Cyfoeth Naturiol Cymru
Natural Resources Wales

Survey of Industrial and Commercial Waste Generated in Wales 2018 Technical Appendices

Rev No 2, Final

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1. Sample Frame Design and Size Calculations

This survey used a sampling matrix of local business sites[1] grouped by Commercial and Industrial sectors (defined by Standard Industrial Classification comparable with EU NACE codes) and by business site size bands (defined by the number of full time equivalent (FTE) employees on site). Business units include public and third sector operations[2].

This combination of a SIC code and an employee size band is referred to in this Technical Appendix as a 'brick'.

1.1. Sample Frame Design – Sector Classification

Business sites were stratified into 27 sectors (as opposed to 25 used in the previous 2012 survey), based upon EU NACE codes (NACE Rev. 2) and the identical UK Standard Industrial Classification 2007 (SIC) divisions. These are shown in Table 1.

One of the aims of this survey was to improve food waste arisings estimates for Wales, so the sample frame design from 2012 was augmented by extra sampling of business sites likely to produce large quantities of food waste. To achieve this, NACE codes 13 and 15 were each split into two. The "Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles" sector was split into:

- "Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles (excluding Food Retail)" and "Food Retail Only"
- As with the previous 2012 survey, Wholesale of Waste and Scrap (SIC 46.77) was omitted to avoid duplication of waste tonnages.

In addition, the "Accommodation and Food Service Activities" sector was split into

- "Accommodation", SIC2007 55 and "Food Service Activities", SIC2007 56.

The SIC codes used in the new groupings are detailed in Table 2. Apart from these changes the sectors were identical to those used in the 2012 Wales I&C survey and allow direct comparisons to be made with the previous survey.

[1] A business site is an individual location. A single registered business may operate at multiple business sites. ONS describe these as "local units".
[2] These are collectively referred to as business sites within the report.

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Table 1: NACE and SIC codes and descriptions

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NACE. Rev 2	SIC2007 Codes	SIC Description	Label Abbreviation (used in charts and tables)
Industrial Sector			
NACE01	10-12	Manufacture of Food Products, Drinks and Tobacco	Food Products
NACE02	13-15	Manufacture of Textiles, Wearing Apparel, Leather	Textiles
NACE03	16	Manufacture of Wood and Wood Products	Wood Products
NACE04	17-18	Manufacture of Paper and Paper Products	Paper Products
NACE05	19	Manufacture of Coke and Petroleum Products	Coke Products
NACE06	20-22	Manufacture of Chemical, Pharmaceutical, Rubber & Plastic Products	Chemical Products
NACE07	23	Manufacture of Other Non-Metallic Mineral Products	Other Products
NACE08	24-25	Manufacture of Basic Metals, and Metal Products	Basic Metals
NACE09	26-30	Manufacture of Computer, Electrical Equip, Machinery and Motors	Computer Equipment
NACE10	31-33	Manufacture of Furniture, Other Manufacturing, Repair and Installation	Furniture
NACE11	35	Generation of Electricity, Gas, Steam and Air Conditioning Supply	Energy Supply
NACE12	36	Water Collection, Treatment and Supply	Water
Commercial Sector			
NACE13	45-47 (excl. 46.77, and Food Retail)	Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles (excl. Food Retail)	Wholesale and Retail
	47.11,47.21-25,47.29, 47.81	Food Retail Only	Food Retail
NACE14	49-53	Transportation and Storage	Transportation
NACE15	55	Accommodation	Accommodation
	56	Food Service Activities	Food Service Activities
NACE16	58-63	Information and Communication	Information
NACE17	64-66	Financial and Insurance Activities	Financial
NACE18	68	Real Estate Activities	Real Estate
NACE19	69-75	Professional, Scientific and Technical Activities	Professional
NACE20	77-82	Administrative and Support Service Activities	Administrative
NACE21	84	Public Administration and Defence, Compulsory Social Security	Public Admin
NACE22	85	Education	Education

NACE. Rev 2	SIC2007 Codes	SIC Description	Label Abbreviation (used in charts and tables)
NACE23	86-88	Human Health and Social Work Activities	Human Health
NACE24	90-93	Arts, Entertainment and Recreation	Arts
NACE25	94-96	Other Services	Other Services

Table 2: SIC codes and descriptions for groupings new for 2018 survey

New Sector Grouping	SIC2007	SIC Description
Food Retail	47.11	Retail sale in non-specialised stores with food; beverages or tobacco predominating
	47.21	Retail sale of fruit and vegetables in specialised stores
	47.22	Retail sale of meat and meat products in specialised stores
	47.23	Retail sale of fish; crustaceans and molluscs in specialised stores
	47.24	Retail sale of bread; cakes; flour confectionery and sugar confectionery in specialised stores
	47.25	Retail sale of beverages in specialised stores
	47.29	Other retail sale of food in specialised stores
	47.81	Retail sale via stalls and markets of food, beverages and tobacco products
Food Service Activities	56.10	Restaurants and mobile food service activities
	56.21	Event catering activities
	56.29	Other food service activities
	56.30	Beverage serving activities

1.2. Sample Frame Design – Size Classification

The other element of the sampling matrix involved stratification of Welsh business sites into eight size bands based upon the number of employees at each local business site.

As waste would be scaled by waste per employee, those sites that had uniquely high waste arisings were allocated to size band 'special'. In an approach consistent with 2012 two size bands were used at the smaller end (1-2 and 3-4 employees) in order to mitigate against any biases arising from differential response rates of 1-2 and 3-4 employee business sites, and to allow comparison. Analysis in 2012 showed that the creation of an extra size band had a negligible effect on the overall precision of the survey.

Of the three 'special' businesses identified in 2012, two were retained in the 'special' size band for the 2018 survey with the third being replaced by another similar site. Selection of 'special' sites was based upon waste arisings reported by IPPC submissions for 2018. Table 3 shows the final set of size bands used to define the I&C sample frame.

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Table 3: Size bands used to stratify the I&C sample frame

Size Band Code	Number of employees
1	1-2
2	3-4
3	5-9
4	10-19
5	20-49
6	50-99
7	100-249
8	250+
10	Special businesses

1.3. Survey Population

The total population of business sites in each brick (N) was obtained from the ONS Inter-Departmental Business Register (IDBR) database, which lists business sites in Wales based on VAT and PAYE information.

By 2012 the scope of the IDBR had expanded to include business sites that are PAYE based but not VAT registered. There has been no change in scope between the 2012 and 2018 survey, so the total figures are comparable.

The data is shown in Table 4.

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Table 4: ONS population of business units (March 2018 figures)

Size band (number of employees -full time equivalent)

Sector	1-2	3-4	5-9	10-19	20-49	50-99	100-249	250+	Total
Food Products	240	70	80	50	55	30	35	25	**580**
Textiles	140	45	35	25	20	5	5	5	**270**
Wood Products	255	55	50	45	30	5	5	5	**445**
Paper Products	220	60	70	45	30	20	15	5	**460**
Coke Products	5	5	5	5	5	5	5	5	**5**
Chemical Products	155	75	95	60	70	45	35	10	**545**
Other Products	120	40	55	40	25	5	10	5	**295**
Basic Metals	790	135	155	115	95	45	25	15	**1,375**
Computer Equipment	425	80	110	95	90	45	50	30	**920**
Furniture	930	155	165	80	55	25	20	10	**1,440**
Energy Supply	170	30	20	10	15	15	10	5	**275**
Water	10	10	15	20	15	5	5	5	**80**
Wholesale and Retail	9,100	2,685	3,690	1,805	935	205	75	15	**18,510**
Food Retail	1,275	600	665	590	350	25	80	45	**3,630**
Transportation	2,845	505	445	310	290	120	50	15	**4,580**
Accommodation	725	230	270	270	225	70	25	10	**1,830**
Food Service Activities	2,455	1,725	2,015	1,340	755	95	40	5	**8,430**
Information	3,780	380	310	170	110	45	20	10	**4,820**
Financial	1,525	345	415	220	75	15	15	15	**2,625**
Real Estate	2,175	480	390	170	55	20	10	5	**3,310**
Professional	9,580	1,175	1,075	655	300	75	35	15	**12,910**
Administrative	6,100	1,190	1,020	525	285	125	80	55	**9,380**
Public Admin	555	175	210	235	215	105	85	75	**1,645**
Education	780	230	340	475	870	330	185	40	**3,250**
Human Health	2,215	1,095	1,715	1,630	1,080	340	155	65	**8,295**
Arts	1,475	500	655	305	210	70	25	10	**3,250**
Other Services	2,855	1,050	785	285	90	25	10	5	**5,105**
Total	**50,885**	**13,125**	**14,840**	**9,560**	**6,345**	**1,910**	**1,100**	**490**	**98,255**

1.4. Sample Frame Optimisation

The survey adopted a stratified sampling scheme based on the 27 SIC sectors and 8 size bands described above. For consistency this process repeated that used for the previous survey in 2012.

In 2012 statistical analysis showed that a good precision could be achieved with 1,500 samples. This figure was used to decide the initial total sample size (the number of surveys able to be undertaken) for the 2018 survey. To give the best possible precision for

the estimated total national waste generated the total sample size was optimally distributed across the sample frame bricks.

The optimal sample (survey) size for each brick was found by analysing three factors:

- the total number of businesses (the population) in each brick taken from the actual figures behind Table 4;
- the expected variation in waste generation among business sites in each brick based on 2012 results (calculation explained below); and
- the sample rate required to generate a food waste arisings estimate of acceptable precision.

In each of 216 bricks (27 x 8) with sufficient waste data[3] from the 2012 survey the data was used to estimate the mean waste arisings per business site and the variance between-business sites. Where the 2012 survey captured less than two business sites in a brick these figures were estimated.

- Mean waste generated per business site was estimated with linear regression to model the $\log_e$ mean as a function of sector and size band using tonnage data from the bricks which had valid mean estimates.
- Variance between business sites was estimated with linear regression to model the $\log_e$ variance as a function of the $\log_e$ mean using tonnage data for all bricks which had valid mean and variance estimates.

Following Neyman optimal sampling theory, the sample size in each brick was set to be proportional to the product of the population size (N) and the standard deviation (√Variance), so N*√Variance. Sample sizes were rounded to the nearest integer.

Three samples is regarded as the minimum sample size required to provide a meaningful estimate of the mean waste generated in a given brick. So the optimising algorithm was constrained to require a minimum of three business sites to be surveyed in every brick (providing that there were at least three business sites in the brick population).

Table 5 shows how the resulting sample frame targets as a percentage of the number of available business sites in each brick.

[3] Non-wastes (for instance virgin timber and blast furnace slag) were excluded from the calculations.

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Table 5: I&C sample frame: percentage of business sites to be sampled in each brick

Size band (number of employees -full time equivalent)

Sector	1-2	3-4	5-9	10-19	20-49	50-99	100-249	250+
Food Products	1.3%	4.0%	3.8%	6.0%	11.7%	48.6%	94.3%	92.0%
Textiles	2.1%	6.7%	8.6%	12.0%	15.0%	60.0%	40.0%	20.0%
Wood Products	1.2%	5.0%	5.5%	6.0%	10.0%	30.0%	80.0%	20.0%
Paper Products	1.4%	5.0%	4.3%	6.7%	10.0%	55.0%	80.0%	80.0%
Coke Products	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Chemical Products	1.9%	3.8%	3.2%	5.0%	8.0%	42.2%	97.1%	73.3%
Other Products	2.4%	6.7%	5.5%	6.7%	12.0%	60.0%	80.0%	20.0%
Basic Metals	1.0%	2.1%	1.9%	2.5%	13.0%	6.0%	92.0%	93.3%
Computer Equipment	0.7%	3.8%	2.7%	3.0%	3.3%	6.0%	5.5%	73.3%
Furniture	0.7%	1.9%	1.8%	3.8%	5.5%	12.0%	28.0%	40.0%
Energy Supply	1.8%	10.0%	12.0%	20.0%	15.0%	20.0%	90.0%	100.0%
Water	30.0%	20.0%	15.0%	15.0%	20.0%	60.0%	60.0%	40.0%
Wholesale and Retail	0.4%	0.4%	0.8%	1.6%	7.7%	9.1%	95.7%	73.3%
Food Retail	0.8%	1.3%	2.3%	2.6%	9.3%	10.8%	95.8%	96.0%
Transportation	0.2%	0.6%	0.7%	1.0%	2.1%	2.5%	20.0%	20.0%
Accommodation	0.4%	1.3%	1.1%	2.5%	1.3%	4.0%	90.0%	90.0%
Food Service Activities	0.4%	0.7%	0.7%	1.0%	3.3%	4.2%	91.1%	60.0%
Information	0.1%	0.8%	1.0%	1.8%	2.7%	6.7%	12.0%	20.0%
Financial	0.2%	0.9%	0.7%	1.4%	4.0%	15.0%	20.0%	15.0%
Real Estate	0.1%	0.6%	0.8%	1.8%	5.0%	15.0%	20.0%	30.0%
Professional	0.1%	0.3%	0.3%	2.3%	1.0%	3.8%	7.5%	15.0%
Administrative	0.0%	0.3%	0.3%	2.1%	1.0%	2.4%	3.8%	5.5%
Public Admin	0.5%	1.7%	1.4%	1.3%	1.4%	2.7%	3.5%	4.0%
Education	0.4%	1.3%	0.9%	0.6%	0.8%	0.9%	4.3%	27.5%
Human Health	0.1%	0.3%	0.2%	0.2%	0.3%	2.1%	7.7%	18.6%
Arts	0.2%	0.6%	0.5%	1.0%	1.4%	4.0%	12.0%	20.0%
Other Services	0.1%	0.3%	0.4%	1.0%	3.2%	12.0%	30.0%	100.0%
Total	**0.3%**	**0.8%**	**0.9%**	**1.6%**	**3.6%**	**7.2%**	**38.5%**	**44.3%**

1.5. Sample Frame Revision

As with the 2012 survey, the sample frame was revised mid-way through the survey to take into account the following factors:

- Shortfalls per brick in company detail data supplied by ONS, which did not match the totals in the original business site numbers ONS population data.
- Companies identified in the original ONS dataset which through the recruitment process were identified to have been wrongly allocated to a particular sector or size band (for

instance if they had recruited further employees since the ONS data were collected, putting them in a different size band).

- Companies that were unobtainable or had declined to take part in the survey (i.e. impact of low participation rate).

The first step of the review estimated the number of business sites expected to be surveyed for each brick, based upon:

- the number of successful surveys to date in the brick,
- the number of booked appointments;
- the number of refusals to participate; and
- the overall survey response rate.

This identified some bricks where the original target sample size could not be met, presenting the opportunity for them to be reallocated.

The second step of the review re-allocated surveys to bricks where the target sample size was expected to be met but there was more likely to be variation in results as there were more business sites in the population. Again, the number in each brick of the sample frame was optimised to give the best possible precision, particularly by targeting recruitment in the size bands associated with higher waste arisings.

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2. Survey Delivery and Quality Assurance Detail

Business contact data were secured from Inter-Departmental Business Register (IDBR) provided by the Office of National Statistics (ONS). Those who carried out the collection and analysis of the ONS data bear no responsibility for the further analysis and interpretation of the data used for the purposes of this survey.

2.1. Data Sample Preparation

Company selection for the telephone recruitment process was based upon a random selection of business sites in proportion to their relevance in the sample frame. A significant amount of data clean-up was required before the ONS dataset could be used. Unfortunately, the ONS data, which are based on VAT and PAYE records, contained only a small number of telephone numbers, a number of duplicate records, and also some records of businesses that were subsequently found to be no longer trading. As part of the ONS database cleansing, as each booking was made, operators checked SIC code (business type) and number of employees, and business address details.

In summary:

- Data were received from ONS for 25,483 business sites.
- Cleaning identified 538 duplicate records which were removed.
- 1,361 (5.3%) of original records had telephone numbers.
- 6,747 telephone numbers were added by research.

2.2. Data Security

Anthesis is registered under the Data Protection Act to handle personal data. From the initial outset of the project, systems were established to ensure the integrity and confidentiality of the business and personal details contained within the ONS dataset. Both the tele-bookers and the surveyors accessed the business contact data they needed by logging onto a secure internet site. Neither of these groups had access to the ONS dataset, and only one copy of the ONS dataset was retained on the Anthesis server which was accessible only to the Anthesis data manager.

Each business in the dataset was assigned a unique code which allowed identification of material stream (waste type) records and their positioning in the sample frame for grossing up. Only Anthesis and SLR held a copy of the unique code/business name relationship table for data checking purposes and this, along with the original ONS dataset, was deleted on completion of the project. This method of data management met the requirements of ONS.

2.3. Tele-Booking Process

Tele-bookers from Ainsworth & Parkinson (A&P) were trained in the use of a conversational call script for this survey. Appointment booking began by focussing on the

areas of highest business concentration, attempting to emulate the 30% North and 70% South split of businesses in Wales. Later in the survey process, the geographical focus was broadened to deliver a cross section of surveys in North Wales, Mid & South West Wales and South East Wales.

A bespoke web-enabled software system was used to support the telephone bookers' recruitment of business sites. This system was securely hosted on A&P's server and was a modification of that used for the 2012 survey. The software presented the tele-bookers with business contact details and address for a company selected at random, cycling through the sample frame bricks. Bricks, and all the remaining company details contained therein, were closed off once the brick target for number of bookings required had been achieved, and these details were subsequently no longer presented to the tele-bookers.

Once a business site had agreed to participate in the survey, the tele-booker made an appointment. Through the software the tele-bookers saw a calendar of the availability and location of each of the surveyors involved in delivery of the surveys. To identify an appropriate appointment time, the software offered the tele-booker a selection of dates and time slots (4 per working day), and displayed the estimated travel time for each surveyor based on the surveyor's location or the location of their previously booked appointments. This latter facility allowed the clustering of visits. Clustering visits geographically in this way allowed the booking process to maximise the number of visits per day for each individual surveyor, whilst keeping the travel distances to a practicable minimum.

Each business being surveyed received a confirmation email (if an email address was available) on the day the booking was made. The surveyors retrieved their booked appointments diary by securely logging onto a website which accessed the software on A&P's server.

Analysis of the tele-booking process shows:

- A total of 16,952 calls were made, including calls which resulted in there being incorrect phone numbers, no answer, the contact was busy, a refusal to participate, a call-back being required, or an appointment being secured.
- A total of 13,760 calls were answered by a contact at a company site.
- This resulted in 1,756 appointments being made.
- The final outcome was 1,452 completed face-to-face surveys.

2.4. Surveyor Training

Surveyors were provided by Groundwork Wales. In order to ensure the smooth delivery of the surveys and the collection of consistent and accurate data, each surveyor received specific training for the project. The training addressed the purpose of the survey, its key requirements, the surveying strategy and the structure of the questionnaire including waste categories to be used, waste management options, and the use of the survey software including the inbuilt waste quantity calculators. Health & Safety training was also included.

A detailed technical guidance manual, designed for use when surveyors were out visiting sites, meant surveyors always had a reference document to consult on the survey aims, supporting letters of reference, waste terminology and use of the survey tool. A telephone and email Help Line to support the surveyors was also established should they have any specific issues requiring assistance during the delivery of their surveys.

As part of the training programme, the surveyors conducted accompanied and unaccompanied pilot surveys on six company sites in order to both trial the survey systems and software, and to put into practice what they had learned during the initial training. These pilot surveys allowed Groundwork Wales surveyors to gain practical experience in the delivery of the project whilst having access to supervision and support.

2.5. Survey Visit

Each surveyor visited the business site at which they had appointment in person. The survey visit started with a discussion to explain the reason for the survey to 'break the ice', and as a reminder as the recruitment could have been one or two weeks earlier.

The surveyors then tried to collect as much data as possible from written records, such as waste transfer notes, disposal invoices, or electronic records. If necessary, the surveyor would prompt the business contact by suggesting the types of records which might be available. The data was recorded using the project survey software on the surveyor's laptop.

After completion of the interview stage, the surveyor asked to be taken on a brief tour of the business's facilities on site, to check the data already collected and to identify other material streams which the business representative may have forgotten. For example, surveyors were trained to look for office and canteen waste which is often overlooked.

2.6. Data Collation

After a series of visits had been completed, the surveyors used the export function in the survey software to upload completed datasets to the project server. To ensure data security, only the business site unique code was exported and associated with the exported individual material stream data.

As the surveyors picked up details of future bookings from their online diaries, they also registered the outcome for previous survey visits.

2.7. Monitoring Performance

Data and overall performance were reviewed on a regular basis.

On arrival of each surveyor upload, the data were checked for completion and obvious errors and appended to the main survey database. Throughout the survey, the project and

data managers at SLR and Anthesis monitored booking statistics, brick completion and surveyor utilisation rates.

The project software produced performance indicators that allowed the team to monitor:

- calls made by each tele-booker;
- number of refusals, wrong numbers and no answers;
- appointments booked to date, in total and by allocation to each surveyor;
- number of completed surveys;
- number of cancellations and re-bookings required, and
- percentage completion of each brick in the sample frame.

At periods throughout the survey, both the tele-bookers and the surveyors were directly monitored to check performance and correct any problems. This proved to be an effective and reliable process.

2.8. Checking for Outliers

Each week all data received by the team were reviewed electronically to identify outliers, i.e. those data points that lay outside the expected range based on 2012 variance by sector and business site size. Once identified, these outliers were further checked by the Anthesis survey manager in discussion with the surveyor who would either confirm the data or change it if necessary. These checks identified errors in data entry or calculation as well as incorrect classifications. During the survey period a weekly review between Anthesis, SLR and Natural Resources Wales examined issues identified during the week and progress to date.

Following completion of the survey Anthesis re-compiled and checked the main database to capture any and all changes made by surveyors. SLR reviewed the resultant data comparing tonnage per employee per sector, drilling into the highest waste arising figures and looking at material streams by management method for anomalies. This resulted in review with the business unit and or the surveyor and some changes to tonnages, categorisation of wastes and employee numbers.

2.9. Data from Multi-Location Businesses

When contacted, some business sites reported data on waste arisings were not held locally but centrally on either a regional or national basis. This was particularly true for large supermarket chains and other similar businesses. A site survey would therefore not be appropriate, and so these business head offices were contacted to request data for the site in question, plus any other suitable sites in Wales. The source of these data tended to be the contractors used for waste collection. In some cases where corporate did not have the individual site data an apportionment was made using either employee data per site, or turnover data per site.

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These bulked data were added to the survey dataset, on a ‘per site’ and ‘per material stream’ basis, so as to mirror the structure of the survey data.

This practice had been used in previous surveys but was more extensive in the 2018 survey as it was observed that an increased number of business sites that were part of larger organisations did not hold arisings data at their local sites. This did mean that more surveys than planned were able to be completed.

For this survey:

- At total of 1,452 survey site visits were delivered and data successfully collected.
- Data for an additional 308 business sites was collected centrally from businesses as “bulk” data.
- Final data checks rejected data from 5 business sites[4], resulting in a final dataset of 1,755 individual business sites.

[4] This was mainly due to anomalies or inconsistencies with the data that could not be rectified within the allocated timeframe.

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3. Data Grossing Methodology

The process of extrapolating the waste arisings of surveyed businesses to estimate total waste arisings at a national or local authority level is termed 'grossing up'. As the survey followed a sample frame structured by 'bricks' of sector (s) and size band (b), the grossing up methodology was also performed on a brick by brick basis.

The following two tables give the final sample frame by brick after all corrections.

Table 6: Final population of business units (after adjustments to ONS provided data)

Size band (number of employees -full time equivalent)

Sector	1-2	3-4	5-9	10-19	20-49	50-99	100-249	250+	Total
Food Products	240	65	75	50	50	30	30	25	**560**
Textiles	140	45	35	20	15	5	5	0	**265**
Wood Products	255	55	50	40	25	5	5	5	**435**
Paper Products	220	55	70	40	30	20	15	5	**450**
Coke Products	5	5	5	5	5	5	5	5	**5**
Chemical Products	155	70	90	60	70	45	35	10	**530**
Other Products	120	40	50	30	25	5	10	5	**285**
Basic Metals	790	135	155	115	90	45	25	15	**1,370**
Computer Equipment	425	75	110	95	80	45	50	30	**910**
Furniture	930	155	165	70	50	25	20	10	**1,425**
Energy Supply	170	25	20	10	10	15	10	5	**265**
Water	10	5	15	10	10	5	5	5	**60**
Wholesale and Retail	9,100	2,685	3,690	1,805	935	205	75	15	**18,510**
Food Retail	1,275	600	665	590	350	25	80	45	**3,630**
Transportation	2,845	505	445	310	290	115	50	15	**4,575**
Accommodation	725	230	270	260	225	70	25	10	**1,815**
Food Service Activities	2,455	1,725	2,015	1,340	740	90	40	5	**8,415**
Information	3,780	380	310	170	110	45	20	10	**4,815**
Financial	1,525	345	415	220	75	15	15	15	**2,625**
Real Estate	2,175	480	390	170	55	20	10	5	**3,305**
Professional	9,580	1,175	1,075	655	300	75	35	10	**12,905**
Administrative	6,100	1,190	1,020	525	285	125	75	50	**9,375**
Public Admin	555	175	210	235	215	95	65	65	**1,605**
Education	780	230	340	475	870	330	170	35	**3,230**
Human Health	2,215	1,095	1,715	1,630	1,080	340	150	65	**8,285**
Arts	1,475	500	655	305	210	70	25	10	**3,245**
Other Services	2,855	1,050	785	285	90	25	10	5	**5,105**
Total	**50,885**	**13,095**	**14,835**	**9,505**	**6,285**	**1,885**	**1,050**	**465**	**98,000**

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Table 7: I&C sample frame: percentage of business sites actually sampled in each brick

	Size band (number of employees -full time equivalent)[5]							
Sector	**1-2**	**3-4**	**5-9**	**10-19**	**20-49**	**50-99**	**100-249**	**250+**
Food Products	1.3%	4.6%	5.3%	12.0%	42.0%	56.7%	63.3%	76.0%
Textiles	1.4%	8.9%	8.6%	15.0%	20.0%	80.0%	40.0%	0.0%
Wood Products	0.8%	10.9%	2.0%	2.5%	28.0%	80.0%	60.0%	20.0%
Paper Products	1.4%	5.5%	5.7%	10.0%	10.0%	55.0%	66.7%	60.0%
Coke Products	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Chemical Products	0.6%	4.3%	5.6%	3.3%	17.1%	48.9%	60.0%	80.0%
Other Products	4.2%	10.0%	12.0%	6.7%	28.0%	60.0%	30.0%	20.0%
Basic Metals	1.3%	2.2%	1.9%	4.3%	33.3%	17.8%	68.0%	33.3%
Computer Equipment	0.5%	4.0%	2.7%	5.3%	7.5%	8.9%	28.0%	70.0%
Furniture	0.6%	1.9%	3.0%	5.7%	10.0%	8.0%	50.0%	90.0%
Energy Supply	0.6%	16.0%	15.0%	30.0%	60.0%	13.3%	60.0%	80.0%
Water	30.0%	20.0%	6.7%	30.0%	30.0%	40.0%	40.0%	40.0%
Wholesale and Retail	0.4%	0.7%	1.0%	1.7%	7.3%	15.1%	17.3%	46.7%
Food Retail	1.2%	2.2%	7.2%	16.1%	39.4%	76.0%	78.8%	100.0%
Transportation	0.2%	1.0%	0.9%	1.3%	1.7%	4.3%	24.0%	13.3%
Accommodation	0.7%	1.7%	0.7%	3.1%	1.3%	14.3%	60.0%	60.0%
Food Service Activities	0.4%	0.6%	0.8%	1.6%	3.0%	16.7%	65.0%	20.0%
Information	0.1%	0.8%	1.3%	1.2%	4.5%	2.2%	10.0%	20.0%
Financial	0.2%	0.6%	1.2%	1.4%	2.7%	13.3%	20.0%	20.0%
Real Estate	0.1%	0.2%	1.0%	1.8%	5.5%	15.0%	30.0%	40.0%
Professional	0.0%	0.2%	0.4%	2.1%	2.3%	2.7%	8.6%	30.0%
Administrative	0.1%	0.3%	0.5%	1.3%	2.8%	2.4%	1.3%	4.0%
Public Admin	0.7%	2.9%	1.9%	0.9%	1.9%	3.2%	4.6%	3.1%
Education	0.3%	1.7%	0.9%	1.1%	0.9%	0.9%	5.9%	34.3%
Human Health	0.1%	0.2%	0.3%	0.2%	0.6%	4.4%	12.0%	26.2%
Arts	0.2%	1.0%	0.2%	1.3%	3.3%	4.3%	20.0%	10.0%
Other Services	0.1%	0.4%	0.5%	1.1%	3.3%	20.0%	40.0%	40.0%
Total	**0.3%**	**0.9%**	**1.3%**	**2.6%**	**6.2%**	**10.6%**	**27.4%**	**38.9%**

3.1. National Methodology

For each brick (sb) a grossing factor g_{sb} was calculated by dividing the brick population N_{sb} by the number of sampled businesses n_{sb} in the brick

$$g_{sb} = N_{sb} / n_{sb}$$

The grossed-up weight for each business site sampled W_{sb} was calculated by multiplying the sample weight w_{sb} by grossing factor g_{sb}:

$$W_{sb} = w_{sb} \times g_{sb}$$

The grossed-up weights for each sample W_{sb} were then added together to give the grand total grossed up weight W :

[5] Note: These percentages were calculated using rounded population figures.

$$W = \sum_{s,b} W_{sb}$$

The same approach was used for grossing up a particular category of waste (e.g. a particular waste type); the only difference being that w_{sb} represents the total sample weight *for that category*.

3.2. Regional Methodology

The ONS Local Authority data was used to calculate the population of each brick within the region R_{sb}. A regional grossing factor g_{rsb} was then calculated by dividing the regional population of a brick N_{rsb} by the total number of samples in the brick n_{sb} .

$$g_{rsb} = N_{rsb} / n_{sb}$$

If there were no business sites for a brick in a region then the regional grossing factor would be zero and no waste allocated from the sample.

The grossed-up weight for each region from each business site sampled W_{rsb} was calculated by multiplying the sample weight w_{sb} by the regional grossing factor g_{rsb}:

$$W_{rsb} = w_{sb} \times g_{rsb}$$

The regional grossed up weights for each sample W_{rsb} were then added together to give the grand total grossed up weight for each region W_r:

$$W_r = \sum W_{rsb}$$

Thus, the waste arisings from unsurveyed businesses were estimated by the national average for that brick.

The same approach was used for grossing up a particular category of waste (e.g. a particular waste type); the only difference being that w_{sbl} and w_{sb} represented the total sample weight *for that category*.

3.3. Special Businesses

The ‘special’ businesses were grossed up separately, which means that their waste arisings were not extrapolated in the usual way but instead added directly to the grossed-up total. For regional grossing the waste arisings were added to the region they were in.

3.4. Estimating N

The total population of businesses in each brick and local authority N_{sbl} was supplied by ONS. Of the businesses surveyed, several were found to be in the wrong sector or size band and the ONS population figures were adjusted accordingly. For example, if N_{sbl} = 100, and 4 out of 10 businesses surveyed were mis-classified, then N_{sbl} was re-estimated as: 100 – 4 = 96. This correction was necessary to avoid numerous instances where there were more businesses surveyed than listed on the ONS database.

3.5. Unsurveyed Bricks

Due to difficulties in recruiting businesses, particularly in bricks with very small populations, two bricks had no businesses surveyed. The average weight of waste per business in these bricks was estimated from a neighbouring brick (the next smallest size band in the same sector). No adjustments were made to the figures to account for differences among size bands because the number of companies and the tonnages involved were small.

3.6. Quality Assurance Checks

In addition to screening the data for outliers, SLR and Anthesis carried out a range of additional checks on the grossed-up results to flag up inconsistencies and individual material streams that needed checking. In response to these checks, a number of surveyed businesses were contacted by phone to check and confirm or change key data.

Specifically, the following checks were undertaken.

(1) Sensitivity Analysis

A sensitivity analysis was undertaken using the grossed-up data to identify the material streams that had the greatest influence on national and sectoral waste totals. The accuracy of the information for these material streams was checked with the businesses surveyed (i.e. correct size band, reported tonnages, waste types and management methods).

(2) ‘Special’ Company Checks

Checks were undertaken to identify and investigate any businesses that had unusually high waste arisings compared with others in the same brick to see whether they were unique and could be treated as ‘special’ companies and grossed up separately. Apart from the three businesses identified at the outset of the project, no other special businesses were found.

(3) Comparison of 2018 Results with 2012 I&C Survey Results and Population Data

Both the 2012 and 2018 I&C surveys reported waste arisings by SIC Code 2007. The totals and sub-totals of the two datasets were compared and statistically significant

differences between the two surveys were identified. These differences were resolved following comparisons with population data or checks made with businesses on the 2018 waste data. The Index of Production[6], which looks at the output of industrial and commercial sectors in Wales, was also compared between 2012 and 2018 as this may affect the waste arising of sectors and therefore assist in interpreting trends.

3.7. Assessment of Uncertainty

For the national estimates, the variance in the grossed-up weight for each brick $Var(W_{sb})$ was estimated by:

$$Var(W_{sb}) = \frac{Var(w_{sbi})}{n_{sb}} \times \left(\frac{N_{sb} - n_{sb}}{N_{sb} - 1} \right) \times N_{sb}^2$$

where $Var(w_{sbi})$ is the variance in the weight of waste among the n_{sb} businesses in that brick and $\left(\frac{N_{sb} - n_{sb}}{N_{sb} - 1} \right)$ is a finite population correction factor that ensures that the variance is zero when all the businesses in a brick have been surveyed (i.e. $n_{sb} = N_{sb}$).

It was not possible to calculate a variance for the bricks where just one business was surveyed. In these bricks, the variance was instead estimated from the average tonnage using the formula:

$$Var(W_{sb}) = \left(0.84 \times \overline{w}_{sb}\right)^2$$

where 0.84 is the average coefficient of variation across all bricks with at least two sampled businesses and $\overline{w}_{sb}$ is the average sample weight per business in that brick (i.e. the tonnage for the one surveyed company).

The variance in the grand total grossed up weight $Var(W)$ was then estimated by summing the variances for all bricks:

$$Var(W) = \sum_{s,b} Var(W_{sb})$$

This variance was then converted to a measure of precision (ρ_W , %):

$$\rho_W = 100 \times 1.65 \times \frac{\sqrt{Var(W)}}{W}$$

where 1.65 is a multiplier to give the precision at 90% confidence (i.e. we can be 90% confident that the true value of W lies within ± ρ_W %).

[6] Published by StatsWales “Index of Production and Index of Construction for Wales”

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A similar set of calculations were done for the local estimates. Here, the waste of the surveyed businesses is known without error, so the only uncertainty arises from the unsurveyed businesses. The variance in the grossed-up weight for each sector, band and local authority $Var(W_{sbl})$ was estimated by:

$$Var(W_{sbl}) = \frac{Var(w_{sbi})}{n_{sb}} \times \left(\frac{N_{sb} - n_{sb}}{N_{sb} - 1} \right) \times \left(N_{sbl} - n_{sbl} \right)^2$$

The variance in the grand total grossed up weight for that local authority $Var(W_l)$ was estimated by summing the variances for all bricks:

$$Var(W_l) = \sum_{s,b} Var(W_{sbl})$$

and then converted to a measure of precision (ρ_W , %):

$$\rho_W = 100 \times 1.65 \times \frac{\sqrt{Var(W_l)}}{W_l}$$

Note that these precision calculations take into account only the uncertainty arising from random sampling error; it was assumed that all surveyed weights and the ONS population figures were correct. It was also assumed that all surveyed weights are normally distributed and are independent data points. This assumption does not hold for “bulk” data representing 308 sites that was obtained centrally from businesses. This will result in an overstatement of precision in final estimates associated with bricks containing such data, and so this data was not included in the precision calculations.

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4. Survey Questionnaire

The questionnaire had three main elements: company data, material (waste) stream data and additional qualitative questions.

Record per Company

Company Details:

- Allocated unique code (from booking operation)
- Sector as SIC code (SIC 2007)
- employee or employment number (including temporary workers) and
- local authority area

NOTE: All data is recorded anonymously to ensure confidentiality

Record per Material Stream (Waste Type)

A1. Description of materials (waste) stream (SOC group and sub-group)

- e.g. plastic, mixed recyclates, residual mixed waste stream

A2. Form of Waste

- Solid
- Liquid
- Gas

A3. Nature of waste:

- Hazardous
- Non-hazardous
- Inert

A4. Annual tonnage (and container and conversion factor equivalents)

- Can be calculated from the waste container/bin size and frequency of collection if direct tonnage data is not available

A5. Source of tonnage data:

- Written records – split into weighbridge, invoice, waste transfer note etc
- Company estimate (from volume or collection data)
- Surveyor estimate (from on-site observations)

A6. Waste Management Fate

- Waste management category and sub-category eg. landfill, recycling. Also includes any waste reused on site
- This needs to be the final destination if it is known, however there is the option to put “transfer” if the final fate is not known BUT transfer option is last resort.

A7. Where is final waste management destination?

- e.g. Within UK, Outside UK Or Reused on site

A8. Who collects your waste?

- e.g. Local authority (e.g. Blaenau Gwent, Bridgend etc), Waste management contractor (e.g. Biffa, Veolia, Shanks etc)

General Qualitative Questions about Company Practises:

Waste Minimisation

- B.1: Details of any substances, products and components re-used on site
- B.2: Details of any food waste minimisation / redistribution
- B.3: Importance of waste minimisation

Waste and your business

- C.1. Thinking about your business's major overheads/outgoings, where would you place your business's waste management costs?
- C.2. On a scale of 0 – 10, where 0 is 'not at all', 5 is 'reasonably well' and 10 is 'extremely well' to what extent do you understand what happens to your business's waste once it's been removed?

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5. Examples of Businesses in the Sectors Surveyed

The following two tables give examples of the types of businesses in the sectors surveyed.

Table 8: Examples of business types in the industrial sector categories.

Industrial (Manufacturing) Sectors	
SIC abbreviation	**Company Type examples**
Food Products	Production, processing and preserving of meat and meat products. fish and fish products, fruit and vegetables, vegetable and animal oils and fats, dairy products, grain mill products, starches and starch products and of prepared animal feeds. Manufacture of beverages including alcohol, manufacture of tobacco products. **NOTE**: This is manufacturers only.
Textiles	Manufacture of Textiles and Textile Products including spinning of fibres (cotton, wool, worsted etc), textile weaving, manufacture of articles including carpets, soft furnishings, manufacture of clothes are wearing apparel including from leather, and of luggage and footwear.
Wood Products	Manufacture of Wood and Wood Products including sawmills, manufacture of plywood, laminboard, particle board, fibre board and other panels and boards, Manufacture of builders' carpentry and joinery and wood; of articles of cork, straw and plaiting materials.
Paper Products	Manufacture of Pulp, Paper and Paper Products Publishing and Printing including pulp, paper and paperboard and articles of paper and paperboard including stationery, wallpaper, cartons, boxes. Publishing, Printing and Reproduction of Recorded Media including newspapers and books, sound and recording media.
Coke Products	Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel.
Chemical Products	Manufacture of Chemicals and Chemical Products including basic chemicals, dyes & pigments, fertilisers, plastics, synthetic rubber, pesticides & agrochemicals, paints, varnishes and similar coatings, printing ink and mastics pharmaceuticals, medicinal chemicals and botanical products soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations, man-made fibres. Manufacture of Rubber and Plastic Products including tyres, plastic products including floor coverings.
Other Products	Manufacture of Other Non-metallic Mineral Products including of glass and glass products, of ceramic goods; manufacture of tiles and flags, or bricks cement and plaster and articles of concrete, plaster and cement. Cutting, shaping and finishing of ornamental and building stone.
Basic Metals	Manufacture of basic iron and steel and of ferro-alloys including tubes and wire, Aluminium, Lead, zinc, tin and Copper production. Casting of metals. Manufacture of Fabricated Metal Products, Except Machinery and Equipment Including metal tanks, radiators, metal coatings, manufacture of cutlery and tools, steel drums, screws, chains.

Industrial (Manufacturing) Sectors	
SIC abbreviation	**Company Type examples**
Computer Equipment	Manufacture of Machinery and Equipment for the production and use of mechanical power, except aircraft, vehicle and cycle engines, agricultural and forestry machinery, machine tools, machinery for mining, quarrying and construction, for food, beverage and tobacco, textile, paper & pulp processing Manufacture of weapons and ammunition Manufacture of domestic appliances Manufacture of Electrical and Optical Equipment, including office machinery and computers, electric motors, generators and transformers, batteries and insulated wire, lighting equipment Manufacture of Radio, Television and Communication Equipment and Apparatus Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks Manufacture of industrial process control equipment, optical instruments and photographic equipment Manufacture of Motor Vehicles, Trailers and Semi-trailers, of ships, boats, cycles, aircraft.
Furniture	Manufacture of Furniture; of jewellery and related articles, musical instruments, sports goods, games and toys.
Energy Supply	Electricity and Gas production and Supply including Steam and hot water supply.

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Table 9: Examples of business types in the commercial sector categories.

Commercial (Service) Sectors

SIC abbreviation	Company Type examples
Wholesale and Retail	Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods, including car sales and maintenance, petrol, Wholesalers and agents, retail shops and stores (excluding food and drink).
Food Retail	Wholesalers and agents, retail shops and stores selling food and drink, including supermarkets.
Transportation	Land transport and transport via pipelines; Water transport Air transport; Warehousing and support activities for transportation Postal and courier activities.
Accommodation	Hotels and campsites.
Food Service Activities	Restaurants, pubs and bars.
Information	Publishing activities; Motion picture, video and television programme production, sound recording and music publishing activities; Programming and broadcasting activities; Telecommunications; Computer programming, consultancy and related activities; Information service activities.
Financial	Financial including banks, building societies, insurance and pension funds; Insurance, reinsurance and pension funding, except compulsory social security; Activities auxiliary to financial services and insurance activities.
Real Estate	Estate Agents.
Professional	Legal and accounting activities; Activities of head offices; management consultancy activities; Architectural and engineering activities; technical testing and analysis; Scientific research and development; Advertising and market research; Other professional, scientific and technical activities; Veterinary activities.
Administrative	Rental and leasing activities; Employment activities; Travel agency, tour operator and other reservation service and related activities; Security and investigation activities; Services to buildings and landscape activities; Office administrative, office support and other business support activities.
Public Admin	Public Administration and Defence; Compulsory Social Security, Local Authorities, fire stations, police.
Education	Education (schools and colleges).
Human Health	Health & social work, including hospitals & doctors, Human health activities; Residential care activities; Social work activities without accommodation.
Arts	Creative, arts and entertainment activities; Libraries, archives, museums and other cultural activities; Gambling and betting activities; Sports activities and amusement and recreation activities.
Other Services	Activities of membership organisations; Repair of computers and personal and household goods; Other personal service activities.

6. Survey Look-Up Tables

The following sections give details of the options available to the business site contacts and surveyors when completing the questions.

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6.1. Waste Descriptions

For the survey waste was categorised based on Substance Oriented Classification (SOC) using the knowledge of the site contact and available data. There was no waste sorting undertaken in this survey. The 9 groups, 39 sub-groups and then in some cases sub-sub-groups used are listed in the table below. Note the sub and sub-sub groups for food waste were additional to those used in the 2012 survey.

Table 10: Waste categorisation codes.

SOC Group	Sub Group	Sub-Sub Group
Chemical wastes	Spent Solvents	Halogenated spent solvents
		Non- halogenated spent solvents
		Other solvents
	Acid, Alkaline or Saline wastes	Acid
		Alkaline
		Other saline
	Used Oils (mineral)	Used motor oils
		Other used oils
	Spent Chemical Catalysts	-
	Chemical Preparation wastes	Unused medicines
		Paints, varnish, inks & adhesive wastes
		Other chemical preparation wastes
		Minor mixed chemical wastes
	Chemical Deposits and Residues	Tars and carbonaceous wastes
		Oils/water emulsions sludges
		Chemical reaction residues
		Spent filtration and absorbent materials
		Other Chemical deposits and residues
	Industrial Effluent Sludges (Chemical)	Sludges from industrial processes & effluent treatment
		Sludges containing hydrocarbons

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SOC Group	Sub Group	Sub-Sub Group
Healthcare	Healthcare and Biological wastes	Human infectious health care wastes
		Animal infectious health care wastes
		Genetic engineering wastes
		Other healthcare wastes
		Sanitary waste
Metallic wastes	Metallic wastes	Ferrous metal waste and scrap
		Waste precious metal
		Other waste aluminium
		Copper waste
		Other metal wastes
		Mixed metallic packaging
		Other mixed metallic wastes
Non-Metallic wastes	Glass wastes	Glass packaging
		Other glass waste
	Paper & Cardboard wastes	Paper packaging
		Other paper waste
		Card packaging
		Other card waste
		Mixed paper & card packaging
		Other mixed paper & card waste
	Rubber wastes	Used tyres
		Other rubber waste
	Plastic wastes	Plastic packaging
		Other plastic wastes
	Wood wastes	Wood packaging
		Treated or coated wood sawdust and shavings
		other treated or coated wood wastes
	Textile wastes	Carpet
		Clothing
		Other textile wastes
	Waste containing PCBs	-

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SOC Group	Sub Group	Sub-Sub Group
Discarded Equipment	Discarded Vehicles (ELVs)	-
	Batteries and Accumulators wastes	Household similar batteries
		Car batteries
		Other batteries
	WEEE and Other Discarded Equipment	Discarded electrical and electronic equipment
		Discarded machines and equipment components
Animal & Vegetable wastes	Animal waste of Food Preparation and Products	Food processing - animal waste
		Domestic & canteen food waste - animal
		Other Animal waste of food preparation and products
	Animal Faeces, Urine and Manure	-
	Other Animal & Vegetable wastes	Food processing - vegetable waste
		Domestic & canteen food waste - vegetable
		food processing waste - mixed animal & vegetable waste
		Domestic & canteen food waste - mixed animal & vegetable
		Green wastes (garden)
		Cooking Oil
		Vegetable oil
		Other animal & vegetable wastes
Mixed wastes	Household and Similar wastes	Mixed residual (including food waste)
		Mixed residual (no food waste)
		Dry mixed recyclates (DMR)
		Bulky waste
	Mixed and Undifferentiated Materials	Mixed residual (including food waste)
		Mixed residual (no food waste)

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SOC Group	Sub Group	Sub-Sub Group
		Dry mixed recyclates (DMR)
		Mixed packaging
	Sorting Residues	-
Common Sludges	Common Sludges (excluding Dredging Spoils)	-
	Dredging Spoils	-
Mineral wastes	Combustion waste	-
	Contaminated Soils and Polluted Dredging Spoils	-
	Solidified, Stabilised or Vitrified wastes	-
	Other Mineral wastes	Artificial mineral wastes
		Waste refractory materials
	Construction and Demolition waste	Concrete, bricks and gypsum waste
		Waste hydrocarbonised road-surfacing material
		Mixed construction wastes
		Gypsum - plasterboard
		Gypsum - excess wet plaster
		Gypsum - plaster powder
		Insulation - fibreglass/mineral wood
		Insulation - natural fibres
		Insulation - insulating concrete blocks
		Insulation - foam based
		Insulation - structural insulated panels
		Insulation - reflective insulation products
	Asbestos wastes	-
	Waste of Naturally Occurring Minerals	-
Non-wastes	Virgin timber	Sawdust and shavings
		Bark
		Solid pieces e.g. plank ends
	Blast Furnace Slag	-
	Naturally Occurring Soil and Mineral Materials	-

SOC Group	Sub Group	Sub-Sub Group
	Food Fit for Consumption	Food packaged
		Food unpackaged
	Food by Product (Not waste)	-

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6.2. Waste Management Methods

Table 11: Waste management descriptions grouped by waste management method

Prime Waste Management Method	Waste Management Description – sub category
Land Disposal	Landfill
	Soakaway
	Lagoon disposal
	Deep injection (borehole)
	Other Land Disposal
Incineration with Energy Recovery	Incineration with Energy Recovery
	Pyrolysis (with Energy Recovery)
	Gasification (with Energy Recovery)
	Waste Derived Fuel (WDF)
	Other Thermal with Energy Recovery
Incineration Without Energy Recovery	Incineration Without Energy Recovery
	Pyrolysis (Without Energy Recovery)
	Gasification (Without Energy Recovery)
	Crematorium
	Other Thermal Without Energy Recovery
Transfer Station	Transfer (use as last resort)
Treatment Plant	MBT (mechanical biological)
	Biological Treatment
	Autoclave
	Mechanical Heat Treatment
	Rendering
	Separation (MRF)
	Physio/Chemical Treatment
	Other Treatment
Recycling	Source Segregated – direct to reprocessor
	Mixed/Co-mingled sent to MRF/Transfer Station
	Waste Recycling Centre/Civic Amenity site
	Other Recycling
Composting	Windrow Composting
	In-Vessel Composting
	Anaerobic Digestion (AD)
	Other Composting
Land Recovery	Landspread
	Injection
	Other Land Recovery
Preparation for Reuse	Preparation for Reuse on site
	Preparation for Reuse off site
	Direct Reuse on site
	Other Reuse
Other (contains options not included for the 2012 survey, related to Food waste fate)	To Animal Feed (Food waste)
	Redistribution (Food waste)
	Maceration (Food waste)
	Other Recovery
Don't Know	Don't Know

6.3. Standard Container Types

Table 12: Standard containers group, name and assumed volume

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Container Group	Container Name	Volume (m3)
Chamberlain	Chamberlain 940	0.94
	Chamberlain 720	0.72
	Other chamberlain	User define
Drum/barrel	200 litre drum	0.2
	205 litre drum	0.2
	120 litre drum	0.12
	30 litre drum	0.035
	25 litre drum	0.025
	Other drum/barrel	User define
Front-end loader	10 yd3 front-loader	7.6
	8 yd3 front-loader	6.1
	6 yd3 front-loader	4.6
	Other front-loader	User define
IBC	1200 litre IBC	1.2
	1100 litre IBC	1.1
	Other IBC	User define
Large container - RoRo	40 yd3 RoRo	30.6
	35 yd3 RoRo	26.8
	30 yd3 RoRo	23
	25 yd3 RoRo	19.1
	20 yd3 RoRo	15.3
	18 yd3 RoRo	13.8
	15 yd3 RoRo	11.5
	Other RoRo	User define
Other container	Other container	User define
Paladin	Paladin 850	0.85
	Paladin 560	0.56
	Other paladin	User define
Rear-end loader	16 yd3 rear-loader	12.2
	14 yd3 rear-loader	10.7
	12 yd3 rear-loader	9.2
	10 yd3 rear-loader	7.6
	8 yd3 rear-loader	6.1
	Other rear-loader	User define
Refuse sack	Standard refuse sack	0.08

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Container Group	Container Name	Volume (m3)
	Non-standard refuse sack	User define
Wheeled bin	1100 litre bin	1.1
	660 litre bin	0.66
	240 litre bin	0.24
	120 litre bin	0.12
	Other wheeled bin	User define

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6.4. Conversion Factors

Table 13: Standard conversion factors

SOC Group	SOC Sub group	Waste type	Conversion Density
Other Liquids			1
Animal & Vegetable wastes		Sludges/manures	0.92
		Oils and fats	0.61
		Green/garden wastes - compacted	0.61
		General food waste	0.28
		Green/garden wastes - not compacted	0.24
Chemical wastes		Sludges	0.92
		Liquids and oils	0.9
		Petrol and similar fuels	0.72
		Powders	0.36
		Spent carbon and carbon-containing wastes	0.24
Common Sludges		Sludges	0.92
Discarded Equipment	Batteries wastes	Batteries	1.35
	WEEE and Other Discarded Equipment	Components, electronic equipment and similar items	0.3
		Fluorescent tubes	0.19
Healthcare		Clinical waste incl. blood and organs	0.2
Metallic wastes		Ferrous cans - compacted	0.5
		Metal filings and turnings	0.3
		Aluminium cans - compacted	0.2
		Ferrous cans - whole	0.09
		Aluminium cans - whole	0.04
Minerals wastes		Vitrified wastes	1.35
		Soils including contaminated	1.3
		Waste gravel, crushed rocks and other powdery mineral wastes	1.23
		Mixed rock, stone and clays	1.1
		Slags (e.g. furnace slags)	1.08
		Flue-gas dust and similar	0.74
		Ash and boiler dust	0.5
		Moulding (foundry) sands	0.5
		Mixed construction and demolition waste	0.32
		Waste containing asbestos	0.32
Mixed wastes		Mixed waste similar to municipal waste – compacted	0.26
		Mixed waste with similar profile to mixed municipal waste	0.11

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SOC Group	SOC Sub group	Waste type	Conversion Density
Non-Metallic wastes	Glass wastes	Glass powders and small particles	1.21
		Glass pieces (e.g. waste from manufacture of glass products)	0.57
		Glass bottles - whole	0.36
	Paper & Cardboard wastes	Paper & cardboard pulps and fibres	0.9
		Paper & cardboard packaging and newspaper - compacted	0.51
		Paper & cardboard packaging and newspaper - whole	0.2
	Plastic wastes	Plastic film - compacted	0.5
		Plastic packing and shavings - compacted	0.32
		Plastic bottles - compacted	0.3
		Plastic packing and shavings/turnings from manufacture of plastic products	0.22
		Plastic bottles - whole	0.02
	Rubber waste	End-of-life tyres	0.47
	Textile wastes	Textile fibres	0.61
		Cloths, off-cuts and other textile pieces	0.2
	Wood wastes	Sawdust, shavings and other small pieces from wood processing	0.25
		Pallets and other wooden packaging	0.11

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6.5. Standard Items

Table 14: Standard item weights

Item Name	Item Weight kg
Battery - car	18
Battery - commercial vehicle	25
ELV item	0
Chairs - office	12
Computer - full	28
Cooker	52.5
Dishwasher	50
Drums, plastic, empty ca 200l	10
Drums, steel, empty ca 200l	18
Fluorescent tube	1
Freezer	45
Fridge	45
Furniture - office	25
Glass item	User defined
IBC, Empty ca 1,000l	70
Mattress	40
Microwave cooker	17
Other discarded equipment	User define
Other metallic item	User define
Other plastic item	User define
Other rubber item	User define
Other WEEE item	User define
Other wooden item	User define
Pallet	20
Photocopier	50
Printer - for computer	6
Television set	20
Tyre - car	10
Tyre - Commercial Vehicle	30
Video recorder	11
Washing Machine	75

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7. Detailed Results

The detailed results table are available in the accompanying Technical Appendix spreadsheet, “landCwaste-Wales-2018-detailed_results.xlsx”.

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