



Environment,
Climate Change
& Water

Guidelines for Conducting Household Kerbside Residual Waste, Recycling and Garden Organics Audits in NSW Local Government Areas –2008

Addendum 2010

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Table of contents

Summary	1
1. Recommended sample sizes	2
2. Recommended sampling techniques	3
3. Classification of waste types	3
4. Accounting for seasonal variability	3
5. Choosing sample populations	4
6. Use of stratified sampling – auditing SUDs and MUDs	4
7. Managing unusual and ‘non-compliant’ addresses	4
8. Auditing multi unit dwellings (MUDs)	5
9. Managing privacy and information security concerns.....	7
10. Managing presentation and non presentation of bins at the kerbside	8
11. Contamination and potentially recyclable material	8
12. Detecting sample bias	9
13. Sampling Protocols	9
14. Occupation Health and Safety.....	9
Appendix 1: Materials data sheet.....	11

Summary

DECCW is currently updating the *Guidelines for Conducting Household Kerbside Residual Waste, Recycling and Garden Organics Audits in NSW Local Government Areas, 2008*. A revised version of the Guidelines will be available in early 2011. This addendum to the 2008 Guidelines has been prepared as an interim Guide, encompassing the key modifications to the current Guidelines.

The Guidelines are for weight based physical audits and aim to provide councils and their auditors with cost-effective, accurate and repeatable audit methodologies that:

- collect good quality data using standardised and repeatable techniques to allow comparison and monitoring of performance
- allow statistical assessment of the quality and accuracy of collected data
- allow demographic differences in waste generation and management to be accounted for
- allow assessment of differences in waste generation and management within and between sampled populations.

Modifications and clarifications to the 2008 Guidelines are summarised under the following headings.

1. Recommended sample sizes

Statistical analysis of audit data submitted by NSW councils has led to a revision of default samples sizes. These new sample sizes are shown in Table 1.

The recommended sample sizes should provide acceptable levels of accuracy for common material categories including:

- food organics
- paper
- plastics
- metals
- garden organics
- glass.

Councils that have previously conducted audits and submitted audit data can seek guidance on a more specific recommended sample size by contacting DECCW.

Please note: Where audits of more than one waste stream are conducted ensure that all bins, for example residual waste and recycling, are collected from the same household and assessed as part of an audit. This allows for a holistic analysis of generation and composition on a household level for example determination of participation rates and recovery rates within the community, and to determine the effectiveness of recycling programs targeting households.

Table 1: Recommended default sample sizes for household waste audits

Option	Stream	Timing	Method Of collection	Sample size (minimum number of households)
1 (preferred)	Combined Domestic Residual Waste and Recycling (and/or Garden Organics Audit)	Undertaken over 1-2 week period to capture a fortnightly collection cycle for audited households	Random selection of streets and households	220
2	Domestic Residual waste (only)	Undertaken over 1-2 week period	Random selection of streets and households.	220
3	Recycling (only)	Undertaken over 1-2 week period	Random selection of streets and households	260
4	Garden Organics (only)	Undertaken over 1-2 week period	Random selection of streets and households	220

2. Recommended sampling techniques

The updated Guidelines will continue to recommend ‘household-by-household’ auditing (also referred to as ‘bin-by-bin’ in the previous Guidelines). This involves:

- > Collection of the contents of all of the residual waste and/or dry recyclables and/or organics presented by households included in the sample
- > separate bagging and labelling of bin contents so that data about differences in household generation and management of wastes can be collected.

This method is preferred because:

- > It provides better quality data for the sample sizes
- > Allows assessment of the accuracy of data, and enables exclusion of ‘outlier’ samples that are found to be biasing the sample
- > Allows observations about different types of waste generation and resource recovery behaviours across the community. It may, for example, allow councils to identify if, say, most contamination is caused by relatively few households, and determine what proportions of their communities are recycling well, poorly or not at all.

Although household-by-household is clearly preferred for all audits, councils may decide to use aggregated sampling for some audits. The Updated Guidelines will recommend that where this occurs:

- > At least one in four consecutive audits uses household-by-household auditing.
- > Aggregated sampling is conducted using at least five and preferably ten separate sub-samples (so, for example, if 220 households are to be audited, sub-samples of 22 or 44 households are taken separately). This will allow some statistical analysis of variability and accuracy.

3. Classification of waste types

A modified Materials Data Sheet has been developed. The Material Data Sheet has been simplified, with removal of glass cullet colour classifications and clarification of some categories. Depending on the purpose of the audit, categories may be contracted or expanded from the Materials Data Sheet. For example, all glass might be expanded.

Councils and audit contractors should consult their specific recycling receipt and processing contractors to find out what is not recycled. For example, food containers still holding food and drink, soiled paper packaging and smaller pieces of broken glass may be typically rejected. Similarly, bagged items may be routinely rejected even if they are source separated recyclables that householders have placed in a bag. The audit methodology should categorise and measure such items as classes of 'un-recycled recyclables'. All bags in the residual waste and recycling streams should be opened and the contents audited.

4. Accounting for seasonal variability

The current Guide provides good direction on avoiding periods and events that may skew results. This advice still applies. In addition, it is recommended that annual data from weekly waste, recyclables and organics collection services is used to identify periods where materials streams can be expected to be close to the annual average (see figure 1). It is also recommended that the annual average per household waste and recyclables as well as the week-to-week collections data taken during the period of the audit are compared to assess how closely the audited population matched the wider population.

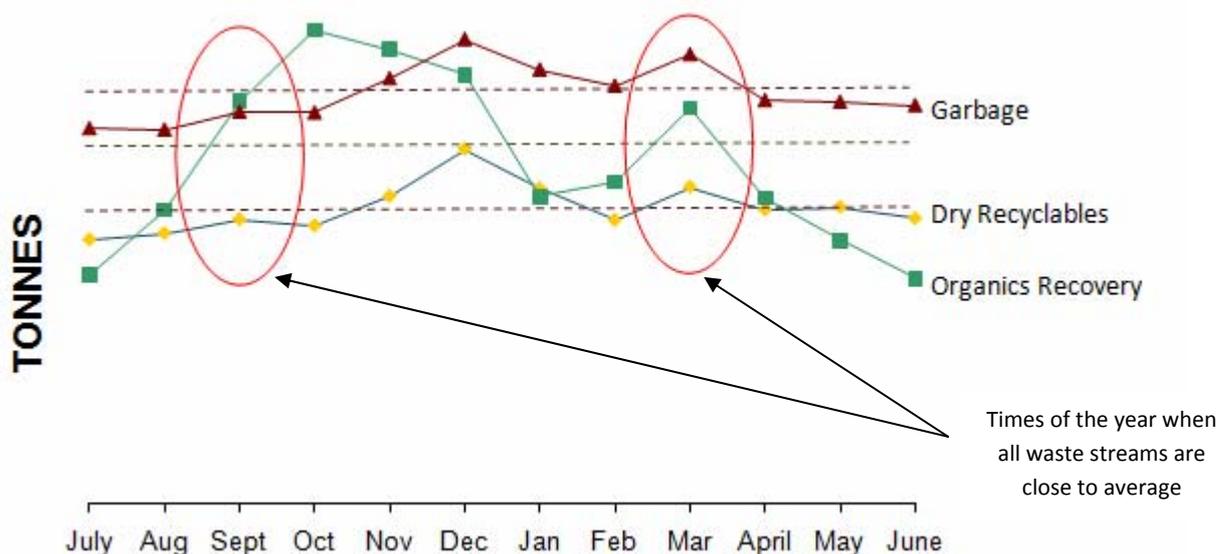


Figure 1: An example of using week-by-week waste and recyclables collection data to identify the times of the year when all materials streams are close to average. The dotted lines represent the annual average for each of the materials streams.

5. Choosing sample populations

The updated Guidelines will continue to recommend random sample selection. It is recommended that representative samples are selected from across the municipality using a randomised method of selection of streets to be sampled. This involves allocating numbers to all streets within the local government area (LGA) and using random number sets (generated using MS Excel or similar) to select streets. This method ensures that the sample is taken from across the LGA. Where stratified sampling is used, the LGA can be 'mapped' to show differences and/or street types classified to belonging to particular 'strata', and the appropriate number of samples can then be drawn from these areas/strata.

Where there are significant number (>10 per cent) of residences are in Multi-Unit Dwellings (MUDs), stratified sampling should be used. Stratified sampling may also be used to account for other differences across an LGA.

It is recommended that samples of 10-20 households should be sampled from each selected area depending on the number of households on the streets selected. Every 2nd to 5th household should be selected for sampling. In streets with fewer than twenty households, every 2nd household should be sampled. However, where it is practical, a greater spread of households should be sampled in larger streets. This ensures that a sample is drawn from a bigger area and improves the statistical 'power' of the sampling.

It is recommended that matched pair audits should be taken during the weeks when recycling and residual waste collection is to occur.

The 'first' household in a street to be sampled should be selected randomly at the site (for example, through the throwing of dice, with the number corresponding to the first street number to be sampled). In most audits, no record should be made of the first house number's address. This is to protect privacy by making it virtually impossible to trace samples back to individual addresses.

The sample tags used to label bags should not identify the address.

6. Use of stratified sampling – auditing SUDs and MUDs

The updated Guidelines will continue to recommend stratified sampling however more detail will be provided. Stratified sampling is where representative samples from sub-populations are taken to represent differences in housing, demography and/or geography. This will most typically be applied to sampling of communities that have a significant proportion of Multi-Unit Dwellings (MUDs), or areas of higher and lower density housing. It is recommended that stratified sampling should be applied to areas where more than 10 per cent of residences are in MUDs.

7. Managing unusual and 'non-compliant' addresses

The updated Guidelines will contain more information on managing unusual and 'non-compliant' addresses. Audit teams will periodically encounter addresses that are 'unusual', such as sites where there is building or renovations, a small commercial or mixed use building with a council kerbside service, or clearly unoccupied premises. Where bins are presented they should be collected, with a note made of the unusual nature of the premises and, where the preferred household-by-household method is used, the label number for the premises. This information can be used to determine whether the sample is 'typical' of the

wider population and whether it should be excluded from the analysis if it is found to be biasing the sample.

8. Auditing multi unit dwellings (MUDs)

The updated Guidelines will contain more information on auditing Multi Unit Dwellings. MUDs present a challenge for audits. A MUD is classified as a Unit, Flat, Apartment, Townhouse, Villa, Duplex or Mixed Use Building (e.g. a building containing residential and commercial space). MUDs can cover a wide range of demographic groups, from low income households to luxury units, from students to pensioners. Waste streams and recycling services may vary considerably for example individual bins, shared bins and bulk bins. The recommended approach for dealing with these is as follows:

- > High rise MUDs (more than 3 floor walk-ups) and MUDs where waste is not collected by councils should be excluded from the sample. Where there are a large number of high rise MUDs, councils may decide to conduct a separate audit of these premises, which will typically require different collection and auditing techniques compared to general kerbside waste and recycling audits.
- > Where more than 10 per cent of residences in an LGA are in MUDs, stratified sampling should be adopted.
- > Within the stratified MUD sample effort should be made to collect the MUD sample from at least 10 MUD properties/sites/premises, with sample selection to include a representative range of MUD demographic situations. Sub-samples should be collected to allow analysis of statistical variability within the sample and between different demographic situations. If variability is significant, additional sampling of MUDs may be required in municipalities with high numbers of MUDs.
- > MUDs encountered during sampling that are not 'typical' (for example, a new building with few occupants) should not be audited, with the auditor moving on to the next MUD on their list. If there are significant numbers of motels with a council-provided collection service in an area, then these could be audited as a separate strata, as the waste stream is likely to differ significantly from household waste.
- > When audit teams conducting household-by-household audits encounter a MUD during their general audit collection program:

For MUDs with non shared bins

- If each unit has separate waste and recycling bins that are not shared and not kept in a common bin corral, then they should be collected as part of the wider sample. Details of the number of units in the MUD should be noted by counting the number of letter boxes.
- If the MUD has fewer than five units, then all waste and recycling bins should be collected.
- If the MUD has more than five units, then a random sample of five residual waste and recycling bins should be selected, with matching where possible when a residual waste and recycling audit is being conducted (i.e. if unit numbers are marked on bins, the same units' bins should be collected). The bins should be selected randomly without looking or feeling how full bins are

before they are sampled (i.e. there should not be sample bias in favour of smaller or less malodorous bins). The total number of units and number and types of bin set out should be noted and used in data analysis.

- When a MUD premises is audited it counts as one sample in terms of the sample size no matter how many bins or units are audited within the MUD property/site/premises.

For MUDs with shared bins or shared bin storage areas

- > If units do not have separate bins and/or bins are stored in a common corral, then the MUD should not be audited as part of the household-by-household audit. This should be noted and the audit team move on to the next premises to be audited, and continue until the full sample number is collected.
- > In LGAs with a significant number of larger MUDs with shared bins, the stratified sample of MUD should involve a separate aggregated collection of waste from MUDs. This should be conducted after the general audit, where any units sampled as part of the general audits can be counted as part of the stratified sample. (For example, if 30 per cent of residences in an LGA are in MUDs, and a total of 220 households are to be audited, then a total of 66 MUD units need to be sampled as part of the stratified sample. If the general audit samples 23 MUD premises with non shared bins, then another 43 premises with shared bins need to be sampled via an aggregated sample method to make up the full sample). A representative list of MUDs should be selected using random number sets, with all bins of the waste streams being audited being collected each MUD until the number of premises collected from reaches the required sample number. The number of units at each MUD should be recorded. Where possible, apparent occupancy rates should be noted (sometimes this can be noted by looking at accumulated junk mail in letter boxes).
- > Because MUD waste is typically aggregated at kerbside, aggregated sampling rather than household-by-household may be appropriate for auditing MUDs especially larger MUDs with shared bins. When aggregate sampling is used at least 10 MUD sites/premises/properties should be collected, with each being a separate subsample so that variability between MUDs can be assessed. Also where there are five or fewer units at an MUD, all bins should be sampled. Or where there are more than five units in an MUD, five rubbish bins and five recycling bins (for a paired audit) should be selected at random. Notes should be made of how full the selected bins are and how full all presented bins area. This data will allow some assessment of how closely the sample matched the total amount of waste and recyclables presented at kerbside.

9. Managing privacy and information security concerns

The updated Guidelines will contain more information on managing privacy and information security concerns. Some people are sensitive about having their waste sorted. The sample should be designed to make it virtually impossible to trace the bagged waste back to individual households. There will remain risks associated with personal information such as addressed letters, bank statements and receipts. These risks are the same for both household-by-household and aggregated audits.

Household-by-household audits make it more obvious that an audit is being conducted than aggregated audits. This can lead to audit teams being confronted by people who do not want their bin contents looked at.

Privacy issues associated with household-by-household audits can be managed by:

- > Selecting households randomly and not recording addresses so the contents cannot be traced back to a particular address (i.e. all bins presented by an individual household are tagged with the same random number, so the variability in 'total' waste presented can be measured, as well as variability in recovery rates, etc.). Matched pair waste and recycling audits should be collected during the weeks where recycling services are provided, so there is typically no need to return to households.
- > Use of 'random number generator' in the field, so that the first house number is selected randomly and without record, with each second or fifth household sampled from this starting point.
- > Having an 'Opt out' system where council informs their communities in writing of the intent to do audits and provides them with the option of not being audited. To avoid serious sample bias, this should be managed to avoid the risk of people changing behaviour because of the audits. It is recommended that residents are given several months notice before the audits are conducted and not specify the period of the audit. Publicity and information about the audits should make it clear that the contents of bins will not be able to be traced back to particular addresses. The addresses of those opting out should be considered during audit design when areas and streets are being selected. If a household that has opted out falls within the sample area, then the audit teams should be briefed to ensure that the house is not sampled.
- > Ensuring that any audit company which may be engaged to carry out an audit in an LGA provides a detailed plan for maintaining and safeguarding confidentiality in their scope of works.
- > Requiring audit managers to conduct criminal record checks of staff engaged to carry out audits.
- > Supervision of auditing teams to ensure that no confidential materials are used or removed from the audit site.
- > Having sampling protocols stating that if a householder challenges the audit team during collection, then their waste is returned to them and the next premises is audited instead.
- > Giving those doing the audits a 'letter of authorisation' from councils and contact details if they are challenged.
- > Protocols for disposal (not recycling) of all paper/materials sorted from the garbage stream.
- > Ensuring audit staff are made aware of relevant policies and procedures associated with safeguarding confidentiality and appropriate training is provided as necessary.

10. Managing presentation and non presentation of bins at the kerbside

The updated Guidelines will contain more information on managing presentation and non presentation of bins at the kerbside.

Not all households present all bins for collection every week. Information about participation and non-presentation is useful for estimating average per household waste and recycling within sampled populations, and also for measuring differences in waste generation and recycling management behaviours.

Audit teams need to record information about rates of non-presentation of bins as well as collect 'substitutes' or 'replacements' so that the full sample number of bins is collected. It is recommended that in matched pair/combined audits, waste and recyclables should only be collected from households that have all bins presented at the kerb. In situations where households have more than one bin presented of the waste stream being audited (e.g. an additional waste bin), the content of all of the bins presented for the waste stream being audited should be collected.

The procedure for dealing with non presenters is as follows:

1. Record households who do not present a bin for each of the waste streams being audited as 'non presenters' on the recording sheets.
2. Auditors should note this as a 'non-presenter', provide appropriate comments on this household (eg. "no residual waste bin presented") and move to a substitute household that has all bins presented, bagging and analysing the contents of bins.
3. Record bin data from replacement or substitute households, with a note clearly identifying the household as a 'replacement' or 'substitute' household for the non presenter. This may be from a neighbouring property or the next randomly selected property as determined by the method described in 5 above.
4. Data about non-presenters should be used to estimate rates of non-presentation across the LGA.

11. Contamination and potentially recyclable material

In the updated Guidelines the meaning of contamination will be explained. Contamination is to be considered on a Council-by-Council basis. DECCW recognizes that what is acceptable in some Council kerbside collections is not in others. Contamination should reflect the situation in the Council area being audited.

Recycling receival and processing contractors and personnel should be asked to identify what is recycled through their facilities. In particular, details are needed of when 'recyclable' items are rejected due to contamination. For example: food and drink containers may be rejected if they contain food or drink; glass breakages below a certain size are often not recovered; some plastic items might be rejected if they have different polymer lids still on them, etc. Another common issue is the management of 'bagged' materials at recycling centres. Some households will put source separated recyclables in bags, but many recycling centres routinely reject bagged materials. Where this is the case, audit teams should open and sort the bags, and identify bagged recyclable materials as 'un-recycled recyclables'. Information on potentially recyclable material in both waste and recycling streams should be captured in the raw data sheets provided.

12. Detecting sample bias

Auditing involves sampling a small sub-population and assuming that the results approximate the situation in the wider community. The preferred Guideline methodology is designed so that it should provide a representative sample, but it is possible that an 'improbable' sample of atypical samples will bias the sample results. The household-by-household method allows statistical analysis of the variability and accuracy of the sample, and helps to identify the incidence of atypical loads in a sample.

The veracity of audit results should be interrogated by:

- > Statistical analysis of data.
- > Comparing the results of sub-samples within the sample population.
- > Reviewing audit notes where observations of atypical premises or samples have been made. These atypical samples occur within the wider community, but if a high proportion of them occur within an audit sample they may skew results.
- > Comparing results with annual per household rates of waste, recyclables and organics generation.
- > Comparing results with collection contractors' records for waste, recyclables and organics generation during the same period as when the audit was conducted. If the audit results are significantly higher or lower than the wider population during the audit period, then samples should be further investigated for bias. Abnormally high or low results should be noted. Sometimes results may be excluded from analysis to make the audit results better 'fit' the known figures from the wider population. Both sets of data (i.e. with and excluding the atypical samples) should be reported.

13. Sampling Protocols

The updated Guidelines will suggest that written sampling protocols should be developed to ensure consistent methodologies by audit teams. This is particularly important where audits are being conducted over a period of one or two years and audit team personnel may change.

These should contain clear direction about:

- > How to determine the first house to audit on a street (e.g. roll of a dice, reference to random number sets, etc).
- > The number of households that should be counted from the first house for the next and then subsequent samples. What to do if no bins are presented by a household that is counted 'in' the sample.
- > What to do if a site is clearly atypical, for example a MUD, a vacant block or a commercial building. Materials classification, including how to deal with 'problem' items such as a recyclable container half full of liquid, or other food packaging still containing foodstuff

14. Occupational health and safety

The updated Guidelines will contain more information on Occupation Health and Safety.

The latest advice on Occupational Health and Safety can be found by visiting NSW WorkCover's website www.workcover.nsw.gov.au or phoning 13 10 50.

Bin auditing has high levels of OH&S risk. During collection and physical auditing there are issues associated with lifting, movement in traffic, and handling of waste that may contain 'sharps' and infectious materials.

DECCW recommends that any party commissioning, outsourcing or authorising a waste audit should ensure that the auditor used has: a site-specific OH&S plan; adequately trained and equipped auditing teams; and appropriate levels of OH&S, Public Liability and Professional Indemnity insurance.

NSW WorkCover has produced a number of important publications containing information which should be considered prior to the commencement of an audit. These include:

- > NSW WorkCover 2010. *Collection of Waste: Code of Practice*
- > NSW WorkCover 2010. *!Hazpak Making Your Workplace Safer: A Practical Guide to Basic Risk Management*

DECCW recommends that OHS plans are developed in advance of all audits with appropriate personnel protective equipment supplied to staff and risk assessments carried out. All staff engaged during an audit should be made aware of the OHS plan and if necessary complete appropriate and relevant training prior to the commencement of an audit.

Appendix 1: Materials data sheet

Domestic kerbside audits
All households – single bin audit sheet

LGA	
ABS code	
Household reference number	
Residual waste (Y/N)	
Dry recycling (Y/N)	
Green waste (Y/N)	
No. collections per week	
Collection date	
Collection time (range)	
Normal collection date by truck	
Weather conditions (on pick up day)	
Dwelling type (SUD/MUD)	
Household bin presented (Y/N)	
Was this a substitute household (Y/N)	
Bin type	
Bin size	
No. of households serviced by this Bin	
% Full by volume (Bin)	
Sorted by	

NOTE: A value must be entered for all materials (ie. enter Zero if no material found)

		DESCRIPTION	Wt (kgs)	No. Items	Overall comments on bin
		Net weight of bin contents	0.000		
		Net weight of individually bagged items in sample	0.000		
MATERIAL TYPE	AWD CODE	DESCRIPTION	Wt (kgs)	No. items	Comments
PAPER	A01	Newspaper	0.000		
	A02	Magazines/brochures	0.000		
	A03	Miscellaneous packaging	0.000		
	A04	Corrugated cardboard	0.000		
	A05	Cardboard / package board	0.000		
	A06	Liquid paper containers	0.000		
	A07	Disposable paper product	0.000		
	A08	Print/ writing/ office paper	0.000		
	A09	Composite (mainly paper)	0.000		

	A90	Nappies disposable	0.000		
	A92	Contaminated soiled paper	0.000		
ORGANICS	B01	Food/kitchen	0.000		
	B02	Garden/vegetation	0.000		
	B03	Other putrescible	0.000		
	C01	Wood/timber	0.000		
	C02	Textile/rags	0.000		
	C03	Leather	0.000		
	C04	Rubber	0.000		
	C05	Oils	0.000		
GLASS	D012	Glass beverage containers	0.000		
	D012	Glass non beverage containers / Other packaging glass	0.000		
	D02	Miscellaneous/other glass	0.000		
	D050	Mixed glass / fines	0.000		
PLASTIC	E01	PET beverage containers	0.000		
		PET packaging (excluding beverage containers)	0.000		
		PET other non beverage / non packaging	0.000		
	E02	HDPE beverage containers	0.000		
		HDPE packaging (excluding beverage containers)	0.000		
		HDPE other non beverage / non packaging	0.000		
	E03	PVC beverage containers	0.000		
		PVC packaging (excluding beverage containers)	0.000		
		PVC other non beverage / non packaging	0.000		
	E04	LDPE packaging	0.000		
		LDPE non-packaging	0.000		
	E05	PP packaging	0.000		
		PP non-packaging	0.000		
	E06	PS & EPS packaging	0.000		
PS & EPS non-packaging		0.000			
E07	Other plastics	0.000			
E08	Composite (mostly plastic)	0.000			
FERROUS	F01	Steel beverage containers	0.000		
		Steel packaging (excluding beverage containers)	0.000		
	F02	Steel other non-packaging	0.000		
	F03	Composite (mostly ferrous)	0.000		
NON FERROUS	G01	Aluminium beverage containers	0.000		
		Aluminium packaging (excluding beverage containers)	0.000		
		Aluminium non-packaging	0.000		
	G02	Non-ferrous - other	0.000		
	G03	Composite (mostly non-ferrous)	0.000		
HAZARDOUS	H01	Paint	0.000		
	H02	Fluorescent tubes *	0.000		
	H03	Dry cell batteries (non rechargeable) *	0.000		
	H03	Dry cell batteries (rechargeable) *	0.000		
	H04	Vehicle batteries *	0.000		
	H05	Household chemicals	0.000		
	H061	Asbestos	0.000		
	H07	Clinical pathogenic infectious	0.000		

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	H08	Gas bottles *	0.000		
	H00	Hazardous other	0.000		
BUILDING WASTE	I50	Building materials and fittings (nec)	0.000		
EARTH BASED	I0	Ceramics, dust, dirt, rock, inert, ash	0.000		
E-WASTE		Computer equipment *	0.000		
		TVs *	0.000		
		Mobile phones *	0.000		
		Electrical items and peripherals*	0.000		
	Y571	Toner cartridges *	0.000		
MISCELLANEOUS	XX00	Other (specify)	0.000		
SUMMARY DATA		Net Weight of bin contents	0.000		
		% Difference to net bin weight	#DIV/0!		

