



Carbon Balances and Energy Impacts of the Management of UK Wastes

Defra R&D Project WRT 237

Annex A

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Annex A

Review of UK Waste Arisings and Composition

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The overall aim of this project was to carry out a macro-level investigation of the source and scale of energy and greenhouse gas benefits and impacts associated with the management of waste streams arising in the UK. To do this, the current waste management situation (arising, composition and management) had first to be defined.

The starting point for the research was therefore a review of data and information pertaining to the range of UK waste streams. This report presents the results of this review, setting out:

- definitions of the specific streams comprising UK waste;
- estimated current arisings for each waste stream;
- best estimates of waste stream composition; and
- current and anticipated waste management routes.

An estimated composition has been developed for each waste stream comprising total UK waste, employing fractional components such as paper/card; food/animal waste; green waste; textiles; fines; ferrous metals; non-ferrous metals; glass; dense plastic; plastic film; and miscellaneous wastes (split by combustible/non-combustible fractions). In addition, estimated carbon content (fossil and biogenic) and calorific value of alternative waste fractions has been presented.

Some analysis and discussion has been presented regarding the potential growth of these waste streams. However, we will see that data and information are lacking and make it difficult to make reliable predictions regarding waste growth over the assessment period, however. For this reason, and to aid the clarity of results, it was decided that greenhouse gas and energy impacts would be modelled on the basis that waste growth will be static over the period of the study, and the most up to date estimates of arisings were used.

A1.1

WASTE STATISTICS

The shortage, and limitations, of the statistics on specific waste stream arisings, their growth rates, composition and management is well-documented and hampers the development of effective waste strategies and the ability to measure and monitor progress effectively. As a result, Defra has implemented a programme to ensure effective co-ordination, provision and dissemination of reliable data on different waste streams, through the development of a national three-year data strategy.

In reality, a long term vision is needed to ensure cohesive and comparable statistics on the range of waste streams and sources. Meanwhile, one must

rely is on the limited number of published sources of data regarding UK waste arisings.

The waste data available derive predominantly from the various UK Government bodies which gather and/or publish waste statistics. These include:

- Defra;
- the Environment Agency for England & Wales (EA);
- the Scottish Environmental Protection Agency (SEPA);
- the Northern Ireland Environment and Heritage Service (EHS);
- the Office of the Deputy Prime Minister (ODPM);
- local waste authorities;
- Water UK; and
- the Centre for Environment, Fisheries and Aquaculture Science (CEFAS).

Each of these bodies has been consulted to collate an overall data set for waste arisings, management and composition.

A1.2

WASTE DEFINITIONS

The first task in this review was to clarify the waste streams to be included (ie the predominant UK waste streams) and to determine the wastes incorporated within each stream. Direction was taken from Pat Kilby and Guy Lever in Defra's Waste Statistics Division in answering these questions. *Table A1.1* shows the assumed definition of waste for this study, together with descriptions of the predominant waste streams arising in the UK. Waste stream definitions have been supplemented, where necessary, with information from relevant reporting bodies.

Table A1.1 Waste Stream Definitions

Waste Type	Background and Definition
Waste	<p>In the EU, the Waste Framework Directive (Council Directive 75/442/EEC as amended)(WFD) sets out the legal framework of controls governing the management of waste in the EU. When the WFD was first adopted in 1975, it was left to Member States to adopt their own national definition of waste. However, in 1991 the WFD was substantially amended, including the introduction of an EU-wide definition of waste. The amended Directive, including the definition of waste, was transposed into UK national legislation in May 1994. The definition of waste in force in the UK then is the definition in Article 1(a) of the WFD which provides that “waste” is:</p> <p><i>“...any substance or object...which the holder discards or intends or is required to discard.”</i></p> <p>Article 2 of the WFD lists a number of waste streams which are excluded from the Directive’s scope. These wastes have to be defined as waste in accordance with the definition in Article 1(a) in order to be excluded from the Directive’s scope.</p>
Agricultural waste	<p>The legal definition of agricultural waste, as drafted in the proposed Waste Management (England and Wales) Regulations 2006, states that agricultural waste is:</p> <p><i>“waste from premises used for agriculture within the meaning of the Agriculture Act 1947.”</i></p> <p>The Agriculture Act 1947 stipulates that:</p> <p><i>“Agriculture includes: horticulture, fruit growing, seed growing, dairy farming and livestock breeding and keeping, the use of land as grazing land, meadow land, osier land, market gardens and nursery grounds, and the use of land for woodlands where that use is ancillary to the farming of land for other agricultural purposes, and ‘agriculture’ shall be construed accordingly.”</i></p>
Mining & Quarrying waste	<p>For historical reasons, mineral waste from mines and quarries is largely controlled through the town and country planning system in the UK and, as a consequence, falls under the remit of the ODPM.</p> <p>Mine and quarry waste is now defined by reference to, and regulated in accordance with, the Mining Waste Directive. In setting out the scope of the Directive, Article 2(1) effectively defines extractive waste by providing that:</p> <p><i>“...this Directive covers the management of waste resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries, hereinafter “extractive waste”.</i></p> <p>Further, recital 4 of the Mining Waste Directive effectively indicates the types of waste which are to come under the heading of ‘extractive waste’</p> <p><i>“In accordance with the objectives of Community policy on the environment, it is necessary to lay down minimum requirements in order to prevent or reduce as far as possible any adverse effects on the environment or on human health which are brought about as a result of the management of waste from the extractive industries, such as tailings (ie the waste solids or slurries that remain after the treatment of minerals by a number of techniques), waste rock and overburden (ie the material that extractive operations removed during the process of accessing an ore of mineral body, including during the pre-production development stage), and topsoil (ie the upper layer of the ground) provided that they constitute waste as defined in the Waste Framework Directive.”</i></p>

Waste Type	Background and Definition
Sewage Sludge	<p>This waste stream is formally defined by the European Commission in the Urban Wastewater Treatment Directive (UWWTD) as <i>Sludge from urban waste water treatment plants, whereby 'urban waste water' is understood as: "domestic waste water or the mixture of domestic waste water with industrial waste water and/or run-off rain water"</i> (Directive 91/271/EEC).</p> <p>The definition of 'domestic waste water' in Directive reads: <i>"waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities"</i>.</p>
Dredged Material	<p>CEFAS defines dredging wastes as: <i>"Material generated when dredging ports, harbours, rivers and approach channels."</i></p>
Municipal waste	<p>Article 2(b) of the Landfill Directive and provides that: <i>"municipal waste' means waste from households, as well as other waste which, because of its nature or composition, is similar to waste from household."</i></p>
Commercial waste	<p>Defra defines commercial wastes as those wastes arising from any premises which are used wholly or mainly for trade, business, sport recreation or entertainment, excluding municipal and industrial waste.</p>
Industrial waste	<p>The definition of industrial waste is set out in section 75(6) of the Environmental Protection Act 1990 (EPA 1990) as "waste from any of the following premises: (a) any factory (within the meaning of the Factories Act 1961); (b) any premises used for the purposes of, or in connection with, the provision to the public of transport services by land, water or air; (c) any premises used for the purposes of, or in connection with, the supply to the public of gas, water or electricity or the provision of sewerage services; or (d) any premises used for the purposes of, or in connection with, the provision to the public of postal or telecommunication services."</p> <p>It is a further point of notes that waste from mines and quarries is excluded from the definition of commercial waste in section 75(7) (c) of EPA 1990 but not from the definition of industrial waste. The effect of the proposals in the Waste Management (England and Wales) Regulations 2006 will be to repeal this exclusion and reclassify (non-mineral) waste from mines and quarries, as well as agricultural waste, as industrial waste.</p>
Construction & demolition waste	<p>Construction and demolition waste (C&D waste) includes hard C&D and excavation waste materials. ODPM defines these waste materials as those that arise as a direct result of:</p> <ul style="list-style-type: none"> • the total or partial demolition of buildings and/or civil engineering infrastructure; or • the construction of buildings and/or civil engineering infrastructure.

A1.3 AGRICULTURAL WASTES

Agricultural waste arisings in the UK have been estimated to amount to around 90 million tonnes per annum. The Defra e-digest statistics (Defra, 2003) suggest 87 million tonnes per annum, while the EU survey of wastes spread on land (European Communities, 2001) estimates 91 million tonnes per annum in the UK. It is reported that the overwhelming majority of the waste arisings consists of natural manure or slurry, with non-natural waste likely to be less than 1 million tonnes per annum. The European Commission judged in September 2005 that livestock effluent may fall outside of the classification of waste if it is used as a soil fertiliser as part of a lawful practice of spreading.

The Environment Agency comment that this would not be classed as waste. However, other legal controls such as the Nitrate Vulnerable Zones (NVZ) Action Programme and the Groundwater Regulations would still need to be complied with. The quantity and fate of livestock effluent is therefore included within estimates of waste arisings

In the following sections, a review is made of agricultural waste and its fate arising from both natural and non-natural waste in turn.

A1.3.1 *Natural Waste*

The natural waste comprising the majority of agricultural waste arisings consists of housed livestock waste, crop residues, animal tissue; and animal carcasses. The estimated quantities reported for each of these waste streams is summarised in *Table A1.2*. The DETR report summarised in the Review of Agricultural Waste Research and Development Projects (DETR, 2000) calculated a UK arisings estimate from farm unit waste estimates and information on crop areas and livestock numbers from farm census data. The 2001 Environment Agency report used a similar method. The Biffaward estimates are on a farm unit basis, the report gives no indication of the number of each type of farm unit in the UK. The annual quantities are estimated in all sources from data collected from farm surveys and census, in many cases stockpiled wastes were included suggesting that the annual tonnages have been over estimated.

Housed Livestock Waste

Housed livestock waste is handled as solid manure (mainly cattle, sheep, pig and poultry) and liquid slurry (cattle and pig). The amount of manure and slurry produced varies depending on the type of stock and the degree of dilution with either straw or water. However, the quantities produced by various classes of livestock have been predicted for England and Wales (*Table A1.3*). It is also reported that an additional 60 million tonnes of excreta are deposited directly on fields by grazing cattle, sheep and pigs.

The majority of the housed livestock waste is applied to farmland at the site of production, slurry is stored prior to use on land in the drier months of the year, while manure is stored on bare field land and left to digest slowly. The European Commission (European Communities, 2001) states that only a small minority of farmers treat slurry before landspreading, mainly to mitigate odour problems.

Table A1.2 *Estimated Annual Quantities of Natural Waste Arisings*

Natural Waste Stream	UK Total (million tonnes) (1)	UK Total (million tonnes) (2)	Dairy Unit (tonnes) (3)	Pig Unit (tonnes) (3)	Poultry Unit (tonnes) (3)	Sheep Unit (tonnes) (3)	Beef Unit (tonnes) (3)	Arable Unit (tonnes) (3)
Housed Livestock Waste - Manure	28.8 to 40.46	83.0 (manure, slurry and silage effluent)	231	1700		20	643	
Housed Livestock Waste - Slurry	27.83 to 42.37 (m ³ per year)		1361	3000				
Poultry Litter					4125			
Crop Residues	4.63 to 6.56	22.0	35				16	377
Animal Tissue	0.099	0.11	0.48			0.66	1	
Animal Carcasses	0.098	0.23	0.88	5.2 (with tissue)	25 (with tissue)	1.17	1.5	
Total	33.6 - 47.2*	22.3	1628.4	4700.0	4125.0	21.8	661.5	377.0

Sources:

1) Environment Agency, 2004. Review of Agricultural waste research and development projects. Produced by Atkins Environment.

2) Environment Agency, 2001. Towards Sustainable Agricultural Waste Management. Environment Agency R&D Technical Report P1-399 co-sponsored by the Environment Agency and Biffaward. Prepared by Marcus Hodges Environment, BDB Associates and the Westcountry Rivers Trust.

3) Biffaward, 2002. Agricultural Waste Mass balance: Opportunities for recycling and producing energy from waste technologies. A Biffaward Programme on Sustainable Resource Use. Prepared by C-Tech Innovations Ltd.

Notes:

* Not including housed livestock waste

Table A1.3 *Estimated Quantities of Farm Yard Manure Handled Annually in England and Wales (Million Tonnes)*

Animal Type	As Solid Manure (million tonnes)	As Liquid Manure (million tonnes)	Total Fresh Weight (million tonnes)
Cattle	21	32	53
Pig	4.3	4.6	8.9
Poultry	3.5	-	3.5
Sheep	1.9	-	1.9
Total	30.7	36.6	67.3

Source:

European Communities, 2001 European Commission-Directorate-General for Environment Survey of Wastes Spread on Land - Final Report Study Contract B4-3040/99/110194/MAR/E3. Prepared by WRc Ltd, SEDE and REL.

40% of the poultry and 15% of pig manure is transported off-site for disposal (European Communities, 2001). Some poultry waste is disposed via incineration in specially built power plants (Biffaward, 2002) and pig manure is used by neighbouring arable enterprises as a fertiliser. Silage effluent is either fed directly back to cattle or landspread without treatment.

The Biomass Task Force was launched in October 2004 to assist the Government and the biomass industry in optimising the contribution that biomass energy can make to renewable energy targets and to sustained farming and forestry and rural objectives. The Biomass Task Force (BTF) has raised the potential for certain agricultural waste to be used as a biomass resource for energy production. The Task Force report stated that dry agricultural materials, cereal straw and poultry manure can be used to generate energy through biomass-fired processes such as mass-burn steam turbines, heat-only boilers or combined heat and power (CHP) plants.

Wet materials, such as pig and cattle slurries, would not be viable inputs for the biomass-fired processes due to the high energy cost of drying the materials prior to burning or the reduced calorific values of incinerating 'wet' materials directly. However, anaerobic digestion (AD) offers a potential solution for these waste streams. It is estimated that the maximum available arisings total around 2.9 million tonnes (mt): 0.36mt from poultry manure; 2.02mt from dairy cattle slurry; and 0.54mt from pig manures (Biomass Task Force, 2005).

Small-scale on-farm incinerators (of which there are approximately 3000 in England and Wales) are used on large scale poultry and pig farms for the disposal of animal carcasses (Environment Agency, 2001).

Crop Residues

Crop residues consist of straw, vegetable waste, and cereal waste. The estimated arisings of each of these waste streams reported are presented in *Table A1.4*.

Table A1.4 *Estimated Annual Quantities of Crop Residues*

Crop Residue	UK Total (million tonnes per year) (1)	Per Arable Unit (tonnes per year) (2)
Straw	1.84 to 3.14	344
Vegetable Waste	0.67 to 1.30	33
Cereal Waste	2.12	
Total	4.63 to 6.56	377

Sources:

- 1) Environment Agency, 2004. Review of Agricultural waste research and development projects. Produced by Atkins Environment.
- 2) Biffaward, 2002. Agricultural Waste Mass balance: Opportunities for recycling and producing energy from waste technologies. A Biffaward Programme on Sustainable Resource Use. Prepared by C-Tech Innovations Ltd.

Some straw is recycled as animal bedding, some ploughed into the land, and some burnt. Under the proposed new Agricultural Waste Regulations (to begin in 2006) the burning of crop residues will be allowed provided a licensing exception has been registered and any conditions applied adhered to. It is reported in the Biffaward report (Biffaward, 2002) that about 200,000 tonnes of baled straw are used as a fuel in a purpose-built power station operating at Sutton, near Ely, Cambridgeshire. Vegetable and cereal waste is mostly returned to land, with composting increasing.

A1.3.2 *Non-Natural Waste*

Non-natural waste comprises plastics, paper and board, machinery, chemicals, medicines, scrap metal, glass, rubber and general building waste. The estimated quantities reported for each of these waste streams is summarised in *Table A1.5*, with estimated totals ranging between 0.5 mt (Environment Agency, 2001) and 1 mt (Defra, 2003). Non-natural waste from farms that have diversified (to include, for example, tourism) is not yet well documented, but is anticipated to be growing in scale.

Table A1.5 Non-Natural Waste Estimated Annual Quantities

Non-Natural Waste Stream	UK Total (thousand tonnes) (1)	UK Total (thousand tonnes) (1)	Agricultural Waste						
			Estimate Model 1998 UK total (thousand tonnes) (3)	Dairy Unit (tonnes) (4)	Dairy Unit (tonnes) (4)	Poultry Unit (tonnes) (4)	Sheep Unit (tonnes) (4)	Beef Unit (tonnes) (4)	Arable Unit (tonnes) (4)
Plastics and packaging	58.8	34 (packaging) 60 (non-packaging)	135.7	0.78	0.44	0.18	0.096	0.77	0.32
Paper and board		10.9	10.9	0.072	0.20	0.13	0.03	0.11	0.12
Machinery	73.0 to 76.0	79.5	79.2	0.36	0.32		0.36	0.36	0.32
Glass			1.95 (plus rubber)	0.0012	0.24	0.04	0.0012	0.0012	
Rubber				0.001	0.0029		0.001	0.001	
Scrap Metal				0.11	0.096		0.11	0.11	0.096
Chemicals	144.2 to 300.3 (m ³ /yr)		104.5				1.62		3.2
Medicines	0.25		116.5						
General Building Waste			33.6						
Total	276.3 to 435.4*	90.4	480.5	1.3	1.3	0.35	2.2	1.4	4.0

Sources:

1) Environment Agency, 2004. Review of Agricultural waste research and development projects. Produced by Atkins Environment.

2) Environment Agency, 2001. Towards Sustainable Agricultural Waste Management. Environment Agency R&D Technical Report P1-399 co-sponsored by the Environment Agency and Biffaward. Prepared by Marcus Hodges Environment, BDB Associates and the Westcountry Rivers Trust.

3) Environment Agency, 2003. Agricultural Waste Survey 2003: A study of the management of non-natural agricultural waste on farms. Environment Agency R&D Technical Report co-sponsored by the Environment Agency and a grant from Biffaward (the latter with contribution from DEFRA and the Crop Protection Association). Prepared by Marcus Hodges Environment, BDB Associates and the Westcountry Rivers Trust.

4) Biffaward, 2002. Agricultural Waste Mass balance: Opportunities for recycling and producing energy from waste technologies. A Biffaward Programme on Sustainable Resource Use. Prepared by C-Tech Innovations Ltd.

Notes:

* Assuming density of chemicals to be 1kg/litre

Plastics and Packaging

Plastic and packaging waste from agriculture consists of silage film, horticultural film, agrochemical containers, fertiliser and seed bags and other miscellaneous packaging. The types of plastic are principally polyethylene and polypropylene. Quantities reported in the Environment Agency's Agricultural Waste Survey 2003 are presented in *Table A1.6*.

Table A1.6 UK Estimates of Plastics and Packaging Agricultural Waste Arisings (Tonnes per Year)

Waste Type	Total UK Estimate (tonnes per year)
Plastic Packaging	
Agrochemical packaging	2400
Fertiliser bags	12,200
Seed bags	1000
Animal feed bags	11,400
Animal health packaging	750
Oil containers	669
Miscellaneous packaging	3800
Non-packaging Plastics	
<i>Films</i>	
Silage plastic	25,000
Silage plastic and contamination	50,000
Greenhouse and tunnel film	500
Mulch film and crop cover	4500
Mulch film and crop cover and contamination	22,500
<i>Other Non-Packaging Plastics</i>	
Cores for silage wrap	1506
Other horticultural plastics	6000
Bale twine and net wrap	11,100
Tree guards	11,900
Total	165,225

Source: Environment Agency, 2003. Agricultural Waste Survey 2003: A study of the management of non-natural agricultural waste on farms. Environment Agency R&D Technical Report

Traditionally, plastics have been burnt on-site, either in incinerators or in the open. This will not be permissible under the proposed new Agricultural Waste Regulations, when the only realistic way of disposal will be to send it off-farm for recovery or disposal. As the pressure to stop burning has grown, more stockpiling has occurred on-site.

Recycling schemes for farm films exist in certain parts of the country; with film taken to the BPI reprocessing site in Dumfries. Take-back schemes run by suppliers also exist (Biffaward, 2002). Survey responses from farmers have shown that some plastics are buried on-site, where old quarries or suitable excavations exist, and some is included in the household waste collection. This will be banned under the proposed new Agricultural Waste Regulations and will potentially lead to increased arisings.

Paper and Board

Paper is mainly in the form of secondary cardboard packaging, with some cardboard arising from silage sheet, horticultural film and net wrap cores. Quantities reported in the Agricultural Waste Survey 2003 are presented in *Table A1.7*.

Table A1.7 *UK Estimates of Paper and Board Agricultural Waste Arisings (Tonnes per Year)*

Waste Type	Total UK Estimate (tonnes per year)
Agrochemical packaging	1600
Animal health packaging	250
Animal feed bags	6000
Seed bags	1800
Silage wrap boxes	335
Cores for silage sheet	929
Total	10,914

Source: Environment Agency, 2003. Agricultural Waste Survey 2003: A study of the management of non-natural agricultural waste on farms. Environment Agency R&D Technical Report

Paper and cardboard waste is recycled (13%), burnt for heating (8%) or burnt in the open (just over two thirds) (Environment Agency, 2004). Under the proposed new Agricultural Waste Regulations, the burning in the open of paper and cardboard will be banned, and therefore this proportion will require an alternative disposal route.

Machinery

The main wastes related to machinery are oils, tyres, batteries and scrap machinery or parts. Quantities reported in the Agricultural Waste Survey 2003 are presented in *Table A1.8*. Equipment containing chlorofluorocarbons (CFCs) and halons, and electrical equipment containing polychlorinated biphenyls (PCBs) still exists on farms at unknown quantities.

Table A1.8 *UK Estimates of Machinery Agricultural Waste Arisings (Tonnes per Year)*

Waste Type	Total UK Estimate (tonnes per year)
Oils	27,095
Batteries	2812
Tyres	25,974
Redundant vehicles and machinery	23,312
Total	79,193

Source: Environment Agency, 2003. Agricultural Waste Survey 2003: A study of the management of non-natural agricultural waste on farms. Environment Agency R&D Technical Report

Tyres are either recycled (around half of farms do this) or re-used on-farm (Environment Agency, 2004). It has been found that around 20% of farms have been stockpiling tyres, and, in addition, it has been reported that around 10% of farms burn tyres in the open. This will be banned under proposed new Agricultural Waste Regulations. The stockpiling of other machinery and batteries is also common practice.

Batteries are re-used by around 10% farms, typically for powering electric fences. Some batteries and machinery are taken back by suppliers as part of take-back schemes. Scrap metal is mostly recycled off-farm, although around 10% has been reported to be stockpiled with no disposal plans (Environment Agency, 2004).

Chemicals

Chemical waste produced consists of agrochemicals, such as: pesticides; sheep dip chemicals; and waste oil.

The recommended practice is for pesticide washings to be applied to unsprayed areas of crop. The quantities of unused agrochemical concentrates stored on farms have declined due to improved control and take back schemes.

It is estimated that the total quantity of waste sheep dip solution is 116,000 tonnes per year (Environment Agency, 2001). The spent sheep dip is typically spread to land. This requires authorisation from the Environment Agency. Approximately 11,000 authorisations had been issued at 2000. Unused sheep-dip concentrate is typically returned to the supplier.

Generally around 30% to 50% of farms recycle oils off-farm, with a quarter reusing the oil (Environment Agency, 2004). It is also stated that one in seven farms were burning waste oil for heating, or burning oils in the open. This will be banned under the proposed new Agricultural Waste Regulations.

Medicines

It is estimated that the total quantity of waste syringes and needles is around 46 tonnes per year (Environment Agency, 2001) and includes vaccines, antibiotics and mineral supplements. Each type of farming will have a different type and quantity of health waste arising.

Veterinary needles are most often returned to the vet. However it has been reported that one in seven practices dispose of them to the dustbin (Environment Agency, 2004). It is reported that some veterinary product waste is burnt, some buried and some included in the household waste collection (Environment Agency, 2001). Under the proposed new Agricultural Waste Regulations, veterinary waste will be classified as hazardous, which will have associated cost implications.

Glass waste arises from the packaging from the supply of medicines, and is estimated to be around 750 tonnes per year (Environment Agency, 2004).

General Building Waste

The general building waste that can be produced on farms includes bricks, concrete, metal and cement-bonded asbestos. No reliable data exists on quantities, but arisings are likely to increase in the future due to diversification and building conversion. An estimate of asbestos cement roof sheeting waste arisings is made in the Agricultural Waste Survey 2003 at around 33,600 tonnes per year. This is classed as a hazardous waste and is therefore a management issue.

Survey responses from farmers have shown that some building waste is buried on-site, where old quarries or suitable excavations exist (Environment Agency, 2001). The burial of waste onsite will be banned under the proposed new Agricultural Waste Regulations, unless the tips acquire a permit under the Pollution Prevention and Control Regulations (2000). Some building waste is re-used for farm tracks, with some re-use of asbestos sheeting reported. Long term storage with no plans for disposal is also common.

A1.3.3 *Summary of Treatment and Disposal Methods*

As discussed in the previous sections, the treatment and disposal of agricultural wastes varies according to the type of waste handled. The treatment and disposal routes currently employed for agricultural wastes are detailed in *Table A1.9*.

Table A1.9 Best Estimates of Agricultural Waste Management (Tonnes per Year)

Management Route	Manure ¹	Slurry ¹	Crop Residues ¹	Animal Tissue ¹	Animal Carcasses ^{1,4}	Plastics ^{2,4}	Paper ^{2,4}	Tyres and Other Machinery ^{2,5}	Chemicals ^{2,6}	Medicines ^{2,6}	Building Waste ^{2,6}
Land Spreading	40,460,000	42,370,000	6,360,000						116,000 (sheep dip) +92,300 (pesticides)		
Incineration with energy recovery			200,000								
Incineration without energy recovery				99,000	98,000	Unknown		7919		11,650	
Anaerobic Digestion ³		50,000				Unknown					
Recycled on Farm						Unknown			23,000		11,201
Recycled off Farm						Unknown	1420	55,435	46,000	81,550	
Burnt for heating							874		23,000		
Buried on Farm					Unknown	Unknown				11,650	11,201
Stock Piled								15,839			
Included in Household Waste						Unknown	Unknown			11,650	
Landfilled						135,725	8634				11,201
Total	40,460,000	42,370,000	6,560,000	99,000	98,000	135,725	10,914	79,193	300,300	116,500	33,602

Notes:

1. Natural Waste arisings taken from Environment Agency 2004
2. Non- Natural Waste arisings taken from Environment Agency 2003, except chemicals from Environment Agency 2004
3. Data from Holsworthy Anaerobic Digestion plant
4. 'Unknown' shows where quantities of arisings are unknown due to qualitative nature of the surveys
5. Machinery estimates and disposal routes mainly from information regarding tyres due to qualitative nature of the surveys
6. With exception of Sheep dip, quantities are estimated due to the qualitative nature of the surveys

A1.3.4 *Agricultural Waste Composition*

Table A1.10 presents the assumed composition and properties of agricultural wastes. The carbon content for each waste fraction has been estimated using a common set of fractional components and carbon content estimates.

Table A1.10 *Estimated UK Agricultural Waste Composition (2003/2004)*

Waste Fraction	Thousand Tonnes Arising	% of Sector Arisings	% Carbon (Biogenic)¹	% Carbon (Fossil)¹	Gross Calorific Value (MJ/kg)¹
Paper	10.9	0.01%	32%		12.6
Manure/Slurry/Other					
Organics ²	83,027	92.0%	12.4%		5.7
Crop Residues	6,560	7.3%	17.3%		13.5
Chemicals	300.3	0.3%		38.4% ³	15.6 ³
Medicines	116.5	0.1%	3.5% ⁴	3.5% ⁴	2.8 ⁴
Building Waste	33.6	0.05%	3.5% ⁵	3.5% ⁵	2.8 ⁵
Tyres and Other					
Machinery ⁶	79.2	0.09%		45%	19.7
Plastic (Film)	135.7	0.2%		48%	23.6
Total	90,263	100%	14%	0.3%	5.5

Sources:

1. Environment Agency, 2004. Review of Agricultural waste research and development projects.

Produced by Atkins

2. Environment Agency, 2003. Agricultural Waste Survey 2003: A study of the management of non-natural agricultural waste on farms. Environment Agency R&D Technical Report

Notes:

1. Carbon content and gross calorific value estimated from work carried out as part of the development of the WRATE LCA tool for waste management (ERM and Environment Agency data, 2003-2005)

2. Includes animal tissue and animal carcasses (0.1%)

3. Values for the waste fraction 'paint/varnish/herbicides&pesticides' have been used (ERM and Environment Agency data, 2003-2005)

4. Values for the waste fraction 'clinical waste' have been used (ERM and Environment Agency data, 2003-2005)

5. Values for the waste fraction 'miscellaneous non-combustible' have been used (ERM and Environment Agency data, 2003-2005)

6. Waste categories described as 'Tyres and Other Machinery' assumed to comprise 50% tyres and 50% WEEE waste.

A1.3.5 *Agricultural Waste Growth*

The report, 'Towards sustainable agricultural waste management' (Environment Agency, 2001), concludes that there is potential for reduction of some waste streams through improved farming practices ⁽¹⁾.

(1) http://www.environment-agency.gov.uk/commondata/acrobat/toward_sust_ag_588593.pdf

A1.3.6 *Agricultural Waste Future Management* ⁽¹⁾

There is a legal obligation to implement the Waste Framework Directive (75/442/EEC, as amended) in the agricultural sector. The implementation of this Directive will mean that, from 2006, the on-farm disposal of waste packaging, plastic films and other 'non-natural' waste, including the burning of plastic waste, will no longer be allowed and alternative management routes will be required.

Note that the Directive will not apply to manures and other non-dangerous substances used on farms for agricultural benefit. This follows a recent court decision that manures and slurries are not classified as wastes when used as a fertiliser on agricultural premises ⁽²⁾.

The future management of agricultural waste will need an integrated strategy, although perhaps the most likely option for most farms will be to transfer waste to a registered waste contractor for disposal or recovery at a licensed facility. It is expected that the following methods of waste management will become more important:

- waste minimisation – it is easiest to persuade farmers to minimise their waste, since this will deliver cost savings;
- recycling schemes and take-back schemes by suppliers – this is the favoured option for dealing with plastic wastes and health care wastes. Defra are looking into the introduction of a national scheme for collecting and recycling non-packaging plastic waste;
- composting – this is a growing industry in the UK, and may be suitable for some agricultural wastes;
- landspreading – will continue to be available for the disposal of natural agricultural waste but is required to be properly controlled;
- energy recovery Schemes – schemes such as the burning of straw, poultry litter etc are becoming increasingly important, along with the collection of methane from other processes such as anaerobic digestion (AD);
- AD schemes – it has been recommended by the Biomass Task Force that the UK AD capacity is increased, even though is constrained by poor financial returns since most waste is spread to land. British Biogen (now merged with the Renewable Energy Association) has proposed a programme that aims to achieve the installation of 50 AD plant, 100 on-site agri-industrial AD plant and 500 on-farm AD plant by 2010. The on-farm AD plants will only be appropriate for large farms due to the large capital outlay required; and

(1) Biffaward, 2002, Biffaward, 2003, Biomass Taskforce, 2005, Defra, 2004

(2) This includes when they are used on other agricultural premises that did not produce the manure and slurries.

- stockpiled materials - one-off schemes are recommended for the recovery of stockpiled materials, such as scrap metal, tyres and asbestos.

A1.4 MINING AND QUARRYING WASTES

Mine and quarry waste includes materials such as overburden (useless material that overlies a bed of useful material), interburden (rock inter-bedded with the mineral) and residues left over from initial processing of the extracted material into saleable products. The majority of these wastes are either tipped locally, used for infilling prior to restoration of land, or re-used.

Wastes derived from mining and quarrying activities are comprised of approximately two-thirds quarrying, china clay extraction and colliery-derived waste and one third wastes from other clay extraction, coal mining wastes and chemical residues. *Table A1.11* shows estimates of minerals waste arising since 1992 for the six major categories of minerals waste. The overall trend shows waste arisings decreasing, predominantly due to the decline in UK collieries (deep-mined coal production) over this period. The decrease in waste arisings has stabilised over the last few years, but still shows some decline across the board.

Data have been sourced from Defra waste statistics, and originate from the 2002 volume of the United Kingdom Minerals Yearbook, compiled by the British Geological Society (British Geological Survey, 2002). Annual production data are collated by the British Geological Survey and are published in the United Kingdom Minerals Yearbook. All information sources are referenced in the Yearbook, however the principal sources of annual production data are:

- the Office of National Statistics (ONS) Annual Minerals Raised Inquiry (AMRI);
- the Aggregate Minerals Survey for England and Wales;
- the Quarry Products Association; and
- the Coal Authority.

Estimates for 2004 UK mineral production are provided in the revised, 2004 volume of the Minerals Yearbook and show a slight decline in production in comparison with 2003. However, the most complete dataset available remains that for 2003.

Minerals waste estimates have been derived based on the ratios of waste to product, as defined by Defra's Waste Statistics Division. It should be noted that mineral extraction processes differ significantly with respect to waste generation and vary from site to site. The arisings presented herein are very much estimates, therefore.

Table A1.11 UK Mineral Waste Arisings (estimated as a ratio to production) (Thousand Tonnes)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Colliery	32,900	25,229	15,927	17,575	16,112	15,141	12,543	10,444	8,594	8,674	8,196	7,818
Coal	9,347	8,871	8,559	8,944	9,292	9,107	8,094	8,095	7,005	7,292	6,799	6,300
China												
Clay	22,526	22,156	22,778	23,283	20,537	26,648	21,608	20,738	21,388	19,839	19,469	18,875
Clay	15,172	13,799	15,174	16,725	14,507	13,791	14,110	13,560	13,096	12,352	12,114	12,041
Slate	6,520	9,240	8,040	5,500	8,180	6,940	9,000	7,220	9,580	11,020	14,840	18,000
Quarrying	38,525	39,464	42,115	40,769	39,039	37,541	25,602	36,530	36,223	36,897	34,190	33,849
Total	124,990	118,759	112,593	112,795	107,666	109,167	90,957	96,586	95,886	96,073	95,608	96,882

Source: Defra e-Digest of Environmental Statistics, Published August 2003, Defra

Notes:

- Colliery waste estimate is based on deep-mined coal assuming a ratio of waste to saleable product of 1:2
- Coal waste is based on opencast and other coal production and is also based on a 1:2 ratio.
- China clay waste is estimated on the ratio of waste to saleable product of 9:1
- Clay waste is estimated on the ratio of waste to saleable product of 9:1
- Slate waste is estimated on the ratio of waste to saleable product of 20:1
- Quarrying waste is estimated on the ratio of waste to saleable product of 1:9
- Figures are provisional for 2003.

A1.4.1 Mining and Quarrying Waste Composition

Mining and quarrying wastes are assumed to consist of top and sub-soils, rock and soil overburden and interburden and primary processing wastes. The majority of these materials will have a relatively low carbon content and calorific value. For example, work carried out as part of the Environment Agency's development of the WRATE tool reports non-combustible mineral materials, such as bricks, plaster and soil, to have a carbon content of 7% and a gross calorific value of 2.8 MJ/kg.

Some minerals and their wastes may contain carbon fixed in carbonates, or appreciable organic content, for example associated with coal seams or peat. In the absence of further, reliable information, however, it will be assumed that mining and quarrying wastes have similar properties to those reported for non-combustible materials and that proportions of biogenic carbon (in soils) to fossil carbon (in rock/mineral) will be 50:50.

It is a further point of note that the carbon contained within these materials will not be emitted unless the material is subjected to intentional or unintentional roasting or combustion. As such, these materials are likely to have only a minimal direct impact in terms of greenhouse gases. Of greater significance will be assumptions regarding fuel and transport requirements in their management.

A1.4.2 Mining and Quarrying Waste Management

There are no definitive statistics available regarding mineral waste management, as individual mines and quarries will manage wastes according to local conditions.

In most mineral workings, extraction wastes are deposited in tips and lagoons. In some workings, at least part of the tipped material may be returned to the void as part of the restoration landscaping scheme (with or without other wastes brought onto the site). In a few cases, notably opencast coal extraction, the amount of waste is large compared with the product and the void is refilled and restored close to original ground levels.

In practice, it is normally required that the topsoil and subsoil are stored temporarily and then used in reinstating the site. Some over and interburden and processing wastes may in some circumstances be saleable products. In other cases, they may remain in tips/lagoons or be returned to the void depending on local circumstance and requirements ⁽¹⁾.

For the purposes of this study, it has been assumed that 1% of mineral materials are recycled, 50% of remaining minerals are used as void fill, 50% of remaining minerals are deposited in tips on site and 100% of soils are used as void fill.

A1.4.3 *Mining and Quarrying Waste Growth*

According to the British Geological Survey's 2004-2005 annual report ⁽²⁾, it is becoming increasingly challenging to locate areas of the UK which contain high-grade, economically-viable minerals and which can be consensually worked in line with modern principles of planning and sustainable development.

This might imply that mining operations in the UK may decrease over the long-term. However, no definitive statistics are available and, while some minerals are now significantly constrained by environmental designations, many are widespread in occurrence and sites will be identified for the foreseeable future (eg aggregates, industrial limestone, brick clays, building and roofing stone) ⁽³⁾.

A1.5 *SEWAGE SLUDGE*

Sewage sludge is an inevitable by-product of sewage treatment. It is produced at sewage works as a thick, odorous liquid containing around 4% solid matter (Water UK, 2005).

This waste stream is formally defined by the European Commission in the Urban Wastewater Treatment Directive (UWWTD) as *Sludge from urban waste water treatment plants, whereby 'urban waste water' is understood as: "domestic waste water or the mixture of domestic waste water with industrial waste water and/or run-off rain water"* (Directive 91/271/EEC).

The definition of 'domestic waste water' in the Directive reads:

(1) Brian Marker, ODPM, pers. comm.

(2) http://www.bgs.ac.uk/annualreport/0405/ar0405_lr.pdf

(3) Brian Marker, ODPM, pers. comm.

“waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities”.

Water UK monitor sewage sludge arisings and management as an indicator of the extent to which the water industry takes the opportunity to reuse the main by-products of its treatment operations, water treatment sludge and sewage sludge. In 2003/04, approximately 1.3 million tonnes of sludge (dry weight) was produced as a result of treating drinking water and sewage. 77.3% of sewage sludge and 71% of drinking water sludge was recycled on agricultural land, reaching a combined recycling rate of 77% (Water UK, 2005) ⁽¹⁾.

Historical data regarding sewage sludge arisings and disposal are presented in *Table A1.12* and *Table A1.13*. When compared against Water UK's 2004 estimate, these data show that there has been an increase, albeit not significant, in arisings for this waste stream over the last 15 years. Further, an Environment Agency survey carried out in 1999 (Gendebien *et al*, 1999) predicted that sludge production in the UK would reach 1.22mt (dry weight) by 2005, as a result of the implementation of the UWWTD. Water UK's current figures show that this predicted increase has been surpassed.

The Environment Agency survey further considered that the increase in sludge arisings would be accommodated by use in agriculture or by incineration. *Table A1.13* accordingly shows that agricultural and incineration disposal routes have increased significantly. The amount of sewage sludge disposed of at sea decreased by 41% between 1997/98 and 1998/99 and disposal of sewage at sea ceased altogether at the end of 1998 as a result of the UWWTD. Incineration is now the second largest disposal route.

(1) Data on sewage sludge are complete for the UK. Data on water treatment sludge are from operators that serve about 85% of the UK population. Overall confidence in the data set is medium/high

Table A1.12 Estimated UK Sewage Sludge Arisings (Thousand Tonnes Dry Weight)

Administration	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2001	2002	2003	2004
England and Wales	945	945	907	902	916	993	942	873	936	999	-	1,191	-	-
Scotland	80	100	80	80	90	93	105	98	97	97	-	-	-	-
N.Ireland	27	27	32	32	33	34	31	34	25	34	-	-	-	-
Total	1,052	1,072	1,019	1,014	1,039	1,124	1,079	1,005	1,058	1,130	1,123	-	-	1,334

Sources 1990/91-1999/00: Water UK (Water Companies; Scottish Executive; DOE (NI) Water Service), e-Digest of Environmental Statistics, Published August 2003, Defra

Notes:

- Information on sewage sludge arisings and disposal in 1990/91 was obtained on a dry weight basis in a UK-wide survey of the sewerage authorities.
- Value for 1989/90 estimated from wet sludge data assuming uniform solid content. The methodology used for this estimate was not used in subsequent years. This estimate is now looked upon as an overestimate.
- No data collected in 1991, therefore 1990 figure is used as a best estimate for 1991.
- No data collected in 1993 or 1994, therefore 1992 figure is used as a best estimate.
- Data are estimated for 1989/90.

Sources 2001-2004: Water UK, Sarah-Jane Hadlow, personal communication 2005-12-19.

Notes:

- Only data for England and Wales are included for 2002.
- No data collected for 2003.

Table A1.13 UK Disposal of Sewage Sludge (Thousand Tonnes Dry Weight)

Fate	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000	2001	2002	2003	2004
Farmland	507	482	502	504	548	535	525	504	587	610				-
Agriculture											690	701	-	818
Industrial crops											47	46	-	60
Landfill	123	130	104	123	115	97	75	115	192	102	62	64	-	15
Sea disposal	279	274	270	263	254	264	258	150	-	-			-	
Incineration	69	72	84	72	82	88	81	185	237	282	211	269	-	243
Compost											6	5	-	16
Land reclamation											106	93	-	150
Cement manufacture													-	12
Other	94	61	54	77	125	95	67	105	113	135		13	-	20
Total	1,072	1,019	1,014	1,039	1,124	1,079	1,005	1,058	1,130	1,130	1,123	1,191	-	1,334

Sources 1991/92-2000: Water UK (Water Companies; Scottish Executive; DOE (NI) Water Service), e-Digest of Environmental Statistics, Published August 2003, Defra, ENDS 2001.

Notes:

- 'Other' includes beneficial uses for land reclamation and forestry and soil and compost products.
- Totals may not add up due to rounding.
- Figures for 1999/00 and 2000 taken from estimated percentages based on ENDS 2001 report "Sewage sludge disposal outlets" and based on arisings estimates for 1999/00.

Sources 2001-2004: Water UK, Sarah-Jane Hadlow, personal communication 2005-12-19.

Notes:

- Only data for England and Wales are included for 2002.
- No data collected for 2003.

A1.5.1 Sewage Sludge Composition

Sewage sludge composition varies depending on catchment. Typical carbon content will also vary according to moisture content. Data collated as part of the Environment Agency's development of WRATE estimated the biogenic carbon content of dry sewage sludge to be 30.9% and gross calorific value to be 12 MJ/kg.

A1.5.2 Growth in Sewage Sludge Arisings

Legislation

Growth of sewage sludge arisings has historically been directly correlated to changes in sewage treatment standards. In the early 1990s, the EC Bathing Water Directive was transposed into national legislation through Regulations and Directions, leading to increased treatment standards for the UK. The Urban Waste Water Directive was transposed into legislation across the UK in 1995, leading to further increases in treatment standards. Historical data regarding sewage sludge arisings are presented in *Table A1.12* and *Table A1.13* and show a significant increase in arisings since the late 1990s, in accordance with tighter regulations.

The latest piece of legislation potentially having an impact on treatment standards for sewage sludge is the Water Framework Directive, which came into force in 2000. Defra note that the Water Framework Directive is the most substantial piece of EC water legislation to date. It requires all inland and coastal waters to reach "good status" by 2015 ⁽¹⁾.

Growth estimate by the water industry

In 2004, the water industry supplied Defra with an estimation of total sludge available for disposal in 2010, in order to help Defra collate the Regulatory Impact Assessment for the forthcoming consultation on the Sludge (Use in Agriculture) Regulations. Nine of the ten main water and sewerage companies supplied data in response. The total estimated sludge arisings in 2010 were 1,428,400 tonnes dry weight per year ⁽²⁾, corresponding to a 7% increase in comparison with arisings in 2004.

A1.5.3 Future Sewage Sludge Management

The dominating and increasing use of sewage sludge has historically been on farmland (see *Table A1.13*). This corresponds with information sourced from UK water companies (outlined in the following sections). Concerns are expressed, however, that future legislation and public perception may restrain the use of sewage sludge on farmland.

The use of sewage sludge in agriculture has, in some European countries, decreased due to protection of soils and health concerns. As an example, the

(1) <http://www.defra.gov.uk/environment/water/wfd/>

(2) Sarah-Jane Hadlow, Water UK. E-mail 2005-12-19.

use of sewage sludge in agriculture has been banned altogether in Switzerland, a favour of incineration with energy recovery as the waste management treatment option (Federal Administration, Switzerland, 2003).

The Sewage Sludge Directive 86/278/EC regulates the use of sewage sludge in agriculture. Restrictions on heavy metal content and receiving land type are given in the Directive. A proposed revision of the Directive intends to ⁽¹⁾:

- broaden its scope to include a wider range of sludges and receiving land types;
- result in a diversion into other treatment/disposal options; and
- require the development of more advanced technologies in the long term.

The Defra Waste and Resources Research Advisory Group working paper (2004) discusses the potential implications of revisions to the Directive ⁽²⁾:

“(...) The UK already has a strong voluntary code of practice in place but will come under pressure from lobby groups concerned about pathogen content. Market forces from food retailers and manufacturers also discourage sludge spreading. If this becomes a high profile issue more sludge may end up being diverted to landfill or incineration. (...)”

There are ten main water and sewage operators in the UK. The following sections summarise thoughts on future sewage sludge management for three of the largest operators.

Thames Water ⁽³⁾

Thames Water processed 245,584 tonnes (dry solids) of sewage sludge in 2004, corresponding to approximately one fifth of the total UK arisings.

Sewage sludge disposal is one of the sustainability indicators that Thames Water report on. The target for 2004 was to put 100% of sewage sludge to beneficial use, which was achieved through use in agriculture (57%), incineration with energy recovery (32%), industrial crops (5%), land restoration (5%), and composting (1%). The target for 2005 is again 100% put to beneficial use.

Severn Trent⁽⁴⁾

In 2004, Severn Trent Plc undertook a carbon management project, with the support of the Carbon Trust. The Carbon Management Report was launched in 2005, which produced a scenario projecting the group's net UK greenhouse gas emissions to 2020. The future of sludge arisings and sludge waste management is discussed in the report, and summarised below.

(1) CIWM webpage 2005-12-16.

<http://www.ciwm.co.uk/pma/1581>

(2) Defra (2004). Background Info: Future legislative drivers on waste and resource management.

<http://www.defra.gov.uk/environment/waste/wip/research/wrrag/papers/drivers-background.pdf>

(3) http://www.thameswateruk.co.uk/en_gb/Downloads/PDFs/Measuring_performance_2004.pdf

(4) http://www.severntrent.com/ss_pdf/corporateresponsibility/downloads/carbon_management_report_05.pdf

The greenhouse gas emissions associated with sludge treatment are projected to decrease from the current baseline of 8000 tonnes CO₂/year to -6000 tonnes CO₂/year in 2020. This decrease is explained by business decisions to increase the percentage of methane that is captured/utilised from landfills and sewage treatment works, and by decisions to increase the percentage of methane utilised in CHP plant to generate electricity.

Projected policy drivers are also considered to decrease the greenhouse gas emissions. According to the study, the quantity of sludge requiring treatment will increase by 20%, which in turn will increase the amount of methane from sludge digestion. This methane can be used for renewable energy generation.

Concerns are expressed in the report regarding the consequence of possible stricter legislation on the use of sewage sludge, possibly ending the use of sewage sludge on farmland.

Anglian Water ⁽¹⁾

Anglian Water details in their Monitoring Plan 2005-2010 commitments for service and quality improvements. For sewage sludge, use in agriculture is planned to continue. However, concerns are expressed on potential loss of agricultural disposal routes due to public attitudes to food production.

A1.6 *DREDGED MATERIALS*

Dredged spoils consist of the sediments left over from dredging aggregates and through maintenance and capital dredging activities. CEFAS defines this waste stream as “the material generated when dredging ports, harbours, rivers and approach channels”.

A1.6.1 *Dredged Material Arisings*

Marine Dredging

Harbour Authorities, port and marina operators, dredging companies, developers, the marine aggregate industry and others carry out a variety of dredging operations including:

- maintenance dredging - removal of accumulated sediments from harbour channels and berths to ensure a safe depth of water for navigational purposes, to restore an adequate flow of water to mitigate risk of flooding or to protect a sensitive habitat;
- capital dredging - excavation of material to deepen or create navigational channels and berths, to provide additional harbour infrastructure or during construction works at sea; and

(1) <http://www.anglianwater.co.uk/assets/MonitoringPlanSectionTwo.pdf>

- extraction - of sands and gravels (marine aggregates) to provide material for construction works and for 'soft engineered' sea defences and beach replenishment.

Waste from marine sand extraction is difficult to quantify. However, it is returned to the sea and hence never becomes a waste issue. Sea movements (coastal drift and tide) are also likely to redistribute any discarded fine material back in to the location, and fill voids left through extraction.

The majority of material from UK capital and maintenance dredging is also disposed of at sea, at a number of licensed disposal sites. *Table A1.14* shows the amounts of dredged materials dumped at sea in the UK between 1996 and 2003 and that they are extremely variable over this time, dependent on when dredging activities occur.

Table A1.14 UK Marine Dredged Materials (Thousand Tonnes)

	1996	1997	1998	1999	2000	2001	2002	2003
Total amount dumped (wet weight)	51,251	41,241	35,724	56,821	33,053	-	-	-
Total amount dumped (dry weight)	27,235	22,333	17,359	32,828	16,567	20,768	39,758	23,114

Source 1990-2000: CEFAS, e-Digest of Environmental Statistics, Published August 2003, Defra
Source 2001-2003: CEFAS, Marie Pendle, personal communication 2005-12-19.

Inland Waterways

Dredging activities are further carried out on inland waterways as part of routine maintenance works by water authorities. In 2002/03, approximately 84,000 tonnes of material was dredged from waterways in the UK ⁽¹⁾.

Dredging spoils from inland waterways are usually disposed of in lagoons where excess water drains, although some sands and silts can be removed for reuse as construction materials.

There are three large publicly-funded navigation authorities operating in Great Britain: British Waterways; the Environment Agency; and the Broads Authority. British Waterways manage more than 70% of Great Britain's inland dredging operations. The remaining 30% are handled by the Environment Agency, Broads Authority and around 20 other operators, including local authorities, national park authorities, drainage commissioners, port and harbour authorities and original canal companies ⁽²⁾⁽³⁾.

Collated information relating to all inland dredging operations is currently unavailable. However, it is assumed that data provided by British Waterways are representative for dredging operations throughout the UK, given that this authority manages a significant proportion of all dredged materials. Waste

(1) British Waterways Facts & Figures, http://www.britishwaterways.co.uk/london/about/facts_figures.html

(2) The Association of Inland Navigation Authorities (AINA). Philip Burgess, personal communication 2005-12-14.

(3) <http://www.aina.org.uk/about.asp>

arisings data provided by British Waterways have been scaled accordingly in order to generate a total for the UK.

Data relating to inland dredging arisings are summarised in *Table A1.15*. Discussion with British Waterways revealed that the amount of material dredged varies significantly year-by-year and is difficult to predict. A large proportion of sands and gravels are recycled as aggregate. There are four predominant disposal routes for the remaining materials:

- deposited onto banks and in bankside lagoons;
- spread on agricultural land;
- disposed in British Waterways-owned licensed facilities; and
- sent to commercial landfill sites, following pre-treatment (eg with lime, pulverised fuel ash (PFA) or cement).

Table A1.15 *Inland Dredged Material Arisings (Thousand Tonnes).*

	1999/00	2000/01	2001/02	2002/03	2003/04
Rivers dredged	12.8	365		149.6	194.7
Contamination removed from channels	19.1	0.22		170	50.2
Total British Waterways	31.8	366		320	245
Total UK¹	45.5	523	-	457	350

Source: British Waterways. Paul Beckwith, personal communication 2005-12-22.

No data available for 2001/02.

1. Scaled up from British Waterways figure. British Waterways are handling 70% of the inland dredging operations

A1.6.2 *Dredged Materials Composition, Growth and Future Management*

Marine Dredging ⁽¹⁾

Detailed information relating to the composition of materials dredged at sea are currently unavailable, with the exception of heavy metal content, which is monitored by CEFAS. Given its origin, it is reasonable to assume that the waste material consists predominantly of sand, silts and minerals, with a relatively low carbon content.

CEFAS has been tracking the quantities marine dredged materials arising for many years, but no trends are apparent in historical arisings data. This, together with the intermittent and unpredictable nature of dredging operations, makes it difficult to make any estimation of future change in arisings. However, CEFAS note a trend towards the use of larger ships, necessitating large capital dredging projects at many ports around the country.

There are a number of factors which may affect the future of sea disposal for maintenance dredging. In particular, consideration is now being given to sediment budgets and sea level rise in estuarine habitats. Soft engineering approaches to flood defence, bolstering extant mudflats, salt marshes or

(1) CEFAS, Marie Pendle, personal communication 19/12/2005

beaches with suitable dredged material are becoming more commonplace. However, no strong predictions can be given as to the balance, or consequence, of these factors can be made.

Further detail regarding marine dredging composition and future management potential was not available within the timescale of this project. A simplistic assumption was made that 50% of marine dredgings are sand and 50% are silt. It was assumed that all marine dredgings would be disposed at sea.

Inland Dredging

As earlier noted, discussions with British Waterways revealed that the amount of material dredged from inland waterways varies significantly year-by-year and, as such, is difficult to predict. The quantities of material arising are dependent on the type and extent of dredging activities to be undertaken. British Waterways have indicated that their dredging budget will increase from £2.5 million in 2004/04 to £7 million in 2005/06 ⁽¹⁾. This is likely to correlate with an increase in dredged material arisings. However, beyond 2005/06, a prediction of trends cannot be made.

Further detail regarding inland dredging composition and future management potential was not available within the timescale of this project. A simplistic assumption was made that 50% of inland dredgings are sand and recycled as aggregate and 50% are silt, disposed of in landfills, was made.

A1.7 ***MUNICIPAL SOLID WASTE (MSW)***

Municipal waste includes all waste under the control of local authorities, or agents acting on their behalf. This encompasses all household waste, street litter, waste delivered to council recycling points, municipal parks and gardens wastes, council office waste, civic amenity site waste and some commercial waste from shops and smaller trading estates where local authority waste collection arrangements are in place (*Waste Strategy 2000* for England and Wales).

A1.7.1 ***Municipal Waste Arisings***

Published data relating to municipal waste arisings in each of the UK's devolved administrations are relatively complete.

England

The 2003/04 Municipal Waste Management Survey for England and Wales was published by Defra in July 2005. The survey collates municipal waste arisings, management and composition data from waste authorities across the UK. The response rate to the survey is high, enabling relatively accurate

(1) British Waterways, Nick Smith, personal communication 21/12/2005

national estimates to be made. For the 2003/04 survey, 96% of authorities returned a questionnaire.

Table A1.16 shows estimated arisings of household and municipal waste in England from 1996/97 to 2003/04, based on the Municipal Waste Management Survey results. Some of the key results of the survey were:

- the total amount of municipal waste has fallen slightly to an estimated 29.1 million tonnes in England in 2003/04 compared to 29.4 million tonnes in 2002/03, a decrease of 1.0%. This was the first time, in recent years, that the statistics have shown a reduction in municipal waste arisings;
- the proportion of municipal waste being disposed of at landfill has continued to fall from 75% in 2002/03 to 72% in 2003/04. The actual tonnage of waste being disposed of in this way has also decreased, from 22.1 million tonnes to 20.9 million tonnes following the previous years' fall;
- approximately 8.1 million tonnes (28%) of municipal waste had some sort of value (recycling, composting, energy recovery, RDF manufacture) recovered from it in 2003/04. This represents an increase from 7.3 million tonnes (or 24.7%) in 2002/03;
- around 87% of municipal waste comes from households, a total of 25.4 million tonnes in 2003/04 and a 1.5% reduction on the previous year. This represent 1.2 tonnes of waste per household per year;
- the household recycling rate increased to 17.7% in 2003/04, up from 14.5% in 2002/03;
- the proportion of households served by 'kerbside' collection schemes has increased to 79%. The amount of waste collected for recycling through such schemes has increased by 52% compared to the previous year, to 1.9 million tonnes in 2003/04. Almost all authorities collected some waste for recycling through kerbside schemes; and
- waste for composting remained the most commonly collected material for recycling, with 1.4 million tonnes collected (30% of the total recycling) in 2003/04. Paper and card was the next most commonly collected (28%, 1.3 million tonnes).

Table A1.16 Management of Municipal Waste in England (Thousand Tonnes)

Method of Management	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Landfill	20,635	21,798	21,517	21,963	22,039	22,421	22,068	20,936
Incineration with energy recovery	1435	1573	2139	2302	2391	2438	2600	2596
Incineration without energy recovery	619	61	17	8	20	9	7	8
RDF manufacture	148	167	131	106	67	84	87	12
Recycled/composted	1751	2068	2523	3097	3446	3921	4572	5528
Other	0	45	10	4	95	32	59	26
Total	24,588	25,711	26,337	27,480	28,057	28,905	29,394	29,106

Source: Municipal Waste Management Survey, Published July 2005. Defra

Notes: 'Other' treatment and disposal processes are unspecified but exclude any processing prior to landfilling and materials sent to Materials Reclamation Facilities (MRFs).

Wales

Summary results from the Environment Agency's 2003/04 Municipal Waste Management Survey for Wales were published in October 2004. *Table A1.17* shows estimated arisings of household and municipal waste in Wales from 1996/97 to 2003/04. Some of the key results of the survey were:

- the total amount of municipal waste arising in Wales in 2003/04 was 1.83 million tonnes, up from 1.79 million tonnes in 2002/03. This represents an increase of 2%;
- waste from household sources in Wales (1.52 million tonnes) accounted for 83% of municipal waste in 2003/04;
- excluding abandoned vehicles, the proportion of municipal waste being recycled or composted increased from 12.7% in 2002/03 to 17.6% in 2003/04;
- excluding abandoned vehicles, the amount of municipal waste which was recycled or composted increased by 41% from around 226,000 tonnes in 2002/03 to 319,000 tonnes in 2003/04. In particular, the amount of municipal waste being composted increased by 56% from around 71,000 tonnes in 2002/03 to 111,000 tonnes in 2003/04; and
- excluding abandoned vehicles, the amount of municipal waste which was landfilled decreased by 3% from 1.55 million tonnes in 2002/03 to 1.50 million tonnes in 2003/04.

Table A1.17 Management of Municipal Waste in Wales (Thousand Tonnes)

Method of Management	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Landfill	Not detailed		1472	1515	1537	1573	1547	1496
Incineration	Not detailed		-	-	-	-	-	-
Recycled	Not detailed		67	86	96	107	155	208
Composted	Not detailed		8	23	19	37	71	111
Total	1391	1455	1547	1624	1652	1717	1773	1815

Source: Municipal Waste Management Survey, Published October 2005. Department for Environment, Food and Rural Affairs.

Note: Municipal waste reported here refers to household waste plus waste collected from non-household sources. Abandoned vehicles are excluded.

Scotland

SEPA publishes an annual Waste Data Digest of data collected on controlled waste in Scotland. It deals with waste arisings, recovery and disposal and with waste-related operational activities. Information from Scottish local authorities on their recycling, composting and waste disposal activity is collated every three months and available in the Quarterly Recycling/Composting Returns.

The Local Authority Waste Arisings Survey (LAWAS) is the main source of municipal waste data routinely collected by SEPA. The survey collects data on wastes collected by, or on behalf of, Scottish local authorities and is completed annually on a voluntary basis by Scotland's 32 local authorities. The survey has run successfully since April 2001.

The data presented below are based on the returns provided for the Local Authority Waste Arisings Survey (LAWAS) 2003/2004. All 32 Scottish local authorities responded to SEPA's 2003/2004 LAWAS. In 2003/2004, a total of 3.32 million tonnes of controlled wastes were collected by, or on behalf of, local authorities in Scotland.

Table A1.18 Management of Municipal Waste in Scotland, 2003/2004 (Thousand Tonnes)

Management Route	Proportion of Arisings (thousand tonnes)
Disposal: Landfill	2830
Disposal: Energy from Waste	70
Recycling and Composting	420
Total	3320

Source: SEPA (2005) Waste Data Digest 5.

http://www.sepa.org.uk/pdf/publications/wds/wdd_5.pdf

Northern Ireland

In January 2002, the EHS commissioned MEL Research and Envirocentre Ltd to carry out the Waste Arisings Survey Phase III, consisting of a census of District Councils on municipal waste and a survey of industry and commerce.

Table A1.19 shows the estimated arisings resulting from the municipal survey, supplemented with data collected as part of more recent Key Performance Indicator reports from District Councils (ERM, 2005). The data show a progressive increase in household waste and household waste recycling from 1998/99 to 2003. However, over the period 2001-2003, there has been a decline in overall municipal waste arisings, resulting from a decline in local authority commercial and industrial waste collections. It should be noted that this does not necessarily reflect a reduction in waste production *per se*, merely that the commercial and industrial waste formally categorised as municipal waste may have entered the commercial or industrial waste streams, as described in *Section A1.8*.

Table A1.19 *Municipal Waste Arisings in Northern Ireland 1998/99-2003 (Thousand Tonnes)*

	1998/99 (1)	1999/00 (1)	2001 (1)	2002(2)	2003 (2)
Household waste	868	869	879	913	925
Household waste recycling and composting (%)	5.9	6.4	8.9	10	12
C&I waste	88	159	135	118	101
Total Municipal waste	960	1004	1056	1031	1027

Sources:

- (1) Environment and Heritage Service Waste Arisings Survey Phase III (2002). MEL Research and Envirocentre Ltd
- (2) KPI reports of the District Councils. Source publication: Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005)

Table A1.20 further shows a more detailed breakdown of municipal waste arisings and management across Northern Ireland in 2003.

Table A1.20 Northern Ireland Waste Treatment and Disposal Methods 2003 (Tonnes)

Waste Stream	Landfilled	Recycled		Composted	Total
		(via MRF)	(direct to reprocessor)		
Household	589,850	279	0	0	590,129
Bulky household waste	18,528	0	133	0	18,661
Household clinical waste	151	0	0	0	151
Garden waste (not composted)	0	0	128	0	128
Street cleansing and litter	39,710	0	0	157	39,867
Kerbside collection of recyclables	537	3130	4738	490	23,641
Kerbside collection compostables	0	0	0	7670	7670
Civic Amenity sites	172,960	2193	3514	42,579	257,236
Other bring recycling schemes	7054	253	1965	419	14,088
Municipal parks/gardens waste	3183	0	0	217	3400
Fly-tipped waste clearance	1353	0	0	0	1353
Commercial or Industrial waste	61,295	186	351	0	63,147
Third parties / voluntary groups	3168	0	5	239	3412
Other sources (unspecified)	3728	0	68	0	3796
Total municipal waste	901,517	6040	10,902	51,771	1,026,679

Source: KPI reports of the District Councils. Source publication: Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005)

Total UK

Combining national datasets results in a total estimated 35.3 million tonnes of municipal waste arisings in 2003/04. A breakdown of the routes by which wastes were managed is shown in Table A1.21.

Table A1.21 Total Municipal Waste Arisings UK 2003/04 (Thousand Tonnes)

Management Route	England	Wales	Scotland	Northern Ireland	
				Ireland	Total
Landfill	20,936	1496	2830	902	26,164
Recycled/composted	5528	319	420	125	6392
Incineration	2604	0	70	0	2674
Other (unspecified)	38	0	0	0	38
Total	29,106	1815	3320	1027	35,268

Sources:

- Municipal Waste Management Survey for England and Wales (2005). Department for Environment, Food and Rural Affairs.
- SEPA (2005) Waste Data Digest 5. http://www.sepa.org.uk/pdf/publications/wds/wdd_5.pdf
- Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005)

A1.7.2 MSW Composition

Estimates of municipal waste composition vary in detail according to national datasets available. The most complete dataset relating to total MSW (household and non-household wastes) derives from the National Assembly for Wales and is presented in Table A1.22.

Table A1.22 *Estimated MSW Composition in Wales*

Waste Fraction	% of Municipal Waste	Thousand Tonnes (2003/04 Arisings in Wales)
Paper and card	21%	381
Plastic film	3%	51
Dense plastic	5%	82
Textiles	2%	33
Absorbent hygiene products	2%	42
Wood	3%	51
Other combustibles ¹	7%	127
Non-combustibles	8%	145
Glass	6%	105
Ferrous metal	5%	85
Non-ferrous metal	1%	15
Kitchen waste	18%	323
Green waste	13%	231
Fine material <10mm	5%	94
Waste Electrical and Electronic Equipment	2%	36
Specific Hazardous Household Waste Items (including all batteries)	1%	15
Total	100%	1815

Source: Adapted from: *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003. Data as used in the ERM/Environment Agency update to the WISARD software tool.

Notes:

1. includes furniture

The Northern Ireland Environment and Heritage Service have also carried out municipal waste compositional analyses. *Table A1.23* shows the composition used in the assessment of best practicable options for waste management in Northern Ireland. It includes a compositional estimates for household, civic amenity and municipally-derived trade waste.

Table A1.23 Estimated MSW Composition in Northern Ireland

Waste Fraction	% of Municipal Waste	Thousand Tonnes (2003/04 Arisings in Northern Ireland)
Paper and card	18.2%	187
Kitchen waste ¹	19.8%	204
Green waste ¹	14.2%	145
Textiles	1.8%	19
Fines	5.4%	56
Absorbent hygiene products ²	2.3%	24
Wood ²	2.8%	29
Other combustibles ²	7.1%	73
Non-combustibles	6.0%	62
Ferrous metal	3.7%	38
Non-ferrous metal	0.9%	9
Glass	6.6%	68
Plastic dense	5.3%	54
Plastic film	3.0%	31
Waste Electrical and Electronic Equipment ³	2.0%	21
Specific Hazardous Household Waste Items (including all batteries) ³	0.8%	8
Total	100%	1027

Sources:

- Towards Resource Management (EHSNI, 2005), Annex 2 "Waste stream summaries"
- Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005)

Notes:

1. Proportional split between organic kitchen and green waste unknown. Assumed to be equivalent to that estimated for Wales in 'The Composition of Municipal Waste in Wales. National Assembly for Wales (NAW)/AEAT Technology - December 2003'.
2. Proportional split between combustible materials (wood, absorbent hygiene products and 'other' (including furniture) unknown. Assumed to be equivalent to that estimated for Wales in 'The Composition of Municipal Waste in Wales. National Assembly for Wales (NAW)/AEAT Technology - December 2003'.
3. Quantity of WEEE and hazardous material unknown. Assumed to be equivalent to that estimated for Wales in 'The Composition of Municipal Waste in Wales. National Assembly for Wales (NAW)/AEAT Technology - December 2003' and proportion of miscellaneous non-combustibles was adjusted accordingly.

Data relating to municipal waste composition are more limited for England and Scotland. Estimates relating to collected household waste composition are available, but data are limited regarding the composition of other household wastes (litter, street sweepings, bulky wastes) and non-household elements of the municipal waste stream. In the absence of this information, and in order to derive a representative picture of waste composition across the UK, a number of assumptions were made regarding the composition of these sub-streams. On the majority of occasions, assumptions were based on estimates derived from the National Assembly for Wales study, as this provides detail on the range of municipal waste sub-streams. Resulting estimates, together with all assumptions made are shown in *Table A1.24* and *Table A1.25*.

Table A1.24 Estimated MSW Composition in England

Waste Fraction	% of Household Collected Waste ^a	% of Other Household Sources ^b	% of CA Site Waste (Residual) ^c	% of Non-household Sources (residual) ^d	% of Total Recycling ^e (Household and Non-household)	Total MSW (Thousand Tonnes, 2003/04 Arisings)	% of Total MSW
Paper and card	19.8%	12.5%	3.3%	7.4%	28.7%	5234	18.0%
Plastic film	4.4%	3.0%	0.4%	0.9%	0.0%	780	2.7%
Dense plastic	5.2%	5.9%	1.1%	1.6%	0.3%	1012	3.5%
Textiles	3.3%	0.7%	2.3%	0.2%	1.3%	703	2.4%
Absorbent hygiene products	3.3%	0.4%	2.9%	0.4%		650	2.2%
Wood	3.0%	2.5%	11.2%	0.1%		918	3.2%
Other combustibles ¹	0.3%	17.9%	4.2%	0.5%		433	1.5%
Non-combustibles	1.6%	1.5%	17.5%	55.3%	22.0% ⁴	3574	12.3%
Glass	7.0%	3.0%	1.0%	0.6%	12.8%	1934	6.6%
Ferrous metal	2.2% ²	3.3%	0.001% ²	0.9%	0.8%	469	1.6%
Non-ferrous metal	0.6%	1.4%	0.041%	0.2%	0.2%	125	0.4%
Kitchen waste	25.6% ³	12.8%	14.8%	7.1%	0.3%	5016	17.2%
Green waste	16.0%	7.7%	32.1%	14.5%	25.2%	5601	19.2%
Fine material <10mm	4.1%	16.9%	1.2%	10.0%		1176	4.0%
Waste Electrical and Electronic Equipment	3.0%	10.2%	6.2%	0.2%	8.4%	1305	4.5%
Hazardous Household Waste Items (inc. batteries)	0.7% ⁵	0.2%	1.7% ⁵	0.1%		180	0.6%
Total	100%	100%	100%	100%	100%	29,109	100%
Arisings ('000 Tonnes)	16,071	1293	3574	2647	5524	29,109	29,106

Sources:

- Parfitt, J. (2002). Analysis of household waste composition and factors driving waste increases. WRAP, Banbury. <http://www.number-10.gov.uk/su/waste/report/downloads/composition.pdf>. Household collection composition
- Average of composition datasets for litter, street sweepings and bulky waste. Adapted from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.
- Parfitt, J. (2002). Analysis of household waste composition and factors driving waste increases. WRAP, Banbury. <http://www.number-10.gov.uk/su/waste/report/downloads/composition.pdf>. Residual CA composition.
- The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003. Non-household sources composition.
- Defra Waste Statistics group (personal communications). Total municipal recycling. Co-mingled recycling (8%) assumed to have the same composition as segregated materials

Notes:

- Includes furniture
- 80% of metal cans assumed to be ferrous, 20% non-ferrous
- Includes 'other' organic material
- Includes rubble and 'other' category
- Quantity of hazardous material unknown. Assumed to be equivalent to that estimated for household collected waste/CA site waste in Wales in '*The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003' and proportion of miscellaneous non-combustibles was adjusted accordingly.

Table A1.25 Estimated MSW Composition in Scotland

Material	% of Household Waste (kerbside collected/ residual) ^a		% of Non-household Sources (residual) ^c	% of Non-household Recycling ^d	Total MSW (Thousand Tonnes, 2003/04 Arisings)	% of Total MSW
	% of CA Site Waste ^b					
Paper and card	25.0%	9.3%	7.4%	1.4%	660	20%
Plastic film	4.2%	0.7%	0.9%		107	3%
Dense plastic	6.3%	2.8%	1.6%		166	5%
Textiles	4.8%	2.2%	0.2%		121	4%
Absorbent hygiene products	3.8% ²	0.3%	0.4%		92	3%
Wood	1.2% ²	12.6%	0.1%		73	2%
Other combustibles ¹	3.7% ²	13.7%	0.5%		138	4%
Non-combustibles	2.3%	18.5%	55.3%	90.2%	481	15%
Glass	7.2%	2.8%	0.6%	1.1%	184	6%
Ferrous metal	4.3%	5.8%	0.9%		127	4%
Non-ferrous metal	1.4%	0.9%	0.2%		38	1%
Kitchen waste	21.4% ³	3.2%	7.1%		552	17%
Green waste	6.7% ³	18.0%	14.5%	7.4%	305	9%
Fine material <10mm	0.5%	0.8%	10.0%		69	2%
Waste Electrical and Electronic Equipment	0.3%	6.7%	0.2%		32	1%
Hazardous Household Waste Items (inc. batteries)	7.0%	1.7%	0.1%		171	5%
Total	100%	100%	100%	100%	3317	100%
Arisings 2003/04 (Thousand Tonnes)	2346	360	544	66	3317	3317

Sources:

a. SEPA (2005) Waste Data Digest 5. http://www.sepa.org.uk/pdf/publications/wds/wdd_5.pdf

b. *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003. CA composition.

c. *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003. Non-household sources composition.

d. Adapted from J. Parfitt, J. (2002). Analysis of household waste composition and factors driving waste increases. WRAP, Banbury. (assumed estimates of non-household waste recycling in England)

Notes:

1. Includes furniture

2. Proportional split between combustible materials (wood, absorbent hygiene products and 'other' (including furniture) unknown. Assumed to be equivalent to that estimated for Wales in 'The Composition of Municipal Waste in Wales. National Assembly for Wales (NAW)/AEAT Technology - December 2003'.

3. Proportional split between organic kitchen and green waste unknown. Assumed to be equivalent to that estimated for Wales in 'The Composition of Municipal Waste in Wales. National Assembly for Wales (NAW)/AEAT Technology - December 2003'.

Combining national datasets and estimates results in an estimated municipal waste composition as shown in *Table A1.26*.

It should be noted that there is still some uncertainty surrounding these estimates, particularly with regard to relative proportions of biodegradable materials.

Table A1.26 *Estimated UK MSW Composition*

Waste Fraction	England	Wales	Scotland	Northern Ireland	Total	% of Total	% Carbon (Biogenic) ²	% Carbon (Fossil) ²	Gross Calorific Value (MJ/kg) ²
	('000 Tonnes, 2003/04 Arising)	('000 Tonnes, 2003/04 Arising)	('000 Tonnes, 2003/04 Arising)	('000 Tonnes, 2003/04 Arising)					
Paper and card	5234	381	660	187	6462	18%	32%		12.6
Plastic film	780	51	107	31	969	3%		48%	23.6
Dense plastic	1012	82	166	54	1313	4%		55%	26.7
Textiles	703	33	121	19	876	2%	20%	20%	16.0
Absorbent hygiene products	650	42	92	24	807	2%	15%	4%	8.0
Wood	918	51	73	29	1070	3%	44%		18.3
Other combustibles ¹	433	127	138	73	771	2%	19%	19%	15.6
Non-combustibles	3574	145	481	62	4262	12%	3.5%	3.5%	2.8
Glass	1934	105	184	68	2291	6%	0.3%		1.5
Ferrous metal	469	85	127	38	719	2%			
Non-ferrous metal	125	15	38	9	186	1%			
Kitchen waste	5016	323	552	204	6095	17%	14%		5.3
Green waste	5601	231	305	145	6282	18%	17%		6.5
Fine material <10mm	1176	94	69	56	1395	4%	7%	7%	4.8
Waste Electrical and Electronic Equipment	1305	36	32	21	1394	4%		16%	7.6
Hazardous Household Waste Items (inc. batteries)	180	15	171	8	374	1%		30% ³	12.4 ³
Total	29,109	1815	3317	1027	35,268	100%	14%	6%	8.4

Sources:

- The Composition of Municipal Waste in Wales. National Assembly for Wales (NAW)/AEAT Technology - December 2003.
- Parfitt, J. (2002). Analysis of household waste composition and factors driving waste increases. WRAP, Banbury. <http://www.number-10.gov.uk/su/waste/report/downloads/composition.pdf>
- SEPA (2005) Waste Data Digest 5. http://www.sepa.org.uk/pdf/publications/wds/wdd_5.pdf
- Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005)
- Towards Resource Management (EHSNI, 2005), Annex 2 "Waste stream summaries"

Notes:

1. Includes furniture
2. Source: National Household Waste Analysis Programme NHWAP (1992/3). UK Department of Environment
3. Average values for the category used.

A1.7.3 MSW Growth

Growth in MSW production is generally believed to be a function of two factors: increase in the numbers of households in a specific area; and growth in mean waste production per household, as a result of changing patterns of

consumption. However, since time series data regarding waste arisings are generally poor, the relationship between these two factors is not clearly defined, and can not be predicted reliably.

The average rate of UK municipal waste growth over the past six years was 2.5% and over the past three years was 1.3% ⁽¹⁾. In comparison, the best estimate of historical growth in household waste only is 1.5% ⁽²⁾.

A1.7.4 *Future MSW Management*

With the introduction of targets for the diversion of biodegradable municipal waste (BMW) from landfill under the Landfill Directive, the future management of MSW is expected to change considerably over the next 15 years.

Although considerable emphasis is currently placed on prevention and recycling initiatives, there are limits to the quantities of waste that can be diverted via these routes. If local authorities are to meet their assigned landfill allowances, it is recognised that significant additional treatment through recovery processes will be required. Authorities may employ a number of options to achieve diversion targets, including:

- recovery of materials from source segregated collection systems;
- recovery through production of compost from source-segregated green/kitchen wastes;
- potential stabilisation of residual mixed wastes using biological treatment processes such as mechanical biological treatment (MBT), or anaerobic digestion; and
- recovery of energy from waste using conventional mass-burn (EfW), or advanced thermal treatment technologies (eg gasification, pyrolysis).

A1.8 *COMMERCIAL AND INDUSTRIAL (C&I) WASTE*

The term 'commercial waste' relates to wastes arising from wholesalers, catering establishments, shops and offices. 'Industrial waste', in comparison, relates to wastes arising from factories and industrial plants. Both streams have discreet composition and growth implications and so will be addressed separately in the research. However, the majority of data regarding arisings and management of commercial and industrial wastes are reported in a combined fashion, and are based on combined survey work. As a result, these streams will be discussed in parallel with regard to waste arisings.

(1) Defra waste Statistics Division, personal communication

(2) Represents household waste growth in England. Growth estimate used for Defra LAWRRD model.

A1.8.1 Commercial and Industrial Waste Arisings

Published data relating to commercial and industrial waste arisings in the UK derive from a number of sources, dependent on devolved administration.

England and Wales

In 1998, the Environment Agency carried out a survey of some 20,000 industrial and commercial businesses. The survey was carried out across England and Wales and collected data regarding the type, quantity of waste arising from businesses/industry and the waste disposal or recovery method. A summary of the results of this survey is presented in *Table A1.27* and *Table A1.28*.

The survey showed that, in 1998/99, industrial and commercial waste totalled around 75 million tonnes. Of this, approximately 50 million tonnes was attributable to industry and 25 million to commerce. The individual sector that produced the most waste was the basic metals sector (over 9 million tonnes of waste). This was followed by the food, drink and tobacco industry at more than 7 million tonnes and the coke, oil, gas, electricity and water industries at just under 7 million tonnes.

Table A1.28 summarises the waste management options adopted for the types of waste streams within industry and within commerce. Almost all (90%) of the separated paper and card and the metals and scrap equipment waste streams were recycled irrespective of whether they were generated in an industrial or a commercial organisation. However, it should be appreciated when using this data, that the 'paper and card' waste stream refers only to that collected separately. It does not include the paper and card component in the general waste streams.

Landfill disposal was the main waste management option employed for almost half the wastes arising in 1998/99. 30% of the waste arising in this period was recycled and a further 7% was re-used. The survey further found that industrial companies are more inclined to recycle or re-use their waste (44%) than are commercial companies (24%).

Data Updates

The Environment Agency recently carried out a second survey of industrial and commercial waste arising in England (England, Commercial and Industrial Waste Survey, 2002/03). The results of this survey were under analysis at the time of writing, but initial findings are shown in *Table A1.29* and *Table A1.30*.

Table A1.27 Industrial and Commercial Waste Arisings in England and Wales (1998/99) (Thousand Tonnes)

Sector/Type	Construction		Paper	Food	General commercial	General industrial	Other general & biodegradable	Metals & scrap equipment	Contaminated general	Healthcare risk	Mineral wastes & residues	Chemical & other	Total
	Inert	demolition & asbestos	& card										
<i>Industrial</i>													
Food, drink and tobacco	292	143	233	1939	12	1065	2118	67	417	280	8	629	7203
Textiles	0	1	60	1	1	321	97	5	49	0	2	11	548
Wearing apparel	0		11	1	0	171	16	1	6	0		0	207
Leather, luggage, handbags and footwear	8		5		0	69	99	1	56	0		18	255
Wood and wood products	28	1	22	0	0	230	763	6	5	0	0	9	1064
Pulp, paper and paper products	0	5	409	3	4	465	1165	12	15	0	34	155	2265
Publishing, printing and recording	0	2	1056	2	84	615	78	28	22	0	1	46	1935
Chemicals and chemical products	27	187	21	3	2	233	605	376	698	44	134	1541	3870
Cleaning products, man-made fibres etc.	5	5	44	2	5	142	90	24	72	0	6	159	555
Rubber and plastic products	69	0	91	2	1	571	446	55	33	0	3	69	1339
Other non-metallic mineral products	744	214	37	1	2	400	68	36	174	0	443	98	2217
Basic metals	102	72	26	1	1	267	77	1066	720	0	6218	559	9108
Fabricated metal products	9	7	25	0	7	624	57	835	78	1	11	119	1774
Machinery and equipment	20	4	36	3	2	464	71	571	123	0	13	158	1467
Office machinery, computers and electrical	11	0	46	2	0	262	32	270	14	0	11	22	670
Radio, television and communication	7	1	21	1	0	113	55	13	3	0	0	30	244
Medical and optical instruments and clocks	1	0	10	2	0	165	6	17	11	0	0	6	219
Motor vehicles	6	3	31	2	10	313	81	512	43	0	1	281	1283
Other transport equipment	0	1	10	1	1	167	36	126	432	0		50	825
Furniture and other manufacturing	4	0	56	1		442	446	47	207	0	22	27	1252
Coke, oil, gas, electricity, water	55	76	23	3	2	296	44	50	17	0	5821	198	6585
Transport, storage, communications	8	3	349	208	18	1655	310	119	71	0	0	525	3266
Miscellaneous	3	51	123	9	2	1045	112	18	11	337	56	175	1942
<i>Industrial total</i>	<i>1399</i>	<i>777</i>	<i>2744</i>	<i>2185</i>	<i>155</i>	<i>10093</i>	<i>6873</i>	<i>4254</i>	<i>3278</i>	<i>663</i>	<i>12,785</i>	<i>4886</i>	<i>50090</i>

<i>Commercial</i>													
Wholesale	4	3	539	54	2098		306	149	26	0	1	113	3293
Retail - motor vehicles, parts and fuel	0	6	62	0	654		171	125	12	0	0	67	1097
Retail - others	7	3	951	253	3515		329	49	511	27	1	8	5654
Hotels, catering	30	17	126	10	3083		199	51	63	1	1	15	3596
Finance	0	8	173	4	653		7	10	6	0	0	5	865
Education	11	21	78	41	1681		370	24	13	9	0	2	2251
Travel agents, other business and others	23	48	305	19	3977		333	64	71	10	7	29	4887
Real estate and computer	1	1	63	2	877		40	14	9	1	0	5	1013
Social work and public administration	2	18	206	20	1566		156	51	23	31	9	65	2146
<i>Commercial total</i>	78	125	2502	404	18,105	0	1911	537	734	79	19	309	24802
Total Commercial and Industrial	1477	902	5245	2589	18,260	10,093	8784	4790	4012	741	12,804	5195	74892

Source: EA National Waste Production Survey 1998

Source publication: e-Digest of Environmental Statistics, Published August 2003, Department for Environment, Food and Rural Affairs,
<http://www.defra.gov.uk/environment/statistics/index.htm>.

Table A1.28 Industrial and Commercial Waste Management in England and Wales (1998/99) (Thousand Tonnes)

Type/Management	Land disposal	Land recovery	Re-used	Recycled	Thermal	Transfer	Treatment	Unrecorded	No local data	Total
<i>Industrial</i>										
Inert	699	15	34	568	0	40	42	1	1	1399
Construction, demolition & asbestos	635		35	65	0	26	11	2	3	777
Paper and card	144	2	13	2487	23	17	44	13		2744
Food	500	154	885	493	12	12	120	1	7	2185
General commercial	123	0	0	8	4	3	1	17		155
General industrial	8822	46	45	335	217	387	106	135		10,093
Other general & biodegradable	1454	969	839	2320	309	156	785	40		6873
Metals & scrap equipment	241		67	3880	0	20	37	8		4254
Contaminated general	1951	17	93	905	3	21	272	2	12	3278
Healthcare risk	15	7	20	11	203	2	403		2	663
Mineral wastes & residues	4793	3	2840	5087	0	21	14	2	24	12,785
Chemical & other	1721	65	263	802	131	88	1810	0	6	4886
<i>Industrial total</i>	<i>21,099</i>	<i>1278</i>	<i>5135</i>	<i>16,961</i>	<i>902</i>	<i>793</i>	<i>3645</i>	<i>221</i>	<i>55</i>	<i>50,090</i>
<i>Commercial</i>										
Inert	37	1	1	35	0	3	1	0	0	78
Construction, demolition & asbestos	108		3	8	0	4	1	0	0	125
Paper and card	130	1	11	2270	24	17	33	15		2502
Food	130	19	121	96	4	3	29	0	2	404
General commercial	12,175	1	7	1507	469	461	94	3391		18,105
Other general & biodegradable	429	162	228	758	97	35	183	20		1911
Metals & scrap equipment	30		16	482	0	4	4	2		537
Contaminated general	352	5	13	282	1	6	71	1	3	734
Healthcare risk	2	1	1	1	31	0	41		0	79
Mineral wastes & residues	8	0	1	8	0	0	2	0	1	19
Chemical & other	84	3	13	62	8	7	132	0	1	309
<i>Commercial total</i>	<i>13,484</i>	<i>193</i>	<i>416</i>	<i>5508</i>	<i>633</i>	<i>540</i>	<i>591</i>	<i>3429</i>	<i>7</i>	<i>24,802</i>
Total Commercial and Industrial	34,583	1471	5552	22469	1535	1334	4236	3650	62	74,892

Source: EA National Waste Production Survey 1998

Source publication: e-Digest of Environmental Statistics, Published August 2003, Department for Environment, Food and Rural Affairs,

<http://www.defra.gov.uk/environment/statistics/index.htm>.

Table A1.29 Commercial and Industrial Waste Arisings in England (2002/03) by Sector (Thousand Tonnes)

Commercial/Industrial Sector	Arisings (thousand tonnes)
<i>Commercial</i>	
Education	1939
Hotels/Catering	3352
Miscellaneous	1554
Retail	12,753
Social work and public administration	1390
Transport, storage, communications	2182
Travel agents, other business, finance, real estate and computer related activities	7150
<i>Total Commercial</i>	<i>30,320</i>
<i>Industrial</i>	
Food, drink and tobacco	7230
Furniture and other manufacturing	675
Manufacture of basic metals	4815
Manufacture of chemicals and chemical products; cleaning products, man-made fibres etc; rubber and plastic products	5257
Manufacture of fabricated metal products	1525
Manufacture of machinery and equipment	939
Manufacture of motor vehicles and other transport equipment	1475
Manufacture of office machinery, computers, electrical, radio, television and communication equipment; medical and optical instruments and clocks	515
Manufacture of pulp, paper and paper products	1822
Manufacture of textiles, wearing apparel, leather, luggage, handbags and footwear	1234
Other non-metallic mineral products	2272
Production of coke, oil, gas, electricity, water	6182
Publishing, printing and recording	2174
Wood and wood products	1471
<i>Total Industrial</i>	<i>37,587</i>
Total	67,907

Source: EA England, Commercial and Industrial Waste Survey 2002/03

Table A1.30 Commercial and Industrial Waste Arisings in England (2002/03) by Waste Type (Thousand Tonnes)

Waste Type	Industrial Arisings (thousand tonnes)	Commercial Arisings (thousand tonnes)
Oils & solvents	583	546
Paints, varnishes, etc.	221	16
Industrial sludges	1621	36
Other chemical wastes	3267	1343
Metallic Wastes	2727	604
Paper and card	2656	5976
Other non-metallic, non-mineral wastes	2526	2675
Discarded equipment	88	262
Food	4121	2067
Other animal and Sorting residues	22	84
	665	0
Other mixed general waste	5392	15,569
Common Sludges	761	154
Combustion wastes	9598	92
C&D	859	772
Other mineral wastes	2482	123
Total	37,587	30,320

Source: EA England, Commercial and Industrial Waste Survey 2002/03

Table A1.31 Commercial and Industrial Waste Management in England (2002/03)

Management Route	% of Total Commercial and Industrial Arisings
Land disposal	47%
Land recovery	3%
Recycled	38%
Thermal	4%
Transfer	2%
Treatment	5%

Source: EA England, Commercial and Industrial Waste Survey 2002/03

Scotland

Gathering data on non-municipal waste arisings in Scotland is difficult. There is currently no requirement for organisations to report non-municipal waste arisings to SEPA. To address this data gap, and to meet EU requirements for waste data reporting, SEPA commissioned a pilot national survey of commercial and industrial waste producers in 2004. The survey was completed in May 2005. However, results are still in the process of being analysed and so are, as yet, unavailable.

Data relating to commercial and industrial waste arisings, according to European Waste Catalogue codings were provided by SEPA and collated as part of their review of licensed site returns.

Table A1.32 Commercial and Industrial Waste Arisings in Scotland 2004/05 (Tonnes)

European Waste Catalogue (2002) Code	Tonnes to Landfill	Tonnes to Recycling
02 - Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing	94,153	54,412
03 - Wastes from wood processing (including paper and card production)	85,371	55,196
04 - Wastes from the leather, fur and textiles industries	37,743	3791
05 - Wastes from Petroleum refining, natural gas purification and pyrolytic treatment of coal	636	108
06 - Wastes from inorganic chemical processes	11,558	-
07 - Wastes from organic chemical processes	12,540	1143
08 - Waste from the manufacture and use of coatings, adhesives, sealants and printing inks	960	5
09 - Wastes from the photographic industry	113	0.0
10 - Wastes from thermal processes	1,255,384	1209
11 - Wastes from chemical surface treatment and coating of metals and other materials	52	-
12 - Wastes from shaping and physical and mechanical surface treatment of metals and plastics	960	93,803
13- Oil wastes and wastes of liquid fuels	538	1861
15 - Waste packaging, absorbents, wipings cloths, filter materials and protective clothing not otherwsie specified	90,291	62,818
16 - Waste not otherwise specified	46,163	703,795
18 - Wastes from human or animal health care and/or related research	15340	-
19 - Waste from waste management facilities, off-site waste water treatment plants and water treatment plants	922,527	77,879
20 - Municipal waste (household waste and similar commercial and industrial waste)	3,237,472	416,634
Uncoded/alternative classification system used	152,800	242
Total	5,964,602	1,472,896

Source: SEPA Waste Statistics Regulations Review of Licensed Site Returns Database (Jan 2004 – 31 March 2005).

Notes:

- Estimates are based on data from licensed waste management site returns. 95% of licensed sites in Scotland provided information on waste throughputs
- Data regarding tonnages sent directly to landfill or reprocessing sites are compiled in the database and these amounted to some 8.5 million tonnes in 2004/05 (including mining and quarrying, construction and demolition and municipal wastes collected by local authorities). Total waste arisings at licensed sites were estimated to be approximately 13.7 million tonnes, however, with the remaining 5 million tonnes passing through transfer and civic amenity sites. Data regarding the classification of wastes passing through these sites, or their final destination, are not currently available. It was assumed that the composition/management of these arisings is proportional to those sent directly to treatment facilities.
- Data regarding exempt sites are not available, but relate predominantly to construction and demolition wastes (estimated to be in the region of 1.3-2 million tonnes/year)

- EWC code 01 – *Mining and quarrying wastes* and 17 – *Construction and demolition wastes* have been discounted from the total in order to prevent double counting with the mining and quarrying and C&D waste streams
- EWC code 02 – *Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing* has been included in the total as it was considered that this waste code encompasses wider wastes than those included within the agriculture waste stream. However, it is noted that there is a risk of double counting between these two streams of arisings.
- Municipal wastes known to be collected by local authorities have been discounted from EWC code 20 – *Municipal waste*. Thus this code is considered only to include similar commercial and industrial wastes

Northern Ireland

In January 2002, the EHS commissioned MEL Research and Envirocentre Ltd to carry out the Waste Arisings Survey Phase III, consisting of a census of District Councils on municipal waste and a survey of industry and commerce.

Table A1.33 shows the estimated arisings resulting from the industrial and commercial waste survey. Further, work carried out by ERM as part of a Best Practicable Environmental Option (BPEO) assessment for waste management in Northern Ireland collated information on the fate of commercial and industrial wastes. These data are shown in *Table A1.34*.

Estimates show that, in 2001, the commercial and industrial waste stream totalled approximately 635,000 tonnes. Over 500,000 tonnes was from the commercial sector, the most significant fraction of which was paper/card. *Table A1.33* further shows that recovery rates were high, with only 40% of the total waste stream being landfilled. The most significant route for recovery was through reuse/recycling.

Table A1.33 *Commercial and Industrial Waste Arisings in Northern Ireland (2001)*

Waste Fraction	Commercial Waste (tonnes)	Industrial Waste (tonnes)
Paper/card	225,804	66,149
Putrescible	32,990	9814
Misc non-combustible	40,891	7832
Ferrous metal	30,149	5308
Non-ferrous metal	10,050	1769
Glass	82,060	0
Plastic dense	74,436	17,127
Plastic film	24,812	5709
Total	521,192	113,708

Source: Environment and Heritage Service Waste Arisings Survey Phase III (2002). MEL Research and Envirocentre Ltd

Table A1.34 Fate of Commercial and Industrial Waste in Northern Ireland (2001)

Management Route	% of Arisings
Landfill	39.6%
Recycled	32.7%
Incinerated	18.9%
Land Application	2.3%
Other Treatment (unspecified)	6.4%

Source: Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005)

Total UK

Combining national datasets results in a total best current estimate of 82.1 million tonnes of commercial and industrial waste across the UK. Final estimates of total UK commercial and industrial waste arisings and management are summarised in *Table A1.35* to *Table A1.37*.

Table A1.35 Total Commercial and Industrial Waste Arisings in the UK (latest estimate) (Thousand Tonnes)

Management Route	Northern				Total
	England	Wales	Scotland	Ireland	
Landfill	32075	2,896	5965	251	41186
Recycled	26111	2,357	1473	208	30148
Incinerated/Burned	2954	267		120	3341
Land Application/ Recovery	2021	182		15	2218
Other Treatment (unspecified)	4747	429		41	5216
Total	67,907	6130	7437	634	82,109

Sources:

- EA National Waste Production Survey 1998.
- EA England, Commercial and Industrial Waste Survey 2002/03.
- SEPA Waste Statistics Regulations Review of Licensed Site Returns Database (Jan 2004 – 31 March 2005).
- Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005).
- Environment and Heritage Service Waste Arisings Survey Phase III (2002). MEL Research and Envirocentre Ltd

Notes:

- Estimates for England based on 2002/03 survey data
- Estimates for Wales based on 1998 survey data
- Estimates for Scotland based on SEPA licensed site returns database 2004/05
- Estimates for Northern Ireland based on 2001 survey data

Table A1.36 Total Commercial Waste Arisings in the UK (latest estimate) (Thousand Tonnes)

Management Route	Northern				Total
	England	Wales	Scotland	Ireland	
Landfill	15,240	574	3314	206	19,258
Recycled/reused	9147	344	417	170	10,078
Incinerated/Burned	1170	44		99	1313
Land Application/ Recovery	15	1		12	28
Other Treatment (unspecified)	4747	179		33	4959
Total	30,320	1141	3731	521	35,636

Sources:

- EA National Waste Production Survey 1998.
- EA England, Commercial and Industrial Waste Survey 2002/03.
- SEPA Waste Statistics Regulations Review of Licensed Site Returns Database (Jan 2004 – 31 March 2005).
- Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005).
- Environment and Heritage Service Waste Arisings Survey Phase III (2002). MEL Research and Envirocentre Ltd

Notes:

- Estimates for England based on 2002/03 survey data
- Estimates for Wales based on 1998 survey data
- Estimates for Scotland based on SEPA licensed site returns database 2004/05, assuming that commercial waste comprises EWC code 20 and 50% of uncoded wastes
- Estimates for Northern Ireland based on 2001 survey data

Table A1.37 Total Industrial Waste Arisings in the UK (latest estimate) (Thousand Tonnes)

Management Route	Northern				Total
	England	Wales	Scotland	Ireland	
Landfill	13,148	1745	2651	45	17,666
Recycled	18,256	2423	1056	37	21,772
Incinerated/Burned	1014	135		21	1170
Land Application/ Recovery	2230	296		3	2529
Other Treatment (unspecified)	2939	390		7	3337
Total	37,587	4989	3707	114	46,474

Sources:

- EA National Waste Production Survey 1998.
- EA England, Commercial and Industrial Waste Survey 2002/03.
- SEPA Waste Statistics Regulations Review of Licensed Site Returns Database (Jan 2004 – 31 March 2005).
- Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005).
- Environment and Heritage Service Waste Arisings Survey Phase III (2002). MEL Research and Envirocentre Ltd

Notes:

- Estimates for England based on 2002/03 survey data
- Estimates for Wales based on 1998 survey data
- Estimates for Scotland based on SEPA licensed site returns database 2004/05, assuming that industrial waste comprises EWC codes 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 18, 19 and 50% of uncoded wastes
- Estimates for Northern Ireland based on 2001 survey data

A1.8.2 *Commercial Waste Composition*

Estimates of commercial waste composition vary in detail according to national datasets available. The most complete and recent data relating to commercial wastes derive from the Environment Agency's second survey of C&I waste arising in England (England, Commercial and Industrial Waste Survey 2002/03). These data are disaggregated by commercial sector and provide the most interesting and indicative picture of the composition of wastes that derive from commercial premises.

Estimates are shown in *Table A1.38* to *Table A1.45*. The data clearly show the difference in waste composition between commercial sectors and it is important that these are taken into account when forecasting the growth of alternative material fractions ⁽¹⁾.

The Environment Agency is currently carrying out further analyses of the composition of 'mixed' waste categories, potentially providing more detail and less aggregation into 'miscellaneous' categories. This work will be incorporated into the modelling of waste stream impacts as far as is possible within the timescales of the research.

Further, it must be noted that there is some debate regarding the tonnage of paper assumed to be present in the pooled municipal, commercial and industrial waste streams. The British Paper Federation estimates paper consumption (production and imports less exports) in Great Britain to be in the region of 13 million tonnes per annum. However, the estimates below show paper and card arisings in the commercial and industrial waste streams alone, and in England only, to be in excess of 10 million tonnes. Coupled with the estimated 6 million tonnes of paper and card arising through municipal sources, it is clear that the proportion of this waste fraction in one, or more, waste streams may have been overestimated.

This overestimation may have occurred, in part, due to inconsistencies in volume to weight conversion estimates during data collection. Inconsistencies such as this highlight the need for care when interpreting results driven by the currently available data. The figures presented represent only estimates of the breakdown of materials present in commercial and industrial wastes, and should be treated as such. Further, ERM have made a number of assumptions in assigning waste categories from the original data.

⁽¹⁾ *Section A1.8.3*

Table A1.38 Commercial Waste Composition (England, 2002/03): Education Sector

Waste Fraction ¹⁻⁶	Tonnes	
	Arising 2002/03	% of Sector Arisings
Paper & Card	411696	21.2%
Organic/Food Waste	369809	19.1%
Green Waste	238704	12.3%
Wood	44746	2.3%
Textiles	33862	1.7%
Fines	51314	2.6%
Glass	100274	5.2%
Plastic (dense)	51271	2.6%
Plastic (film)	49987	2.6%
Ferrous Metal	54587	2.8%
Non-Ferrous Metal	13918	0.7%
WEEE	45842	2.4%
End of Life Vehicles	205	0.01%
Tyres	2644	0.1%
Batteries	4103	0.2%
Oils/fuels	215	0.01%
Paints/Inks/Varnishes	172	0.01%
Organic Chemicals	19	0.001%
Inorganic Chemicals		
Unknown Chemicals	12184	0.6%
Aqueous Chemical Effluents	148	0.01%
Organic Sludges	11413	0.6%
Inorganic Sludges		
Unknown/Mixed Sludges		
Combustion Residues		
Miscellaneous - Combustible ⁷	209363	10.8%
Miscellaneous - Non-Combustible ⁸	232564	12.0%
Total	1939041	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.39 Commercial Waste Composition (England, 2002/03): Hotels and Catering Sector

Waste Fraction ¹⁻⁶	Tonnes Arising	
	2002/03	% of Sector Arisings
Paper & Card	571424	17.0%
Organic/Food Waste	554400	16.5%
Green Waste	370719	11.1%
Wood	71245	2.1%
Textiles	54595	1.6%
Fines	82867	2.5%
Glass	847408	25.3%
Plastic (dense)	83463	2.5%
Plastic (film)	79196	2.4%
Ferrous Metal	81862	2.4%
Non-Ferrous Metal	16190	0.5%
WEEE	63984	1.9%
End of Life Vehicles		
Tyres		
Batteries	6563	0.2%
Oils/fuels	54	0.002%
Paints/Inks/Varnishes	36	0.001%
Organic Chemicals		
Inorganic Chemicals		
Unknown Chemicals	19636	0.6%
Aqueous Chemical Effluents		
Organic Sludges		
Inorganic Sludges		
Unknown/Mixed Sludges		
Combustion Residues		
Miscellaneous – Combustible ⁷	169422	5.1%
Miscellaneous - Non-Combustible ⁸	278567	8.3%
Total	3351629	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.40 Commercial Waste Composition (England, 2002/03): Miscellaneous Sector

Waste Fraction ¹⁻⁶	Tonnes Arising	
	2002/03	% of Sector Arisings
Paper & Card	338532	21.8%
Organic/Food Waste	220006	14.2%
Green Waste	124936	8.0%
Wood	27473	1.8%
Textiles	18519	1.2%
Fines	27927	1.8%
Glass	53062	3.4%
Plastic (dense)	29169	1.9%
Plastic (film)	22537	1.5%
Ferrous Metal	54218	3.5%
Non-Ferrous Metal	14269	0.9%
WEEE	30641	2.0%
End of Life Vehicles	4	0.0003%
Tyres	1353	0.1%
Batteries	2779	0.2%
Oils/fuels	7842	0.5%
Paints/Inks/Varnishes	1076	0.1%
Organic Chemicals	26696	1.7%
Inorganic Chemicals	130	0.01%
Unknown Chemicals	15706	1.0%
Aqueous Chemical Effluents	11126	0.7%
Organic Sludges	2746	0.2%
Inorganic Sludges		
Unknown/Mixed Sludges	232	0.0%
Combustion Residues	6820	0.4%
Miscellaneous - Combustible ⁷	370259	23.8%
Miscellaneous - Non-Combustible ⁸	145515	9.4%
Total	1553572	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.41 Commercial Waste Composition (England, 2002/03): Retail Sector

Waste Fraction¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	4522145	35.5%
Organic/Food Waste	1079420	8.5%
Green Waste	798308	6.3%
Wood	494414	3.9%
Textiles	127546	1.0%
Fines	169211	1.3%
Glass	376153	2.9%
Plastic (dense)	279877	2.2%
Plastic (film)	1025223	8.0%
Ferrous Metal	412265	3.2%
Non-Ferrous Metal	211047	1.7%
WEEE	181062	1.4%
End of Life Vehicles	33584	0.3%
Tyres	146966	1.2%
Batteries	40037	0.3%
Oils/fuels	181180	1.4%
Paints/Inks/Varnishes	5127	0.04%
Organic Chemicals	29997	0.2%
Inorganic Chemicals	15	0.0001%
Unknown Chemicals	42485	0.3%
Aqueous Chemical Effluents	15250	0.1%
Organic Sludges	10969	0.1%
Inorganic Sludges		
Unknown/Mixed Sludges	92728	0.7%
Combustion Residues	722	0.006%
Miscellaneous - Combustible ⁷	1826560	14.3%
Miscellaneous - Non-Combustible ⁸	650545	5.1%
Total	12752835	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.42 Commercial Waste Composition (England, 2002/03): Social Work and Public Administration Sector

Waste Fraction ¹⁻⁶	Tonnes Arising	
	2002/03	% of Sector Arisings
Paper & Card	431052	31.0%
Organic/Food Waste	167592	12.1%
Green Waste	129699	9.3%
Wood	25002	1.8%
Textiles	19119	1.4%
Fines	28991	2.1%
Glass	51703	3.7%
Plastic (dense)	28577	2.1%
Plastic (film)	22696	1.6%
Ferrous Metal	31518	2.3%
Non-Ferrous Metal	7908	0.6%
WEEE	32984	2.4%
End of Life Vehicles		
Tyres	28	0.002%
Batteries	2321	0.2%
Oils/fuels	2428	0.2%
Paints/Inks/Varnishes	28	0.002%
Organic Chemicals	9	0.001%
Inorganic Chemicals	2	0.0001%
Unknown Chemicals	8976	0.6%
Aqueous Chemical Effluents		
Organic Sludges		
Inorganic Sludges		
Unknown/Mixed Sludges		
Combustion Residues	1070	0.1%
Miscellaneous – Combustible ⁷	252534	18.2%
Miscellaneous - Non-Combustible ⁸	146228	10.5%
Total	1390465	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.43 Commercial Waste Composition (England, 2002/03): Transport, Storage and Communications Sector

Waste Fraction ¹⁻⁶	Tonnes Arising	
	2002/03	% of Sector Arisings
Paper & Card	517368	23.7%
Organic/Food Waste	276451	12.7%
Green Waste	168230	7.7%
Wood	136407	6.3%
Textiles	30393	1.4%
Fines	38203	1.8%
Glass	106437	4.9%
Plastic (dense)	41192	1.9%
Plastic (film)	37781	1.7%
Ferrous Metal	93106	4.3%
Non-Ferrous Metal	53018	2.4%
WEEE	38940	1.8%
End of Life Vehicles	8342	0.4%
Tyres	9000	0.4%
Batteries	11292	0.5%
Oils/fuels	184062	8.4%
Paints/Inks/Varnishes	8778	0.4%
Organic Chemicals	6328	0.3%
Inorganic Chemicals		
Unknown Chemicals	8928	0.4%
Aqueous Chemical Effluents	32316	1.5%
Organic Sludges	40064	1.8%
Inorganic Sludges		
Unknown/Mixed Sludges	8439	0.4%
Combustion Residues		
Miscellaneous – Combustible ⁷	166082	7.6%
Miscellaneous - Non-Combustible ⁸	160852	7.4%
Total	2182010	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.44 Commercial Waste Composition (England, 2002/03): Travel Agents, Other Business, Finance, Real Estate and Computer-related Activities Sector

Waste Fraction ¹⁻⁶	Tonnes Arising	
	2002/03	% of Sector Arisings
Paper & Card	1984889	27.8%
Organic/Food Waste	921577	12.9%
Green Waste	725330	10.1%
Wood	185115	2.6%
Textiles	117211	1.6%
Fines	162133	2.3%
Glass	471766	6.6%
Plastic (dense)	185128	2.6%
Plastic (film)	178327	2.5%
Ferrous Metal	199816	2.8%
Non-Ferrous Metal	69067	1.0%
WEEE	145448	2.0%
End of Life Vehicles	735	0.01%
Tyres	1320	0.02%
Batteries	49819	0.7%
Oils/fuels	6280	0.1%
Paints/Inks/Varnishes	604	0.0%
Organic Chemicals	29558	0.4%
Inorganic Chemicals	0	0.0%
Unknown Chemicals	354192	5.0%
Aqueous Chemical Effluents	3412	0.05%
Organic Sludges	25437	0.4%
Inorganic Sludges	0	0.0%
Unknown/Mixed Sludges	0	0.0%
Combustion Residues	49854	0.7%
Miscellaneous – Combustible ⁷	280893	3.9%
Miscellaneous - Non-Combustible ⁸	1002320	14.0%
Total	7150230	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.45 Commercial Waste Composition (England, 2002/03): All Sectors Combined

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings	% Carbon (Biogenic) ⁹	% Carbon (Fossil) ⁹	Gross Calorific Value (MJ/kg) ⁹
Paper & Card	8732896	28.8%	31.9%		12.6
Other Organics	448894	1.5%	13.5%		5.3
Food Waste	2983120	9.8%	17.2%		6.5
Green Waste	2704280	8.9%	13.5%		5.3
Wood	999597	3.3%	43.8%		18.3
Textiles	327554	1.1%	19.9% ¹⁰	19.9% ¹⁰	15.9
Fines	590162	1.9%	6.9% ¹⁰	6.9% ¹⁰	4.8
Glass	1962875	6.5%	0.3%		1.5
Plastic (dense)	882145	2.9%		54.8%	26.7
Plastic (film)	1306030	4.3%		47.8%	23.6
Ferrous Metal	706152	2.3%			
Non-Ferrous Metal	458965	1.5%			
WEEE	730494	2.4%		15.8%	7.6
End of Life Vehicles	42870	0.1%		15.8% ¹¹	7.6 ¹¹
Tyres	161310	0.5%		74.0%	31.7
Batteries	102176	0.3%			
Oils/fuels	382061	1.3%		80.4%	37.7 ¹²
Paints/Inks/Varnishes	15821	0.1%		38.4%	15.6
Organic Chemicals	92606	0.3%		38.4% ¹³	15.6 ¹³
Inorganic Chemicals	149	0.0005%		38.4% ¹³	15.6 ¹³
Unknown Chemicals	447369	1.5%		38.4% ¹³	15.6 ¹³
Aqueous Chemical Effluents	62818	0.2%		38.4% ¹³	15.6 ¹³
Organic Sludges	11119	0.0%	30.9% ¹⁴		12.0 ¹⁴
Inorganic Sludges	0	0.0%		30.9% ¹⁴	12.0 ¹⁴
Unknown/Mixed Sludges	101540	0.3%	15.5% ¹⁴	15.5% ¹⁴	12.0 ¹⁴
Combustion Residues	58466	0.2%		7.0% ¹⁵	2.8 ¹⁵
Miscellaneous - Combustible ⁷	3161665	10.4%	19.2% ¹⁰	19.2% ¹⁰	15.6
Soils/silts	528092	1.7%	7.0%		2.8
Mineral/aggregate waste	360549	1.2%		7.0%	2.8
Other Non-Combustible ⁸	1958005	6.5%	3.5%	3.5%	2.8
Total	30319781	100%	17%	9%	10.7

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes minerals, bricks, blocks, plaster, ceramics etc.

9. Source: ERM and Environment Agency Data (2003-2005)

10. Assumed 50% biogenic carbon content and 50% fossil carbon content

11. Assumed to be the same as the waste fraction, WEEE

12. Net Calorific Value

13. Generic value assumed for chemicals

14. Assumed to be the same as the waste fraction, sewage sludge and apportioned accordingly

15. Assumed to be the same as the waste fraction, non-combustibles

Composition data disaggregated at the sector-level have not been compiled for commercial waste arisings in Scotland, Wales and Northern Ireland. However, an estimate of total commercial waste composition has been published for Northern Ireland, and this is presented in *Table A1.46*. No estimates are currently available regarding commercial waste composition in Scotland and Wales.

Table A1.46 Commercial Waste Composition in Northern Ireland (2001)

Waste Fraction	% of Arisings	Tonnes Arising	% Carbon (Biogenic) ¹	% Carbon (Fossil) ¹
Paper/ card	43%	225,804	32%	
Putrescible	6%	32,990	14%	
Misc non-combustible	8%	40,891	3.5% ²	3.5% ²
Ferrous metal	6%	30,149		
Non-ferrous metal	2%	10,050		
Glass	16%	82,060	0.28%	
Plastic dense	14%	74,436		55%
Plastic film	5%	24,812		48%
Total	100%	521,192	15%	10%

Source: Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005)

Notes:

1. ERM and Environment Agency Data (2003-2005)

2. Assumed 50% biogenic carbon content and 50% fossil carbon content

A1.8.3 Commercial Waste Growth

There is a common opinion that commercial waste production is linked, to some degree, with economic growth. However, the relationship cannot be confirmed by the available statistics, due to a lack of consistent time series data, making forecasting of commercial waste arisings difficult.

A workshop on commercial and industrial waste arisings and management was held early in the research period. This highlighted the need to forecast growth in arisings on a sector-by-sector basis. Representatives from waste-producing industries confirmed the opinion that waste growth in the commercial sector as a whole is on the rise and that some sub-sectors, such as travel and hotels and catering, are likely to grow faster than others.

A1.8.4 Industrial Waste Composition

Estimates of industrial waste composition vary in detail according to national datasets available. The most complete and recent data relating to industrial wastes derive from the Environment Agency's second survey of C&I waste arising in England (England, Commercial and Industrial Waste Survey 2002/03). These data are disaggregated by industrial sector and provide the most interesting and indicative picture of the composition of wastes that derive from alternative industry sectors.

Estimates are shown in *Table A1.47* to *Table A1.61*. The data clearly show the difference between waste composition between industry sectors ⁽¹⁾.

As discussed in *Section A1.8.2*, there is a need for care to be taken when interpreting results driven by currently available data. The figures presented represent only estimates of the breakdown of materials present in commercial and industrial wastes, and should be treated as such. Further, ERM have made a number of assumptions in assigning waste categories from the original data.

(1) *Section A1.8.5*

Table A1.47 Industrial Waste Composition (England, 2002/03): Food, Drink and Tobacco Sector

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	388483	5.4%
Organic/Food Waste	1161241	16.1%
Green Waste	144843	2.0%
Wood	117611	1.6%
Textiles	16618	0.2%
Fines	25874	0.4%
Glass	79083	1.1%
Plastic (dense)	30405	0.4%
Plastic (film)	76928	1.1%
Ferrous Metal	52476	0.7%
Non-Ferrous Metal	31447	0.4%
WEEE	18267	0.3%
End of Life Vehicles	37	0.001%
Tyres	174	0.002%
Batteries	2027	0.03%
Oils/fuels	4331	0.1%
Paints/Inks/Varnishes	38	0.001%
Organic Chemicals	3162	0.04%
Inorganic Chemicals	93553	1.3%
Unknown Chemicals	11628	0.2%
Aqueous Chemical		
Effluents	159564	2.2%
Organic Sludges	444702	6.2%
Inorganic Sludges		
Unknown/Mixed Sludges	890580	12.3%
Combustion Residues	14785	0.2%
Miscellaneous -		
Combustible ⁷	2787764	38.6%
Miscellaneous - Non-		
Combustible ⁸	674618	9.3%
Total	7230238	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.48 Industrial Waste Composition (England, 2002/03): Furniture and Other Manufacturing Sector

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	104289	15.5%
Organic/Food Waste	69568	10.3%
Green Waste	61629	9.1%
Wood	193489	28.7%
Textiles	9065	1.3%
Fines	13776	2.0%
Glass	26528	3.9%
Plastic (dense)	13853	2.1%
Plastic (film)	12267	1.8%
Ferrous Metal	79030	11.7%
Non-Ferrous Metal	4926	0.7%
WEEE	12615	1.9%
End of Life Vehicles	5	0.001%
Tyres	68	0.01%
Batteries	1126	0.2%
Oils/fuels	282	0.04%
Paints/Inks/Varnishes	2583	0.4%
Organic Chemicals	574	0.1%
Inorganic Chemicals	2	0.0003%
Unknown Chemicals	3263	0.5%
Aqueous Chemical		
Effluents	204	0.03%
Organic Sludges		
Inorganic Sludges		
Unknown/Mixed Sludges	454	0.1%
Combustion Residues	1020	0.2%
Miscellaneous -		
Combustible ⁷	18217	2.7%
Miscellaneous - Non-		
Combustible ⁸	45795	6.8%
Total	674628	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.49 Industrial Waste Composition (England, 2002/03): Manufacture of Basic Metals

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	38367	0.8%
Organic/Food Waste	30205	0.6%
Green Waste	25272	0.5%
Wood	12999	0.3%
Textiles	3721	0.1%
Fines	5670	0.1%
Glass	9824	0.2%
Plastic (dense)	6036	0.1%
Plastic (film)	5190	0.1%
Ferrous Metal	192147	4.0%
Non-Ferrous Metal	114341	2.4%
WEEE	4774	0.1%
End of Life Vehicles		
Tyres	5	0.0001%
Batteries	479	0.01%
Oils/fuels	9645	0.2%
Paints/Inks/Varnishes	566	0.01%
Organic Chemicals	4772	0.1%
Inorganic Chemicals	33077	0.7%
Unknown Chemicals	4940	0.1%
Aqueous Chemical		
Effluents	11087	0.2%
Organic Sludges	37745	0.8%
Inorganic Sludges	28262	0.6%
Unknown/Mixed Sludges	53632	1.1%
Combustion Residues	435217	9.0%
Miscellaneous -		
Combustible ⁷	3443035	71.5%
Miscellaneous - Non-		
Combustible ⁸	304141	6.3%
Total	4815147	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.50 Industrial Waste Composition (England, 2002/03): Manufacture of Chemicals and Chemical Products

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	292845	5.6%
Organic/Food Waste	148789	2.8%
Green Waste	118645	2.3%
Wood	90885	1.7%
Textiles	28681	0.5%
Fines	26448	0.5%
Glass	59256	1.1%
Plastic (dense)	71356	1.4%
Plastic (film)	111562	2.1%
Ferrous Metal	68736	1.3%
Non-Ferrous Metal	54670	1.0%
WEEE	23595	0.4%
End of Life Vehicles	6	0.0001%
Tyres	1033	0.02%
Batteries	3284	0.1%
Oils/fuels	9160	0.2%
Paints/Inks/Varnishes	26358	0.5%
Organic Chemicals	357666	6.8%
Inorganic Chemicals	318656	6.1%
Unknown Chemicals	78388	1.5%
Aqueous Chemical Effluents	147580	2.8%
Organic Sludges	17071	0.3%
Inorganic Sludges	41	0.001%
Unknown/Mixed Sludges	539652	10.3%
Combustion Residues	18445	0.4%
Miscellaneous - Combustible ⁷	2408569	45.8%
Miscellaneous - Non-Combustible ⁸	236104	4.5%
Total	5257480	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.51 Industrial Waste Composition (England, 2002/03): Manufacture of Fabricated Metal Products

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	89549	5.9%
Organic/Food Waste	58278	3.8%
Green Waste	45037	3.0%
Wood	32709	2.1%
Textiles	6676	0.4%
Fines	10067	0.7%
Glass	20810	1.4%
Plastic (dense)	13084	0.9%
Plastic (film)	10771	0.7%
Ferrous Metal	396399	26.0%
Non-Ferrous Metal	298177	19.6%
WEEE	35340	2.3%
End of Life Vehicles	93	0.01%
Tyres		
Batteries	864	0.1%
Oils/fuels	8313	0.5%
Paints/Inks/Varnishes	1783	0.1%
Organic Chemicals	1863	0.1%
Inorganic Chemicals	113837	7.5%
Unknown Chemicals	4512	0.3%
Aqueous Chemical		
Effluents	28180	1.8%
Organic Sludges	8666	0.6%
Inorganic Sludges	448	0.03%
Unknown/Mixed Sludges	60466	4.0%
Combustion Residues	25615	1.7%
Miscellaneous -		
Combustible ⁷	217789	14.3%
Miscellaneous - Non-		
Combustible ⁸	35360	2.3%
Total	1524684	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.52 Industrial Waste Composition (England, 2002/03): Manufacture of Machinery and Equipment

Waste Fraction ¹⁻⁶	Tonnes Arising	
	2002/03	% of Sector Arisings
Paper & Card	95228	10.1%
Organic/Food Waste	43723	4.7%
Green Waste	34185	3.6%
Wood	40968	4.4%
Textiles	5027	0.5%
Fines	7649	0.8%
Glass	20475	2.2%
Plastic (dense)	84237	9.0%
Plastic (film)	15911	1.7%
Ferrous Metal	196687	20.9%
Non-Ferrous Metal	65244	6.9%
WEEE	7921	0.8%
End of Life Vehicles		
Tyres		
Batteries	1272	0.1%
Oils/fuels	10819	1.2%
Paints/Inks/Varnishes	1910	0.2%
Organic Chemicals	5443	0.6%
Inorganic Chemicals	285	0.03%
Unknown Chemicals	1871	0.2%
Aqueous Chemical		
Effluents	5532	0.6%
Organic Sludges	1364	0.1%
Inorganic Sludges	40	0.004%
Unknown/Mixed		
Sludges	6681	0.7%
Combustion Residues		
Miscellaneous -		
Combustible ⁷	35729	3.8%
Miscellaneous - Non-		
Combustible ⁸	251128	26.7%
Total	939331	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.53 Industrial Waste Composition (England, 2002/03): Manufacture of Motor Vehicles and Other Transport Equipment

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	103604	7.0%
Organic/Food Waste	59356	4.0%
Green Waste	49622	3.4%
Wood	94309	6.4%
Textiles	7727	0.5%
Fines	11959	0.8%
Glass	21221	1.4%
Plastic (dense)	13753	0.9%
Plastic (film)	16903	1.1%
Ferrous Metal	531519	36.0%
Non-Ferrous Metal	235928	16.0%
WEEE	13887	0.9%
End of Life Vehicles	443	0.03%
Tyres	301	0.02%
Batteries	14373	1.0%
Oils/fuels	13332	0.9%
Paints/Inks/Varnishes	7231	0.5%
Organic Chemicals	6431	0.4%
Inorganic Chemicals	9779	0.7%
Unknown Chemicals	2920	0.2%
Aqueous Chemical		
Effluents	13051	0.9%
Organic Sludges	6458	0.4%
Inorganic Sludges	2546	0.2%
Unknown/Mixed		
Sludges	15007	1.0%
Combustion Residues	87450	5.9%
Miscellaneous -		
Combustible ⁷	88259	6.0%
Miscellaneous - Non-		
Combustible ⁸	47851	3.2%
Total	1475221	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.54 Industrial Waste Composition (England, 2002/03): Manufacture of Office Machinery, Media and Medical Equipment

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	120831	23.4%
Organic/Food Waste	36734	7.1%
Green Waste	32433	6.3%
Wood	19982	3.9%
Textiles	5102	1.0%
Fines	7250	1.4%
Glass	15840	3.1%
Plastic (dense)	10115	2.0%
Plastic (film)	20918	4.1%
Ferrous Metal	57599	11.2%
Non-Ferrous Metal	32465	6.3%
WEEE	15636	3.0%
End of Life Vehicles		
Tyres		
Batteries	2252	0.4%
Oils/fuels	1008	0.2%
Paints/Inks/Varnishes	1690	0.3%
Organic Chemicals	52801	10.2%
Inorganic Chemicals	4072	0.8%
Unknown Chemicals	9750	1.9%
Aqueous Chemical		
Effluents	2346	0.5%
Organic Sludges	21	0.004%
Inorganic Sludges		
Unknown/Mixed		
Sludges	8719	1.7%
Combustion Residues	61	0.01%
Miscellaneous -		
Combustible ⁷	20230	3.9%
Miscellaneous - Non-		
Combustible ⁸	37445	7.3%
Total	515300	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.55 Industrial Waste Composition (England, 2002/03): Manufacture of Pulp, Paper and Paper Products

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	418712	23.0%
Organic/Food Waste	35081	1.9%
Green Waste	28134	1.5%
Wood	33653	1.8%
Textiles	4391	0.2%
Fines	6289	0.3%
Glass	11136	0.6%
Plastic (dense)	6210	0.3%
Plastic (film)	17093	0.9%
Ferrous Metal	11104	0.6%
Non-Ferrous Metal	5596	0.3%
WEEE	4536	0.2%
End of Life Vehicles		
Tyres		
Batteries	504	0.03%
Oils/fuels	774	0.04%
Paints/Inks/Varnishes	1544	0.1%
Organic Chemicals	10432	0.6%
Inorganic Chemicals	15	0.001%
Unknown Chemicals	1611	0.1%
Aqueous Chemical		
Effluents	23360	1.3%
Organic Sludges	63471	3.5%
Inorganic Sludges	168385	9.2%
Unknown/Mixed		
Sludges	164245	9.0%
Combustion Residues	64558	3.5%
Miscellaneous -		
Combustible ⁷	720933	39.6%
Miscellaneous - Non-		
Combustible ⁸	20260	1.1%
Total	1822025	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.56 Industrial Waste Composition (England, 2002/03): Manufacture of Textiles and Other Apparel

Waste Fraction ¹⁻⁶	Tonnes Arising	
	2002/03	% of Sector Arisings
Paper & Card	73248	5.9%
Organic/Food Waste	71559	5.8%
Green Waste	49097	4.0%
Wood	18593	1.5%
Textiles	22838	1.9%
Fines	10975	0.9%
Glass	19091	1.5%
Plastic (dense)	12127	1.0%
Plastic (film)	40898	3.3%
Ferrous Metal	17734	1.4%
Non-Ferrous Metal	8775	0.7%
WEEE	7897	0.6%
End of Life Vehicles		
Tyres		
Batteries	878	0.1%
Oils/fuels	261	0.02%
Paints/Inks/Varnishes	1	0.0001%
Organic Chemicals	137	0.01%
Inorganic Chemicals	4	0.0003%
Unknown Chemicals	37543	3.0%
Aqueous Chemical Effluents	2643	0.2%
Organic Sludges	350	0.03%
Inorganic Sludges		
Unknown/Mixed Sludges	497537	40.3%
Combustion Residues		
Miscellaneous – Combustible ⁷	305056	24.7%
Miscellaneous - Non-Combustible ⁸	37188	3.0%
Total	1234430	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.57 Industrial Waste Composition (England, 2002/03): Manufacture of Non-Metallic Mineral Products

Waste Fraction ¹⁻⁶	Tonnes Arising	
	2002/03	% of Sector Arisings
Paper & Card	62383	2.7%
Organic/Food Waste	33227	1.5%
Green Waste	29774	1.3%
Wood	31711	1.4%
Textiles	4379	0.2%
Fines	6655	0.3%
Glass	70709	3.1%
Plastic (dense)	13578	0.6%
Plastic (film)	13281	0.6%
Ferrous Metal	78536	3.5%
Non-Ferrous Metal	69221	3.0%
WEEE	8269	0.4%
End of Life Vehicles	1	0.00002%
Tyres	484	0.02%
Batteries	580	0.03%
Oils/fuels	2464	0.1%
Paints/Inks/Varnishes	3211	0.1%
Organic Chemicals	699	0.03%
Inorganic Chemicals	46	0.002%
Unknown Chemicals	1725	0.1%
Aqueous Chemical Effluents	664	0.03%
Organic Sludges	5166	0.2%
Inorganic Sludges	103686	4.6%
Unknown/Mixed Sludges	25690	1.1%
Combustion Residues	151064	6.6%
Miscellaneous – Combustible ⁷	992898	43.7%
Miscellaneous - Non-Combustible ⁸	562342	24.7%
Total	2272442	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.58 Industrial Waste Composition (England, 2002/03): Production of Coke, Oil, Gas, Electricity and Water

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	32608	0.5%
Organic/Food Waste	21170	0.3%
Green Waste	18500	0.3%
Wood	8601	0.1%
Textiles	2730	0.04%
Fines	4135	0.1%
Glass	8239	0.1%
Plastic (dense)	6842	0.1%
Plastic (film)	6063	0.1%
Ferrous Metal	27348	0.4%
Non-Ferrous Metal	17412	0.3%
WEEE	10109	0.2%
End of Life Vehicles	2	0.00003%
Tyres	15	0.0002%
Batteries	1295	0.02%
Oils/fuels	13298	0.2%
Paints/Inks/Varnishes	4	0.0001%
Organic Chemicals	11781	0.2%
Inorganic Chemicals	2401	0.04%
Unknown Chemicals	1156	0.02%
Aqueous Chemical		
Effluents	2193	0.04%
Organic Sludges	6516	0.1%
Inorganic Sludges	1183	0.02%
Unknown/Mixed		
Sludges	172577	2.8%
Combustion Residues	5585760	90.4%
Miscellaneous -		
Combustible ⁷	176105	2.8%
Miscellaneous - Non-		
Combustible ⁸	43696	0.7%
Total	6181738	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.59 Industrial Waste Composition (England, 2002/03): Publishing, Printing and Recording Sector

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	1431317	65.8%
Organic/Food Waste	99235	4.6%
Green Waste	90590	4.2%
Wood	30266	1.4%
Textiles	13322	0.6%
Fines	20250	0.9%
Glass	36323	1.7%
Plastic (dense)	21380	1.0%
Plastic (film)	22025	1.0%
Ferrous Metal	25657	1.2%
Non-Ferrous Metal	67584	3.1%
WEEE	16184	0.7%
End of Life Vehicles		
Tyres		
Batteries	1599	0.1%
Oils/fuels	777	0.04%
Paints/Inks/Varnishes	5173	0.2%
Organic Chemicals	60189	2.8%
Inorganic Chemicals	408	0.02%
Unknown Chemicals	11483	0.5%
Aqueous Chemical		
Effluents	14210	0.7%
Organic Sludges	2430	0.1%
Inorganic Sludges		
Unknown/Mixed Sludges	232	0.01%
Combustion Residues	308	0.01%
Miscellaneous -		
Combustible ⁷	130713	6.0%
Miscellaneous - Non-		
Combustible ⁸	72189	3.3%
Total	2173844	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.60 Industrial Waste Composition (England, 2002/03): Wood and Wood Products Sector

Waste Fraction ¹⁻⁶	Tonnes Arising 2002/03	% of Sector Arisings
Paper & Card	55450	3.8%
Organic/Food Waste	45596	3.1%
Green Waste	41663	2.8%
Wood	1152698	78.4%
Textiles	6127	0.4%
Fines	9313	0.6%
Glass	17940	1.2%
Plastic (dense)	10641	0.7%
Plastic (film)	9123	0.6%
Ferrous Metal	14937	1.0%
Non-Ferrous Metal	7906	0.5%
WEEE	8567	0.6%
End of Life Vehicles		
Tyres	2	0.0001%
Batteries	735	0.05%
Oils/fuels	172	0.01%
Paints/Inks/Varnishes	1142	0.1%
Organic Chemicals	878	0.1%
Inorganic Chemicals		
Unknown Chemicals	2206	0.1%
Aqueous Chemical		
Effluents	620	0.04%
Organic Sludges	526	0.04%
Inorganic Sludges		
Unknown/Mixed Sludges	18	0.001%
Combustion Residues	1983	0.1%
Miscellaneous -		
Combustible ⁷	29420	2.0%
Miscellaneous - Non-		
Combustible ⁸	53290	3.6%
Total	1470953	100%

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes inert wastes only

Table A1.61 Industrial Waste Composition (England, 2002/03): All Sectors Combined

Waste Fraction ¹⁻⁶	Tonnes	% of	% Carbon	% Carbon	Gross Calorific Value (MJ/kg) ⁹
	Arising 2002/03	Sector Arisings	(Biogenic) ⁹	(Fossil) ⁹	
Paper & Card	3293968	8.8%	31.9%		12.6
Other Organics	1727712	4.6%	13.5%		5.3
Food Waste	1771351	4.7%	17.2%		6.5
Green Waste	814361	2.2%	13.5%		5.3
Wood	1882842	5.0%	43.8%		18.3
Textiles	114830	0.3%	19.9% ¹⁰	19.9% ¹⁰	15.9
Fines	174940	0.5%	6.9% ¹⁰	6.9% ¹⁰	4.8
Glass	403563	1.1%	0.3%		1.5
Plastic (dense)	353831	0.9%		54.8%	26.7
Plastic (film)	360300	1.0%		47.8%	23.6
Ferrous Metal	1673341	4.5%			
Non-Ferrous Metal	1023419	2.7%			
WEEE	243689	0.6%		15.8%	7.6
End of Life Vehicles	586	0.002%		15.8% ¹¹	7.6 ¹¹
Tyres	2081	0.01%		74.0%	31.7
Batteries	26952	0.1%			
Oils/fuels	74636	0.2%		80.4%	37.7 ¹²
Paints/Inks/Varnishes	53233	0.1%		38.4%	15.6
Organic Chemicals	516827	1.4%		38.4% ¹³	15.6 ¹³
Inorganic Chemicals	576134	1.5%		38.4% ¹³	15.6 ¹³
Unknown Chemicals	171336	0.5%		38.4% ¹³	15.6 ¹³
Aqueous Chemical Effluents	434039	1.2%		38.4% ¹³	15.6 ¹³
Organic Sludges	143066	0.4%	30.9% ¹⁴		12.0 ¹⁴
Inorganic Sludges	304592	0.8%		30.9% ¹⁴	12.0 ¹⁴
Unknown/Mixed Sludges	1880621	5.0%	15.5% ¹⁴	15.5% ¹⁴	12.0 ¹⁴
Combustion Residues	9590609	25.5%		7.0% ¹⁵	2.8 ¹⁵
Miscellaneous - Combustible ⁷	6659626	17.7%	19.2% ¹⁰	19.2% ¹⁰	15.6
Soils/silts	708297	1.9%	7.0%		2.8
Mineral/aggregate waste	752295	2.0%		7.0%	2.8
Other Non-Combustible ⁸	1854382	4.9%	3.5%	3.5%	2.8
Total	37587459	100%	11.3%	9.6%	8.5

Source: EA England, Commercial and Industrial Waste Survey 2002/03. Data provided by the Strategic Waste and Resource Management group of the Environment Agency

Notes: 1. Waste category 'mixed municipal waste' (EWC code 20 03 01) has been included in the statistics and has been assumed to have the same composition as that assumed for municipal waste. This may potentially have resulted in a double-count of municipal wastes.

2. Composition of waste category 'bulky waste' assumed on the basis of Welsh bulky waste composition, taken from *The Composition of Municipal Waste in Wales*. National Assembly for Wales (NAW)/AEAT Technology - December 2003.

3. Waste category 'construction & demolition' assumed to comprise 99% non-combustible waste and 1% combustibles

4. Waste category 'mixed packaging' assumed to comprise 20% paper & card, 20% glass, 20% metals, 20% wood and 20% plastics

5. Waste categories described as 'plastics' assumed to comprise 50% dense and 50% film

6. Waste categories described as 'metals' assumed to comprise 50% ferrous and 50% non-ferrous

7. Includes all miscellaneous wastes not otherwise specified

8. Includes minerals, bricks, blocks, plaster, ceramics etc.

9. ERM and Environment Agency Data

10. Assumed 50% biogenic carbon content and 50% fossil carbon content

11. Assumed to be the same as the waste fraction, WEEE

12. Net Calorific Value

13. Generic value assumed for chemicals

14. Assumed to be the same as the waste fraction, sewage sludge and apportioned accordingly

15. Assumed to be the same as the waste fraction, non-combustibles

Composition data disaggregated at the sector level have not been compiled for industrial wastes arising in Scotland, Wales and Northern Ireland. However, an estimate of total industrial waste composition has been published for Northern Ireland, and this is presented in *Table A1.62*. No estimates are currently available regarding industrial waste composition in Scotland and Wales.

Table A1.62 Industrial Waste Composition in Northern Ireland (2001)

Waste Fraction	% of Arisings	Tonnes Arising	% Carbon (Biogenic) ¹	% Carbon (Fossil) ¹
Paper/ card	58%	66,149	32%	
Putrescible	9%	9814	14%	
Misc non-combustible	7%	7832	3.5% ²	3.5% ²
Ferrous metal	5%	5308		
Non-ferrous metal	2%	1769		
Glass	0%	0	0.28%	
Plastic dense	15%	17,127		55%
Plastic film	5%	5709		48%
Total	100%	113,708	20%	11%

Source: Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005)

Notes:

1. ERM and Environment Agency Data (2003-2005)

2. Assumed 50% biogenic carbon content and 50% fossil carbon content

A1.8.5 Industrial Waste Growth

In a similar way to commercial wastes, forecasting of industrial waste arisings is difficult due to a lack of historical data and incomplete understanding of future technological developments.

Opinions raised at the workshop on commercial and industrial waste arisings and management suggested that this relatively high economic growth would not translate into an equivalent rate of waste growth. Instead, it was generally felt that technological advances are such that waste growth is likely to be lower than economic growth and that this, together with a decline in heavy industry, would lead to static industrial waste growth overall.

A1.8.6 Future Management of Commercial and Industrial Waste

The workshop on commercial and industrial waste arisings raised the question of the future management of these waste streams. A number of issues were highlighted that have influence on the way that future scenarios for the management of these waste streams may be developed. Some key points that were raised are listed below.

- It should be less important where it comes from (waste stream) – more, what it is and how much is extractable and recyclable.
- Waste management policy should be by material and not source and it is for government and the waste management sector to facilitate the

development of infrastructure and cheaper alternatives to landfill. Businesses do not want to build or operate waste management facilities. They are happy to segregate wastes but they need financial incentives to do so. The biggest incentive will be when a waste service provider offers a cheaper alternative to landfill.

- Industry feels that there is scope to increase segregation of wastes for recycling/biological treatment but this would be limited by physical space and cost. For example, glass in commercial sector wastes is a likely target in light of packaging targets for glass recycling. However, segregation by small businesses is likely to be difficult. Organisations such as WRAP have been involved in schemes to increase collection of segregated glass in the service sector.
- Recycling is limited by markets and is dependent on economics. There will always be a demand for energy and so thermal processing is likely to increase for this reason. Recycling and composting only so much, especially with shift from industry to commerce.
- Recycling output will never match manufacturing demand (theoretical maximum for recycling = 60-70% for municipal waste). However, there is still a need to look at case specific industries eg glass - increased use as aggregates, plastics - future increase eg with car/electronics industries increasing recycling effort.
- One size fits all is not the solution. For example, anaerobic digestion leading to recovery on land should become of increased importance for biological commercial wastes.
- Waste itself generates residues (eg ash, APC residues) - this will be the bottom line, landfill will never disappear.
- It is unlikely that commercial waste will be required to be picked up by local authorities in the future, but the waste management industry is looking for more integration and commercial waste may bolt on to PFI schemes - merchant facility on back of PFI capital investment (but can't use for excessive capacity).
- Obstacles for waste management industry include waste producers themselves - eg on-site treatment of sludges (dependant on size of industry (not likely with small and medium enterprises (SMEs) - need to consider how much of waste stream is from SMEs.)).

A1.9

CONSTRUCTION AND DEMOLITION (C&D) WASTE

The construction and demolition waste stream relates to those wastes arises from the construction, repair, maintenance and demolition of buildings and structures. It mostly includes brick, concrete, hardcore, subsoil and topsoil, but it can also include quantities of timber, metal, plastics and small quantities of hazardous waste materials (*Waste Strategy 2000* for England and Wales).

A1.9.1

C&D Waste Arisings

Published data relating to construction and demolition waste arisings in the UK derive from a number of sources, dependent on devolved administration.

England & Wales

In 2001, ODPM carried out a survey into the arisings and use of construction and demolition wastes (ODPM, 2001). This followed an initial survey in conjunction with the Environment Agency in 1999/2000 and was commissioned in November 2001 by the Minerals and Waste Planning Division of the Department for Transport, Local Government and the Regions (DTLR) with the support of the Welsh Assembly. *Table A1.63* summarises the results of the 2001 survey.

There are plans to repeat this survey at regular, two yearly intervals so that a time series can be formed. As a result, a subsequent survey was carried out in 2003. At the time of writing, data from this survey had yet to be fully analysed and published. However, summary data comparing construction and demolition arisings and management between 1999 and 2003 are shown in *Table A1.64*. Note that these data relate to arisings in England only.

Data show that total construction and demolition waste arisings in England were estimated at 90.9 million tonnes in 2003. This represents an increase of 2 million tonnes from 2001. Approximately 50% of the total waste stream was recycled as aggregate or soil. A further 18% was used spread on land at registered sites and the remaining 32% was either disposed at landfill sites, or used for layering or topping.

The estimates suggest that the production of recycled aggregate and soil increased significantly (19 million tonnes) between 1999 and 2001, but relatively less from 2001 to 2003 (2 million tonnes). However, further detail regarding the 2003 survey results is required to investigate changes in other management categories.

Table A1.63 *Management of Construction and Demolition Waste in England and Wales, 2001 (Million Tonnes)*

Management Route	England	Wales	Total England & Wales
Used as recycled aggregate	36.5	1.6	38.0
Used as recycled soil	6.8	0.24	7.1
Used for landfill engineering / restoration	8.8	0.66	9.4
Used to backfill quarry voids	10.6	0.94	11.5
Spread on registered exempt sites	22.4	1.3	23.7
Disposed of at landfills	3.9	0.35	4.2
Total arisings	88.9	5.0	93.9

Source: ODPM (2001) Survey of Arisings and use of Construction and Demolition Waste
 Source publication: e-Digest of Environmental Statistics, Published August 2003, Department for Environment, Food and Rural Affairs, <http://www.defra.gov.uk/environment/statistics/index.htm>.

Table A1.64 *Management of Construction and Demolition Waste in England, 1999-2003 (Million Tonnes)*

Management Route	1999	2001	2003
Recycled by crushers/screeners (as aggregate or soil)	24.4	43.3	45.5
Used or disposed in Landfill	25.8	23.2	29.1
Spread on exempt sites	19.0	22.4	16.4
Total	69.2	88.9	90.9

Source: ODPM 2003 survey of construction and demolition waste

Scotland

Data for arisings and management of C&D waste have been provided by SEPA ⁽¹⁾. The amount of waste sent to landfill has decreased significantly between the mid-1990 and 2004. This is likely to be explained by both increased recycling and increased quantities of wastes sent to exempt sites. Data are currently limited, however, as SEPA possess only information relating to waste recycled at fixed sites. These data exclude materials recycling through mobile reprocessing plant and therefore underestimate both total arisings and quantities of material recycled.

Since April 2003, exempt sites in Scotland have been registered to handle 6.5 million tonnes of C&D waste. SEPA estimate the total amount of C&D waste handled at exempt sites to be in the region of 2-3 million tonnes in 2004.

The arisings presented in *Table A1.65* are considered to be a low estimates of the quantity of C&D waste generated in Scotland. However, it is currently not possible to quantify the total amount of C&D waste arisings in Scotland, due to lack of available data. SEPA is investing effort in trying to improve datasets, but the results were not available within the timescales of the current research.

(1) Bill Proctor, Environmental Data Unit Manager, SEPA. Personal communication December 2005.

Table A1.65 *Estimated Arisings and Management of Construction and Demolition Waste in Scotland (Million Tonnes)*

Management Route	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Landfill	5.22	4.85	6.71	7.72	-	-	7.01	5.10	4.28	3.95	2.17	1.91	2.60	2.77
Exempt sites	-	-	-	-	-	-	-	-	-	-	-	-	-	2.50 ¹
Recycling	-	-	-	-	-	-	-	-	-	-	-	-	-	0.855 ²
Total Arisings	-	-	-	-	-	-	-	-	-	-	-	-	-	6.13

Source: SEPA. Bill Proctor, personal communication 2005-12-22. Data based on a based on a review of licensed site returns performed by SEPA for the period 1 April 2004 to 31 March 2005.

Notes:

1. Total amount handled by exempt sites is estimated to be in the region of 2-3 million tonnes.
2. Generated from SEPA's review of licensed site returns. Scaled to match total input to sites. Only recycling at fixed sites is included in the estimate.

Northern Ireland

In 2005, an assessment of the Best Practicable Environmental Option (BPEO) for Waste Management in Northern Ireland was carried out by ERM (ERM, 2005). Arisings for this assessment were estimated to be in the region of 2.5 to 3.75 million tonnes. The upper of these values is considered to be an appropriate, conservative estimate of C&D waste arisings in Northern Ireland. Of this, it was estimated that approximately 35% was reused or recycled and 65% sent to landfill.

Total UK

Combining national datasets results in a total best current estimate of 105.7 million tonnes of construction and demolition waste arising across the UK. Final estimates of C&D waste arisings and management in the UK are summarised in *Table A1.66*.

Table A1.66 *Estimated Arisings and Management of Construction and Demolition Waste in the UK (Million Tonnes)*

	England	Wales	Scotland	Northern Ireland	Total
Landfill	9.19	0.35	2.77	2.44	14.7
Land application/recovery	6.45	0.66			7.11
Exempt sites	16.4	1.28	2.50		20.2
Recycled	45.4	1.79	0.86	1.31	49.4
Void filling	13.4	0.94			14.3
Total	90.86	5.02	6.13	3.75	105.7

Sources:

- ODPM (2001/2003) Survey of Arisings and use of Construction and Demolition Waste.
- SEPA, personal communication
- SEPA licensed site returns 2004 - 2005
- Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis (ERM 2005)

England and Wales

The 2003 ODPM survey of C&D waste in England reports three categories of C&D waste:

- hard C&D waste, which includes both segregated and mixed unprocessed/uncrushed materials. Waste defined by sections 17.01, 17.03 and 17.05 of the European Waste Catalogue is assigned to this stream, which includes wastes such as bricks, concrete, tiles, ceramics, bituminous mixtures and coal and tarred products;
- excavation waste, which includes both clean and contaminated waste soil, stone and rocks arising from land levelling, civil works and/or general foundations. Such materials are defined in two categories of the European Waste Catalogue: 17.05.03 (soil and stones containing dangerous substances) and 17.05.04 (soil and stones other than those mentioned in 17.05.03); and
- mixed hard C&D and excavation waste, which relates to any mixture of the two previous categories.

Arisings of each of these categories of waste in England in 2003 is shown in *Table A1.67*. Further detail regarding composition is unavailable, and so in order to estimate carbon content it has been assumed that these wastes comprise predominantly non-combustible mineral or soil wastes, with an associated carbon content of 7% ⁽¹⁾ (assumed to be proportionally split between inorganic and organic fractions). Compositional data from Scotland and Northern Ireland (*Table A1.68*) shows this to be a not unreasonable assumption.

With a lack of further information, it is assumed that the composition of C&D waste in Wales is similarly comprised predominantly soil and mineral materials.

Table A1.67 *Estimated Composition of Construction and Demolition Waste in England (2003)*

	Million Tonnes Arising
Hard C&D waste	44.4
Excavation waste	34.9
Mixed hard C&D and excavation waste	11.6
Total	90.9

Source: ODPM 2003 survey of construction and demolition waste

(1) Estimated from work carried out as part of the development of the WRATE tool (ERM and Environment Agency Data, 2003-2005)

Scotland

The composition of C&D waste sent to landfill in Scotland between April 2004 and March 2005 has been collated by means of SEPA's review of licensed site returns. In the absence of any further data, it is assumed that all C&D waste arising has the same composition as that sent to landfill. Resulting estimates of Scottish C&D waste composition are presented in *Table A1.68*.

Table A1.68 *Estimated Composition of Construction and Demolition Waste in Scotland (2004/05)*

Waste Fraction	Million Tonnes Arising	% of Sector Arisings	% Carbon (Biogenic)¹	% Carbon (Fossil)¹	Gross Calorific Value (MJ/kg)¹
Soil and stones	4.5	73.4%	3.5% ²	3.5% ²	2.8
Bricks, blocks, plaster	0.01	0.2%		7.0%	2.8
Other non-combustible materials (concrete, tiles, ceramics, insulation materials) ³	1.6	26.1%	3.5% ²	3.5% ²	2.8
Wood	0.005	0.1%	44%		18.3
Other combustible materials (other wood, bituminous material, coal and tarred products)	0.0081	0.1%	19% ²	19% ²	15.6
Ferrous Metals ⁴	0.00008	0.001%			
Non-ferrous Metals ⁴	0.00006	0.001%			
Glass	0.003	0.05%	0.28%		1.5
Plastic (Dense)	0.0007	0.01%		55%	26.7
Total	6.13	100%	3.6%	3.5%	2.8

Source: SEPA, Review of licensed site returns (2004/05).

1. Carbon content and gross calorific value estimated from work carried out for the Environment Agency WRATE tool (ERM and Environment Agency Data, 2003-2005)

2. Assumed 50% biogenic and 50% fossil carbon sources.

3. Includes, mixed construction waste and wastes not otherwise specified

4. Includes 50% of 'mixed metal' categories

Northern Ireland

Estimated C&D waste composition data for Northern Ireland are shown in *Table A1.69*. Data are based on the Northern Ireland Environment and Heritage Service's most recent waste survey (2002).

Table A1.69 *Estimated Composition of Construction and Demolition Waste in Northern Ireland (2002)*

Waste Fraction	Million Tonnes Arising	% of Sector Arisings	% Carbon (Biogenic)¹	% Carbon (Fossil)¹	Gross Calorific Value (MJ/kg)¹
Combustible materials ²	0.075	2.0%	19% ⁴	19% ⁴	15.6
Non-combustible materials ³	3.66	98%	3.5% ⁴	3.5% ⁴	2.8
Non-ferrous Metals	0.015	0.40%			
Total	3.75	100%	3.8%	3.8%	3.0

Sources:

- *Construction and Demolition Waste Survey*, completed by Enviro Consulting Ltd for EHS, 2002
- *Assessment of the Best Practicable Environmental Option for Waste Management in Northern Ireland: Development and Analysis* (ERM 2005).

http://www.ehsni.gov.uk/pubs/publications/BPEO_Technical_Report_1_81mb.pdf

Notes:

1. Carbon content and gross calorific value estimated from work carried out for the Environment Agency WRATE tool (ERM and Environment Agency Data, 2003-2005)
2. Includes the category "Wood, glass and plastic".
3. Includes concrete, bricks, tiles and ceramics, soils, stones and dredging spoil, insulation materials and asbestos containing construction materials and 'other construction and demolition wastes'.
4. Assumed 50% biogenic and 50% fossil carbon sources.

UK Composition

Given the lack of data relating to C&D waste composition, it is not possible to derive a representative picture of the breakdown of C&D waste in the UK. Discussions with WRAP confirm that the scale of arisings estimates presented are consistent with those commonly reported for waste soil and mineral-based materials.

Data relating to arisings of other materials in this waste stream, such as wood, plastics, glass and metals are severely lacking, as the majority of studies focus on minerals and aggregates. This is a limitation of the data available and could not be reconciled within the timescale of the research. As such, the research used approximations of materials arising through the C&D waste stream on estimates of mineral/aggregate materials and soils only.

A1.9.3 *C&D Waste Growth and Future Management*

An evaluation of 13 waste strategies for Northern Ireland, England and Wales, carried out as part of the BPEO assessment for Northern Ireland (ERM, 2005) anticipated that quantities of C&D waste produced would increase with economic growth. The rate at which this occurs should be balanced against other influencing factors, such as landfill tax, the Landfill Directive and the Aggregates Levy, which are likely to counteract the trend of increasing C&D waste growth with economic development.

The Aggregates Levy was introduced in 2002, with the aim of increasing the use of secondary aggregates through increasing the cost of primary

aggregates. As a result, the majority of easily recyclable material in the C&D waste stream (clean hard C&D waste) is currently recycled (ODPM, 2003). Furthermore, there is evidence that the economics of recycling are now encouraging recyclers to employ techniques which increase recovery rates from the 'mixed hard C&D and excavation waste' stream.

A1.10 *SUMMARY: COMBINED ESTIMATES OF UK WASTE ARISING AND COMPOSITION*

Table A1.70 shows combined estimates of UK waste arisings by waste stream and material composition, as determined through literature and data review.

The differentiation in degree to which waste streams are broken down into discreet material fractions highlights the inherent difficulties of compiling a UK waste dataset in this way. Levels of disaggregation differ according to source as there is no consistent data collection methodology currently in existence. As such, a number of fractions may in reality be more significant in quantity than is apparent on the basis of currently available data. For example, tonnages for these fractions may be included within the 'miscellaneous' categories (combustibles and non-combustibles). More work is required to further describe the waste categories we have presented, but it not within the scope of this research to do so.

One method available to us to 'sense check' the estimates, was to consult with WRAP as to UK estimates for individual waste materials. This exercise was carried out in a series of meetings with material managers and resulted in an update of estimates of both arisings and management for a number of materials (paper and card, wood and glass). Further, additional information was sought to reconcile estimates for end of life vehicles (ELVs) and tyres, as they appeared low. Resulting estimates are presented in *Table A1.71* and represent the final material estimates used in the research.

Table A1.70 *Compiled Estimates of UK Waste Arisings by Material Composition (Million Tonnes) – Results of Literature and Data Review*

Waste Fraction	Agricultural Waste¹	Mining & Quarrying²	Sewage Sludge³	Dredged Materials⁴	Municipal Waste⁵	Commercial Waste⁶	Industrial Waste⁶	C&D Waste⁷	Total
Paper & Card	0.01				6.3	10.3	4.1		20.6
Kitchen/food waste					6.1	3.5	2.2		11.8
Garden/Plant Waste	6.6				6.4	3.2	1.0		17.2
Other organic waste	83.0		1.3			0.5	2.1		87.0
Wood					1.1	1.2	2.3		4.6
Textiles					0.9	0.4	0.1		1.4
Fines					1.4	0.7	0.2		2.3
Glass					2.2	2.3	0.5		5.0
Plastic (dense)					1.3	1.0	0.4		2.8
Plastic (film)	0.1				1.0	1.5	0.4		3.1
Ferrous Metal					1.2	0.8	2.1		4.1
Non-Ferrous Metal					0.2	0.5	1.3		2.0
WEEE	0.03				0.9	0.9	0.3		2.1
ELVs	0.03					0.05	0.001		0.1
Tyres						0.2	0.003		0.2
Batteries						0.1	0.03		0.2
Oils/fuels						0.4	0.1		0.5
Organic Chemicals						0.1	0.7		0.8
Inorganic Chemicals	0.3						0.7		1.0
Unknown Chemicals	0.1				0.4	0.5	0.2		1.2
Aqueous Chemical Effluents						0.07	0.5		0.6
Organic Sludges						0.0	0.2		0.2
Inorganic Sludges							0.4		0.4
Unknown/Mixed Sludges						0.1	2.3		2.4
Absorbent Hygiene Products					0.8				0.8
Combustion Residues						0.07	11.9		11.9
Silt/soil		48.4		11.73		0.6	0.9	49.1	110.7
Aggregate/mineral materials		48.4		11.73	2.2	0.4	0.9	56.2	119.9
Other non-combustible materials	0.03				2.2	2.3	2.3		6.8
Miscellaneous combustibles					0.8	3.7	8.2		12.7
Total	90.3	96.9	1.3	23.46	35.3	35.6	46.5	105.7	434.5

Notes: 1-7. Refer to *Sections A1.3 to A1.9* for further detail and data sources and age of data

6. Quantities based on commercial and industrial waste composition estimates for England

7. Quantities based on estimates of mineral/aggregate materials and soils only

Table A1.71 Final Estimates of UK Waste Arisings by Composition (Million Tonnes) – Sense Check

Waste Fraction	Total
Paper & Card	13.7 ¹
Kitchen/food waste	11.8
Garden/Plant Waste	17.2
Other organic waste	87.0
Wood	7.5 ²
Textiles	1.4
Fines	2.3
Glass	3.5 ³
Plastic (dense)	2.8
Plastic (film)	3.1
Ferrous Metal	4.1
Non-Ferrous Metal	2.0
WEEE	2.1
ELVs	2.0 ⁴
Tyres	0.5 ⁵
Batteries	0.2
Oils/fuels	0.5
Organic Chemicals	0.8
Inorganic Chemicals	1.0
Unknown Chemicals	1.2
Aqueous Chemical Effluents	0.6
Organic Sludges	0.2
Inorganic Sludges	0.4
Unknown/Mixed Sludges	2.4
Absorbent Hygiene Products	0.8
Combustion Residues	11.9
Silt/soil	110.7
Aggregate/mineral materials	119.9
Other non-combustible materials	6.8
Miscellaneous combustibles	12.7
Total	431.3

Notes:

1. WRAP, personal communication. Based on CEPI statistics.
2. WRAP (2005). *Review of Wood Waste Arisings and Management in the UK*. M.E.L Research Ltd.
3. WRAP, personal communication.
4. ERM (2006). *Review of 2015 Targets for the ELV Directive*. Draft Report for the DTI
5. Environment Agency 2004. *Life Cycle Assessment of the Management Options for Waste Tyres*. Environment Agency, R&D Report Ref. No. P1 437/TR, ISBN: 1844 32289 0.

A1.11 COMMENTARY ON THE QUALITY OF ALTERNATIVE DATASETS

The poor quality, completeness and consistency of data regarding waste arisings, composition and management have been noted as limitations to the material arisings estimates presented. Some further comments on the relative quality of different datasets used to generate final estimates, is presented below.

Agricultural Waste

The majority of the estimates of non-natural agricultural waste presented in *Section A1.3* were based on data derived from the Agricultural Waste Survey 2003, as this is the most up to date and complete survey of UK agricultural

waste. This survey gathered data from 380 holdings detailed in the June Agricultural Census, using interviews and observations collected during visits to the holdings. The estimates produced in the survey are likely to be a close representation of stockpiled waste quantities, but are likely to overestimate annual quantities of waste arisings. While the survey identified the various waste disposal routes used by farms, the quantities disposed to each were rarely provided, with qualitative descriptions produced instead.

To aid future data collection, a mass balance tool for farms has been developed by Biffaward, in conjunction with Forum for the Future (Biffaward, 2005). This tool comprises an Excel workbook that can estimate waste amounts likely to be produced and their respective waste disposal costs from various farm enterprises. The tool utilises detailed waste flow data, collected from five farms and waste audits from farms participating in the Forum Farm Network, in order to calculate waste streams, such as plastic packaging, paper, glass, wood and mixed waste. The tool could be used in future surveys of agricultural waste. However the quality of resulting estimates requires further consideration.

Mining and Quarrying

Time series data for mining and quarrying activities present only estimates of arisings, and virtually no reliable information on management is available. Minerals waste estimates have been derived based on the ratios of waste to product, as defined by Defra's Waste Statistics Division. Mineral extraction processes differ significantly with respect to waste generation and vary from site to site, and so the arisings presented are very much estimates.

Data on composition of materials are lacking and ERM was required to make a number of assumptions. These data thus cannot be considered reliable, and should be regarded as incomplete and of poor quality.

Sewage Sludge

Data relating to sewage sludge arisings and management derive from, and are monitored by, Water UK (water companies must report sludge generation and management as a sustainability indicator). As such, we can consider these data reliable.

Data regarding the chemical composition of sewage sludge composition are less reliable, as composition varies depending on catchment and typical carbon content will also vary according to moisture content. Data were collated as part of the Environment Agency's ongoing development of WRATE and are considered a reasonable representation. However, the uncertainty with respect to this parameter is noted.

Dredged Materials

Very few data are available regarding arisings and management of waste dredged materials, with inland dredgings lacking in particular. Discussion

with British Waterways revealed that the amount of material dredged varies significantly year-by-year and is difficult to predict. Waste from marine sand extraction and capital and maintenance dredgings is also difficult to quantify.

The majority of data that we have collated for these sources have a high degree of variability over time and so in any one year cannot be taken as reliable estimates. However, this waste stream is of relatively low importance within the context of the research, as the majority it is returned to the sea and hence never becomes a waste issue. That which is retained on land is of a relatively low tonnage.

Municipal Solid Waste

Published data relating to MSW arisings in each of the UK's devolved administrations are relatively complete, derive predominantly from the local authorities responsible for collecting and managing wastes, and, as such, are considered to be of good quality.

Much greater uncertainty exists with regard to MSW composition. The composition data used for this study derive from the most complete sources available. However, gaps exist in a number of national datasets, requiring a number of assumptions to be made, the suitability of which are uncertain (as compositions are likely to vary across, and within, nations). Furthermore, we can expect MSW composition to vary widely over time and, within this context, the data sources available are relatively old (ranging from 2002 to 2005). As such, whilst being the best available, the quality of composition data compiled is considered to be poor.

Commercial and Industrial Waste

Published data relating to commercial and industrial waste arisings, management and composition derive from a number of sources and vary in quality and age.

The most complete and recent survey was carried out by the Environment Agency in 2002/03, and was based on a sample of approximately 4500 sites (data collection was limited to controlled waste and relate to England only). The resulting data have a degree of uncertainty and, whilst being the most complete estimates available (in particular with respect to composition) they are limited to some extent. For example, changes in method between this and previous surveys are such that a direct, time-series comparison cannot be made, and some queries remain over estimates for specific waste materials, such as paper and card. Further, a considerable proportion of waste materials are aggregated into 'miscellaneous' categories and there is ongoing work to disaggregate these further.

Whilst some uncertainty exists, these remain the best and most complete estimates of the composition of commercial and industrial wastes and have been used as a substitute for all commercial and industrial wastes across the

UK. The suitability of making this assumption is, again, uncertain, but remains the best option available to us.

We conclude that estimates regarding commercial and industrial waste arisings are likely to be reliable, but data relating to waste composition across the UK are less so. ERM have had to make a number of assumptions in assigning waste categories from the original data, and, as such, resulting materials stream estimates should be treated with caution.

Construction and Demolition Waste

Data relating to waste arising from construction and demolition activities are of variable quality. The majority of studies and published datasets concentrate on quantifying the arisings and management of minerals and soil-based materials, and very little information is available to quantify arisings of other materials, such as wood, plastics and metals. As such, data for the former are considered relatively reliable and have been used to represent C&D waste arisings. However, it was difficult to reconcile estimates presented in alternative national datasets for alternative materials, and these represent a data gap.

A further breakdown of the specific material fractions comprising the broad categories of 'hard C&D waste', 'excavation waste', 'mixed C&D waste' and 'non-combustibles' was not available in a consistent form to enable a representative picture of the composition of UK C&D waste to be determined. As a result, it is considered that the quality of the material estimates presented is poor.

Refer to *Annex F* for all references and data sources.