REWARD

Regional and Welsh Appraisal of Resource Productivity and Development:

Key Industrial Environmental Pressures – Waste Arisings

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1 Introduction

The Environment Agency, working with a number of Regional Development Authorities (RDAs) in England and Wales, are developing a regional environment-economy quantitative tool that could be used by both regional policy makers and regional stakeholders. A study[1] discussing how this tool could be developed identified that work would be required on both environmental data collection and model development. This report identifies the sources of data used to provide information on waste arisings for the model, updates the information on sources of data on arisings for a number of waste streams, and indicates the expected frequency for updating data on each of the waste streams for which data is supplied. Summaries of the data are presented in this report, and the full data set is provided as a series of spreadsheet files.

The vast majority of the data used in compiling the waste arisings is from published sources, and so can be considered to be in the public domain. However, where data can not be obtained due to reasons of commercial confidentiality, this is highlighted in the report and the assumptions made in order to provide the relevant dataset are discussed. The report also discusses the overall quality of the data which is provided and how this could be improved.

2 Waste streams

This chapter of the report initially assesses the availability of data for a range of waste streams, and identifies the waste streams for which data is provided for the model. It then presents weight arisings data for each of the identified waste streams.

The main source of data identified by the study into the development of the model was the data on the arisings and composition of commercial and industrial waste arisings published by the Environment Agency in the regional Strategic Waste Management Assessment 2000 reports[2] (SWMAs). These cover the nine planning regions in England, and there is also a single report for Wales. One of the aims of the SWMAs is to help regional planning authorities with the production of regional waste management strategies. Other wastes for which data is included in the SWMAs are household waste, agricultural waste, construction and demolition waste, and special wastes. Data is also published[3] by the Government on arisings of wastes such as mineral wastes, sewage sludge and dredging wastes. Further waste streams which could be considered for inclusion in the model include forestry wastes and fishing wastes, but there is little published data on these waste streams. However, although some published data on dredging wastes is available, the lack of data from some types of dredging activities means that it is not possible to produce regional arisings data for dredging wastes. Consequently, the waste streams for which data are provided for the model are:

- Controlled wastes - municipal waste (MSW), commercial waste, industrial waste (including special wastes), and construction and demolition (C&D) waste
- Agricultural waste
- Mineral/mining wastes

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[1] Regional and Welsh Economies Environmental Performance/Resource Productivity. Report E2-053 produced for the Environment Agency by ECOTEC Research and Consulting ltd, August 2001.
[2] There are ten reports covering Wales and the 9 regional areas in England. For example; Strategic Waste Management Assessment 2000: East Midlands. Environment Agency R&D Publication No. 119, October 2000
[3] Data published in the yearly Digest of Environmental Statistics.

- Sewage sludge
- Forestry wastes
- Fishing wastes
- Priority waste streams - batteries, solvents, tyres, vehicles and waste electrical and electronic equipment (WEEE).

The overall arisings of the waste streams which are being considered in this report are estimated to be about 450 million tonnes per year. Figure 1 shows that virtually all of these arisings are from either controlled wastes, agricultural wastes or mining/mineral wastes, and that the total arisings for all the other waste streams for which data are being provided represent less than two percent of total arisings.

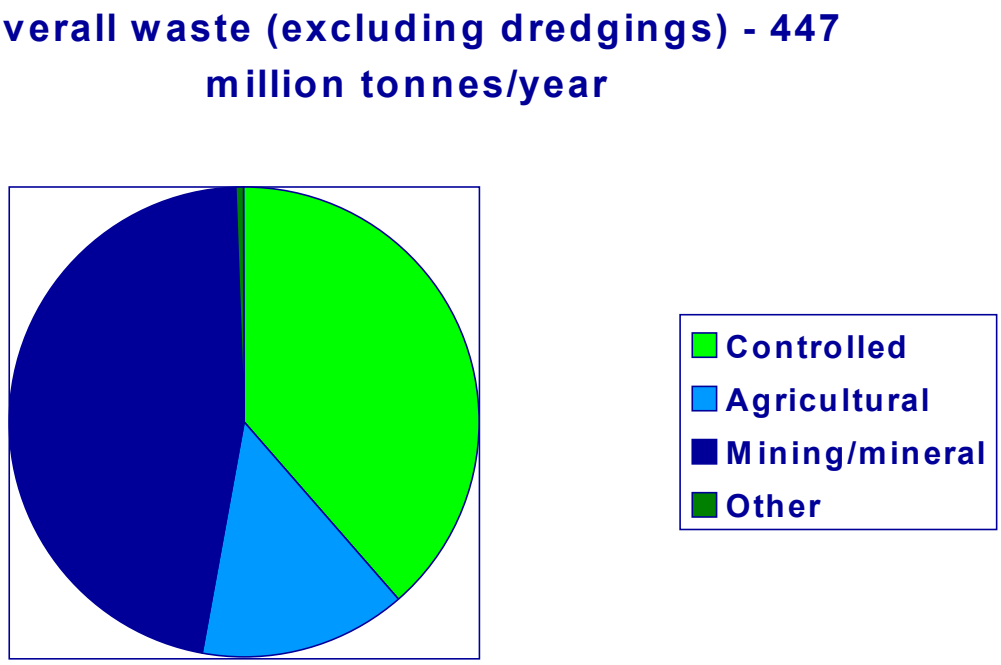

Figure 1: Arisings of waste streams

The aim of the work is to provide data on arisings of each of these waste streams in each of the 10 Regional Development Agencies (RDA) in England and Wales. A report[4] assessing regional arisings of wastes (together with data on areas including emissions to air and rainwater abstraction) published in 1997 provides data for the regions of the UK, but these are based on the Environment Agencies regional boundaries rather than the RDA areas. Further work[5] on mapping resource and material flows in the UK is currently being conducted, but no new data has yet been produced. Consequently, as the SWMAs provide information on the regional arisings of the majority of the waste streams being considered in this report, this information was used to provide data on arisings in each RDA for these waste streams. For waste streams which are not included in the SWMA reports, regional arisings were determined either by the use of other sources of published data or through suitable modelling; for example distributing national waste arisings using population data for each RDA.

The provision of data at a local authority level was considered for some waste streams. However, the methods used to compile the data presented in the SWMA reports meant that significant errors would

[4] Great Britain plc – the environmental balance sheet. Report produced by Biffa Waste Services, October 1997
[5] Mass balance UK – mapping UK resource and material flows. Report by Forum for the Future, May 2001.

be introduced if arisings in each local authority were estimated from this data. Consequently the data is provided at an RDA level.

2.1 Controlled waste

The four current waste streams which are classified as controlled wastes are municipal solid waste (MSW), commercial waste, industrial waste (including special wastes) and construction and demolition (C&D) wastes. The total arisings of these wastes in 1998/99 were estimated to be 174 million tonnes, and shows the percentage arisings of each of the four waste streams.

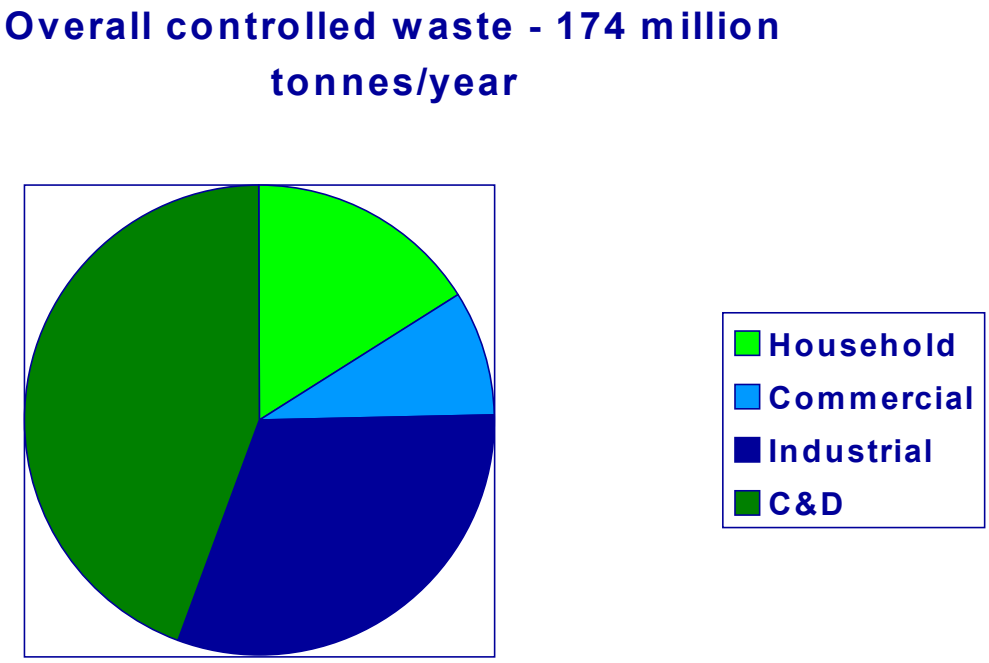

Figure 2: Arisings of controlled waste

This shows that household/municipal waste only represents about 20% of overall controlled waste arisings.

2.1.1 Municipal solid waste

Weight data is published for both arisings and disposal of municipal solid waste in the SWMAs for each RDA in 1998/99. The data available for arisings of municipal solid waste covers a number of streams, including household collected waste, civic amenity waste, non-household sources collected by a local authority, and amount recycled in each local authority.

These figures are updated annually by local authorities in response to a questionnaire from the Department for Environment, Food and Rural Affairs (DEFRA). The latest data (2000/2001 local authority returns) is currently being analysed by DEFRA prior to publication. The reason for the long timescale before the results are published is because DEFRA do not ask local authorities to provide data until September, and the data then needs to be analysed.

DEFRA publish regional data each year, but do not publish data at a local authority level. This is because there is usually only about a 95% response rate (there was almost 100% response for 1998/99 data as this was used to set the baseline for statutory recycling targets). Although DEFRA

have at least some data for each local authority over a five year period, and can produce estimated regional totals for each year, there could well be errors for individual local authorities, particularly on waste management if they have not reported a significant recycling scheme. Consequently, as regional data on municipal solid waste arisings is published each year, the data provided for the model on weight arisings is weight data for each stream in each RDA.

The arisings of MSW in each of the 10 RDAs for 1999/2000, and the methods used to treat these arisings are shown in Table 1 and Table 2 respectively.

	East Anglia	East Midlands	London	North East	North West	South East	South West	Wales	West Midlands	Yorkshire & Humberside	England and Wales
Household waste from:											
Regular household collection	1850	1,470	2,400	870	2,560	2,490	1,650	970	1,700	1,660	17,620
Other household sources	50	60	250	110	80	130	80	100	130	110	1,100
Civic amenity sites	420	360	540	200	750	870	430	250	500	500	4,820
Household recycling	380	220	350	50	260	610	340	90	230	160	2,690
Total household waste	2700	2110	3540	1230	3650	4100	2500	1410	2560	2430	26230
Non household sources (excl. recycling)	120	100	850	220	320	120	50	200	250	330	2,560
Non household recycling	50	40	30	40	90	70	60	10	60	70	520
Total municipal waste	2870	2250	4420	1490	4060	4290	2610	1620	2870	2830	29310

Note – arisings per capita are shown in figure 3

Table 1: MSW Arisings in 1999/2000

Method	East Anglia	East Midlands	London	North East	North West	South East	South West	Wales	West Midlands	Yorkshire & Humberside	England and Wales
Landfill	2,386	1,849	3,185	1,156	3,717	3,495	2,206	1,516	1,686	2,504	23,700
(percentage)	*84%*	*83%*	*72%*	*77%*	*91%*	*82%*	*84%*	*94%*	*58%*	*88%*	81%
Incineration without EfW	0	1	1	0	1	1	3	0	0	2	9
(percentage)	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	0%
Incineration with EfW	42	137	859	249	1	0	0	0	899	106	2,291
(percentage)	*1%*	*6%*	*19%*	*17%*	*0%*	*0%*	*0%*	*0%*	*31%*	*4%*	8%
RDF manufacture	0	0	0	0	0	110	0	0	0	0	110
(percentage)	*0%*	*0%*	*0%*	*0%*	*0%*	*3%*	*0%*	*0%*	*0%*	*0%*	0%
Recycled/composted	426	255	383	89	354	677	404	101	294	235	3,218
(percentage)	*15%*	*11%*	*9%*	*6%*	*9%*	*16%*	*15%*	*6%*	*10%*	*8%*	11%
other	0	0	0	0	0	0	0	0	4	0	4
(percentage)	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	0%
Total	2,854	2,240	4,428	1,495	4,073	4,283	2,613	1,617	2,883	2,847	29,332

Table 2: MSW Treatment in 1999/2000

Table 1 shows that whilst the South East has the highest arisings of household waste, the highest arisings of municipal waste[6] occur in London[7]. This is because of the high amount of commercial waste which is collected by local authorities in London. Table 2 shows that Wales landfills the highest percentage of municipal waste whilst London treats the highest proportion through energy-from-waste (EfW) incinerators. Figure 3 shows that although the arisings of MSW, in terms of weight/person) are relatively constant, there are significant differences in the amount per person which is recycled between the 10 RDAs; the South East recycles the most per person whilst the North East recycles the least.

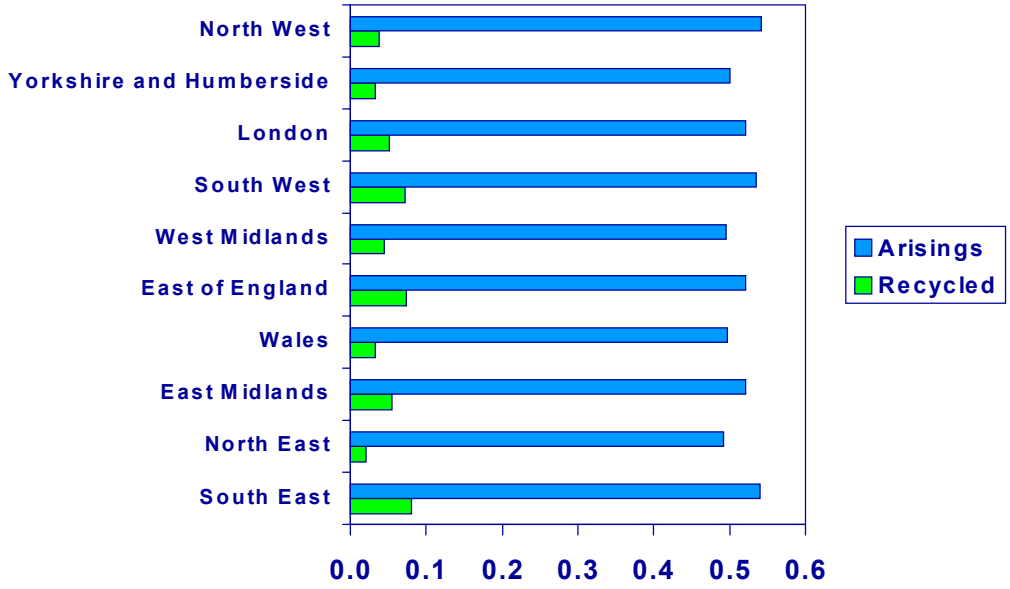

Figure 3: Arisings of MSW and amount recycled (tonnes/person per year)

Provisional data for 2000/2001 indicates that during 2000/01, 25.1 million tonnes of household waste was collected by English local authorities. This represents an increase of over 11 per cent between 1996/97 and 2000/01 and an average annual increase of nearly 3 per cent. Although the amount of municipal waste disposed of in landfill increased from 20.6 million tonnes in 1996/97 to 22.1 million tonnes in 2000/01, the proportion of municipal waste being disposed of in landfill in England and Wales has declined from 84 per cent in 1996/97 to 78 per cent in 2000/01. A total of 6 million tonnes (21 per cent) of municipal waste had some sort of value (recycling, composting, energy from waste) recovered from it in 2000/01, compared with just over 3 million tonnes (or 14 per cent) in 1996/97. Consequently, the proportion of municipal waste being recycled or composted increased from 7 per cent in 1996/97 to 12 per cent in 2000/01. The proportion of waste incinerated with energy recovery also increased from 6 per cent in 1996/97 to 9 per cent in 2000/01.

Data on municipal waste is collected from a number of sources and is supplied to a range of Government bodies. However, the "Dataflow" project (Development of a National Municipal Wastes Database) which aims to develop a national information intranet of waste flows within the municipal waste sector has recently started. The objective of the DataFlow project is to create an online reporting infrastructure leading to more accurate data collected more regularly and efficiently, available for access and/or publication on a timely basis. This project should improve the overall quality of data on municipal waste arisings in future years, and may enable data for each local authority to be provided for the model in due course.

[6] The main difference between household waste and municipal waste is that household waste does not include commercial wastes collected by local authorities.
[7] Data on the amount of MSW produced in London is shown at www.capitalwastefacts.com

Composition of MSW

Samples of collected household (dustbin) waste have been analysed for many years, but the National Household Waste Analysis Programme (NHWAP) was the first programme to provide[8] more detailed information on household waste arisings. A number of studies[9] on civic amenity waste arisings have been conducted, but there is little published data on other municipal waste streams. Consequently, in order to provide more information on the composition of household waste, the Environment Agency initially planned to reactivate the NHWAP during the year 2000, but this work has now been delayed to 2002. However, the National Assembly for Wales has now completed a study[10] on the composition of municipal solid waste in Wales which included analyses of collected household waste, civic amenity waste, litter, street sweepings and bulky household waste. The overall composition of MSW, calculated from the analyses of the individual streams, is shown in Table 3.

	Composition (Wt %)
Newspapers and magazines	8.7
Other recyclable paper	4.1
Card packaging	7.8
Other paper	5.0
Plastic film	3.2
Dense plastic packaging	3.2
Other dense plastic	0.8
Textiles	2.2
Other combustibles	12.1
Glass	6.2
Compostable kitchen waste	8.0
Garden waste	10.3
Soil and other putrescibles	10.7
Ferrous cans	1.7
Other ferrous metal	2.8
Non-ferrous metal	0.9
Waste electrical/electronic equipment	3.0
Potentially hazardous materials	0.5
Fines	3.7
DIY and other non-combustibles	5.1
Total	100.0

Table 3: Initial estimate of the composition of MSW in Wales

Although the data for Wales may not be representative for each of the RDAs in England, it can be updated using data provided by the new Environment Agency NHWAP programme which will cover both England and Wales (and the National Assembly for Wales are also considering the collection of further data for Wales).

Table 3 shows that although MSW contains about 45% by weight of material which could potentially be targeted for dry material recycling, and about 20% of material that could potentially be targeted for

[8] National Household Waste Analysis Project – report on composition and weight data. Report CWM 082/94 by the Department of the Environment, August 1994
[9] For example – The effect of the introduction of wheeled bins on the composition of domestic and civic amenity waste. Warren Spring Laboratory report LR 710, March 1989
[10] Pilot study on municipal waste composition in Wales. Report to be published.

composting (a potential total for recycling/composting of 65%), the actual proportion of MSW which could be recycled or composted will be lower than this. This is because some MSW streams are not targeted for collection of recyclables, and also because current practices indicate that only about 70% of households will participate in most types of kerbside collection schemes. Consequently, this suggests that only about 40% of MSW could be collected for either recycling or composting.

2.1.2 Commercial and Industrial Waste

The data on arisings and composition of both commercial and industrial waste in the SWMAs is based on a survey conducted by the Environment Agency in 1998. The survey was designed to provide information at a RDA level, and aimed to cover every company with over 1,000 employees and a sample of those with less than 1,000 employees. The SIC groupings used in the SWMAs were based on statistical advice[11] regarding the best way to produce estimates that would meet the target level of the survey. These are shown in Table 4.

The SIC codes which were not covered by the survey are construction, agriculture, forestry, fishing, and mining and quarrying. Information on wastes from some of these streams is included in the SWMAs, and all of these waste streams are considered in this report.

Although the SWMA data provides information by groups of SIC codes, there are some grouped areas where a breakdown to individual SIC codes would provide additional information for the model. These are:

- Retail – Others (SIC codes 520-527). These codes cover sales of most types of goods.
- Social work and public administration (SIC codes 750-753, 853).
- Miscellaneous (SIC codes 730-732, 850-852). The SIC codes in this group are R&D establishments and health activities (including hospitals).

In order to provide this breakdown, it was necessary to identify a mechanism for providing the data. The design of the SWMA survey meant that although data which would have enabled more detailed breakdowns to be calculated, e.g. wt/person for SIC codes, any grossing up done on this data would produce estimated arisings which would not be consistent with other SWMA data because of the limited response from smaller companies. However, the use of overall employment[12] in each SIC in a group within the region would provide estimates which would be consistent with other SWMA data. Consequently this method was used to estimate the weight and composition arisings (see Annex 2 Table 1 in each SWMA report) for each grouping of wastes.

[11] The National Waste Production Survey: Estimating Methodology. Report produced for the Environment Agency by Hadley Hunter Ltd, January 2001
[12] Employment data by SIC code from Office of National Statistics

Sector	SWMA category	SICs
Food, drink and tobacco	1.0	150-160
Textiles	2.1	170-177
Wearing apparel	2.2	180-183
Leather, luggage, handbags and footwear	2.3	190-193
Wood and wood products	2.4	200-205
Pulp, paper and paper products	2.5	210-212
Publishing, printing and recording	2.6	220-223
Chemicals and chemical products	3.1	240-244
Cleaning products, man-made fibres etc.	3.2	245-247
Rubber and plastic products	3.3	250-252
Other non-metallic mineral products	3.4	260-268
Basic metals	4.1	270-275
Fabricated metal products	4.2	280-287
Machinery and equipment	5.1	290-297
Office machinery, computers and electrical	5.2	300-316
Radio, television and communication	5.3	320-323
Medical and optical instruments and clocks	5.4	330-335
Motor vehicles	5.5	340-343
Other transport equipment	5.6	350-355
Furniture and other manufacturing	5.7	360-366
Coke, oil, gas, electricity, water	6.0	230-233 400-410
Transport, storage, communications	7.0	502 600-632 634-642
Miscellaneous	8.0	730-732 850-852
Wholesale	9.0	510-517
Retail - motor vehicles, parts and fuel	10.1	500-501 503-505
Retail - others	10.2	520-527
Hotels, catering	11.0	550-555
Finance	12.0	650-672
Education	13.0	800-804
Travel agents, other business and others	14.1	633 740-748 910-930
Real estate and computer	14.2	700-726
Social work and public administration	14.3	750-753 853

Table 4: Groupings of SIC codes used in the SWMA reports

The Retail (others) grouping typically represents about 20-25% by weight of overall commercial waste arisings, and covers the following categories:

SIC code	Activity
521	Retail sale in non-specialised stores
522	Retail sale of food, beverages and tobacco in specialised stores
523	Retail sale of pharmaceutical and medical goods, cosmetic and toilet articles
524	Other retail sale of new goods in specialised stores
525	Retail sale of second-hand goods in stores
526	Retail sale not in stores
527	Repair of personal and household goods

The category composition for this grouping includes food waste. As a very high proportion of the food waste is likely to occur within SIC code 522, all of the food waste in this grouping was allocated to SIC code 522. The remaining categories were then split between the SIC codes using data for employment in each SIC code in the RDA.

The social work and public administration grouping typically represents about 10% by weight of overall commercial arisings, and covers the following categories:

SIC code	Activity
751	Administration of the State and the economic and social policy of the community
752	Provision of services to the community as a whole
753	Compulsory social security activities
853	Social work activities

The categories were split between the SIC codes using data for employment in each SIC code in the RDA.

The Miscellaneous grouping typically represents less than 5% by weight of overall industrial waste arisings, and covers the following categories:

SIC code	Activity
731	Research and experimental development on natural sciences and engineering
732	Research and experimental development on social sciences and humanities
851	Human health activities
852	Veterinary activities

As a very high proportion of the healthcare risk waste is likely to occur in SIC code 851, all of the healthcare risk waste in this grouping was allocated to SIC code 851. The remaining categories were then split between the SIC codes using data for employment in each SIC code in the RDA.

The composition and overall weight arisings for each of these SIC codes are presented in the spreadsheet tables.

The SWMA grouping – coke, oil, gas, electricity, water – covers the following SIC codes:

SIC code	Activity	Percent of total employment in this sector
231	Manufacture of coke oven products	1
232	Manufacture of refined petroleum products	9
233	Processing of nuclear fuel	8
401	Production and distribution of electricity	43
402	Manufacture of gas and distribution of gas through mains	16
403	Steam and hot water supply	1
410	Collection, purification and distribution of water	22

This table shows that the majority of those employed within this grouping work in either the electricity, gas or water sectors, with 43% of total employment in England and Wales in this sector being in

electricity generation. As the overall model will include sources of water and energy use, it would clearly be useful to provide waste arisings data for each of these activities.

The EA commercial and industrial waste survey covered all coal-fired power stations, and produced data for ash production in each region. The overall composition of this stream was 88% mineral waste/residues (5.8 million tonnes – mainly ash from electricity generation), 5% general industrial waste, 3% chemical and other wastes, and 1% C&D waste.

As a very high proportion of the mineral wastes and residues is likely to occur in SIC code 401 (electricity production and distribution), all of the mineral wastes and residues in this grouping was allocated to SIC code 401. The remaining categories were then split between the SIC codes using data for employment in each SIC code in the RDA. The composition and overall weight arisings for each of these SIC codes are presented in the spreadsheet tables.

The possibility of providing data for commercial and industrial waste at a local authority level was assessed. As there is no requirement for waste arisings data to be produced at a local authority level because local authorities are not responsible for management/disposal of this waste stream, the survey conducted by the Environment Agency was not designed to provide data at a local authority level (the survey would also have needed to be considerably larger to provide this level of detail). In addition, although SIC data could be used to allocate waste arisings for any grouping of SIC codes to individual local authorities within a region, this would not take account any differences in the processes used in a grouping of SIC codes in the individual local authorities. As these two factors could significantly reduce the level of confidence for data produced at a local authority level, the data presented for use in the model are provided at a regional level.

The arisings and treatment methods for both commercial and industrial waste are shown in Table 5 to Table 8.

	Inert	Construction demolition & asbestos	Paper & card	Food	General commercial	General industrial	Other general	Metals & scrap equipment	Contaminated general	Healthcare risk	Mineral wastes & residues	Chemical & other	Total
East Anglia	7	10	261	46	1,796	0	194	53	80	7	2	32	2,487
East Midlands	6	7	182	30	1,292	0	145	39	54	5	2	26	1,787
London	17	31	454	61	3,208	0	313	86	114	14	4	48	4,350
North East	3	4	90	15	747	0	74	19	29	3	1	10	996
North West	10	13	317	59	2,246	0	253	63	91	12	2	37	3,104
South East	12	17	421	65	2,928	0	318	98	117	12	4	51	4,043
South West	6	11	221	38	1,714	0	178	47	73	7	2	25	2,322
Wales	3	6	106	18	853	0	80	22	33	4	1	15	1,141
West Midlands	7	10	227	37	1,695	0	187	61	74	7	2	33	2,340
Yorkshire & Humberside	7	15	221	35	1,626	0	169	50	68	6	1	33	2,231
England & Wales	**78**	**125**	**2,502**	**404**	**18,105**	**0**	**1,911**	**537**	**734**	**79**	**19**	**309**	**24,802**

Table 5: Arisings and composition of commercial waste in 1998 ('000 te/year)

	Land disposal	Land recovery	Re-used	Recycled	Thermal	Transfer	Treatment	Unrecorded	Total
East Anglia	1,579	21	43	517	18	18	66	226	2,487
East Midlands	883	12	46	367	97	34	23	326	1,787
London	2,440	5	34	1,334	58	45	111	324	4,350
North East	452	14	8	180	82	21	14	225	996
North West	1,754	36	86	637	39	58	62	430	3,104
South East	2,263	64	55	898	27	28	52	656	4,043
South West	1,210	17	44	463	20	30	71	467	2,322
Wales	781	2	19	182	3	50	31	71	1,138
West Midlands	1,058	3	54	481	218	81	79	366	2,340
Yorkshire & Humberside	1,065	18	27	449	71	176	82	344	2,231
England & Wales	**13,484**	**190**	**416**	**5,508**	**633**	**540**	**591**	**3,436**	**24,798**

Table 6: Treatment of commercial waste in 1998 ('000 te/year)

Industrial	Inert	Construction demolition & asbestos	Paper & card	Food	General commercial	General industrial	Other general	Metals & scrap equipment	Contaminated general	Healthcare risk	Mineral wastes & residues	Chemical & other	Total
East Anglia	97	58	280	239	80	992	641	295	259	60	203	448	3,652
East Midlands	195	70	280	254	6	1,079	652	426	411	42	2,198	306	5,919
London	66	38	378	174	14	989	360	140	154	59	27	341	2,740
North East	56	34	117	108	6	467	413	364	163	31	1,630	372	3,761
North West	223	128	357	364	8	1,433	1,294	491	580	101	488	1,008	6,475
South East	98	82	373	232	11	1,349	856	313	297	172	713	461	4,958
South West	95	42	256	204	5	867	617	244	207	55	42	281	2,914
Wales	76	53	150	105	5	567	370	393	198	32	2,654	386	4,989
West Midlands	281	105	237	215	15	1,211	619	791	596	49	535	564	5,219
Yorkshire & Humberside	212	167	316	291	5	1,139	1,050	797	412	62	4,294	720	9,465
England & Wales	**1,399**	**777**	**2,744**	**2,185**	**155**	**10,093**	**6,873**	**4,254**	**3,278**	**663**	**12,785**	**4,886**	**50,090**

Table 7: Arisings and composition of industrial waste in 1998 ('000 te/year)

Industrial	Land disposal	Land recovery	Re-used	Recycled	Thermal	Transfer	Treatment	Unrecorded	Total
East Anglia	1,664	131	164	1,117	70	68	421	16	3,652
East Midlands	2,905	70	281	2,245	123	97	174	23	5,919
London	1,107	48	56	1,030	116	25	337	21	2,740
North East	1,717	51	43	1,671	73	25	176	5	3,761
North West	2,894	364	685	1,801	50	95	555	31	6,475
South East	2,297	315	196	1,613	52	51	350	85	4,958
South West	1,177	82	204	966	99	73	278	35	2,914
Wales	1,650	17	1,478	1,574	34	8	210	20	4,989
West Midlands	2,147	20	350	1,802	191	134	549	26	5,219
Yorkshire & Humberside	3,542	181	1,677	3,142	95	218	596	15	9,465
England & Wales	**21,099**	**1,278**	**5,135**	**16,961**	**902**	**793**	**3,645**	**277**	**50,091**

Table 8: Treatment of industrial waste in 1998 ('000 te/year)

These tables show that:

- For industrial waste, Wales landfills the smallest percentage (due to 30% of arisings being re-used, whilst the North East recycles the highest proportion
- For commercial waste, Wales landfills the highest percentage and London recycles the highest proportion
- 22% of commercial waste and 34% of industrial waste was recycled in 1998/99.

Figure 4 compares the arisings of commercial and industrial waste in each of the RDAs and shows that London has the highest proportion of commercial waste.

Figure 4: Proportion of commercial and industrial waste in each RDA

The Environment Agency are currently planning to conduct the next survey of commercial and industrial waste arisings in the period January to June 2003, and expect that a report will probably be published by June 2004.

2.1.3 Special wastes

Special waste is defined as any waste which is hazardous/toxic as classified by the UK Special Waste Regulations. These wastes include solvents. The SWMA reports provide information on arisings by waste type in each region. These are based on the EA's Special Waste Tracking Database.

The information in the EA's Special Waste Tracking Database could be used to produce arisings at either a regional, sub-regional (for example the SWMA for Wales provides data for 7 sub-regions in Wales), or local authority level. However, as data for other waste streams is provided at a regional level, and as special waste arisings represent only a very small proportion of the overall waste arisings considered in this report, the data for the model is provided at a regional level.

The arisings of special wastes in each of the 10 RDAs is shown in Table 9.

	Weight arising (tonnes)
East Anglia	970,000
East Midlands	410,000
London	49,000
North East	249,000
North West	820,000
South East	480,000
South West	305,000
Wales	420,000
West Midlands	610,000
Yorkshire & Humberside	605,000
Total for England and Wales	**4,910,000**

Table 9: Arisings of special waste in 1998/99

The highest arisings occur in East Anglia, and this is due to a high arising for the category C&D waste and asbestos. The North West has the second highest arising.

The Environment Agency are expected to publish information for the year 2000 during 2002.

2.1.4 Construction and demolition waste

A number of studies[13] on the arisings and recycling/disposal of construction and demolition (C&D) waste have been conducted. The most recent survey was conducted during the year 2000, and its aim was to provide regional and national estimates of construction and demolition waste produced, recycled, re-used and disposed of in England and Wales. This survey determined that the total arisings of construction and demolition waste in England and Wales in 1999 was 72.5 million tonnes, and that 35% of arisings were recycled, 41% was re-used, and 24% was landfilled as waste.

The regional estimates produced from the survey have a lower level of confidence than the national figures, but results have been published in the SWMA reports, and these are summarised in Table 10. These show that the South East, with arisings of 13.1 million tonnes had the highest regional arisings, and this was due to both the high level of economic activity in the region and the movements of waste out of London. 35% of the total arisings in England and Wales were recycled, and a further 13% was re-used in landfills. However, the number of survey returns does not support breaking the data down to a county or local authority level.

[13] For example – Managing demolition and construction wastes. Report by Howard Humphreys & Partners for the Department of the Environment, 1994

	Recycled aggregates and soil	C&D waste and soil re-used on landfills	Inert materials recovered on exempt sites	C&D waste and soil landfilled	Total estimated production
East of England	2,109	897	2,783	1,374	7,163
East Midlands	2,084	1,085	1,442	1,524	6,135
London	3,313	629	1,016	1,637	6,595
North East	2,305	505	751	1,193	4,754
North West	3,240	1,178	3,758	2,049	10,225
South East (excluding London)	4,390	2,094	3,352	3,287	13,123
South West	2,477	797	2,052	1,481	6,807
Wales	747	421	1,299	818	3,285
West Midlands	2,134	929	1,808	1,437	6,308
Yorkshire & Humberside	2,336	997	2,052	2,703	8,088
Total for England and Wales	**25,135**	**9,532**	**20,313**	**17,503**	**72,483**

Table 10: Arisings and treatment of C&D waste ('000 tonnes)

A further survey has just started to determine arisings in 2001, but the results from this will not be available until 2003. It is expected that this will allow data for each RDA to be determined. The current plan is to conduct further surveys at two year intervals. As the results from the survey being conducted during 2002 (arisings in 2001) will not be available until 2003 the RDA data for 1999 published in the SWMA reports is provided for the model.

2.1.5 Overall recycling rate for controlled waste

Table 11 summarises the recycling rates achieved for each of the controlled waste streams. Although only about 10% of municipal waste is recycled, over 30% of both industrial waste and C&D waste are currently being recycled. Consequently, the overall recycling rate for controlled waste is 29%.

	Wt recycled ('000 te)	Total arising ('000 te)	% recycled
Municipal	2690	26250	10
Commercial	5508	24798	22
Industrial	16961	50091	34
C&D	25135	72483	35
Total	**50294**	**173622**	**29**

Table 11: Recycling rate for controlled wastes

The recycling rate for C&D waste shown in Table 11 is for recycled aggregates and soil. However, Table 10 shows that some C&D waste can be beneficially reused at landfills If this is included in the calculation of recycling rate, then the amount of C&D waste recycled increases to 48%, and the total amount of controlled waste which is recycled increases to 34% of overall controlled waste arisings.

2.2 Agricultural waste

There are approximately 240,000 farms or agricultural holdings in the UK (with some 180,000 in England and Wales) employing about 460,000 people. During the 1980's agricultural waste arisings were estimated to be about 240 million tonnes per year but this was reduced to about 80 million tonnes per year when wastes deposited by animals on fields was excluded.

The EC Waste Framework Directive, implemented through the Environmental Protection Act 1990, requires the disposal, recovery, treatment, transport and collection of a number of waste streams (defined as controlled waste streams in the UK) to be regulated. Agricultural waste has not previously been subject to these controls, but the Government intends to amend UK legislation to bring agricultural waste within the definition of controlled waste. This means that there is a requirement to obtain better data on this waste stream.

The Agricultural and Horticultural Census[14] provides regularly updated information on the agricultural industry (surveys are conducted at approximately yearly intervals), but the census does not provide any information on waste arisings. Consequently a model[15] which could be used to provide data on waste arisings from this information was developed for the Environment Agency. This model was used with results from the 1998 Agricultural and Horticultural Census to produce the agricultural waste data published in the SWMA reports. This data is summarised in Table 12 and shows that compostable and digestible wastes comprise over 95% of the 63 million tonnes of agricultural waste arisings in England and Wales. It also shows that the South West has the highest arisings (23% of total arisings), that Wales has the second highest arisings, and that London produces significantly less agricultural waste than any of the other RDAs.

	Compostable & digestible	**Combustible**	**Difficult and chemical**	**Other**	**Total**
East Anglia	4,891,508	511,250	34,534	3,614	5,440,906
East Midlands	4,924,410	367,791	46,954	3,559	5,342,714
London	54,385	2,468	563	213	57,629
North East	1,995,971	88,696	25,579	1,019	2,111,265
North West	7,816,201	57,210	99,999	5,554	7,978,964
South East (excluding London)	4,619,828	277,209	55,930	3,759	4,956,726
South West	14,059,450	251,756	173,672	8,580	14,493,458
Wales	8,263,988	45,400	134,489	4,316	8,448,193
West Midlands	6,518,066	187,600	69,778	4,290	6,779,734
Yorkshire & Humberside	7,000,456	273,393	51,045	3,715	7,328,609
Total for England and Wales	**60,144,263**	**2,062,773**	**692,543**	**38,619**	**62,938,198**

Table 12: Arisings of agricultural waste

A programme aimed at updating the current model for producing waste estimates from the information provided by the Agricultural and Horticultural Census has recently started. The main aim of this work is test the assumptions made when the model was initially developed. Further reviews of the model could be used to update factors as farming practices change.

[14] For example – Agricultural and horticultural census: 1 June 2001. Published by the Department for Environment, Food and Rural Affairs and National Statistics, 18 January 2002

[15] Information on the model can be found in "Towards Sustainable Agricultural Waste Management". Report produced by Marcus Hodge Environment for Environment Agency R&D report P1-399, February 2002

As the Agricultural and Horticultural Census is regularly conducted (the last survey was in June 2001), it is possible to regularly update the information published in the SWMA reports using the model developed for the EA. However, the Environment Agency are planning to update data on arisings of agricultural waste, and although updates could be provided at a regional level, there are currently no plans to produce any data at a local authority level. This is because the model may not be valid, or would have too low a level of confidence, at a local authority level. Consequently the data provided for the model is the overall arisings of agricultural waste at a RDA level for 1998 published in the SWMAs.

2.3 Mineral/mining wastes

The total arisings of mineral/mining wastes in the UK are updated yearly by DEFRA and are published in the Digest of Environmental Statistics. The waste arising are produced using published data[16] from the British Geological Survey on the amounts of mineral products produced, and estimated ratios of the waste produced for each tonne of material mined. DEFRA have recently updated the estimated ratios for the amounts of waste produced.

The British Geological Survey (BGS) produce a directory showing the locations of mines and quarries which could possibly be used to model regional production of each mineral and hence its waste output. However, the data published in the BGS Minerals Yearbook provides information on production of each mineral in each RDA. As the statistics in the Minerals Yearbook are updated annually, approximately 15 months after the end of the latest year, this information enables the regional waste arisings to be calculated, and for these figures to be updated at yearly intervals.

Although regional production data is available for most minerals, there is no regional data for slate. This is probably because of commercial confidentiality issues as there are a limited number of slate producers in the UK. The overall arisings of slate waste are estimated to be about 8.6 million tonnes per year, and a report[17] suggests that one area of Wales produces about 6 million tonnes per year of slate waste. Consequently, the predicted RDA arisings for slate waste assume that 80% of slate waste is produced in Wales, with 5% each in Yorkshire and Humberside, North West England, South West England and Scotland.

The data provided for the model is arisings of mineral/mining waste in each RDA for the 6 types of mineral/mining waste for which overall arisings are published in the Digest of Environmental Statistics. This is summarised in Table 13, and shows that Yorkshire and Humberside has the highest arisings, followed by the East Midlands. This is due to wastes from deep mined coal. The South West has the third highest arisings, and this is due to wastes from china clay production.

[16] United Kingdom Minerals Yearbook published yearly by the British Geological Survey
[17] North Wales Slate Tips – A Sustainable Source of Secondary Aggregates. Report published by the National Assembly for Wales, 2001

	East Anglia	East Midlands	London	North East	North West	South East	South West	Wales	West Midlands	Yorkshire & Humberside	Total for England and Wales
Colliery	0	22,391	0	4,967	0	0	0	3,226	6,143	62,393	104,440
Coal	0	5,623	0	13,201	1,314	0	0	8,294	3,264	9,797	80,400
China Clay	0	0	0	0	0	0	20,736	0	0	0	20,736
Clay	423	1,265	0	149	362	1,122	5,135	178	1,145	558	10,676
Slate	0	0	0	0	433	0	433	6,931	0	433	8,664
Quarrying	1,029	6,285	0	1,995	1,697	4,903	3,985	3,401	2,095	2,659	32,628
Total waste	**1,452**	**35,564**	**0**	**20,312**	**3,807**	**6,025**	**30,289**	**22,030**	**12,647**	**75,840**	**257,544**

Table 13: Mining and mineral waste

It should be noted that waste arisings may be different in different RDAs because of differences in minerals (particularly clays). However, a geologist would be able to comment on whether regional factors are the same as national average factors.

The European Commission is developing[18] a thematic strategy on soil protection. As part of this, it is intended that a directive on mining waste will be proposed during 2002, and that a document will be produced on the best available techniques for the management of mining waste by 2004. It is likely that these will affect the current management of mineral/mining wastes.

2.4 Other waste streams

2.4.1 Sewage sludge

Sewage treatment in the UK has to comply with the provisions of both the Urban Wastewater Treatment Directive and the Bathing Water Directive. The Wastewater Treatment Directive specifies the minimum standards of treatment for wastewater from urban areas discharged into estuarial and inland waters, and into coastal waters. It also deals with the disposal of sewage sludge, and introduced a total prohibition on the disposal of sludge at sea from the beginning of 1999. The disposal of sewage sludge to other waste management options is also strictly controlled.

The annual dry weight arisings of sewage sludge in England and Wales are published in the Digest of Environmental Statistics. The Water companies publish[19] data on the outlets for sewage sludge, and the outlets for sewage sludge in 1998/99 in each water company region in England and Wales (in 000 tonnes of dry solids) were as follows:

Water Company	Farmland	Landfill	Sea	Incinerator	Other	Total
Anglian	76	2	5	-	14	97
Dwr Cymru	30	-	-	-	1	31
Northumbrian	4	7	14	-	4	29
North West	46	36	31	14	7	134
Severn Trent	86	28	-	23	38	175
Southern	63	4	5	4	2	78
South West	18	-	2	-	5	25
Thames	110	-	36	80	16	242
Wessex	24	2	-	-	5	31
Yorkshire	17	5	-	63	9	94
Total	**474**	**84**	**93**	**184**	**101**	**936**
Total (wt %)	**51**	**9**	**10**	**20**	**11**	**100**

Notes
1. Sewage sludge can no longer be disposed of to sea
2. Total arising in Scotland (dry weight) was 97,000 tonnes in 1998/99
3. Total arising in Northern Ireland (dry weight) was 25,000 tonnes in 1998/99
4. Total UK arising was 1,058,000 dry tonnes in 1998/99.

As the water company boundaries do not match the RDA boundaries, the data needs to be converted to RDA areas so that it can be used by the model. This was done by mapping the arisings in each water company to 1 km squares based on population density in each 1 km square (i.e sewage sludge

[18] COM(2002) 179 final – Towards a Thematic Strategy for Soil Protection. European Commission, 16.4.2002
[19] Waterfacts 2000. Publication by Water UK

generation is linked to population density). The arisings in an RDA were then determined by summing the arisings in each 1 km square in that RDA. The results are shown in Table 14, and this is also the data which is provided for use with the model.

	Sewage sludge arisings (dry weight, tonnes)
East Anglia	89,000
East Midlands	78,000
London	146,000
North East	29,000
North West	134,000
South East	150,000
South West	73,000
Wales	30,000
West Midlands	107,000
Yorkshire & Humberside	98,000
Total for England and Wales	936,000

Table 14: Sewage sludge arisings in 1998/99 (dry tonnes)

This table shows that the highest arisings of sewage sludge occur in London and the South East. The data can be updated when updated information on the arisings/disposal of sewage sludge in each water company in the UK is published by the water companies.

The implementation of the Urban Wastewater Treatment Directive has increased the arisings of sewage sludge, and the proportion going to land increased in most EU countries during the 1990s. Over 50% of sewage sludge in England and Wales is currently spread onto farmland. However, potential long-term risks to both the environment and human health from land-spreading of sewage sludge have been identified. Consequently, during 2003 the Commission will undertake a revision of the Sewage Sludge Directive, and this may well result in a reduction in the maximum permitted levels of contaminants in sludge, and possibly its extension to all land where sludge is applied. Similar concerns have also resulted in the Swiss government announcing plans which will ban the use of sewage sludge on farmland from October 2005. The sewage sludge will be disposed of using specialised sludge incinerators, cement plants and municipal waste incinerators.

2.4.2 Forestry wastes

Although the Forestry Commission publishes data

The Food and Agricultural Organisation (FAO) has estimated[23] that between 20 million and 40 million tonnes of whole fish are discarded world-wide each year. Although developments in fishing gear technology are having some effect on addressing this issue, any further reduction in the amount discarded would have to be addressed by a change in policy.

A significant proportion of fish receive some processing before being landed. The resultant waste consists of guts, liver and other viscera, and some fish may also be headed. However, the great majority of fish processing operations are conducted in shore-based processing facilities. The UK has a substantial fish processing industry of around 541 businesses which employs some 22 thousand people. Although the processing operations maximise the yield of edible products from fish, and a small proportion of the waste is used to make fishmeal, the majority of the waste is landfilled, even though a significant proportion of it could be recycled.

This report provides data on fish waste arisings which is based on information on the numbers of different types of fish caught/landed in the UK in 1999. This shows that just over 40% by weight of the fish which are caught ends up being consumed by humans.

	Wt, tonnes	**Wt %**
Discards at sea	145,000	17
Gutting waste at sea	46,000	5
On-shore processing waste	301,000	35
Human consumption	360,000	43
Total	**852,000**	**100**

The resulting regional distribution of all on-shore fish processing waste production is as follows:

	Wt, tonnes	**Wt %**
Highlands & Islands	12,000	4
Grampian	87,000	29
Other Scotland	12,000	4
Northern England	18,000	6
Humberside	133,000	44
South, Midlands & Wales	15,000	5
South West England	15,000	5
Northern Ireland	9,000	3
Total	**301,000**	**100**

This shows that most of the waste from fish processing activities occurs in either Scotland or Yorkshire and Humberside.

The areas where waste produced from gutting operations at sea could be landed in the UK if a suitable recycling operation was available are shown in the following table.

	Wt, tonnes	**Wt %**
Northern Ireland	4,000	9
Scotland	34,000	74
North East England	2,000	4
North West England	1,000	2
Humber	3,000	7
South coast	2,000	4
Total	**46,000**	**100**

The data provided for the model is for 1999 and uses the information in these two tables; where data covers more than one RDA then the weights have been evenly split between the relevant RDAs.

[23] Further information at www.fao.org

Although updated information on the amounts of fish caught and landed in the UK is provided annually, this data could not easily be used to update the information on the amount of fish waste produced. However, the Seafish Industry Authority currently plan to update information on fish wastes about every three years.

Aquaculture (fish farms)
There are over 1,000 fish and shellfish farming businesses in the UK operating on 1,400 sites and employing more than 3,000 people. The main fin fish species farmed are salmon[24] (127,000 tonnes, mainly in Scotland) and rainbow trout[25] (16,000 tonnes). There is also limited production of other species, such as carp and brown trout, and pilot trials on farming non-salmon species, such as turbot, halibut and cod, have produced encouraging results. Molluscan shellfish production was round 12,000 tonnes in 1998. Mussels are the main species produced, with oysters and clams also farmed. Trials on scallop farming have proved to be successful. Considerable funds have been spent by the Government on aquaculture research, particularly on work to control disease. In addition, joint Government/industry research has been undertaken through the Aquaculture Link programme to promote the sustainable development of the industry, including the evaluation of alternative species for cultivation.

Trout is farmed widely in the UK. The main concentrations of production are in Scotland, North Yorkshire and the South of England, with smaller but significant industries also found in Northern Ireland, Wales, and Lincolnshire. The following map shows the locations of British Trout Association members.

Location of British Trout Association members

All farms need an abstraction license for water extraction, and discharge consents (provided by the Environment Agency). The discharge waters contain, on average, about 4 ppm solids, but this is similar to the level of solids in the water going into the farm. Dissolved gases (ammonia is a by-product from feeding the fish) can be removed by biofilters.

Although 20 years ago a significant proportion of farms had suitable processing capacity, very few farms currently have these facilities. There are a small number of processors. Of the 16,000 tonnes of trout which are produced each year, about 12,500 tonnes are used for food; the remainder are used for re-stocking. The processing removes about 5,500 tonnes of waste each year (mainly blood, bones, heads and tails). The proposed Animal Waste Directive will affect most current disposal routes for the fish waste; it can not be used in pig swill and will not be able to be put into material that could

[24] Scottish Quality Salmon – www.scottishsalmon.co.uk
[25] British Trout Association – www.britishtrout.co.uk

be used to feed fish. The fish waste can be used in pet food, but the cost for this is about £50 per tonne. Options for using the fish waste in fertiliser (currently not done in the UK) are being assessed.

The Scottish salmon farming industry produced 127,000 tonnes of fish in 1999. Consumer demand for salmon in the UK alone has nearly trebled between 1992 and 1999 with consumption rising by around 185% - from 31,000 to 88,500 tonnes. Discharge consents for water from the farms are issued by SEPA, and wastes from processing amount to nearly 50% of fish production, i.e. about 60,000 tonnes per year.

About 30% of the farmed weight of shell fish will be consumed by humans. Consequently, the weight of waste from this activity is about 9,000 tonnes per year

As there is no data on the amounts of waste produced by individual farms, some assumptions have to be made in order to estimate waste arisings from aquaculture activities in each RDA. As the majority of salmon are produced in Scotland, it is assumed that all wastes from salmon farming (60,000 tonnes per year) occur in Scotland. Trout farms are located all over the UK, including Scotland and Northern Ireland, and thus it is assumed that 4,000 tonnes of the total of 5,500 tonnes are distributed between the RDAs, with a lower proportion in both London and Yorkshire & Humberside. The 9,000 tonnes of waste from shell fish farming has been equally split between the ten RDAs, Scotland and Northern Ireland.

The data provided for the model is presented in Table 16 and shows that a total of 200,000 tonnes of fish waste arises in England and Wales, with 70% of this arising occurring in Yorkshire and Humberside. The fish wastes arising in England and Wales represent just under half of the total fish waste arisings in the UK.

	Wastes from on-shore fish processing	**Wastes from off-shore gutting**	**Wastes from Salmon farms**	**Wastes from trout farms**	**Wastes from shell farms**	**Total**
East Anglia	0	0	0	200	750	950
East Midlands	4000	0	0	500	750	5250
London	0	0	0	100	750	850
North East	9000	2000	0	500	750	12250
North West	9000	1000	0	500	750	11250
South East (excluding London)	3000	0	0	500	750	4250
South West	15000	2000	0	500	750	18250
Wales	4000	0	0	500	750	5250
West Midlands	4000	0	0	500	750	5250
Yorkshire & Humberside	133000	3000	0	200	750	136950
Total - England and Wales	**181,000**	**8,000**	**0**	**4,000**	**7,500**	**200,500**

Table 16: Arisings of fishing wastes (tonnes)

2.4.4 Other priority waste streams

There are a number of other priority waste streams; for example lead/acid batteries and tyres. The SWMA reports provide information on arisings of these streams in each region; for example, arisings for tyres are predicted for each region using the number of licensed vehicles in each region.

The data supplied for use with the model is the RDA data provided in the SWMA reports for lead-acid batteries, solvents, waste lubricating oil, tyres and waste electrical and electronic equipment (WEEE)

for 1998. However, the data[26] for WEEE relate to the UK, and so regional data for WEEE arisings in each RDA has been estimated after taking account of the population of both Scotland and Northern Ireland. The SWMA reports also provide total arisings for End-of-life vehicles (ELVs), but information[27] on the number of ELVs arising in the year 2000 is now available. The regional data for ELVs has been estimated using the proportion of licensed vehicles in each RDA.

	Solvents	**Lead-acid batteries**	**Waste lubricating oil**	**Tyres**	**End of life vehicles**	**Waste electrical/electronic equipment**
East Anglia	18,000	12,000	29,000	56,000	253,000	84,000
East Midlands	40,000	10,000	22,000	37,000	169,000	65,000
London	9,000	13,000	15,000	52,000	232,000	111,000
North East	41,000	4,000	22,000	19,000	84,000	40,000
North West	86,000	15,000	40,000	56,000	253,000	102,000
South East	34,000	12,000	49,000	80,000	358,000	125,000
South West	24,000	12,000	40,000	52,000	232,000	77,000
Wales	10,000	9,000	30,000	22,000	105,000	45,000
West Midlands	21,000	28,000	24,000	52,000	232,000	82,000
Yorkshire & Humberside	61,000	20,000	24,000	52,000	232,000	82,000
Total for England and Wales	**343,000**	**136,000**	**307,000**	**468,000**	**2,108,000**	**811,000**

Table 17: Arisings of priority waste streams (tonnes)

This data can be updated when new figures for total arisings of any of these streams are produced.

2.4.5 Dredging waste

Dredging operations are conducted to either maintain ship/boat routes or to improve drainage.

Dredging is essential to the safe operation of ports[28], and the disposal of dredged material constitutes one of the most important issues in coastal zone management. However, the dumping of wastes at sea is prohibited, except under licence. Under the OSPAR convention only dredged material, fish processing waste, materials of natural origin and vessel or aircraft waste may be disposed of through the licensing agreement in the UK. Dredged material now comprises the vast majority of all material deposited at sea.

The licensing procedure for the UK is controlled by the Food and Environment Protection Act, and the licensing authority must have regard to the practical availability of any alternative methods of dealing with the disposed materials. In recent years, this consideration of alternatives has shifted the emphasis from disposal per se to whether relocation can be managed in such a way as to derive environmental or other benefits. As a result, a number of beneficial use options have developed whereby the material is regarded as a potential resource and used to recharge or recreate intertidal habitats.

In the UK, approximately 40 million tonnes of dredged material are annually disposed of to the marine environment at estuarine and offshore sites licensed by DEFRA. The annual arisings for the UK for dredged material which is dumped at sea are published in the Digest of Environmental Statistics. No information on the amounts dumped off the coast of any RDA is available, but it may be possible to

[26] UK status report on waste from electrical and electronic equipment. Report by the Industry Council for Electronic Equipment Recycling (ICER), 2000
[27] Automotive Consortium on Recycling and Disposal (ACORD) – 2001 report.
[28] British Ports Authority – www.britishports.org.uk

use information from disposal licenses to estimate the arisings in each RDA if this information is required.

The dredging of inland channels for either navigation or drainage is usually conducted by members of the Association of Drainage Authorities[29]. There is a total of about 16,000 kms of channel, and some of this is dredged each year; the overall level of dredging will vary from year to year depending on the weather. However, there is very little data on the amounts of material removed by these operations. This is because if dredging is conducted in agricultural areas, the material is then usually spread back on the land (it is only taken to a waste disposal site if there is concern about the quality of the material). Although material dredged in urban areas is usually disposed of to a landfill site, there is no readily available information on these quantities, or what proportion of the overall material dredged from inland channels it represents. Consequently, no data for dredging of inland channels has been provided for the model.

3 Data assessment

As the waste data presented in this report has been produced before the development of the model has started, it has not been possible to determine what the model will do with waste data, and thus what level of detail is actually required. However, Table 18 summarises the waste data which has been provided for the model.

Waste Stream	Additional Information	Years	Updating Frequency[30]
Municipal waste	Arisings of the main municipal waste streams. Composition data for use by the model.	1999/2000	Yearly
Commercial and industrial waste	Groups of SIC codes	1998	As new surveys are conducted
Special wastes	Sub-categories used in SWMA reports	1998/99	Yearly
Construction and demolition waste	Sub-categories used in SWMA reports	1999	As new surveys are conducted
Agricultural waste	Sub-categories used in SWMA reports	1998	Yearly
Mineral/mining waste	Sub-categories in Digest of Environmental Statistics	1999	Yearly
Sewage sludge	Disposal route	1998/99	Yearly
Forestry waste	-	1999	Yearly
Fish waste	Information on both sea fishing and aquaculture	1999	As new estimates are determined
Other priority waste streams	Will depend on waste stream	1998/99	Will depend on waste stream
Dredging waste	No data provided	-	-

Table 18: Summary of waste data provided for the model

In addition to providing the data for the model, it is also necessary to assess the frequency with which the data for each of the waste streams will be updated, and the overall quality of the data. Table 18 shows that yearly updates are provided for a number of waste streams, and that data for most of the other streams is likely to be provided on a regular basis. For example, it is intended that surveys on the arisings of construction and demolition waste will be conducted at approximately two yearly intervals. Fishing wastes, and the other priority waste streams for which data is provided, represent a small proportion of overall waste arisings, and thus less frequent updating of the arisings for these

[29] Association of Drainage Authorities – www.ada.org.uk
[30] Yearly updating assumes that yearly surveys for these waste streams continue.

streams will only have a small effect on the accuracy of any estimates of the total amount of waste produced in a RDA.

3.1 1999 Baseline

The developers of the model are currently planning to use a baseline of 1999. Table 18 shows that all of the data which is provided is for either 1998, 1999 or 2000. It also shows that for some waste streams, such as agricultural waste, where data is provided for 1998 that as yearly updates on these data are planned, 1999 baseline data can be obtained in due course.

An alternative approach is to use "economic activity data" to rescale data from earlier years to an arising in 1999. Although this area will be considered by the modellers, they have, so far, not been able to produce a suitable methodology (based on sectorial breakdowns) and thus provided the relevant economic activity data. This means that it has not been possible to rescale all data to the 1999 baseline.

3.2 Data quality

The overall quality of the data can be assessed through the use of the following classification system:

Classification	Descriptor	Explanation
A	Very Good	Data this is either an aggregation of highly resolved data (spatially or by source sector), or a total directly corresponding to the area in question. The dataset is expected to be present with a high percentage of completeness and will probably have been derived from a single source, or multiple sources presenting data in the same format.
B	Good	Typically an aggregation of data from a number of different reliable sources which express the data in differing formats. Therefore a degree of processing is required, or minor assumptions are required to derive a regional total. UK totals disaggregated by a reliable surrogate would fall in this category.
C	Fair	As with the "C" classification except that more significant processing or assumptions are made. This may be required to combine data from different sources or to allow data from a single source which is considered to be low in reliability or incomplete. UK totals disaggregated by an indirectly related surrogate would fall in this category.
D	Poor	Datasets where either the data capture is low, the uncertainties associated with the totals are high or the totals are considered to be questionable. Data with poorly defined spatial boundaries are also included in this category.

Table 19 shows the overall data quality, based on this classification, for each of the waste streams for which data is provided. This table shows that the data quality for the controlled waste streams, and for both agricultural waste and mineral/mining waste is classified as either A or B. As these streams represent over 95% of the overall waste arisings for which data is provided, the overall quality of the data can be classified as good. Data quality will also be higher when a significant proportion of the arisings of a particular stream are weighed, and the introduction of the landfill tax means that arisings of the controlled waste streams which are disposed of to landfill are now weighed.

Waste Stream	Data quality	Comments
Municipal waste	A	Data for a high proportion of local authorities in each RDA is available; data for local authorities which have not provided data in that year can be estimated from data for earlier years.
Commercial and industrial waste	B	The survey was designed to provide information at the RDA level, but the data is aggregated from a wide range of sources
Special wastes	A	Data for all arisings/movements of special waste in each RDA is available
Construction and demolition waste	B	Data is obtained from a wide range of sources, and regional estimates have a lower level of confidence than national estimates
Agricultural waste	B	Questionnaire survey and model factors (model factors being improved)
Mineral/mining waste	B	Good data on mineral amounts, but factors used to estimate wastes. These factors have recently been revised
Sewage sludge	C	Aggregation of data from each water company. Data then redistributed to the 10 RDAs
Forestry waste	D	No data, based on estimate of total waste arisings which is then distributed to the 10 RDAs
Fish waste	C	A number of estimates are required to produce a figure for overall arisings
Other priority waste streams	C	Overall arisings are estimated, and this is distributed between the RDAs
Dredging waste	n/a	No data provided for the model

Table 19: Overall quality of the data for each waste stream

Household waste
As information on both arisings and treatment/disposal options, including recycling, is collected for household waste, then data on the overall arisings and treatment of household waste would be expected to be high. As this information is updated yearly, this should enable high quality updated data on household waste to be provided for the model.

Commercial and industrial waste
The arisings of commercial and industrial waste were estimated as 15 million tonnes (rounded to the nearest 5 million) and nearly 70 million tonnes, including power station ash (rounded to nearest 10 million tonnes) respectively. However, the survey of these streams which was conducted in 1998 has provided much better data, and has also enable arisings in each RDA to be estimated. As further surveys are likely to be conducted, this should enable good quality updated data on these waste streams to be provided for the model.

Special wastes
The Environment agency's Special Waste Tracking Database will enable yearly updates of high quality data on the arisings and treatment/disposal of special wastes to be provided for the model.

Construction and demolition waste
A number of surveys on the arisings and treatment/disposal of C&D waste have been conducted since 1990. As it is currently intended that a series of surveys at two year intervals will be conducted, this should enable good quality data on the arisings and treatment of C&D waste to continue to be provided. These surveys will enable updated data for each RDA to continue to be provided, but the quality of this data will be slightly lower than the overall data for England and Wales.

Agricultural waste
As agricultural waste will become a controlled waste, there is a need to provide better data on both arisings and treatment/disposal of this waste stream. The Environment agency is developing methods for improving the accuracy of estimates of weight arisings which are determined from regular surveys

of agricultural activity. This means that it may be possible to improve the overall quality of the data on this stream over the next 5 years.

Mining and mineral wastes
High quality information on the production of minerals is published at yearly intervals, and apart from slate production (due to the small number of producers), this data is available at a RDA level. The factors which are used to determine waste production have recently been updated, but these may be slightly different in different RDAs. Consequently, although regularly updated high quality data on mining and mineral wastes can be provided for the model, there is a need to both assess if the waste factors are the same in each RDA, and to develop a method for improving the accuracy of slate waste arisings in each RDA.

Sewage sludge
The data provided for sewage sludge has been determined by redistributing information provided by each water company to the 10 RDAs. The need to re-map the data has resulted in the data quality for this stream only being classified as fair. A method for remapping the data which takes better account of higher arisings in major conurbation's may improve the overall quality of the data provided on sewage sludge, but this would need to be developed.

Forestry wastes
The quality of the data on forestry wastes has been classified as poor because there is no data on actual arisings and because the estimate for the UK was mapped to the 10 RDAs. As nearly all this waste decomposes in situ there is no requirement to obtain data on the arisings, and so it is unlikely that the quality of data on this stream could be improved.

Fishing wastes
Initial data on the arisings of wastes from sea fishing has recently been produced. However, as a number of assumptions have been made in producing this data, and as waste from sea fishing represents a high proportion of overall fish waste arisings, the quality of the data provided for the model has only been assessed as fair. Updated estimates on the arisings of sea fishing wastes may be produced, and the methods used to determine the arisings may improve the overall quality of the data.

Other waste streams
The total arisings for the other priority waste streams are dominated by the arisings from end-of-life vehicles (ELVs) and waste electrical and electronic equipment (WEEE). As both of the streams will be covered by Commission Directives, it is likely that better data on the overall arisings and treatment of these streams will be produced. However, there will be a need to consider possible methods for mapping the data to produce estimates for each RDA.

Dredging wastes
No data was provided on dredging wastes for the model. If information on the arisings in each RDA was required, then procedures for recording both the amounts dredged and the methods used for managing/disposing of the dredged material which can be aggregated to provide regional or national figures will need to be developed.

Modelling
For modelling purposes it would be possible to assign an uncertainty range to each of these categories, and hence determine an uncertainty for the modelling output. This would give the benefit of allowing the modelling output to be placed in some context. However, the uncertainty ranges applied to each of these waste streams would need to be discussed with both the Environment Agency and the modelling team.

4 Conclusions

The Environment Agency, working with a number of Regional Development Authorities (RDAs) in England and Wales, are developing a regional environment-economy quantitative tool that could be used by both regional policy makers and regional stakeholders. This report provides information on the arisings of a number of waste streams for the model; these include municipal waste, commercial waste, industrial waste, construction and demolition waste, wastes produced from agricultural activities, and wastes produced from the mining of minerals. These waste streams represent over 95% of the overall weight arisings for the waste streams for which information is provided; other streams covered in the report include sewage sludge, fishing wastes (from both sea fishing and acquaculture) and priority waste streams such as end-of-life vehicles.

The data which is presented is for either 1998 or 1999 (although data for end-of-life vehicles, which represents less than 0.5% of overall waste arisings is for the year 2000). The current plan is for the model to use a baseline of 1999. Although suitable economic activity data could be used to rescale 1998 data to 1999, the modellers have not yet been able to produce a suitable sectoral breakdown which would allow all data to be presented for 1999.

The overall data quality for the main waste streams can be classified as either good or very good, and as it is anticipated that the data for each stream will be updated at regular intervals this will enable the data used by the model to be regularly updated. The overall data quality for the other waste streams, which between them represent less than 5% of the arisings, is classified as either fair or poor due to both a lack of data and the need to remap information to provide estimates for each of the RDAs. Although data quality for these streams could improve as better data on the arisings is produced, further work certainly appears to be required to assess options for mapping the data.