

# Northern Ireland 2008 C&I Report

Comparing 2008 estimates with those from 2005/06

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## 1. EXECUTIVE SUMMARY

- 1.1 Data concerning the types and quantities of wastes managed at licensed waste management facilities in Northern Ireland during 2008 were collected and analysed in 2009 by Capita Symonds on behalf of NIEA to determine how much waste arose from businesses and organisations across Northern Ireland during 2008, and how this waste was managed by waste management facilities.
- 1.2 The data were collected principally from quarterly administrative returns submitted by the licensed facilities to NIEA, although in some cases proxy data, such as data from hazardous consignment notes, was used in place of data from the administrative returns where a licensed facility did not submit the necessary data. In some cases, quarterly data not reported by licensed facilities was imputed on the basis of the data submitted either by the same facility using data submitted in other quarters during 2008, or from data submitted by facilities handling similar wastes.
- 1.3 Data were collected from 183 licensed waste management facilities in Northern Ireland, with 509 quarterly returns submitted by these licensed facilities, implying a 69.5% response rate, inferring that 30.5% of available quarters of administrative data was not submitted and was hence missing from the calculation of total C&I Waste arising in Northern Ireland during 2008. This missing data were imputed based on the data submitted by all other facilities.
- 1.4 The licensed waste management population was broken into groups of directly comparable operators to allow for the missing data from quarterly returns to be imputed on the basis of facilities of a similar nature to derive a more robust estimate of the total tonnage of C&I waste arising and managed in Northern Ireland in 2008. The total tonnage of C&I waste arising in Northern Ireland is reported in Table 1.1 below.

**Table 1.1: Total C&I Waste Arising by Sector in 2008**

Sector	Tonnes
Manufacture of food products	8,942
Manufacture of textiles	3,526
Manufacture of wood	2,073
Manufacture of paper and paper products	3,657
Manufacture of coke and refined petroleum products	10
Manufacture of chemicals and chemical products	22,586
Manufacture of other non-metallic mineral products	1,097
Manufacture of fabricated metal products	4,759
Manufacture of computer, electrical equipment, and motor vehicles	7,489
Manufacture of furniture	2,128

Electricity, gas, steam and air conditioning supply	170,130
Water Supply; sewerage, waste management and remediation activities	717,526
Wholesale and retail trade, restaurants, business services, and public administration and services	404,029
Waste Treatment and Disposal	1,109,442
Total	2,457,394

Source: NIEA

- 1.5 The most significant C&I waste streams managed by licensed waste management facilities in Northern Ireland included common sludges (26.91% of the total), mineral wastes (22% of the total) and metallic wastes (16% of the total).
- 1.6 In terms of the preferred management route for C&I wastes, the majority of C&I waste (approximately 81%) is disposed to land, with only around 16% recovered or recycled.
- 1.7 It is notable in Table 1.1 above that the quantity of C&I waste arising from the waste treatment and disposal sector constituted 45% of the total. This figure may actually contain some double counting within it, as waste arising from an economic sector which first undergoes a preparatory treatment at a licensed waste management facility before moving onto an additional licensed facility, would be counted twice. There are also concerns that a number of licensed facilities may have incorrectly coded the economic sector from which the wastes they manage arose from, which would explain why the quantity of waste arising from the manufacturing sectors is low.
- 1.8 In light of the issues raised by the use of quarterly administrative returns from licensed facilities to estimate the total C&I Waste arising in Northern Ireland, a number of suggestions are made concerning future approaches which could be undertaken to improve the data collected in the future from administrative sources. These suggestions include:
- (i) Drawing on knowledge from industry experts, to characterise industry sectors to identify the key businesses operating in each sector, to obtain a lower limit of the annual quantities and types of waste produced by that industry sector;
  - (ii) Improving the understanding of all licensed facilities in Northern Ireland, allowing for the improvement of the facility stratification, and hence improving the efficiency of imputed data. This can be achieved through site visits to licensed facilities to identify the nature of the business through the types of wastes handled, type of facility, and where it lies in waste management chain (i.e. does it receive waste directly from the C&I sector, or from another waste management facility); and
  - (iii) Analysis of quarterly time series data for licensed sites as basis of data imputation should any quarters be missing.

## 2. INTRODUCTION

- 2.1 This report summarises the quantity and composition of waste produced by commercial and industrial businesses and organisations across Northern Ireland in 2008, and how such waste was managed. Data was compiled for this report by making use of information provided by:
- (i) Administrative site returns submitted by all licensed waste management facilities operational in Northern Ireland during 2008;
  - (ii) Estimates of missing values not included in the administrative site returns made by those same operators of licensed waste sites;
  - (iii) A survey of individuals and organisations managing waste at sites exempt from the Waste Management Licensing Regulations (Northern Ireland) 2003 No. 493; and
  - (iv) Hazardous consignment notes for those sites which did not provide site return data.
- 2.2 The report does not go into any detail regarding the survey methods used or the manipulation of site return data to deal with the issue of missing values. This can be found in the 2009 Exemption Survey Report, and in the Quality Report produced as part of the work necessary for compliance with the EU's Waste Statistics Regulation No. 2150/2002.
- 2.3 This report has primarily been produced to act as a source of more up to date information relating to C&I waste arisings in Northern Ireland than the last source of such data, NIEA's '*Commercial and Industrial Waste Arisings Survey 2004/05*', March 2007.

### 3. C&I WASTE ARISING IN NORTHERN IRELAND IN 2008

- 3.1 Commercial waste is classified as waste arising from wholesalers, catering establishments, shops and offices (in both the public and private sectors) while industrial waste is waste arising from factories and industrial plants. Neither of these categories includes consideration of wastes from the construction, demolition, and excavation sectors<sup>1</sup>.
- 3.2 The 2008 estimate of commercial and industrial waste arising in Northern Ireland, as derived from the sources listed in paragraph 2.1 is presented below in Table 3.1.

**Table 3.1: C&I Waste Arisings in Northern Ireland in 2008 as Derived from Site Returns from Licensed Waste Management Facilities**

NACE Group	Sector (a full description of each industry included in each sector is available in Annex 1)	2008 C&I Estimate		
		Non-Hazardous Waste	Hazardous Waste	Total Waste
CA	Manufacture of food products	8,365	577	8,942
CB+CC	Manufacture of textiles	3,094	432	3,526
CD	Manufacture of wood	1,965	108	2,073
CE	Manufacture of paper and paper products	3,322	335	3,657
CF	Manufacture of coke and refined petroleum products	0	10	10
CG+CH	Manufacture of chemicals and chemical products	18,839	3,746	22,586
CI	Manufacture of other non-metallic mineral products	44	1,053	1,097
CJ	Manufacture of fabricated metal products	832	3,927	4,759
CK+CL+CM	Manufacture of computer, electrical equipment, and motor vehicles	672	6,817	7,489
CN	Manufacture of furniture	1,321	807	2,128
D	Electricity, gas, steam and air conditioning supply	168,784	1,346	170,130

<sup>1</sup> This definition is from Annex C2, 'Waste Strategy 2007', Defra, 2007. Also excluded are wastes arising from agricultural, forestry or fishing activities, and mining and quarrying activities, as well as dredging spoils.

<b>E</b>	Water Supply; sewerage, waste management and remediation activities	717,197	328	717,526
<b>G-Q</b>	Wholesale and retail trade, restaurants, business services, and public administration and services	343,314	60,715	404,029
<b>38</b>	Waste Treatment and Disposal	1,076,302	33,140	1,109,442
<b>Total</b>		2,344,053	113,341	2,457,394

Source: NIEA (2009)

3.3 To enable a comparison to be made between the 2008 data collected primarily from site returns made by licensed waste management facilities, and the C&I waste arisings data collected for the 2004/05 survey, Table 3.2 below presents the industry specific totals derived from the survey data for the year 2004, and also the totals estimated for 2006, based on changes in the total number of people employed in each sector. Note that supplementary data not captured by the original survey, but known to correct from administrative sources, have been added on top of the estimates for various sectors of the economy, notably NACE sectors CK+CL+CM, D and E, accounting for exported scrap metals, and wastes reported by facilities under IPPC licences.

**Table 3.2: C&I Waste Arisings in Northern Ireland in 2004 and 2006 as Derived from Survey of Businesses and Administrative Sources**

<b>NACE Group</b>	<b>Sector (a full description of each industry included in each sector is available in Annex 1)</b>	<b>2004</b>	<b>2006</b>
<b>CA</b>	Manufacture of food products	195,452	189,157
<b>CB+CC</b>	Manufacture of textiles	12,014	8,327
<b>CD</b>	Manufacture of wood	10,491	11,584
<b>CE</b>	Manufacture of paper and paper products	17,911	17,523
<b>CF</b>	Manufacture of coke and refined petroleum products	218	125
<b>CG+CH</b>	Manufacture of chemicals and chemical products	60,872	60,340
<b>CI</b>	Manufacture of other non-metallic mineral products	34,792	35,926
<b>CJ</b>	Manufacture of fabricated metal products	53,167	79,620

<b>CK+CL+CM</b>	Manufacture of computer, electrical equipment, and motor vehicles	428,359	344,983
<b>CN</b>	Manufacture of furniture	20,236	24,781
<b>D</b>	Electricity, gas, steam and air conditioning supply	154,252	206,013
<b>E</b>	Water Supply; sewerage, waste management and remediation activities	35,206	52,595
<b>G-Q</b>	Wholesale and retail trade, restaurants, business services, and public administration and services	854,940	867,108
<b>38</b>	Waste Treatment and Disposal	12,110	31,083
<b>Total</b>		1,890,020	1,929,165

Source: NIEA (2007)

- 3.4 The survey data used to estimate C&I waste arising in each sector in the years 2004 and 2006 was dependent on the quantity of employees in each sector. The 2006 data itself was estimated purely by updating the number of people working in each industry sector, using the ratio estimator of a typical waste per employee per industry sector, estimated from the data collected in the 2004/05 survey. Additional sources of data to the 2004/05 survey were used to compile the total C&I waste arisings in Northern Ireland for the years 2004 and 2006, to account for aspects of wastes arisings which were not captured by the survey. For example, wastes arising at power plants and the sludge incinerator in Northern Ireland were added in on top of the survey estimates to provide a more accurate estimate.
- 3.5 A reason not to use the approach taken in 2006 to estimate the total quantity of C&I waste arising in 2008 is that the assumptions made to allow for a credible estimate probably no longer hold. The critical model assumption relates to accepting that the waste arising per employee in each industry sector has remained constant since 2004, when in all likelihood sufficient time has now passed to arguably believe that production processes and in particular the scale of such processes, has changed sufficiently to alter that ratio in each industry sector. Hence without undertaking another C&I Survey to re-estimate each ratio, a new approach to collecting data to provide an estimate of the total C&I waste arisings was considered necessary.
- 3.6 The quantity of different types of wastes arising from commercial and industrial activities in Northern Ireland during 2008 which constitute over 95% of all waste arisings by tonnage are presented below in Table 3.3.

**Table 3.3: Quantity and Types of Wastes Produced by C&I Businesses in Northern Ireland During 2008**

<b>Eurostat Code</b>	<b>Nature of Waste</b>	<b>Tonnage</b>	<b>Proportion of Total</b>
11. Common sludges (excluding dredging spoils)	Non-hazardous	661,173	26.91%
12. Mineral wastes	Non-hazardous	540,465	21.99%
6. Metallic wastes	Non-hazardous	399,112	16.24%
10.1 Household and similar wastes	Non-hazardous	222,055	9.04%
10.3 Sorting residues	Non-hazardous	103,328	4.20%
10.2 Mixed and undifferentiated materials	Non-hazardous	86,199	3.51%
7.2 Paper and cardboard wastes	Non-hazardous	59,182	2.41%
8. Discarded equipment	Non-hazardous	56,751	2.31%
12. Common sludges (excl. dredging spoils)	Non-hazardous	55,920	2.28%
9. Animal and vegetal wastes	Non-hazardous	37,931	1.54%
12.4 Combustion wastes	Non-hazardous	34,426	1.40%
7.4 Plastic wastes	Non-hazardous	30,455	1.24%
8.1 Discarded vehicles (ELVs)	Hazardous	29,004	1.18%
3.1 Chemical deposits and residues	Hazardous	28,473	1.16%
<b>Sub-total of the proportion of highest volume wastes produced from C&amp;I sector</b>		<b>2,344,473</b>	<b>95.40%</b>

Source: NIEA

## Missing Administrative Quarterly Site Returns

- 3.7 It is important to clarify the extent to which missing data was imputed. This is to demonstrate the proportion of the C&I waste total, which is an artefact of the received data, and hence may or may not be a true representation of non-responding sites.
- 3.8 The information contained in Table 3.4 below provides a summary of the overall response rate to the collection of administrative site return data. The response rate was therefore, when taken over all types of licensed facility, 69.5%.

**Table 3.4: Missing Quarterly Returns by Type of Facility**

Type of Facility	Number of Licensed Facilities	Number of Quarters Responding or for which proxy data was used <sup>2</sup>	Number of Missing Quarters for which Data was Imputed	% of Quarterly Data Imputed
Authorised Treatment Facility	30	78	42	35.0%
Clinical Waste Transfer Station	15	38	22	36.7%
Composting Site	2	7	1	12.5%
Hazardous Transfer Station	7	18	10	35.7%
Hazardous Treatment Facility	15	48	12	20.0%
Landfill (operational)	23	85	7	7.6%
Landfill (closed but receiving capping material)	17	38	30	44.1%
Metal recycling plant	6	18	6	25.0%
Mobile plant	2	5	3	37.5%
MRF	4	5	11	68.8%
Non-hazardous transfer station	5	12	8	40.0%
Non-hazardous treatment facility	13	45	7	13.5%
Unallocated sites	1	4	0	0.0%
Unallocated Transfer Stations	34	100	36	26.5%

<sup>2</sup> If an alternative source, such as hazardous consignment note data, were used as a proxy for a non-responding quarter at any particular facility, this has been included as a responding quarter. The purpose of the table is to highlight how many quarters had data induced from the received data.

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Waste Water Treatment Works	9	8	28	77.8%
<b>Total</b>	<b>183</b>	<b>732</b>	<b>223</b>	<b>30.5%</b>

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Source: NIEA (2009)

- 3.9 Thus 30.5% of all quarterly data to be submitted by licensed facilities in Northern Ireland, or 223 quarters out of 732, had to have data induced on the basis of the quarterly data submitted by responding facilities.

#### 4. THE PATTERN OF MANAGEMENT OF C&I WASTE

4.1 The patterns of management of C&I waste over the period between 2004 and 2008 is presented below in Table 4.1. This table should be interpreted with caution, due to the difference in methodology used to collect the data in the years 2004 and 2008.

**Table 4.1: Management of C&I Waste in Northern Ireland from 2004 to 2008**

Management	2004		2006		2008	
	Non-Haz	Haz	Non-Haz	Haz	Non-Haz	Haz
Energy recovery	0	0	0	0	2,871	0
Incineration	34,347	3,278	31,442	3,277	26,071	11
Disposal to land	762,453	4,066	818,718	4,424	765,829	858
Disposal at sea	0	0	0	0	0	0
Recovery	386,971	13,037	438,834	19,074	180,235	27,696
<b>Total</b>	<b>1,183,771</b>	<b>20,381</b>	<b>1,288,994</b>	<b>26,775</b>	<b>975,006</b>	<b>28,565</b>

Source: NIEA (2009)

4.2 It is evident from Table 4.1 that the only significant divergence in outcome between the data collected under the C&I Survey in 2004/05 and the data collected directly from administrative returns made by licensed waste facilities is that the level of recovery of non-hazardous C&I waste has declined in 2008. The quantity of C&I waste disposed at land as measured by using administrative returns is commensurate with the data collected from the survey.

4.3 The difference between the quantity of C&I waste managed and the quantity of C&I waste arising in Northern Ireland in 2008 is due to two principal factors. The first is due to the extent of double counting of waste as evident by the quantity of C&I waste reported as arising from the waste management sector of the economy. The second relates to the quantity of waste exported from Northern Ireland for final recovery elsewhere, either in the UK or to the rest of the world.

## 5. QUALITY OF DATA AND DISCUSSION OF RESULTS

- 5.1 This section of the report provides an evaluation of the quality of 2008 data collected from administrative quarterly site returns.
- 5.2 The collection of the administrative site return data whilst not subject to sampling errors, was subject to a number of non-sampling errors, including:
- (i) Coverage errors;
  - (ii) Measurement errors;
  - (iii) Processing errors;
  - (iv) Non-response errors; and
  - (v) Model assumption errors.
- 5.3 A brief discussion of each error and how it influenced the quality of the final data collected follows in the following paragraphs.
- 5.4 Coverage errors related to whether facilities were able to be contacted by NIEA to provide quarterly site returns. Any missing quarterly site returns from such facilities required the missing data to be imputed on the basis of data submitted by facilities of a similar nature. This error arose in only a few instances.
- 5.5 Measurement errors related to the collection of unintended data from licensed facilities. It is usually a serious issue with surveys, and was a critical factor for some industry sectors in the 2004/5 C&I Survey in Northern Ireland. For the collection of site return data from administrative sources, the key error to arise was the use of non-standard units to measure quantities of waste, although this was easily converted to tonnages using standard conversion factors. Errors relating to processing errors, such as incorrect completion of site return forms or input into computerised database were kept to a minimum, although errors relating to the former issue could have included the incorrect recording of EWC Code, SIC Code, and R or D code by responding facilities. The extent to this error is unknown, although it is clear that if it were wide scale, then the distribution of wastes arising across particular business sectors would be very unreliable.
- 5.6 Non-response and model assumption errors are arguably the biggest source of non-sampling error in the estimated C&I waste arising in Northern Ireland in 2008. These errors related to the approach taken to imputing missing data from site waste returns, and hence would partly take account of any weaknesses imbedded in the stratification of licensed facilities and hence whether those which responded were representative of those which did not. A further possible model assumption error related to assuming that quarterly data received from one facility was representative of any missing quarters from that same facility. It was assumed that all non-responding licensed sites were representative of responding sites of a similar nature, as there was no basis for believing otherwise. In future reporting periods, new data collected from previously non-responding sites could be used as the basis for inferring whether the aforementioned assumption was valid, or biased the results.
- 5.7 The model assumption errors arising from the non-respondent facilities largely arises because of the limited availability of time series data concerning the quantities and types of wastes managed at each facility, although in future data submissions, when a larger body of quarterly returns from licensed facilities has been collected over a number of quarters, it is expected that all model assumption and the non-response errors associated with them would begin to

decrease. This is because, as the quantity of received quarterly data increases through time, the stratification of facilities can be improved, to reduce any heterogeneity which may exist within and between particular strata (i.e. by further stratifying existing facility lists by size of facility and types of wastes managed or sectors of the economy serviced). This could be facilitated by site visits to identify the nature of the business, types of wastes handled, scale, type of facility, and where it lies in waste management chain (i.e. does it receive fresh wastes from C&I sectors or does it receive waste from other waste facilities).

- 5.8 It is evident that there are significant differences between the distributions of C&I waste arising between business sectors as estimated by the 2004/05 C&I Survey and the data collected in 2008 through the administrative sources. Notably, there is a significant reduction in the quantity of waste arising from the manufacturing sectors of the economy in 2008 relative to 2004, and a significant increase in waste recorded as arising from the waste industry sector compared to the minimal quantity of waste recorded as arising from this sector in 2004.
- 5.9 An explanation for this significant increase in the quantity of waste estimated as arising from the waste management industry in 2008 could be that waste facilities, and in particular transfer stations, are unable to distinguish wastes collected simultaneously from multiple business sectors to particular sources and hence either incorrectly code the waste, do not code it all, or code it in a catch all SIC code 38 (representing the waste industry). Additionally, sites receiving wastes from transfer stations simply code the waste as arising from SIC Code 38, and hence do not attempt to identify the original source of the waste.
- 5.10 It is not possible to report the quantity of C&I waste arising by council area or by Waste Management Group Area due to data relating to the geographic source of waste not being available for the 2008 data. Such data whilst asked of licensed facilities was often not completed. There is no statutory requirement for licensed facilities to provide such data, and nor can it be expected of many facilities as they are not necessarily aware of the geographical source of data. Hence no comparison can be made between the 2008 data and 2004 data relating to geographical arisings of C&I waste.
- 5.11 In summary, the total C&I waste arisings estimated in Northern Ireland in 2004 from data collected from the survey of businesses and the 2008 data derived from administrative site returns are both subject to uncertainty, and both approaches highlight possible issues which should be accounted for when considering the robustness of the estimated totals. The two critical issues arising included:
- (i) Uncharacteristic returns in particular strata skewing distributions and overly influencing the grossed up total of the industry sector totals; and
  - (ii) The quantities of waste imputed to account for missing site return data might not be a reflection of reality due to heterogeneity existing within strata.

## 6. RECOMMENDED APPROACHES TO FUTURE DATA COLLECTION

- 6.1 It is recommended that a number of issues be considered for future data collection, including:
- (i) Drawing on knowledge from industry experts, to characterise industry sectors to identify the key businesses operating in each sector, to obtain a lower limit of the annual quantities and types of waste produced by that industry sector;
  - (ii) Improving the understanding of all licensed facilities in Northern Ireland, allowing for the improvement of the facility stratification, and hence improving the efficiency of imputed data. This can be achieved through site visits to licensed facilities to identify the nature of the business through the types of wastes handled, type of facility and where it lies in waste management chain (i.e. does it receive waste directly from the C&I sector, or from another waste management facility); and
  - (iii) Analysis of quarterly time series data for licensed sites as basis of data imputation should any quarters be missing.
- 6.2 Small scale investigations into particular C&I sectors to identify waste arisings would be beneficial. For example, targeted discussions with large scale producers in particular sectors would identify types of wastes produced, and their destination in the waste chain. Such an approach could be facilitated by drawing on knowledge of industry experts, who could characterise particular industry sectors, such as for example the food production and processing industry, to enable a better understanding of the general structure of the sector, in terms of how the industry is characterised between large and small scale businesses.
- 6.3 This approach would therefore allow for the identification of the key businesses which dominate particular industry sectors, and which as a consequence generate the largest volumes of waste. By understanding the structure of particular industries, the types of wastes produced, and the scale they are likely to be produced in, a better feel for the likely total waste arising from that sector can be made. If this knowledge is developed in conjunction with knowledge of where the waste from those businesses dominating the industry are sent, it would enable a comparison to be made against the data collected from the administrative site returns. Thus an evaluation of the quality of data collected from administrative returns can be made, highlighting any genuine weaknesses that exist in this data collection approach.
- 6.4 Developing a better understanding of all the licensed facilities in Northern Ireland would enable better estimates to be made in terms of allocating wastes recorded as being managed at such sites but for which no information relating to the source of the waste is available. In addition, should missing data again be imputed on the basis of data supplied by other licensed facilities of a similar nature, then an understanding of the scale of operation at each site and a firm categorisation of each facility into strata would significantly reduce the variance of any estimator. In addition, by developing a better understanding of the linkages between waste management facilities, in terms of which facilities pass waste onto others, will enable an evaluation to be made of the site waste return data collected in terms of the validity of the quantity of waste coded under SIC Code 38, which accounted for 45% of the total C&I waste arising in Northern Ireland in 2008.
- 6.5 The continued collection of quarterly administrative site return data by NIEA would constitute a growing set of time series data for each facility, and for each facility strata. This will in itself act as a valuable source of information with which to begin to improve the stratification of facilities based on types of wastes managed and give clues to the likely scale of an operation relative to facilities managing similar waste. In addition, the time series data will provide more information to allow for a more robust approach to imputing missing data should a facility in the future for whatever reason fail to provide a quarterly return.