluation of waste incineration technologies largely depends on the assessment of heavy metal emissions from landfills and the weighting of the corresponding impacts at different points in time. Unfortunately, common LCA methods hardly consider spatial and temporal aspects.'*[33]

Using a geochemical model to model some pollutants, the same study concluded:

> *'Landfills might release heavy metals over very long time periods ranging from a few thousand years in the case of Cd to more than 100,000 years in the case of Cu. The dissolved concentrations in the leachate exceed the quality goals set by the Swiss water protection law (GSchV) by a factor of at least 50.'*

These impacts are however only likely to be significant in the much longer term.

Several possible indicators of the potential to cause harm to water courses exist, and some attempt to measure the toxicity that might result from this type of pollution. However these indicators are not especially reliable as the weightings given to specific pollutants are based on limited evidence.

Given the lack of meaningful indicator with which to measure impacts, and the uncertainties associated with these impacts even in the longer term, impacts associated with water pollution are not included within the assessment matrix or the overall technology scores provided in Section 8.8.

8.4.5 Env5: Energy Balance

The energy balance considers not only the energy use of the facilities and that generated, but the embodied energy contained within materials recovered for recycling at each plant. The methodology used to appraise the residual technology options is similar to that used for the collection options, as was described in Section 7.4.5.

Large energy savings are potentially available by virtue of the materials recovered for recycling, although the potential savings vary between the different types of material being recycled. The amount of energy generated directly is relatively less important for many of the residual treatment options being appraised.[34] In particular, metals have a high-embodied energy value, and these are recovered by most of the residual treatment technologies although the efficiency of recovery varies between the different options.

All technologies were awarded a major positive score within the assessment matrix as each generates a very favourable energy balance in comparison to landfill.

Figure 8-8 shows the energy balance of each of the residual treatment options considered within the current appraisal. Although generating relatively little energy directly, Aerobic stabilisation processes perform relatively well in terms of their energy balance by virtue of

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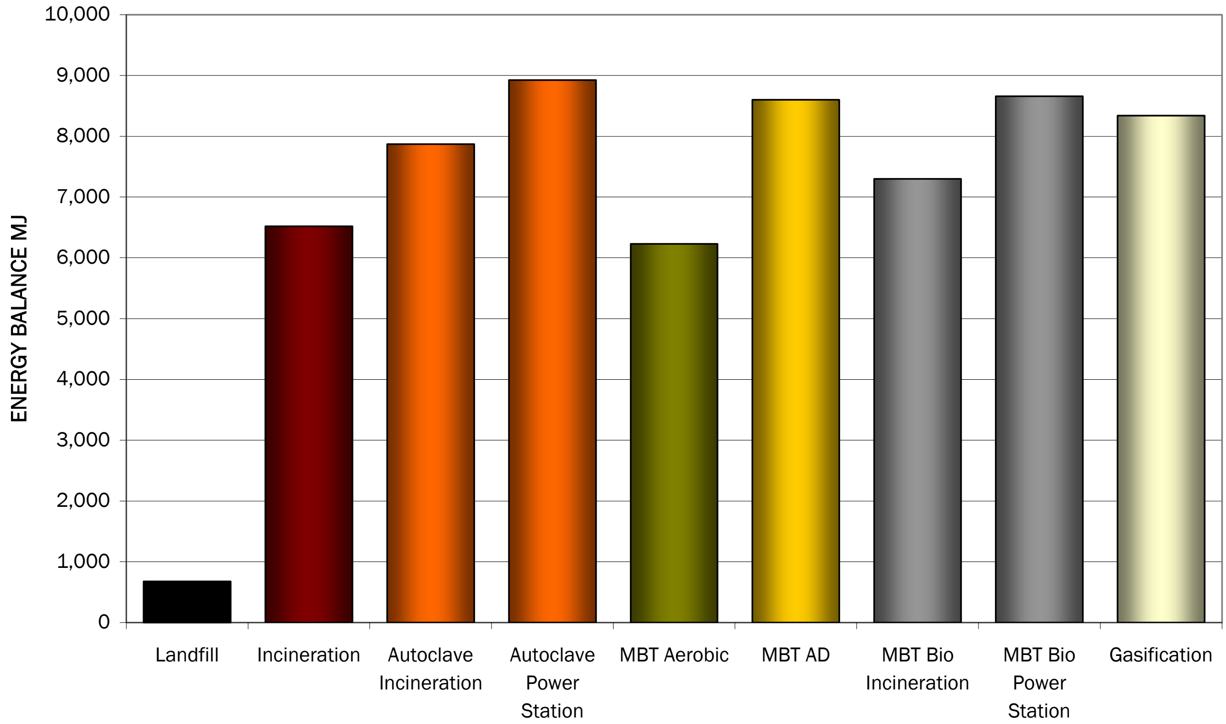
[32] E. Dijkgraaf and H. Vollebergh (2004) Burn or Bury? A Social Cost Comparison of Final Waste Disposal Methods, *Ecological Economics*, 50, pp.233-247

[33] S. Hellweg (2000) *Time- and Site-Dependent Life-Cycle Assessment of Thermal Waste Treatment Processes,* Dissertation submitted to the Swiss Federal Institute of Technology

[34] More information regarding the generation efficiencies used within our modelling is provided in Appendix 6

their materials recovery and their modest process energy requirements in comparison to thermal facilities (where energy must be used within the pollution control system). The AD facility performs well against this objective as the gas engine generates heat in addition to electricity; it also recovers a greater proportion of recyclables with higher embodied energy content in comparison to the Autoclave facility. The gasification facility performs better than the incinerator (despite having similar generation efficiencies) as it is assumed to recover metals for recycling during the initial treatment phase. Although incineration facilities also recover some metal from the bottom ash, the efficiency of removal is less than that achieved by the pre-sorting techniques employed at the gasifier.

Figure 8-8: Energy Balance



8.4.6 Env6: Impact on Global Resources

The Community Panel required consideration of the global impact on wildlife, flora and fauna. As was the case when appraising the collection options, we used as the Total Material Requirement as a proxy for measuring these impacts with respect to each of the residual technology options being appraised. The methodology associated with this type of measurement is outlined in Section 7.4.6.

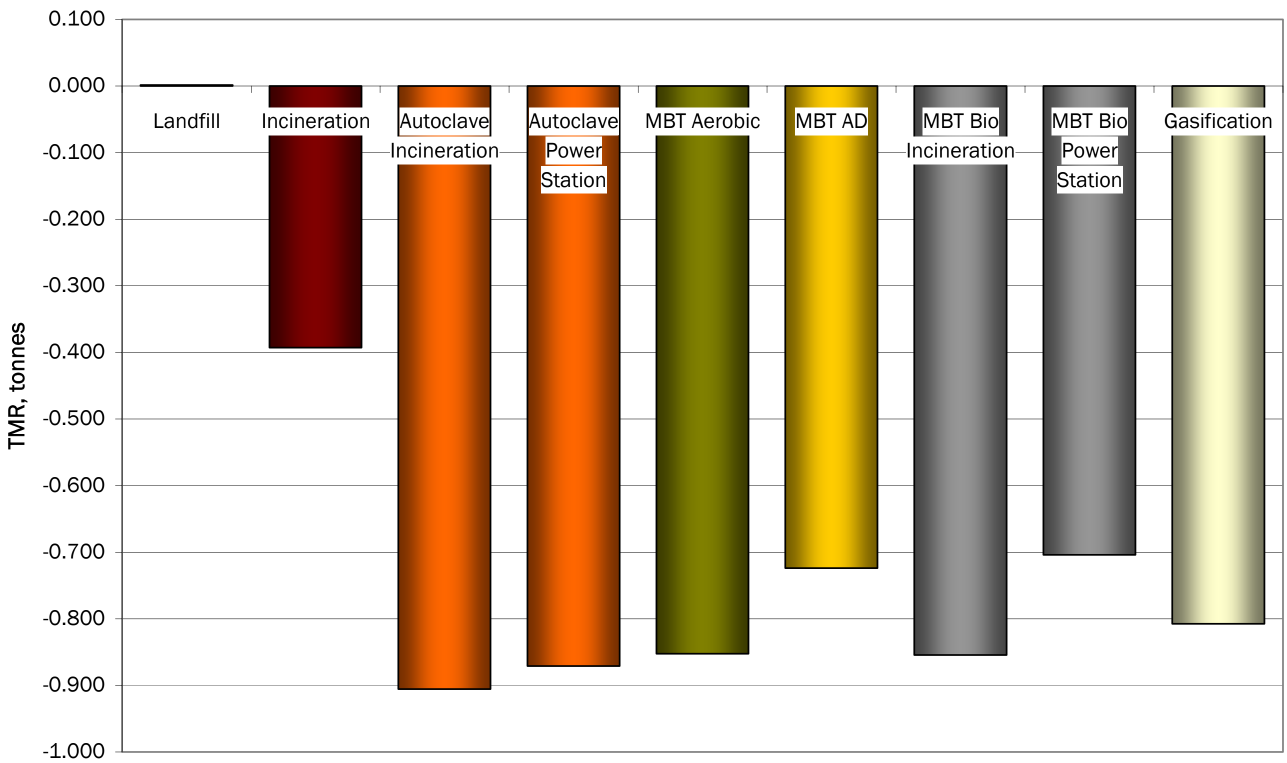
An evaluation of the TMR associated with residual waste treatment options is based upon the use of energy and the extraction of useful products and energy by the process. The figures are negative if a process extracts useful materials, or generates useful energy, thereby offsetting the need to extract primary resources. Consequently, the more negative is the figure for a given process, the better the process performs in this respect. The TMR is reduced the more material is recycled, and the more energy is generated by the technology.[35]

[35] Note that this analysis does not include the materials used in the construction of the facilities themselves.

Since all the residual technologies have a very favourable Total Material Requirement in comparison to landfill each technology option was awarded a major positive score in the assessment matrix.

Figure 8-9 shows the TMR of each of the residual treatment options being appraised. With the exception of landfill, all scores are negative as a result of the energy generated and the amount of material recycled. As was the case with the Energy Balance objective (Env5), technologies that both recover material and generate energy fare well against the Global Resources objective as measured by the TMR. Those with low energy use also perform well.[36] However, in contrast to the results obtained when assessing the Energy Balance, the performance of the technologies against the TMR indicator tends to be dominated by the efficiency of energy generation rather than the quantity of material recovered. This is partly because the materials which can be extracted from residual waste are relatively small in terms of total mass, whereas the generation of electricity is deemed, in part, to reduce the extraction of gas.

Figure 8-9: Total Material Requirement (TMR)



8.4.7 Env7: Water Resources

The Community Panel indicated that the appraisal of technology performance should consider potential impacts associated with water consumption.

All waste management facilities use water. Significant amounts of water may be required:

[36] Although energy generation is assumed to replace gas, energy use is deemed to be of the average mix of electricity generation currently found in the UK (including for coal, gas and renewables).

- Within pollution control mechanisms (particularly for those facilities with a thermal element);
- Within AD facilities to aid the digestion process;
- To form the steam used with the autoclave.

Within the assessment matrix:

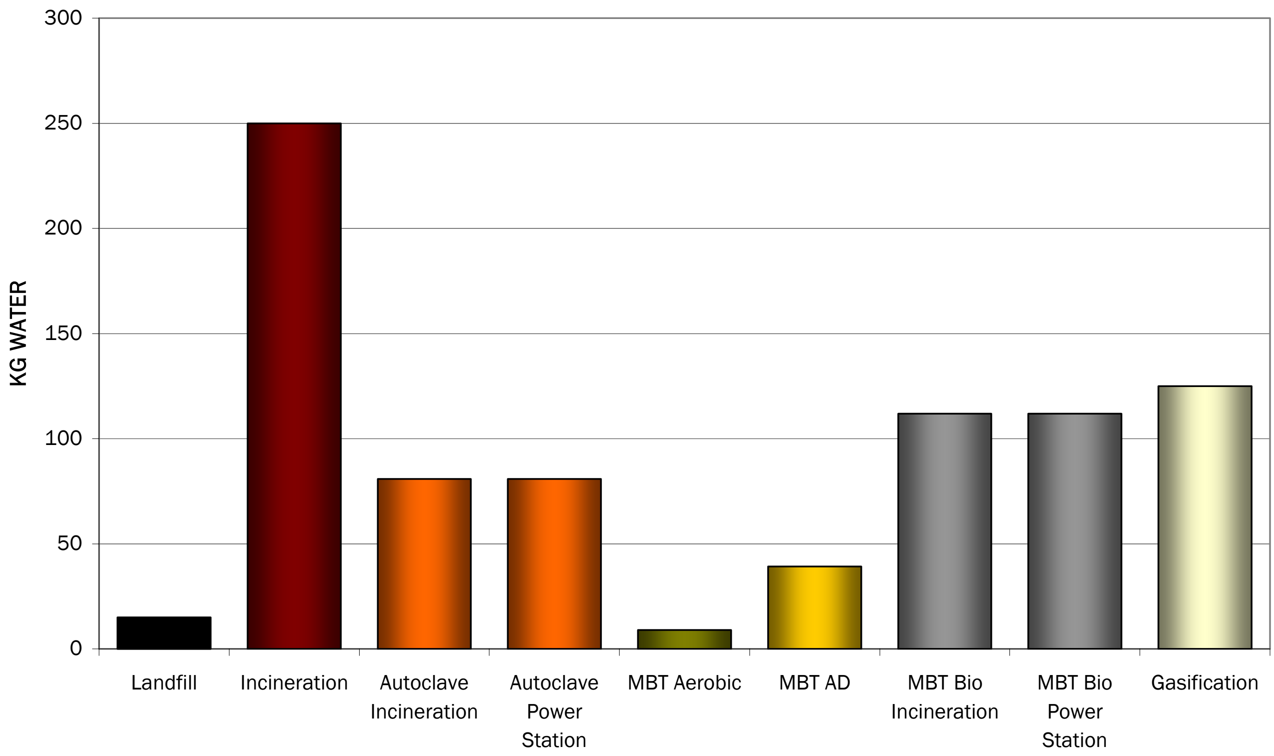
- A minor negative was awarded to those technologies using between 50-99 kg of water;
- A major negative was awarded to those technologies using over 100 kg of water per tonne of waste treated.

Water use within the biological components of MBT plants can vary considerably, even amongst facilities of the same type. The figures used within the current analysis represent the typical usage figures taken from the Best Available Technique Reference Documents for the Waste Treatment industries produced during the development of the IPCC Directive.[37]

Although biodrying facilities produce water within the biological phase of the process, there is a requirement for water within the pollution control mechanisms associated with the thermal element of the process.

Figure 8-10 shows the water use of those technologies appraised within the current analysis.

Figure 8-10: Water Use



[37] European Commission (2006) *Integrated Pollution Prevention and Control: Reference Document on Best Available Techniques for the Waste Treatment Industries*, August 2006

8.4.8 Env8: Soil

The Community Panel indicated that impacts upon soil should be considered with respect to:

- The land-take required by each facility, discussed in more detail in Section 8.4.8.1;
- Potential impacts on soil quality (including acidification) resulting from waste treatments, discussed in Section 8.4.8.2.

Since it is difficult to assess the impacts on soil quality in a meaningful manner, impacts are assessed within the assessment matrix solely on the basis of the land take required by the facility. All score a major positive in comparison to the baseline, given the considerable land area required by landfill.

8.4.8.1 Land-take

Landfills store waste rather than processing it, and as such require a larger land-take in comparison to other facilities. The overall land take required by a facility will depend on the need (or not) for ancillary buildings, and depots. In addition land-take figures quoted for some facilities such as incinerators sometimes relate to the size of the building rather than for the whole site.

The land-take for Aerobic and AD stabilisation facilities is based on the length of the stabilisation process; this in turn is likely to be related to the balance of landfill allowances held by the County. This is likely to be even more the case for the aerobic facilities where virtually all the material will be treated at the same time (a relatively larger land-take being required to treat the larger volume of material).

The land-take required for thermal facilities such as incineration and gasification increases as more flue gas cleaning equipment is required.

Table 8-2 provides indicative land-take requirements for each of the technologies being appraised. These figures are based on work carried out by Enviros which looked a range of treatment facilities of different sizes.[38]

Table 8-2: Land-take required by Facilities

Technology	Land take, m^2
Landfill	100,000
Incineration	4,500
Autoclave incineration	4,500
Autoclave power station	3,000
MBT Aerobic	8,000
MBT Anaerobic	8,000
MBT Bio incineration	5,000
MBT Bio power station	3,000
Gasification	4,000
Notes:	

[38] Enviros (2004) *Planning for Waste Management Facilities: A Research Study*, Report to ODPM, August 2004

Facilities are assumed to handle 70,000 tonnes per annum for 18 years.

8.4.8.2 Soil Contamination

Concerns typically focus on the application of toxic metals and persistent organic pollutants to the soil. Such contaminants may enter the soil via a number of different pathways, with the principle methods being:

1. Via products such as soil improver (produced by MBT processes) that are applied to land;
2. Through the dispersion of flue gases, leading to the deposition of pollutants on land;
3. Material deposited in landfills leaching into the soil and ultimately into groundwater.

The first is of these is not relevant to the current appraisal, as no soil improver or conditioner is produced by any of the technologies considered within this assessment. The second and third pathways have already been examined through objective Env4 which considers both emissions to air (including the dispersion of flue gases) and the leaching of material into groundwater via the soil.

Some attempts have been made to understand terrestrial eco-toxicity burdens associated with different technologies. However these approaches frequently assume that any addition of an element having the potential to be toxic will necessarily be negative. Most soils contain trace concentrations of various metals as natural components which are beneficial in small amounts (in some cases they are essential to plant nutrition) but are harmful in larger concentrations.

As was the case with water contamination, it is therefore difficult to derive a meaningful indicator to assess the impact on soil quality resulting from different residual waste treatment methods. As such we have not included any measurement of soil quality impacts within the assessment matrix provided in Section 8.3. Impacts associated with soil contamination are, however, indirectly assessed through examination of the impacts associated with emissions to air and water, as was previously discussed in Section 8.4.4.

8.5 Social Objectives

As was confirmed in Section 3.2, the following criteria were not assessed when evaluating the performance of the residual treatment options, as they were deemed not relevant to the assessment:

- Soc9: Education;
- Soc10: Convenience;
- Soc11: Nuisance;
- Soc13: Employment (local).

8.5.1 Soc12: Safety

Objective Soc12 relates to the safety of each residual treatment option. The specific assessment question related to an assessment of the potential for catastrophic failure associated with each option.

The potential for catastrophic failure exists for each of the options under appraisal. However, each facility would be required to mitigate the risk associated with this, and to outline these mitigation steps at the planning stage prior to receiving the necessary approval to build and operate the plant.

Impacts are scored 'uncertain' in the assessment matrix as there is no obvious meaningful indicator by which this objective can be assessed.

The impact of each of the residual options on the health of local residents is considered under objective Env4: Local Emissions.

8.6 Technical Objectives

8.6.1 Tech14: De-commissioning Issues

The Community Panel asked for consideration of whether it would possible to recycle each of the residual treatment options when they were due to be decommissioned.

Whilst it is theoretically possible to recycle many parts of the plant on decommissioning the extent to which this is the case is difficult to quantify. Since there is no obvious meaningful indicator by which this can be assessed, impacts have been scored as 'uncertain' in the assessment matrix.

8.6.2 Tech15: Future Proof

The Community Panel asked for consideration of the ease with which the plant could be upgraded in response to technological improvement, and whether the capacity of the facility could be changed.

This was assessed by means of a subjective scoring exercise, the results of which are seen within the Flexibility matrix, described below. Within the assessment matrix provided in Section 8.3:

- A minor positive score was awarded to those that scored greater than 9 in the Flexibility matrix;
- A minor negative score was awarded to those scoring between 6 and 9 in the Flexibility matrix;
- A major negative score was awarded to those that scored less than 6 in the Flexibility matrix.

Consideration was given to whether technology might be:

- *Flexible with respect to variation in input waste composition:* this reflects whether the facility suffers from technical limitations upon what can or cannot be treated safely and effectively;
- *Flexible with respect to variation in tonnages sent to the facility*: here, the issue is the degree to which the facility suffers losses in efficiency / effectiveness if the quantity of material received changes significantly;
- *Adaptable to market conditions*: some treatments are more able to adapt, through altering their configuration, to changing market conditions and changing opportunities.

The Flexibility matrix presents some perspectives on the different technologies in terms of their flexibility, understood in the terms described above. The assessment is scored with regard to the following:

For the input composition:

1. operation shows considerable sensitivity to composition;
2. operation shows sensitivity to composition, not just in extreme cases;
3. operation shows some sensitivity to composition (in relatively extreme cases);

4. all compositions are readily received.

For the tonnage throughput:

1. the facility is inflexible and requires a more or less constant throughput;
2. the facility shows significant sensitivity to changes in throughput;
3. the facility can deal with differing throughputs relatively easily;
4. the facility is very flexible with regard to rate of throughput.

For the output configuration:

1. there is no real opportunity to change nature and destiny of outputs;
2. there is potential to change the nature and destiny of outputs but only under certain specific circumstances, and at cost;
3. there is potential to change nature and destiny of outputs;
4. there is considerable potential to vary nature and destiny of outputs with minimal alteration in process design.

Table 8-3 shows the scores of each of the residual treatment options with respect to the assessment criteria described above. The relatively low score attributed to the Autoclave technology is largely a reflection of the lack of operating experience with respect to these facilities treating MSW.

Table 8-3: Flexibility Matrix

Technology	Input Composition	Tonnage Throughput	Output Configuration
Landfill	4	4	1
	Not an Issue where MSW is concerned	Very flexible to changes in tonnage throughput (subject to planning / licensing conditions)	No real possibility for changes in outputs – electricity generators could be converted to CHP, or biogas could be used in fuel cell technology
Incineration	2	1	1
	Not an issue as long as calorific value does not fall outside range of 8-14MJ/kg	Requires relatively constant throughput	No real possibility for changes in outputs – electricity generators could be converted to CHP, but CHP is preferred under current and emerging legislation (and BAT docs)
MBT Aerobic	3	3	4
	Not an issue as long as biowaste content of residual waste remains > 10% or so (this not so problematic for stabilisation since arguably, objective fulfilled by virtue of composition)	Less flexible than direct landfilling but current LATS rules allow for variation in reduction in biodegradability with residence time	Can be converted to RDF-based MBT facility if legislation / markets become attractive. Subject to spatial constraints, front-end sorting could be added.
MBT AD	2	2	2

Technology	Input Composition	Tonnage Throughput	Output Configuration
	Not an issue as long as biowaste content of residual waste remains > 10% or so	Benefits from relatively constant throughput	Possibilities in terms of front-end sorting and AD outputs
MBT Bio Incineration	3	2	1
	Generally flexible because of capability to adapt to wide range of calorific values	Somewhat more flexible to throughput (also possible to buffer with range of other materials)	No real possibility for changes in outputs – electricity generators could be converted to CHP, but CHP is preferred under current and emerging legislation (and BAT docs)
MBT Bio Power Station	3	3	1-2
	Flexible subject to some fuel criteria being respected	Generally good. Helped by the lack of any dedicated capital for combustion of fuel	For some configurations, it may be possible to derive different fuel fractions for different types of facility
Gasification	2	1	1
	Likely to have constraints both on calorific value (especially at lower end) and in terms of feedstock preparation	Similar to incineration (marginally more flexible for some configurations)	Electricity generators could be converted to CHP. For some facilities, use of syngas for chemical synthesis may be possible
Autoclave	3	1	1
	Should be fairly flexible	Depends upon nature of outputs, notably the fibre	Depends upon nature of outputs, notably the fibre

8.6.3 Tech16: Reliability / Track Record

The Community Panel required consideration of the number of each type of facility currently operating globally, and their total tonnage. The 'reliability' of each type of facility is assessed the basis of a subjective matrix, described below.

Within the assessment matrix:

- No impact was attributed to those with a total score of 5 in the Reliability matrix;
- A minor negative score was awarded to those scoring 3 or 4 in the Reliability matrix;
- A major negative score was awarded to those scoring 1 or 2 in the Reliability matrix.

The results of the Reliability scoring exercise are shown in Table 8-4. This shows that landfill and incineration are the most established of the technologies. Whilst the reliability of the MBT facilities is reasonably good, Gasification and Autoclave technologies are still struggling to establish a track record.

Table 8-4: Reliability Matrix

Technology	Level of Reliability
Landfill	5 Thousands of facilities in operation across the world
Incineration	5 Thousands of facilities in operation across the world – mature technology
MBT Aerobic	5 Relatively simple technology
MBT AD	3 Improving in reliability but still some plants experiencing operational difficulties
MBT Bio Incineration	4 Becoming established in Europe
MBT Bio Power Station	4 Reliability is good – regulatory issues are more important
Gasification	2 Some suppliers becoming considered as reliable – most struggling to establish any track record
Autoclave	1 Not really established for high through-puts

8.7 Economic Objectives

8.7.1 Uncertainties in Cost Modelling

The Economic Objective (Econ17) requires the cost of each of the residual treatment options to be assessed. However, the costs associated with different waste treatments are difficult to appraise in a meaningful manner. It is common to find cost estimates in public documents which seek to give an idea of capital and operating costs, but from the perspective of a local authority, what matters is the cost of the technology under a particular contractual arrangement. This is likely to be influenced by, amongst other things (including scale, and the particular technology design), the chosen approach to financing and procuring the technologies ultimately deployed. This is because these factors affect the cost of finance, as well as the profile for risk sharing and transfer with the project partners. Where project risks lie determines whether or not, and how, they are internalised in the cost of the project, or whether they are retained by the authority.

In recent years, the pricing of risks associated with procurements which seek to transfer responsibility for design, build, operation and finance (so-called DBFO contracts), of which PFI is the most commonly deployed, appears to have increased as the risks of non, or late delivery have become more clear. In addition, the uncertainties in some key variables – for example, the level of support for renewable energy, the degree to which biological treatment processes can guarantee specified levels of reduction in biodegradability – have led to the existence of uncertainties (frequently labelled, and examined – incorrectly - as risks) which tend to encourage defensive pricing in contract bids. Consequently, under approaches to procurement where the aim has been to transfer as much risk as possible to the private sector, contract prices appear to have moved steadily upwards since the turn of the decade.

There have been some studies recently suggesting a presumption in favour of increases in the scale of facilities. If economies of scale are assumed to exist, then this becomes a tautological argument. The more interesting issue is whether these economies of scale are actually being realised in ongoing procurements. No empirical evidence has yet been advanced to suggest that they are.

It would appear to us that the nature of the technology chosen is no longer the *principle* determinant of cost to a local authority. The chosen approach to procurement and financing is likely to be equally important.

Understanding the costs of the management of residual waste is not, therefore, straightforward. For a start, one has to consider not only the costs of a given type of facility itself, but one also needs to consider the implications of the facility for landfill allowances, and whether or not revenues are generated through allowance sales, or costs are incurred through allowance purchases, depends upon the scale of the facility, the timing of its coming into operation, and the performance of the overall waste management system in terms of waste reduction (the growth rate) and waste recycling.

The cost associated with each of the residual treatment options has therefore been scored as 'uncertain' in the assessment matrix in Section 8.3.

In assessing the relative importance of the different assessment criteria, the Community Panel indicated a weighting of 31% be ascribed to the cost associated with implementing the residual treatment method, and that a weighting of 69% be attributed to all other, non-cost criteria. It is clear, therefore, that an understanding of these costs is of importance to Doncaster. As such, we have provided a relatively high-level analysis of the indicative costs associated with the different treatment methods for which an environmental assessment has been performed.

8.7.2 Issues of Relevance to Modelling Treatment Costs in Doncaster

In modelling the cost of residual treatment within a given authority, consideration must be given to:

- Contractual arrangements already in place;
- The authority's attitude to LATS, and the relative proportion of allocated and required allowances (given any existing contractual arrangements);
- Policies already in place within the authority that might preclude the take-up of some technology options.

When examining the likely costs associated with residual treatment options that might be considered in Doncaster, the following points are relevant:

- The authority has agreed an interim treatment contract with a merchant Autoclave facility commencing in June 2008 and continuing for 7 years, with the option to extend the contract for a further 3 years at this point. The Autoclave will treat 25,000 t. p. a. of waste during 2008-2010 and 50,000 t. p. a. from 2011;
- As a result of the interim contract, Doncaster is likely to have surplus landfill allowances until at least 2015 (or 2018 if the contract is extended);
- The authority requires any new residual treatment plant to recycle at least 10% of the incoming waste to the facility.

The recycling target is sufficient to ensure that incineration is unlikely to be considered as an option in Doncaster unless it is coupled with some form of pre-treatment. The costs associated with incineration are therefore provided for information and comparison purposes only.

8.7.3 Methodology for Cost Modelling

The residual waste treatment cost model developed for Doncaster makes the following assumptions:

- Waste arisings are calculated assuming the best performing options of the Strategy (with respect to waste prevention and recycling / composting) are adopted;
- Values for landfill tax and landfill allowances are calculated in real 2008 prices;[39]
- Doncaster is able to re-sell its surplus landfill allowances;[40]
- Landfill tax is assumed to increase by £8 per year up until 2012 but remains constant thereafter;
- New facilities are assumed to treat 50,000 t. p. a. of waste for the Autoclave and MBT options, and 40,000 t. p. a. for the incineration and gasification options (sufficient to treat the non-HWRC element of the MSW stream);[41]
- Treatment costs are calculated using the following formula:
  Treatment Cost = Treatment Gate Fee + Landfill Tax + Landfill Gate Fee;[42]
- The cost associated with the thermal element of autoclave and MBT facilities is apportioned on the basis of the amount of fuel produced, using the gate fee associated with each thermal element;
- The cost associated with the existing interim contract are included for all non-Autoclave options, assuming the output from the Autoclave goes to an incinerator;
- The existing interim contract is assumed to be extended for the incinerator and gasification options to allow for the anticipated additional lead-time associated with

[39] Inflation is at the Treasury Green Book rate of 2.7%

[40] The value of these allowances are provided in Appendix A.8.0

[41] The smaller facility size for the incineration and gasification facilities reflects the additional diversion of Biological Municipal Waste that can be achieved using these options in comparison to that achieved by MBT and Autoclave facilities. Facilities are undersized within our cost model to allow for the possibility that the strategy might perform better than is anticipated here.

[42] The cost of landfill is included within the treatment gate fee cost for incineration and gasification facilities.

building these facilities. For each of the other non-Autoclave options it is assumed that the contract extension is not required;

- Each of the MBT options is assumed to treat waste from 2016, whilst the gasification and incineration options are assumed to treat waste from 2019. The Autoclave ceases to take waste in each of these options when the new facility becomes operational.

The gate fees assumed for the different treatment facilities are shown in Table 8-5.

Table 8-5: Gate Fees for Different Treatment Facilities

Facility	Assumed Gate Fee
Landfill	£ 18.92
Incineration	£ 100.00
Autoclave (pre-treatment only)	£ 50.00
Refuse Derived Fuel at Power Station	£ 30.00
MBT (pre-treatment only)	£ 40.00
MBT Aerobic	£ 55.00
MBT AD	£ 65.00
Gasification	£ 120.00
Notes: Estimated gate fees are provided for all facilities except for landfill (where the fee was provided by Doncaster).	

Table 8-6 outlines the assumptions used within the cost model to determine the overall cost of treatment. The mass flow data used in the cost model is based on that provided to us by technology suppliers.

Table 8-6: Assumptions for Treatment Methods Used in the Cost Model

Treatment Option	Reduction in biodegradability	Proportion of waste landfilled	Fuel produced
Incineration	100%		100%
Autoclave incineration	70%	29%	32%
Autoclave power station	70%	29%	32%
MBT Aerobic	80%	55%	
MBT AD	80%	48%	
MBT bio incineration	75%	20%	45%
MBT bio power station	75%	20%	45%

Gasification	100%		92%
Notes: The cost of landfill is assumed to be incorporated within the treatment gate fee cost for incineration and landfill. Hence the proportion of waste landfill is not included within the table for these facilities.			

The total cost associated with each option includes:

- The costs associated with the interim contract;
- The costs associated with waste treated at the new facility;
- The financial benefit associated with re-selling the surplus landfill allowances;[43]
- The cost of landfilling the remaining waste not treated by the interim contract and the new facility.

8.7.4 Results

The total cost of each option for the period 2008-2025 is provided in Table 8-7. The costs in Table 8-7 reflect the *indicative* costs associated within implementing each option, as was discussed in Section 8.7.1. The actual cost of implementing any of the options considered here is likely to be influenced by the chosen approach to financing and procuring the technology.

The results of this analysis suggest that the cheapest options are those where the fuel can be sent to a power station, whilst treatment options including gasification or an incineration element are the most expensive. The local authority is, however, likely to incur some risk if it chooses a power station option. There is no guarantee that the fuel will be accepted at these facilities for the duration of the treatment contract with the Autoclave or MBT supplier.

Table 8-7: Total Cost Associated with Each Residual Waste Treatment Option

Treatment Option	Total Option Cost (2008-2025)	Rank
Incineration	£ 130,441,721	7
Autoclave incineration	£ 129,778,738	6
Autoclave power station	£ 111,298,738	1
MBT Aerobic	£ 124,587,659	3
MBT AD	£ 127,315,228	4
MBT bio incineration	£ 128,291,272	5
MBT bio power station	£ 112,541,272	2

[43] The LATS modelling used within the residual cost model is described in more detail in Appendix 8.

Gasification	£ 136,041,721	8

8.8 Community Panel Weightings and Overall Scores

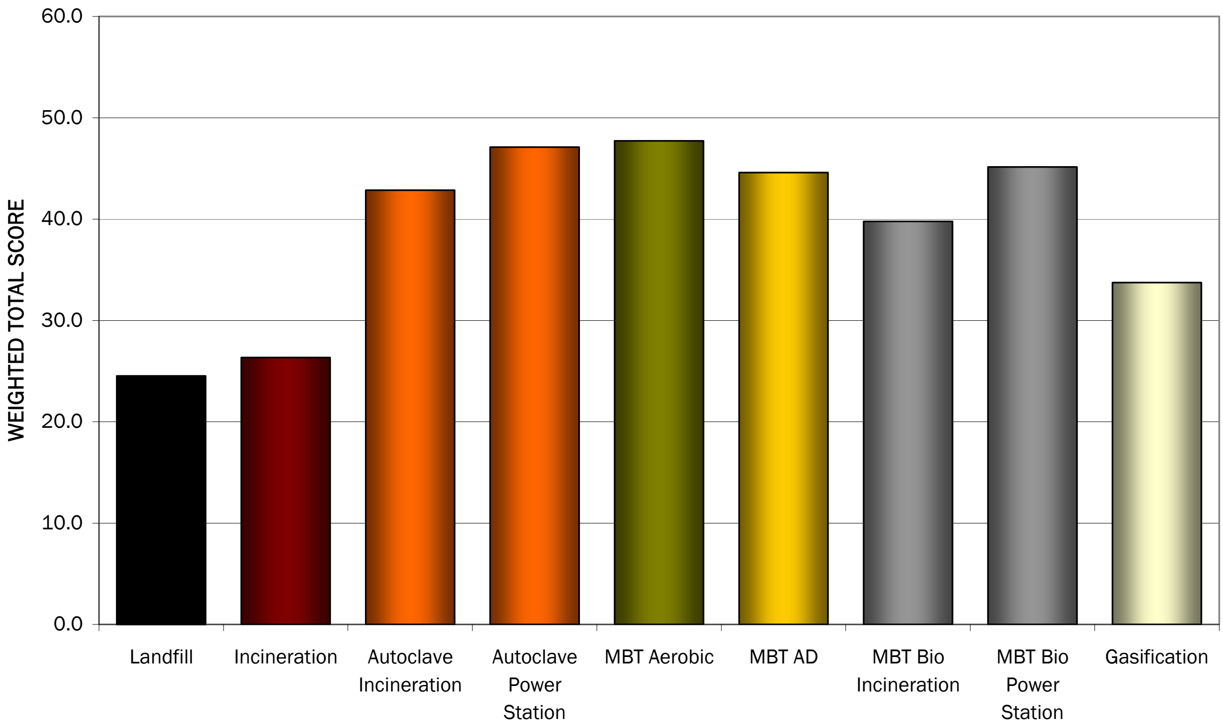
The Community Panel were asked to assign a weighting to each of the assessment objectives outlined in Section 3.2, in order to indicate the relative importance of each objective. The process of assigning the weightings and the results of the weighting exercise are outlined within the accompanying Community Panel Report.

As was the case when assessing the performance of each waste collection option, the Community Panel weightings were used to calculate an overall score for each residual treatment option, taking into account their performance against each of the individual assessment criterion. An overall score for each technology was calculated using the Weighted Spectrum method described in Section 7.8.

The overall scores for each of the technology options are shown in Figure 8-11. The Community Panel ascribed a weighting of 31% to cost, and a weighting of 69% to the other "non-cost" criterion outlined in Section 3.2. Given the uncertainty associated with modelling the cost of the technology options (discussed in Section 8.7), these overall scores do not include the influence of cost.

When the scores are weighted according to the preferences of the Community Panel, landfill and incineration are the worst performing technologies. Autoclave and MBT technologies perform relatively well by comparison.

Figure 8-11: Overall Scores Including Community Panel Weightings



SECTION 3: MITIGATION AND MONITORING

9.0 Mitigating and Enhancing Measures

Mitigating measures have been proposed where the assessment has shown the potential for negative environmental, social and economic effects of a policy or initiative. Table 9-1 outlines the mitigating measures that are required to eliminate/ offset any negative impacts. The aim is to eliminate, where possible, and when this is not possible, to reduce these impacts.

Opportunities to enhance positive outcomes are also included in Table 9-2 for criteria where potential beneficial impacts have been predicted. Waste prevention measures, collection options and residual treatment technologies have all been assessed, although some slightly differently.

Although a relatively comprehensive examination has been made, it is clearly possible that there will be unforeseen impacts as the various initiatives are rolled out. Consequently, it is necessary to monitor the effects of each strategy in order to identify these possible impacts and put in place the relevant measures to either mitigate any negative impacts or enhance any positive benefits. This is fully discussed in Section 10.0.

Table 9-1: Possible Measures to Prevent/Reduce Negative Impacts

Strategy Section	Policy/ Initiative	Potential Negative Impact	Possible Mitigation Measures and Result
Waste Prevention	Home composting	Convenience (Soc10) **Minor negative**	Ensure the waste prevention officers are well-informed and accessible **Minor negative**
Waste Prevention	No Side Waste	Convenience (Soc10) **Minor negative**	Ensure the enforcement team are skilled in dealing with customers and are able to educate residents with information on alternative waste prevention, recycling and re-use solutions. **Minor negative**
Waste Prevention	Zero Waste Challenge	Convenience (Soc10) **Major negative**	Knowledge exchange forum for householders to share their experience and 'top tips'. This raises the opportunity for cooperative procurement. **Minor negative**
Waste Prevention	Reuse at HWRCs	Decommissioning problems (Tec14) **Minor negative**	Ensure that HWRC staff are fully trained and aware of reusability issues **Minor negative**
Waste Prevention	Paint Reuse	Convenience (Soc10) Decommissioning problems (Tec14); Economic (Econ17) **Minor negative**	Good publicity and signage for the service will lead to greater awareness of the scheme therefore mitigating the impact of Soc10 and Econ17 (through greater economies of scale). No mitigation to the technical issue of decommissioning paint has been suggested. **Minor negative**
Waste Prevention	SMART Shopping	Convenience (Soc10) **Major negative**	Knowledge exchange forum for householders to share their experience and 'top tips'. This raises the opportunity for cooperative procurement. **Minor negative**
Waste Prevention	Real Nappies	Convenience (Soc10); Economic (Econ17) **Major / Minor negative**	Good publicity and support for the real nappy laundry service. Until real nappies are more widely used there are no mitigation options for Econ17 **Minor Negative**

Strategy Section	Policy/ Initiative	Potential Negative Impact	Possible Mitigation Measures and Result
Waste Prevention	Council In-House Good Practice	Convenience (Soc10); Economic (Econ17) **Minor negative**	Ensure that all employees are introduced to the scheme and made fully aware of the new waste facilities being made available and the impact that their behaviour might have on the local area. The scheme could potentially be sped up and made more economically viable through encouraging staff in each council office to volunteer as prevention and recycling champions. **Minor negative**
Waste Prevention	Zero Waste HWRC	Convenience (Soc10) **Minor negative**	Good publicity and signage for the service will lead to greater awareness of the scheme **Minor negative**

Strategy Section	Option	Potential Negative Impact	Possible Mitigation Measures and Result
Collection	All Options	Local Emissions (Env4) **Minor negative**	Procurement of newer vehicles, with lower emissions can reduce the amount of pollutants released. **Minor negative/Negligible/No impact**
Collection	Baseline, Intermediate, Options 3 & 5	Cost (Econ17) **Minor negative**	As the modelling results are based on an optimised service, it is difficult to further reduce the costs associated with the service. Savings may be gained through partnering with other Authorities during the procurement stage. **Minor negative**
Collection	Business As Usual, Options 1, 2, 4 & 6	Cost (Econ17) **Major negative**	As discussed above, there are few mitigation measures to reduce costs associated with the service. **Major negative**

Residual waste	All technologies	**Minimum landfill (Env1)** Minor negative	**Maximise recovery of recyclables from MBT treatments.** Minor Negative
Residual waste	All technologies	Local emissions (Env4) **Major / minor negative**	For incineration, reduce emissions through use of selective catalytic reduction (abates NOx and dioxin pollution) or other increased abatement measures, consider wet scrubbing for acid gases, consider avoidance of burning specific materials (e.g. treated wood). At MBT facilities, use of exhaust air extraction and adequate gas cleaning systems (for VOC / Ammonia pollution), ensure proper stabilisation of material going to landfill and preferably landfill at sites employing active cover layer techniques **Minor negative**
Residual waste	All technologies	Water (Env7) **Major / minor negative**	Re-circulate water wherever possible. **Minor negative**

Table 9-2: Possible Measures to Enhance Positive Impacts

Strategy Section	Policy/ Initiative	Potential Positive Impact	Possible Enhancement Measures and Result
Waste Prevention	Home Composting	Reduce global emissions (Env3) Energy balances (Env5) Water (Env7) Soil (Env8) Education (Soc9) Local employment (Soc13) **Minor positive** Minimum landfill(Env1) Impact on global resources (Env6) Latest proven technology (Tec16) Economic (Econ17) **Major positive**	Charge for garden waste collection (currently free). However this may have some minor negative effect on local employment as collection rounds decrease **Major Positive**

Strategy Section	Policy/ Initiative	Potential Positive Impact	Possible Enhancement Measures and Result
Waste Prevention	No Side Waste	Local emissions (Env4) Energy balances (Env5) Education (Soc9) **Minor positive** Minimum landfill (Env1) Maximum by-products (Env2) Reduce global emissions (Env3) Impact on global resources (Env6) Nuisance (Soc11) Latest proven technology (Tec16) Economic (Econ17) **Major positive**	No enhancements identified **Minor/Major Positive**
Waste Prevention	Zero Waste Challenge	Minimum landfill (Env1) Maximum by-products (Env2) Reduce global emissions (Env3) Impact on global resources (Env6) Energy balances (Env5) Soil (Env8) Economic (Econ17) **Minor positive** Education (Soc9) **Major positive**	Increase publicity and community involvement **Major Positive**
Waste Prevention	Reuse at HWRCs	Minimum landfill (Env1) Reduce global emissions (Env3) Impact on global resources (Env6) Energy balances (Env5) Education (Soc9) Latest proven technology (Tec16) Economic (Econ17) **Minor positive**	Longer term solution: extend the scheme to other HWRCs which currently lack the required space **Major Positive**
Waste Prevention	Bulky collections reuse	Minimum landfill(Env1) Maximum by-products (Env) Reduce global emissions (Env3) Impact on global resources (Env6) Energy balances (Env5) Latest proven technology (Tec16) Economic (Econ17) **Minor positive** Local employment (Soc13) Convenience (Soc10) **Major positive**	Increase publicity and participation. This could include the council providing furniture retailers with leaflets to promote the scheme **Major Positive**

Strategy Section	Policy/ Initiative	Potential Positive Impact	Possible Enhancement Measures and Result
Waste Prevention	Paint Reuse	Minimum landfill(Env1) Reduce global emissions (Env3) Local emissions (Env4) Energy balances (Env5) Safety (Soc12) Latest proven technology (Tec16) **Minor positive**	Increase publicity of the local benefits from repaint projects (e.g. local playgroup). Longer term, increase the number of HWRCs that collect paint **Major Positive**
Waste Prevention	SMART Shopping	Minimum landfill(Env1) Reduce global emissions (Env3) Local emissions (Env4) Energy balances (Env5) Impact on global resources (Env6) Local employment (Soc13) Economic (Econ17) **Minor positive** Education (Soc9) **Major positive**	Community plastic bag bans to raise awareness of SMART shopping **Major Positive**
Waste Prevention	No Junk Mail	Minimum landfill(Env1) Reduce global emissions (Env3) Energy balances (Env5) Impact on global resources (Env6) Water (Env7) Education (Soc9) Nuisance (Soc11) Economic (Econ17) **Minor positive** Convenience (Soc10) Latest proven technology (Tec16) **Major positive**	Council to offer paper-free (internet-based) council tax and other services **Major Positive**
Waste Prevention	Real Nappies	Reduce global emissions (Env3)) Impact on global resources (Env6) Education (Soc9) Local employment (Soc13) Latest proven technology (Tec16) **Minor positive** Minimum landfill(Env1) **Major positive**	Potential for targeting the elderly community **Major Positive**

Strategy Section	Policy/ Initiative	Potential Positive Impact	Possible Enhancement Measures and Result
Waste Prevention	Council in house good practice	Minimum landfill(Env1) Maximum by-products (Env2) Reduce global emissions (Env3) Energy balances (Env5) Impact on global resources (Env6) Local employment (Soc13) **Minor positive** Education (Soc9) Latest proven technology (Tec16) **Major positive**	Promote in-house e-business systems and practices. For example electronic procurement and communications **Major Positive**
Waste Prevention	Zero waste HWRCs	Minimum landfill(Env1) Reduce global emissions (Env3)) Energy balances (Env5) Impact on global resources (Env6) Education (Soc9) Latest proven technology (Tec16) **Minor positive** Maximum by-products (Env2) Economic (Econ17) **Major positive**	Longer term, add one more zero waste HWRC (requiring more space on site) **Major Positive**

Strategy Section	Policy/ Initiative	Potential Positive Impact	Possible Enhancement Measures and Result
Collection	All Options	Minimum Landfill (Env1), Maximum By-products (Env2), Reduce global emission (Env3), Energy balances (Env5), Impact on global resources & wildlife (Env6) **Minor/Major Positive**	All of these criteria are heavily based on the amount of recycling obtained under each option. This can be increased through more emphasis on communication campaigns and good design of collection services. Maximum good by-products will depend on the final destination of the materials, but by separately collecting, this will ensure that the recyclate will be of high quality. **Major positive**
Collection	**All options**	Soil (Env8) **Minor/Major Positive**	The collection of organic waste for composting will be beneficial in terms of improving soil quality. The choice of treatment can greatly affect the quality of the end product (i.e. whether it goes to landfill cover or to agriculture/horticultural uses). By ensuring a high-grade compost output, the impact on soil quality can be

Strategy Section	Policy/ Initiative	Potential Positive Impact	Possible Enhancement Measures and Result
			improved. **Major positive**
Collection	**All options**	Education (Soc9) **Minor Positive**	Through the implementation of an educational campaign, either in schools, roadshows, mailings etc. there is scope to increase the awareness of the recycling services offered **Major Positive**
Collection	**All options**	Convenience (Soc10) **Minor Positive**	The convenience of a service will depend on how well it is implemented. Through good design and communication, the convenience of the collection service can be improved. **Major Positive**
Collection	**All options**	Employment (Soc13) **Minor/Major Positive**	Although there are employment opportunities within the collection services, it is difficult to apply enhancement measures to this. **Major/Minor Positive**

Strategy Section	Policy/ Initiative	Potential Positive Impact	Possible Enhancement Measures and Result
Residual Waste	All technologies	Maximum "good" by products (Env2) **Major / minor positive**	Maximise recovery of recyclables **Major positive**

Strategy Section	Policy/ Initiative	Potential Positive Impact	Possible Enhancement Measures and Result
Residual Waste	All technologies	Global emissions (Env3) **Major positive**	For thermal process, maximise energy recovery and reducing utilisation, ensuring utilisation of heat energy wherever possible (CHP should only be considered where prospects for energy utilisation are good). For MBT processes, maximise the recovery of recyclables, ensure the process is well managed (with respect to approach to aeration, C:N ratios, moisture content etc), and ensure high level of stability prior to landfilling of residue. **Major positive**
Residual Waste	All technologies	Energy balance (Env5) **Major positive**	Prioritise energy recovery from the final disposal of residual waste, minimise energy use **Major positive**
Residual Waste	All technologies	Materials balance (Env6) **Major positive**	Maximise recovery of recyclables, improve energy balance **Major positive**

10.0 Monitoring

The SEA regulations make clear the requirement to monitor the implementation of the plan with the purpose of identifying unforeseen adverse effects at an early stage and being able to undertake appropriate remedial action.

Monitoring should be an important factor in the implementation of any plan, and should occur over the course of the Strategy. In particular monitoring helps to answer the following questions:

- Is the MWMS contributing to the sustainability of Doncaster in the way envisaged?
- Have there been any unforeseen impacts (positive or negative) that have arisen from the Strategy? Do these impacts require remediation?

It is therefore important that the correct monitoring framework is put in place for this MWMS. However, such a framework should ensure that while the above questions can be answered, the requirements of the framework are not over-onerous since it will be the responsibility of Doncaster Borough Council to gather all of the required information and to implement any remedial action should any negative impacts be identified.

It will also be essential for Doncaster to maintain the monitoring framework and baseline information as appropriate. The monitoring proposals below are intended to be flexible over the course of the Strategy, taking into account that technical and scientific advances may mean that alternative measures for monitoring become more appropriate or accurate for the purpose and possibly more cost effective. Table 10-1 sets out the proposed monitoring framework for the DWS.

Table 10-1: Proposed Monitoring Framework

	Objective	Indicator / Information Required	Frequency	Data Source(s)	Suggested Trigger for Remedial Action
Env1	Minimum Landfill	NI 193 (% of MSW sent to landfill)	Annually	Waste Data Flow	Levels failing to achieve Strategy targets
Env2	Maximum by products (good ones)	NI 192 (% of household waste reused, recycled or composted) Destination of recyclate	Quarterly	Waste Data Flow	Levels failing to achieve Strategy targets
Env3	Reduce Global Emissions	CO_2 emissions resulting from waste management activities.	Annually	Measured as part of NI 186 (per capita reduction in CO_2)	Two consecutive annual increases in per capita CO_2 emissions
Env4	Reduce Local Emissions	Air pollutant emissions of SOx, NOx, ozone, dioxins and particulates	Annually	Operators/Environment Agency Clean Air for Europe/ European Commission study on externalities from landfill and incineration	Proportional change in emissions greater than change in waste arisings Any breaches of waste management licences
Env5	Energy (balances)	Energy use and energy savings from recycling	Annually	Site audits and operator information Published sources for materials recycled	Two years consecutive negative trend
Env6	Impact on global resources, wildlife, flora and fauna	NI 191 (Residual household waste per household) Household waste arisings per capita	Annually	Waste Data Flow ONS mid year population estimate	Levels failing to achieve Strategy targets
Env7	Water	Volume of net water consumption per tonne of waste treated	Annually	Waste Treatment Facilities	Annual increases in net consumption per tonne for two consecutive years

	Objective	Indicator / Information Required	Frequency	Data Source(s)	Suggested Trigger for Remedial Action
Env8	Soil	Amount of compost/soil conditioner produced	Annually	Waste Data Flow Information from Treatment Facilities	
Soc9	Education	Number of waste educational visits/events	Annually	In house records	Internal targets not met
Soc10	Convenience	Doncaster residents customer satisfaction surveys	Determined by customer satisfaction survey timetables	Customer satisfaction surveys	Decrease in satisfaction of waste services
Soc11	Nuisance	Reported noise or odour issues relating to MSW facilities/services	Quarterly	Environment Agency: Breaches in waste management license conditions related to noise or odour DMBC Environmental Health: Complaints relating to noise or odour	Annual increase in number of complaints or breaches relating to noise or odour from MSW facilities/services
Soc12	Safety	Criterion as defined by Community Panel - not considered appropriate for monitoring			
Soc13	Employment	Total employment (full time equivalents) in waste management services	Annually	DMBC contractors	
Tec14	De-comissioning problems	Criterion as defined by Community Panel - not considered appropriate for monitoring			

	Objective	Indicator / Information Required	Frequency	Data Source(s)	Suggested Trigger for Remedial Action
Tec15	Future proof	Criterion as defined by Community Panel - not considered appropriate for monitoring			
Tec16	Latest proven technology (reliable)	Criterion as defined by Community Panel - not considered appropriate for monitoring			
Econ17	Economic (cost)	Cost of waste management services per household	Annually	DMBC	

11.0 Abbreviations

AD	Anaerobic Digestion
AQMA	Air Quality Management Area
CFC	Chloroflourocarbon
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DMBC	Doncaster Metropolitan Borough Council
DWS	Doncaster Waste Strategy
EfW	Energy from Waste
EIA	Environmental Impact Assessment
ER	Environmental Report
GHG	Greenhouse Gas
HWRC	Household Waste Recycling Centre
IPCC	Intergovernmental Panel on Climate Change
IVC	In-Vessel Composting
LATS	Landfill Allowance Trading Scheme
LCA	Life Cycle Analysis
MBT	Mechanical Biological Treatment
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MWMS	Municipal Waste Management Strategy
NH_3	Ammonia
NOx	Oxides of Nitrogen
NMVOC	Non Methane Volatile Organic Compounds
NPV	Net Present Value
ODPM	Office of the Deputy Prime Minister
ONS	Office for National Statistics
PM_{10}	Particulate Matter less than 10 microns diameter
PPS	Planning Policy Statement
RDF	Refuse Derived Fuel
ROC	Renewables Obligation Certificate

RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
Sb	Antimony
SEA	Strategic Environmental Assessment
SMART	Save Money And Reduce Trash
SOx	Oxides of Sulphur
SR	Scoping Report
TMR	Total Material Requirement
tpa	tonnes per annum
VOC's	Volatile Organic Compounds
WDF	Waste Development Framework
WEEE	Waste Electronics and Electrical Equipment
WET	Waste and Emissions Trading Act
WRAP	Waste and Resources Action Program