

Department of Environment and Climate Change NSW
NSW Litter Report
2006



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Published by

Department of Environment and Climate Change NSW
59–61 Goulburn Street
PO Box A290
Sydney South 1232
Ph: (02) 9995 5000 (switchboard)
Ph: 131 555 (environment information and publications requests)
Ph: 1300 361 967 (national parks information and publications requests)
Fax: (02) 9995 5999
TTY: (02) 9211 4723
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

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Executive Summary

This is the second of the series of biennial reports on littering in NSW. The first litter survey was undertaken in 2004, sampling 60 sites over NSW to establish a baseline of information on the amount and types of litter.

The 2006 survey was undertaken over the same 60 sites plus an additional 40 new sites across NSW. Litter was coded into one of seven categories and was analysed by count, as well as weight and volume. Site type and region were also analysed.

The 2006 litter survey shows:

- The total number of litter items found on sites increased between the 2004 and 2006 surveys by 6%.
- By site the most predominant item was cigarette items (100 sites) followed by plastic (71 sites) paper (70 sites), confectionery (66 sites), Beverage (61), organics (55) and other (45).
- A relatively small number of categories of litter made up the majority of litter items counted. In 2006 Cigarettes comprised 59% of all litter items. The next most common item in 2006 was Beverage comprising 13% of all litter items.
- The number of litter items counted in the Sydney Metropolitan Area (SMA) increased by 8% since 2004 and by 47% in the Extended Sydney Region.¹ However the amount of litter in regional and rural NSW decreased by 41%, mostly due to a drop in Cigarette items.
- The amount of litter collected by site type varied widely. The most prevalent litter category at all sites was Cigarette, with the exception of the site type Natural Waterfront, where Beverage was the most prevalent.
- An average of 47.5 litter items per site was counted for New South Wales. Both SMA and ERA regions had similar results at 51 counts per site. Regional/Rural NSW had 16 counts per site.

Changes in Types and Amount of Litter Since 2004

A direct comparison of the litter counts from the 2004 survey to the 2006 survey was possible following a re-analysis of the 2004 results. Over the 100 sites surveyed there was a small increase (290 or 6.5%) in the number of items littered between 2004 and 2006. The average number of items counted per site increased from 44.6 to 47.5 between 2004 and 2006.

Cigarette butts and related items have remained the most significant litter item in NSW in both 2004 and 2006 comprising 55.4% of all littered items in 2004 and 59.5% in 2006. Beverage items remained the second highest littered item.

Caution is needed when comparing site types due to the small sample size in some types, however, for both surveys the Cigarette items were the most littered items for all site types except Natural Waterfront in 2006 and Natural Waterfront and Beaches in 2004. In both surveys Beverage items were the most littered items for the Natural Waterfront category.

¹ Includes Hunter, Central Coast, Illawarra and Blue Mountains

Comparison with Other Studies

The amounts and types of litter identified in the results of the current 2006 NSW Litter Survey are consistent with the findings of other litter studies in Australia and other countries. Cigarette related items are the single most littered item (by count). Beverage items are the largest proportion by volume.

1. Introduction

'Litter' is any solid waste object (disposable item or resource) that can be held or carried in a person's hand that is left behind or placed in an inappropriate location. Any such material or item disposed in an inappropriate manner is to be regarded as litter – the end outcome of an environmentally undesirable disposal action²

Litter includes a wide variety of solid waste materials. Common types of litter include cigarette butts, cigarette packaging, chewing gum, confectionery wrappers, glass pieces and soft drink containers (both plastic and metal).

The Protection of the Environment Operations Act 1997 (section 146D) requires the Department of Environment and Climate Change NSW (DECC) to report estimates of the composition and quantity of litter types in sites that represent significant littering activity, once in every two years. The first NSW Litter Report 2004³ was prepared to meet these legislative reporting requirements. This NSW Litter Report 2006 report is the second in this series.

The NSW Government has been taking action to reduce litter in and around our homes, workplaces and the broader environment. Some of the initiatives designed to tackle litter include:

- Changes to environmental regulations to increase fines for littering, prevent littering on private land and decrease the quantity of unwanted advertising material that often ends up as litter;
- Media campaigns to make people aware of the impacts of litter on the environment and encourage behaviours that reduce littering;
- Local and regional community education activities that build on media campaigns such as resource kits and community workshops; and
- Information and training for regulatory agencies, such as councils and government agencies, to enable them to better target litterbugs and prevent littering.

The data provided in these biennial litter surveys will assist the government, industry and the community to further improve the management of litter and littering.

The 2006 NSW Litter Characterisation Survey (2006 Survey) is a full scale survey where the litter is collected, sorted, counted, weighed and recorded by material type for each sample site.

The 2006 Survey provides accurate and comprehensive litter data and measures composition in NSW by 7 major categories of litter by number of items. The survey also covered weight and volume.⁴

The categories are: Paper, Organics, Cigarette, Plastic, Beverage, Confectionery and Other. Site types were: Beaches, Landmarks, Local Sports and Recreation Facilities, Malls, Markets, Parks, Public Buildings, Roadside Stops, Schools, Shops, Smoking Areas, Transport Links (ferry terminals, rail easements and bus stops) and waterfronts (natural and constructed). See section 2 for more detail.

² (Community Change (2003) Littering Behaviour Studies, National Benchmark 2002, Beverage Industry Environment Council).

³ NSW Litter Report 2004, DEC 2004

⁴ These are available from DECC but have not been included in this Summary Report.

2. Methodology

The methodology for the Survey was developed by DECC. A copy of the full '2006 NSW Litter Characterisation Survey Methodology' can be found in Appendix 1.

Data collection was done at sites deemed to be significant in terms of littering activity and that would provide data on characteristics of litter on the ground. The methodology takes into account litter accumulation points as well as locations that appear to stay clean most of the time. The method counts 'accumulated litter', that allows for an examination of the occurrence of litter as it has developed over time.

The 2006 Survey was conducted in both urban and regional New South Wales during April – May 2006. A sample site is a defined unit of 48m² area. Litter was collected from all sites with a similar area of 48m². The use of a uniform measurement area of 48m² ensures that the area for litter collection is consistent between sites allowing comparisons of data based on the litter collected. The collected litter was sorted into material type, counted, weighed and recorded for count, weight and volume measurement.⁵

2.1 Site Types

The site types for the surveys were selected with the assistance of expert advice⁶ on the understanding that:

- these would form the core group of sites to be included in future surveys;
- the sites were recognised as significant in terms of littering activity;
- the sites were commonly found across NSW; and
- the selected sites would be consistent with sites selected for the Victorian Litter Monitoring Protocol.

The site types are shown in Table 1. Definitions for each site type are given in Appendix 1.

Table 1: NSW Site Types

Beaches	Shops
Landmarks	Smoking Areas
Local Sports and Recreation Facilities	Transport Links
Malls	- Ferry terminal
Markets	- Rail easements
Parks	- Bus stops
Public Buildings	Waterfronts
Roadside Stops	- Natural
Schools	- Constructed

⁵ Weight and volume is not reported in this summary report. Please contact DECC for further details on this.

⁶ Provided by Community Change in 2004.

2.2 Location Selection

The selection of locations was based on the initial identification of three regions within NSW:

- Sydney Metropolitan Area (SMA);
- Extended Sydney Region (ESR)⁷; and
- Regional/Rural NSW (RNSW) – all remaining areas.

The selection of the number of locations within each region was based on population data from the Australian Bureau of Statistics.⁸ Population distribution across the regions was 56% SMA, 19% ESR and 25% RNSW. Locations were selected within regions based on a number of considerations:

- Population distribution;
- Geographical coverage across NSW;
- Availability of site types;
- Potential level of littering activity;
- Resource optimisation; and
- Consultation with DECC (NSW) Regional Offices.

One hundred sites were identified to sample litter in order to determine accumulation and composition data throughout NSW for the surveys. These 100 sites were a subset of the 200 sites originally identified as areas of significance for the 2004 Litter survey based on The Clean Communities Assessment Tool (CCAT). They were also consistent with sites selected for the Victorian Litter Protocol.⁹

The 2004 Survey was conducted at 60 sites. For the 2006 Survey 40 additional sites from 5 new council areas were included. These sites were chosen to enable comparison of data between sites and with the 2004 litter count data component of the Clean Communities Assessment Tool methodology. Additional sites came from the 5 new council areas of Wollongong, Wellington, Dubbo, Liverpool and Penrith.

⁷ The Extended Sydney Region includes Newcastle and Hunter, Wollongong and Illawarra and the Blue Mountains.

⁸ ABS Cat No. 32180.0 Regional Population Growth, Australia and New Zealand.

⁹ Curnow, Spehr and Casey, 2003.

Table 2 lists the location of the 100 sample sites selected for this survey

Table 2: Locations selected for the 2006 NSW Litter Survey

Location (Original sites used for Clean Communities Assessment Tool 2004)	Litter Survey 2004 and 2006	Additional sites 2006	Total
Sydney Metropolitan Area (SMA)	30	26	56
Council of the City of Sydney	10	2	12
The Council of the Shire of Baulkham Hills	12	0	12
Liverpool City Council		12	12
Manly Council	8		8
Penrith City Council		12	12
Extended Sydney Region (ESR)	15	4	19
Newcastle City Council	10		10
Cessnock City Council (Kurri Kurri)	5		5
Wollongong City Council		4	4
Regional/Rural NSW (RNSW)	15	10	25
Dubbo City Council		5	5
Wellington Council		5	5
Wagga Wagga City Council	15	-5	10
Junee Shire Council		5	5
TOTAL	60	40	100

2.3 Litter Classification

For the 2004 survey, litter classification was based on a set of major material types, with sub categories within each major material type.¹⁰ All litter collected was sorted by the sub-category material type for weight and volume measurement.

The results of the 2004 survey showed that collecting litter data by 29 detailed individual litter sub categories produced highly variable data. However when consolidated into 7 major litter type categories, the data was less variable for analysis. Therefore the 2006 litter data has been collected by seven major litter categories only, rather than sub categories.

The seven litter categories are Confectionery, Cigarette, Organics, Beverage, Paper, Plastic and Film and Others. A checklist of litter material types by a detailed breakdown of each of the seven major categories is given below.

¹⁰ 2004 methodology contained in NSW Litter Report 2004, (DEC 2004).

Table 3: Common littered items by Material Type

Paper	Paper pieces, newspaper, cardboard, bus tickets, grocery docket, ATM receipts, tissues, paper bag, take-away food wrappers.
Organics	Egg shell, wood, onion, seed and toothpick, nutshell, Nicorette tube, orange peel, paddle pop sticks, bread and cheese, food and chocolate, bones, apple core, teabags, fruit, cherry seed, chocolate bar, nuts.
Cigarette	Cigarette butts, Cigarette packets, tobacco.
Plastic	Plastic bag, Pen and fork, condensed milk tube, peg and film, polystyrene, electrical insulation, sundae cups.
Beverage	Glass, plastic bottle, bottle caps, plastic cups, cork, aluminium can, Pet bottle, bottle lids, tube, beverage glass pieces, paper cups.
Confectionery	Chewing gum, Aluminium foil, Chewing gum wrapper, confectionery and ice cream wrappers.
Other	Metals, Batteries, Other scrap includes glass and concrete pieces, fabric, pipe cleaner, chalk, tile, screws, paper clips, Staples, cotton bud, ribbon, elastic, bandaid, hair band, paint.

The 2006 survey for litter data collection includes a 'Non-Litter' Category. The Non-Litter category refers to small particles of dirt, sand or leaves, which are gathered as by product of litter collection process. All material collected from each site was placed in a bag. Before sorting the bag was weighed. In order to reconcile the weight of the contents of the bag, non-litter material was also weighed. Items in the Non-litter category were not considered as litter and were therefore excluded from the analysis.

The litter count data in the Clean Communities Assessment Tool (CCAT) component of the 2004 Litter Report has been re-analysed and classified according to the 7 major material types used in the 2006 Survey. This has enabled a direct comparison of litter counts between 2004 and 2006 and provides some trend data.

One problem that had to be addressed in re-casting the 2004 data was to eliminate several material categories that were not included in the 2006 survey so that the data could be directly compared. The 2006 Survey involved the *collection* of litter for measurement whilst the CCAT was a count of litter *in-situ*. CCAT included chewing gum as confectionery and faeces/goos in the organic category whereas the 2006 survey did not collect old chewing gum flattened on hard surfaces or faeces. The result of this was that the count of confectionery items and organics was a significantly larger component of the 2004 results compared with the 2006 litter survey. The re-casting of the 2004 data has now addressed this.

Adherence to a uniform system of litter identification permits comparison of the data collected in biannual surveys. As far as practicable, the categories of litter adopted for the 2006 survey will be used in future surveys.

3. Results

3.1 Amount of Litter (Counts)

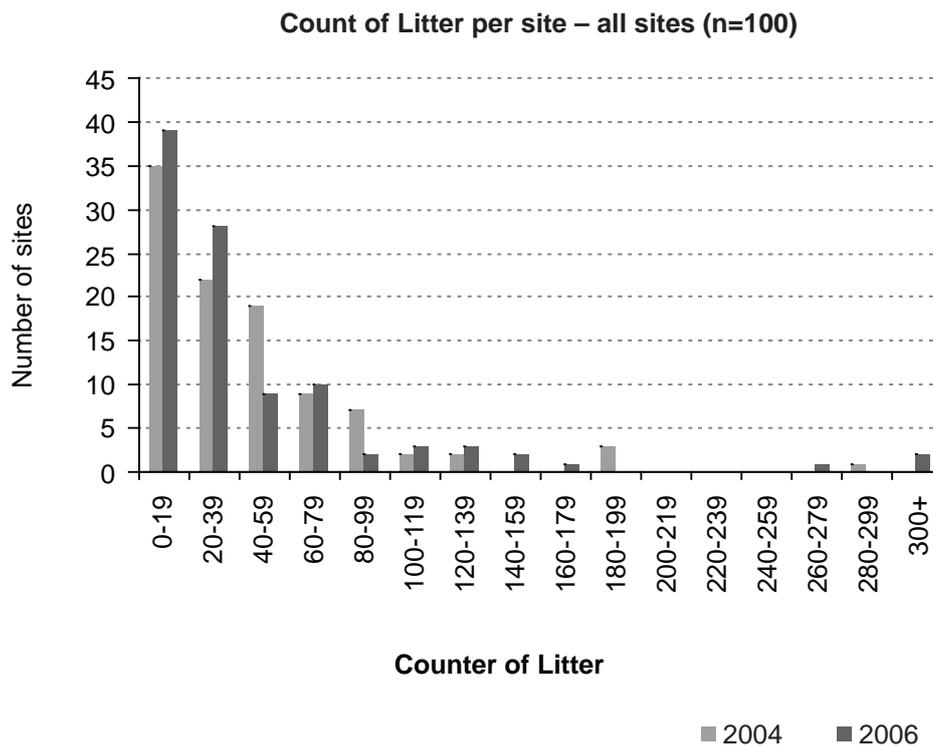
In 2006 4750 pieces of litter were counted over the 100 sites surveyed. This compares with 4460 pieces of litter counted in the same sites in 2004.

The results showed:

- Of the sixty old sites, over 2300 pieces of litter were counted in 2006 (compared to nearly 2100 in 2004); and
- Of the 40 new sites, over 2400 pieces of litter were counted – a similar number to the litter count in 2004.

The number of pieces of litter counted from each site varied in 2006, from 2 pieces of litter in one site, to 416 pieces of litter in another. The number of items per site for both years are shown in Figure 1. Most sites had less than 40 pieces of litter per site. Very few sites had over 100 pieces of litter.

Figure 1: Histogram of litter count, all sites (n=100)



3.2 Composition of Litter

In 2006, Cigarettes were found in all 100 sites. Plastic and Paper were found at 71 and 70 sites respectively. Comparing the same sites in the 2004 survey, Cigarettes were consistently the most frequently found litter type, followed by Paper and Beverage, Figure 2.

Figure 2: Number of all sites with litter type present

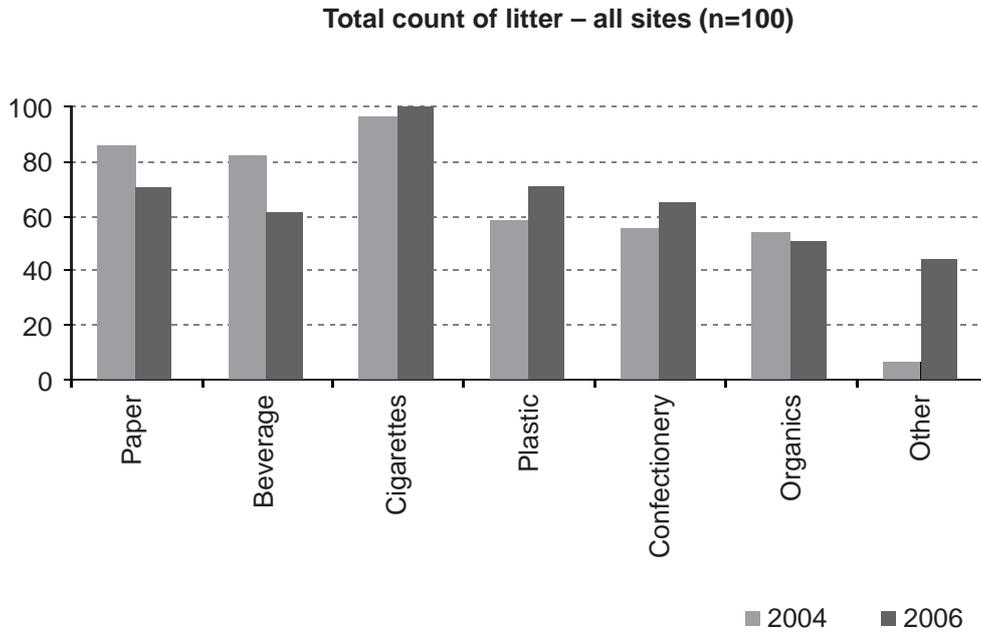
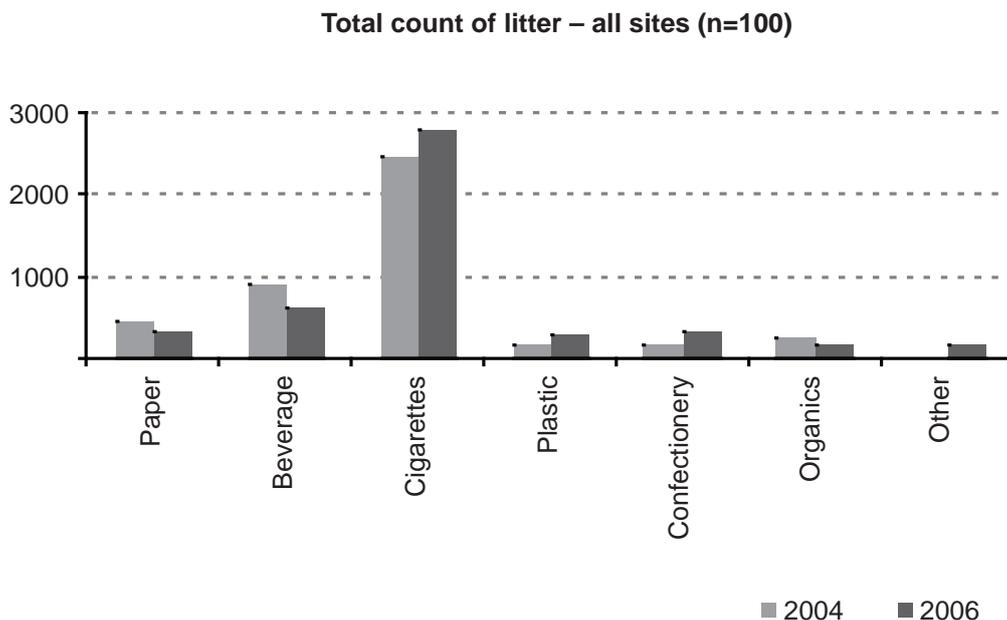


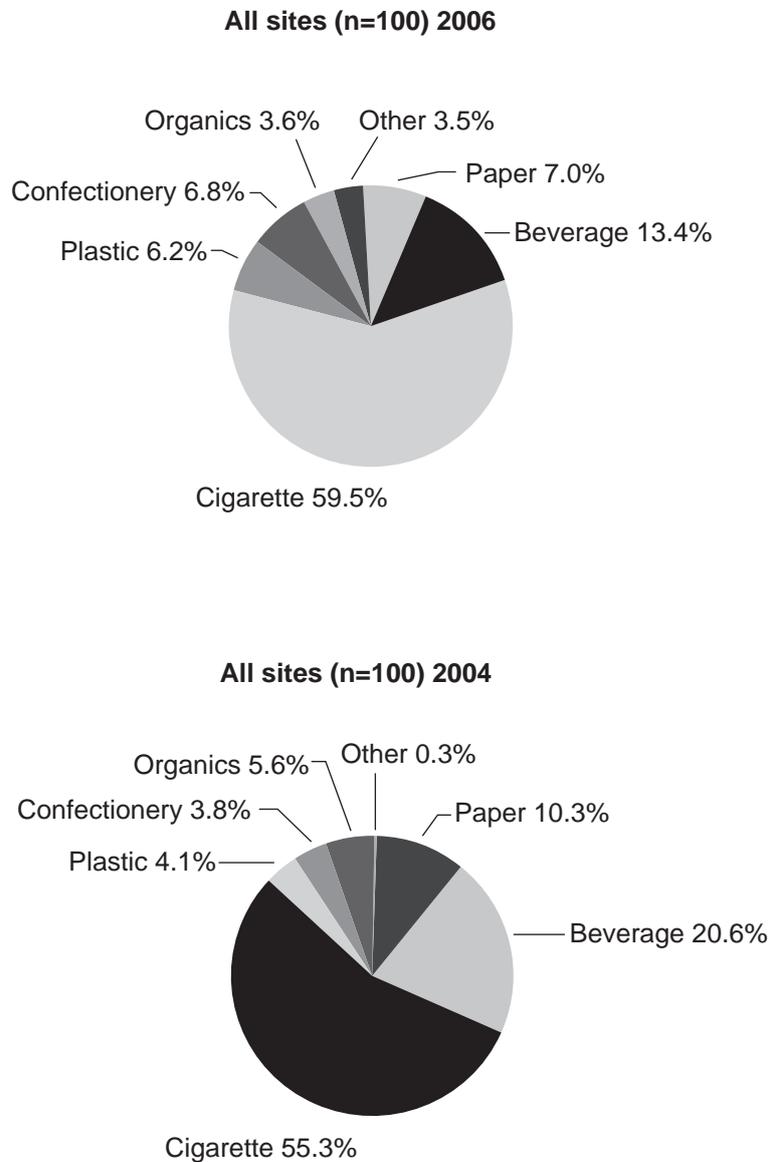
Figure 3 shows the total amount of litter count in each litter category across all 100 sites in both 2004 and 2006.

Figure 3: Total litter count across all sites, 2004 and 2006



Overall in 2006, the Cigarette category made up 60% of all litter collected, with the Beverage category the second largest contributor at 13%. This is shown in Figure 4.

Figure 4: Composition of litter by count, 2006 and 2004



3.3 Litter at Different Site Types

Eleven different site types were identified. The number of sites investigated in each category ranged from 2 sites (in beach and constructed waterfront types) to 18 sites (transport), Table 6.

The average count of litter varied between site types, but because of the relatively small number of sites in some site type categories, care should be taken in interpretation.

Table 4: Litter counts by site type 2006

	Median items per site	Minimum items at any site	Maximum items at any site	Total items at all sites	Total number of sites
Beach	10.5	4	17	21	2
Constructed Waterfront	61.0	15	107	122	2
Mall	20.0	3	108	399	12
Market	10.0	5	310	51	3
Natural Waterfront	15.0	11	359	427	5
Park	41.0	3	174	761	14
Public Building	26.0	7	447	962	16
School	40.0	6	128	332	7
Shops	26.0	5	89	507	17
Smoking	21.0	16	61	119	4
Transport	28.0	4	276	1047	18

Cigarettes contributed the most to the litter counts in all site types apart from Natural Waterfront where the majority of items were Beverage (46%, or 195 out of 427 litter items collected). In all site types, Cigarettes contributed between 33%–74% of all litter collected. This is shown in Table 5.

Table 5: Proportion of litter types by site type 2006

	Paper	Beverage	Cigarette	Plastic	Confectionery	Organics	Other
Beach	14%	5%	38%	19%	14%	10%	0%
Constructed Waterfront	3%	16%	65%	7%	7%	1%	2%
Mall	6%	15%	66%	4%	5%	3%	3%
Market	6%	4%	65%	2%	0%	16%	8%
Natural Waterfront	6%	46%	33%	7%	4%	3%	3%
Park	9%	21%	44%	9%	9%	7%	1%
Public Building	7%	4%	74%	5%	6%	3%	2%
School	13%	4%	73%	2%	8%	1%	0%
Shops	8%	12%	54%	7%	11%	4%	4%
Smoking	1%	3%	70%	5%	3%	3%	15%
Transport	6%	8%	62%	7%	6%	3%	7%

By comparison, results for 2004 indicated that the Cigarette category represented the majority of items littered in the majority of site types. The exceptions were Natural waterfront, and Beaches. For all sites types Cigarette contributed between 25%–73% of all litter collected.

3.4 Amount of Litter by Region

Three regions were investigated, the Extended Sydney Region (ESR) (19 sites), Regional NSW (RNSW) (25 sites) and the Sydney Metropolitan Area (SMA) (56 sites). The average count of litter at the sites in SMA and ESR were similar (around 51 items); compared to the average count in RNSW of 15 items per site.

Table 6: Litter count in all sites by region, 2004 and 2006

	2004	2006	Percentage change
ESR	755	1116	+ 47%
SMA	2924	3171	+ 8%
RNSW	781	461	- 41%

The total litter count from the 100 sites increased since 2004 in both the SMA and ESR by 8% and 47% respectively, but decreased in RNSW (Table 6). The Cigarette category was the most prevalent in each region, followed by Beverage for both 2004 and 2006 (Table 7).

The biggest contributor to the decrease in litter count in RNSW was the Cigarette category – down from 510 items in 2004 to 230 in 2006. The count in this category increased in the other two regions over the same period – from 1491 to 1949 items in the SMA and from 472 to 644 items in the ESR.

Table 7: Types of litter by region, all sites (n=100)

		Paper	Beverage	Cigarette	Plastic	Confectionery	Organics	Other
2004	ESR	9%	16%	63%	5%	3%	5%	0%
	SMA	11%	23%	51%	4%	4%	7%	0%
	RNSW	9%	16%	65%	3%	4%	2%	0%
	Total	10%	21%	55%	4%	4%	6%	0%
2006	ESR	8%	13%	58%	7%	9%	3%	2%
	SMA	6%	14%	61%	5%	6%	4%	4%
	RNSW	11%	12%	50%	11%	9%	4%	2%
	Total	7%	13%	59%	6%	7%	4%	4%

3.5 Comparison with 2004 Litter Characterisation Survey

A direct comparison of the litter counts from the 2004 survey to the 2006 survey was possible following a re-analysis of the 2004 results. The NSW 2004 Litter Characterisation Survey was conducted at 60 sites. This data was re-analysed to realign the data into the 7 new categories used for the 2006 survey. In addition litter count data from an additional 40 sites used for the CCAT component of the 2004 survey was also provided. These 40 additional sites from 5 new council areas were also included in the 2006 survey.

Over the 100 sites surveyed there was a small increase in the number of items littered between 2004 and 2006 (290 or 6.5%). The mean number of items counted per site increased from 44.6 in 2004 to 47.5 in 2006.

Both the 2004 Survey and the 2006 Survey have shown that cigarette butts and related items are the most significant litter problem in NSW at 55.4% of all littered items in 2004 and 59% in 2006. Beverage containers remain the second highest littered item.

Caution should be exercised when comparing site types due to the small sample size in some types. However, for both surveys the Cigarette items were the most littered items for all site types except Natural Waterfront in 2006 and Natural Waterfront and Beaches in 2004. In both surveys Beverage items were the most littered items for the Natural Waterfront category.

3.6 Comparison with Other Studies

The amounts and types of litter identified in the results of the current 2006 NSW litter characterisation survey are consistent with the findings of other litter studies in Australia and other countries. Cigarette related items are identified as single most littered item (by count). Beverage items demonstrating the largest proportion by volume.

Appendix 1

2006 NSW Litter Characterisation Survey Methodology

Overview

The 2006 NSW Litter Characterisation Survey aims to identify long-term trends in litter through collection of information from comparable surveys over a number of years.

The NSW Litter Characterisation Survey will be conducted at sites deemed significant in terms of littering activity and will provide data on the characteristics of litter found on the ground.

'Litter' is any solid waste object (disposable item or resource) that can be held or carried in a person's hand that is left behind or placed in an inappropriate location. Any such material or item disposed of in an inappropriate manner is to be regarded as litter – the end outcome of an environmentally undesirable disposal action (Community Change (2003) Littering Behaviour Studies, National Benchmark 2002, Beverage Industry Environment Council).

The litter characterisation survey methodology will provide an indicative measure of the composition of litter on the ground by count, volume and weight.

The results of the NSW Litter Characterisation Survey are to be reported biennially to the Minister for the Environment as required under Section 146D of the *Protection of the Environment Operations Act (1997)* (see Appendix A).

This document outlines the methodology on the Litter Characterisation Survey for 2006. The 2006 survey will be conducted in 100 sites across NSW. The 100 sites will be visited to collect data on litter by volume, weight and count. DECC will provide all relevant information on each site for the survey.

The consultant will be required to conduct the survey at sites identified for the study, collect data, record and provide data both electronically as well as hard copy for each location and report on the methodology adopted for the data collection. DECC will undertake data analysis and reporting on the 2006 NSW Litter Characterisation Survey.

General Advice on Collecting Litter Data

The Litter Characterisation Survey will identify information on litter deposited within the selected locations, which needs to be collected, removed from the site, counted, weighed and recorded.

Each survey will be carried out during a 'normal' period of weekday and/or weekend activity in the selected locations, that is, not during peak or low times such as during public holidays, tourist peak seasons and the like. Subsequent surveys should be carried out at the same time of year, to reduce seasonal and cyclical bias likely to introduce variability into the survey data.

Types of litter materials have been standardised into broad types based partly on the material they are made of and partly on the functionality they serve (see Appendix B). A more detailed breakdown on what materials are to be grouped under each of these major categories is provided in Appendix C as a checklist to the consultant. If there are any materials that do not fit into any of the major categories listed in Appendix B then a note with explanation on the type, count, weight and volume of the material should be provided by the consultant.

Litter by major categories includes a 'Non-Litter' category. This category is designed to cover small particles of dirt, sand or leaves which are gathered as a by product of the litter collection process. All material collected from each site should be placed in a bag. Before sorting, this bag has to be weighed. In order to reconcile the weight of the contents of the bag, the non-litter also has to be weighed.

The site types for collection of Litter have been selected as:

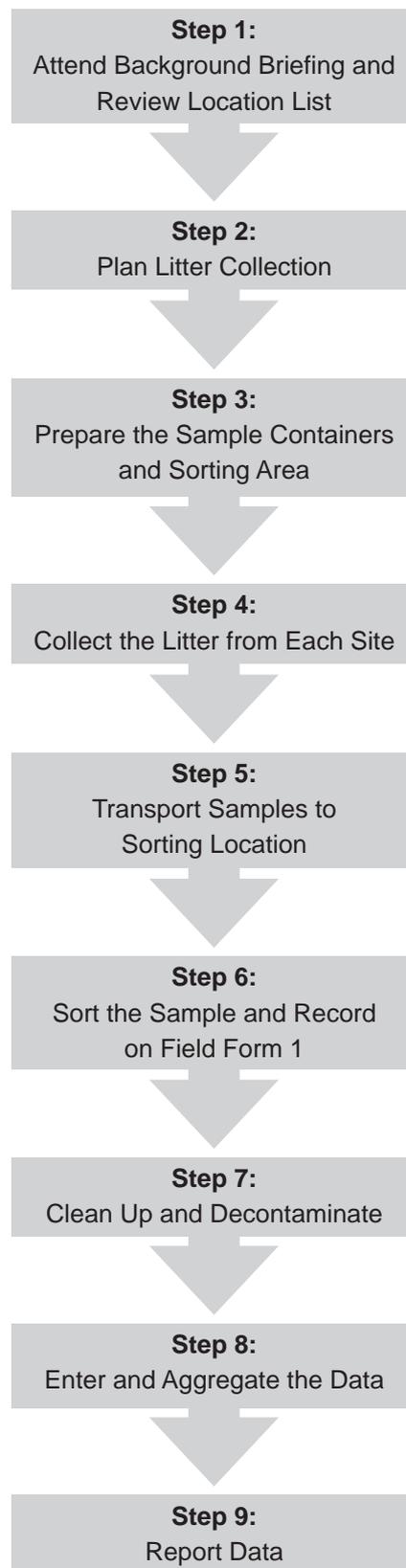
- Beaches
- Local Sports and Recreation Facilities
- Malls
- Markets
- Parks
- Public Buildings
- Roadside stops
- Schools
- Shops
- Smoking Areas
- Tourist Spots
- Transport (Ferry, Rail, Bus)
- Waterfronts (Natural, Constructed)

The definition of each site type can be found in Appendix D.

The locations for collection of Litter have been selected as:

Location	Number of sites
Sydney Metropolitan Area (SMA)	56
CBD	12
Manly	8
Castle Hill	12
Penrith	12
Liverpool	12
Extended Regulated Area (ERA)	19
Newcastle	10
Kurri Kurri	5
Wollongong	4
Rest of NSW (RNSW)	25
Wagga Wagga	10
Junee	5
Wellington	5
Dubbo	5

The next section outlines the steps to follow when conducting litter sampling.

Figure 1. Stepwise procedure for Litter Characterisation Survey

Step 1 – Attend Background Briefing and Review Location List

The Litter Characterisation Survey requires that litter from sites within locations nominated by DECC be collected. Before commencement of the survey, background information on the procedures and locations of litter collection sites will be provided.

The selected area for litter collection within each site will be a 48m² area and the collector will gather all litter before moving onto the next site.

To run through the Litter Characterisation Survey methodology, the supervisor and collectors will visit a site type in the Sydney CBD with the DECC project managers prior to commencement of data collection.

Consultants will need to consider timing and logistics for sorting, including how to manage materials that are potentially water logged. For example, is it better to collect and sort the litter generated at the end of each day or to collect each day and store a weeks worth of items ready for sorting the following week? Consultants need to consider that a small proportion of littered items may be putrescible. Some items may also be wet and any assessment of wet items may well provide an overestimate of weight.

Consultants will also need to ensure logistics of undertaking the survey are finalised and people involved are appropriately trained before commencing the survey. The training programme should achieve the outcomes as outlined in Appendix E.

Step 2 – Plan Litter Collection

DECC will draft a letter to the Waste or Environment Manager of the local council where litter collection is to occur. The letter will outline the purpose of the study and the presence of litter collectors in the area – this letter will be signed by DECC.

A mixture of weekdays and weekends should be selected for litter collection.

A list of the suggested equipment for collecting and sorting litter is itemised in Appendix F. Ensure there are ample spare sets of gloves, overalls, bags and tags etc. to replace equipment worn out or contaminated during sorting.

A supervisor and a back up supervisor should be available to oversee the collection process and the survey. The supervisor's responsibilities are detailed in Appendix G.

A comprehensive Health and Safety Plan must be implemented as per Appendix H.

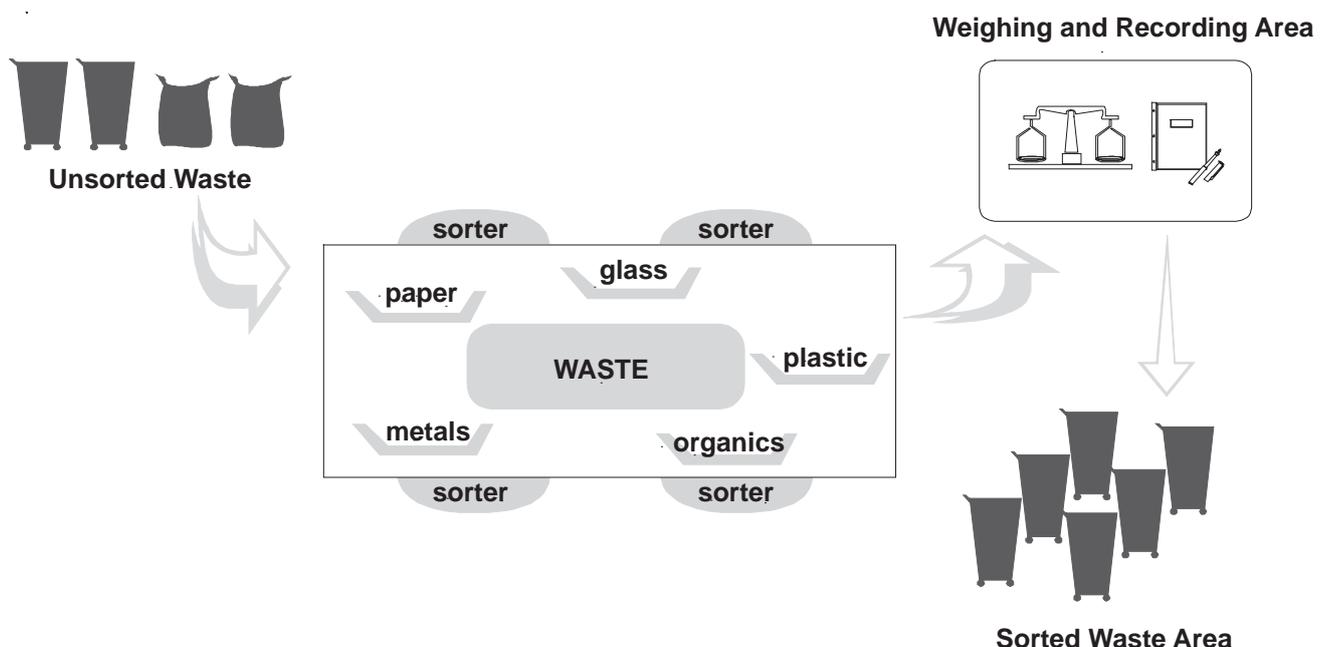
Step 3 – Prepare the Sample Containers and Sorting Area

In order to undertake sorting of litter a suitable area will need to be selected. The area may be a dedicated area on site, a disposal site, a depot or some other vacant site. Whilst the type and location of site are not critical a few basic procedures need to be followed:

- Identify the area where sorting is to be undertaken, ensuring it is protected from the wind and rain.
- Remove any unnecessary items from the sample sorting area to achieve a clear working space.
- Ensure any mechanical ventilation items are operating, or sufficient free airflow is occurring.
- Provide a sufficient number of sample record sheets (Field Form 1, Appendix I) for recording the material composition of all samples.

- Provide a mechanical platform calibrated scale to weigh the total sample (platform scale) and to weigh sorted components to the nearest 10g. Also provide an electronic/battery-operated scale to weigh lighter sorted components to the nearest 0.1g. Make sure a power outlet is located on-site if using electronic scales.
- Provide three tables, two for sorting samples and the other for weighing and recording, approximately 1m wide by at least 2m in length. It is important that the table is not too wide as sorters will not be able to reach the materials.
- Spread out a waterproof plastic ground sheet over the tables where the sample is to be sorted.
- Make sure a rake, broom, dustpan and brush and hose are available for cleaning up the area after sorting.
- Provide a first aid kit equivalent to a St Johns Ambulance Portable Kit B. Ensure all of its contents are up to date.

Figure 2: Layout of a typical sorting area



The following steps should be undertaken to prepare the sample holding containers prior to the commencement of sorting:

- Obtain approximately 10 containers. A mix of buckets tubs and bins (e.g. 10–20 litres in size.)
- Ensure each container is clean and dry.
- Weigh all containers and obtain the volume for each container. Record the tare weights (when empty) and volume of each container.
- Place the pre-weighed sample containers in a strategic location where they will not be contaminated by the work environment and where they are easily accessible for depositing the separated materials.

Step 4 – Collect the Litter from Each Site

The collector will need to pick up all litter within the nominated 48m² area and bring labelled bags to the sorting location. The labels must record where and when the litter was collected and any other relevant information.

Once the litter has been collected then the collector will move onto the next site to begin the process again.

Step 5 – Transport Samples to the Sorting Location

The supervisor must organise and oversee the transportation of the bags of collected litter to the sorting site. If the collected litter is too heavy to be transported in bags consider using rigid containers (e.g. 240 litre wheelie bin) for transporting to the sorting area or using several bags and label them all with a systematic sample number (e.g. Site X (1 of 3), Site X (2 of 3), Site X (3 of 3)) to clearly identify where it came from. The supervisor must account for all bags of litter at the sorting site.

Step 6 – Sort the Sample and Record Results on Field Form 1

Sort and record the contents using the following procedures for the sorting of a sample:

- The supervisor should re confirm that all staff know their OHandS responsibilities and are using appropriate personal protective equipment including gloves and tongs to protect against cuts, needle stick injuries and prevent pathogenic infection.
- Record the source for each numbered sample (site name, and type of site).
- Weigh the total sample (it may be in several bags or wheelie bins) and record the net sample weight on Field Form 1 before beginning any sorting. The net sample weight = total weight – weight of the container/bag(s).
- Transfer the sample onto the sorting table in preparation for material separation.
- Ensure the entire sample is transferred from the container to the sample-sorting table either at once or in smaller portions depending on the quantity involved. Spread the sample out to aid separation.
- Each item that can be easily and safely separated from other items present should be retrieved and placed into the appropriate sample container.
- Sort and separate the larger and/or more easily recognisable materials first (e.g. tins, aluminium cans, plastics, glass bottles etc) into separate containers. This makes more room available for smaller or more complex items to be separated. As more room becomes available on the sheet, the more complex items can be separated. Parcels of materials, such as smaller plastic bags of litter contained in the sample, should be opened to determine whether these parcels could be classified without the need for any further sorting. If the contents are not homogeneous, the bags need to be tipped out onto the sheet and individual materials separated into the material types.

- More complex items, such as composites, will need to be sorted into the category of main composite component. Simple composites may be separated by hand into their respective materials (e.g. glass jar and steel lid).
- A final check to ensure all littered items have been correctly classified should be undertaken. The sorting supervisor may need to make a call on which category provides the best fit for complex items.

Determine the count, weight and volume of each separate material type listed on Field Form 1 by:

- Separating the whole sample into individual containers for each material type, estimate the volume that each category of material occupies (by using the known volume of the containers that they are in) and record on Field Form 1.
- Weigh all containers without litter material in it and subtract the weight of the empty container from the total weight for each material.
- Record the number of bottles, papers, cans, containers etc. This is important to explore the use of light weighting by industry.
- Should any irregularities or unusual items need special consideration or comment record on Field Form 1.

The total weight of the original sample should be then checked against the sum of the weights of the sorted contents to ensure all materials have been recorded. This should be within 5% if weighed correctly and the scales are calibrated. If the weights are significantly different the sample should be resorted. Please refer to Appendix E.

A final check should be undertaken to confirm all of the material in the sample has been checked and Field Form 1 has been correctly filled out.

Step 7 – Clean Up and Decontaminate

As each bag or sample is sorted separately, the sorting table must be cleaned between each sample and bagged ready for disposal or recycling. Clean-up steps are:

- When a sample has been sorted and relevant information recorded, the sorted litter should be removed from the table and weighing containers and bagged ready for recycling or disposal. Sorted litter must be kept separate from unsorted litter.
- Clean off the sorting table and sweep the area. Add residues to the sample for transportation to disposal.
- Proceed with Step 3 'Prepare the Sample Containers and Sorting Area' if another sample is to be sorted.

Step 8 – Aggregate and Analyse the Data for all Survey Sites.

Once the raw data has been collected and written onto the record sheets (Field Form 1) it can then be entered into the data templates provided by DECC. Data entry should include a range of logic and integrity checks agreed by DECC ensuring valid data is prepared for analysis. Data validation to be undertaken is detailed in Appendix E.

Validity testing

The validity of the data should be tested by ensuring that the data is recorded using the appropriate units of measurement (for count, weight and volume) and in the correct cells corresponding to the data item. The weights for each category should add up to the total weight. Values that are missing or cannot be recorded should be included as null values with an explanation in the footnote.

It should be ensured that data for 'Non-Litter' and 'Other' is recorded as outlined in Appendix E.

Any methodological issues with collection, sorting or quantifying litter by category should be explained in the report on Methodology Issues. For example under the material category 'Other' if there is any material type which is either difficult to classify or has extreme values, then it needs to be clearly explained in the Methodology Issues report.

Step 9 – Report Data

The data should be provided in a flat file (csv) format along with a data dictionary. The completed data entry templates and original data collection forms are to be provided to DECC.

Structure and contents of the data

Data on the material composition of litter by count, weight and volume should be provided for each location by each individual site selected for study as outlined in the data entry templates Form 1–2, (see Appendix I for details).

A final report outlining Methodology Issues and summarised data for each location by site should be provided on completion of the data collection.

List of Appendices

Appendix A	Legislative Context for the NSW Litter Survey
Appendix B	Litter material types
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Appendix D	Site Definitions
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Appendix A

Legislative Context for the NSW Litter Survey and Litter Survey Methodology.

The *Protection of the Environment Operations Act 1997* includes Section 146D on littering reports that require the following:

- (1) The EPA is required to furnish to the Minister a biennial report on littering.
- (2) The report is to contain estimates of the type of the composition and quantity of litter, by reference to locations considered by the EPA to be places of significant littering activity.
- (3) The EPA must cause advertisements to be published setting out the proposed methodology to be used in compiling such reports and inviting comments from members of the public concerning the proposed methodology. The EPA must allow at least 30 days for such comments to be made, and must consider comments received within the time allowed.
- (4) The Minister is to cause a copy of each report to be laid before both Houses of Parliament within 30 sitting days after receiving the report.
- (5) If the Minister, after consideration of the report, is of the opinion that:
 - (a) the managers or other persons responsible for any of the locations referred to in subsection (2), or
 - (b) the producers of or other persons responsible for any products whose components or packaging comprise litter at any such locations,are not acting in a manner that minimises littering, the Minister may make recommendations aimed at improving litter avoidance strategies.

Appendix B

Litter Material Types.

Material categories to be surveyed are:

1. PAPER
2. ORGANIC
3. CIGARETTE
4. PLASTIC
5. BEVERAGE
6. CONFECTIONERY
7. OTHER
8. NON-LITTER

Appendix C

Checklist of Litter material types (Detailed Breakdown):

1. Paper	<ul style="list-style-type: none"> • paper bags • serviettes and tissues • receipts • tickets • paper pieces • newspaper • advertising material • take away boxes • card board boxes • cardboard pieces • contaminated food paper
2. Organic	<ul style="list-style-type: none"> • faeces • food • wooden utensils • clothing rags • leather • rubber • other putrescible
3. Cigarette	<ul style="list-style-type: none"> • cigarette butts • cigarette packets • cigarette lighters • wrappers • foil • matches
4. Plastic	<ul style="list-style-type: none"> • plastic bags • wrappers • films
5. Beverage	<ul style="list-style-type: none"> • glass bottles • glass pieces • plastic bottles • plastic cups • plastic caps • straws and utensils • paper cups • tetra boxes • aluminum cans • metal caps • ring pull and pieces
6. Confectionery	<ul style="list-style-type: none"> • Chewing gum • confectionery and ice cream wrappers
7. Other	<ul style="list-style-type: none"> • Packaging straps • syringes and other things • batteries • ceramics
8. Non-litter	<ul style="list-style-type: none"> • Crumbs – small particles of dirt, sand or leaves gathered as a by product of the litter collection process.

Appendix D: Site Definitions

The following site definitions have been adopted from the Victorian Litter Monitoring Protocol and adapted to the NSW Litter Characterisation Survey.

Beaches: the sandy area between the water and a boundary or border that clearly marks areas for recreation. Exclude parks adjoining beaches.

Local Sports and Recreation Facilities: areas designated for general use by local residents for sporting or recreational activities. Exclude stadiums and facilities requiring payment of an entrance fee.

Malls: a pedestrian thoroughfare or sheltered promenade with merchandise and food vendors lining the walkway or street, often with limitations on vehicle access.

Markets: open spaces or covered buildings where merchandise and food stalls provide fresh produce and a range of goods to the public e.g. farmers markets

Parks: Grassy sites with shrubbery or gardens, children's play equipment, seats and tables, and often with barbeque and picnic facilities.

Public Buildings: an area around a building open to the public, which often includes places for people to sit and eat and within walking distance of food vendors.

Roadside stops: public waysides that border roads, used for rest breaks and often include toilets, barbeque areas, seating and gardens. A roadside stop is generally located on a highway in a regional area.

Schools: organisations involved in primary, secondary or tertiary education. The boundary of the school is defined as the area immediately out front of the fence line on the footpath outside the school boundary.

Shops: areas for selling goods or services, often with a vehicular thoroughfare in the middle, lined with merchandise and food vendors with wide footpaths and places for people to sit. Include cafes and restaurants in this definition that provide outdoor seating for patrons.

Smoking areas: are formal or informal areas outside a building designated for cigarette consumption. This may be catered for officially or unofficially by the placement of ashtrays or butt bins.

Tourist Spots: are structures, natural features or areas that have a strong association with tourism activities. These sites are defined by the volume of tourists visiting the site as provided by the Tourist Information Bureau.

Transport: waiting or transit areas with pedestrian traffic going to and from public transport. Transport has been divided into three sub categories of Ferry, Rail or Bus dependent upon the primary mode of transport and each site.

Waterfronts: areas next to bodies of water used by the public. Waterfronts have been divided into two sub categories of Natural and Constructed. Natural waterfronts are characterised by grassy areas used by the public for recreation and picnicking whereas constructed waterfronts are characterised by thoroughfares usually associated with commercial activity such as Darling Harbour.

Appendix E: Data Quality

Introduction

The success of the survey methodology is dependent on data quality. Strict adherence to basic principles of data collection, analysis and reporting cannot be overstated. Hence the need for this section in the methodology. Topics discussed in this section include:

- collection of background information;
- data collection and field data collection forms;
- data entry and
- future data collection.

Collection of Background Information

All background information should be collected from the source and must be current (e.g. planning routes between collection sites from a current street directory). Complete copies of all background information must be appended to the final report for future reference and/or analysis.

Data Collection and Field Data Collection Forms

The recommended data collection forms are found in Appendix I. Collection of all data elements contained in the forms is mandatory. It is considered to be the minimum requirement for the successful completion of the litter survey data collection. All fields of the form should be completed. Null values should be recorded where no data is collected. This is important when reviewing and comparing studies.

All field staff involved in data and/or information gathering aspects of the methodology should undergo preliminary data collection, data entry and data analysis training before commencing. This should be preceded by an on site safety induction course and other requirements of the OHandS plan.

Data collection training is to consist of at least a half-day session on site for all personnel involved in data collection. Critical outcomes of the training are to include knowledge of the physical site:

- litter categorisation;
- volume estimation;
- sorting procedures;
- the determination of the weights of samples; and
- using the data collection form.

The person nominated to perform the data entry should be proficient:

- with the data collection form; and
- with the data entry templates.

Personnel who are recruited after the commencement should undergo training. The DECC should be kept informed of all staff movements during the course of the survey. Instituting periodic testing of data entry quality is required, as any failure to comply with data requirements will result in a flawed study.

Data Entry

Data entry is the responsibility of the data analyst. There are, however, a few mandatory requirements.

- All data should be checked at the end of each day of data collection and audited by the supervisor.
- DECC will provide electronic data entry templates, although the data analyst is responsible for data entry validation and integrity checks.
- All data entry form information should be electronically gathered. An electronic data dictionary is to accompany all files. The intent of the dictionary is to provide a guide to the data.
- A unique key linked to data entry forms should be included for each record. An increasing sequence number should be recorded on each field form1 and entered in form 2 – data entry template (Appendix I).
- ‘Other’ as a material category includes but is not limited to materials such as ceramics, batteries and scrap.
- If the total amount under ‘Other’ is less than 10% of all litter collected, then these should be aggregated and recorded under ‘Other composite’ in column numbers 26, 48 and 70 as shown in form 2 – data entry template. If however the amount of Litter comprising ‘Other’ exceeds 10% then data should be recorded under individual items such as batteries, scrap etc in column numbers 27–29, 49–51, and 71–73 as shown in form 2 – data entry template. It should be noted that the ‘Other’ columns provided in form 2 – data entry template are an example only. The columns should be adjusted to reflect the litter activity collected.
- The Non-Litter category should be recorded separately as shown in column numbers 30, 52 and 74 of form 2 – data entry template.
- The sample number, Sample weight, Bag weight, Sum of material weight, Difference and Percent in Column numbers 14–19 should be recorded as shown in the form 2 – data entry template.
- After data are entered the following data checks should be performed:
 1. Duplicate Records. Check for the same data entered twice. Also check for similar records entered consecutively as an entry may have been entered incorrectly and then re-entered.
 2. Extreme Values. The data collector will need to provide an assessment of extreme values to determine whether they are genuinely extreme or wrong.
 3. Totals are verified.
 4. Calculate and check the difference between the weight of the sample and the total weight of materials collected for each site (please refer to Col numbers 14–19 in the data entry template) and ensure that the weight is within the 5% limits. If the difference exceeds 5% the materials have to be sorted again.

Data Entry and Output

The data entry templates in Appendix I provide the raw data output required by DECC. All working notes and calculations used to arrive at these outputs are to be provided to the DECC as part of the data dictionary.

The release of data is restricted by privacy and confidentiality provisions. No litter data should be released to any party without the express written permission from DECC.

The completed data entry templates, original data entry forms and Methodology Issues report is to be forwarded to:

Department of Environment and Climate Change NSW
Waste Data
Sustainability Programs Division
PO Box 644
Parramatta NSW 2150

Future Data Collection

If the study is to form a part of a time series (multiple studies) it is essential that the same methodology be used for data consistency and comparability.

Changes to the methodology need to be made, prior to implementation, in writing to DECC and agreed by DECC in writing.

Appendix F: List of Equipment

Personal Equipment

Item*
Vests
Gloves
Overalls
Goggles/Glasses
First Aid Kits (full ones)
Sharps container complying with Australian Standards
Masks
Boots
Sunscreen
Mobile phone
Hats
Hardhats (if required)
Water

Note: * All items should be consistent with the specific OHandS plan (see: Appendix H)

Capital Equipment

Item
Tables (1 x 2 metres)
Scales (2 small – 0.1 gram intervals, up to 50 kgs and 2 large – up to 150 kgs)
Aluminium Tongs
Sharps Container
Trays or buckets
Mobile Garbage Bins (240 litres)
Plastic Sheets 2 x 4 metres
Numbered data sheets
Pens/Pencils/Marking Pens
Adhesive Labels
Calculators
Box of large Stickers
Strong/Tough Plastic Bags (clear and green or coloured)
Broom, brush and shovel

Appendix G: The Roles and Responsibilities of the Supervisor

The Supervisor has a key role in ensuring the quality of the data obtained using this methodology. The primary function of the Supervisor is to ensure that all steps in the methodology are followed. This involves accepting the following responsibilities and ensuring:

- All staff receive the relevant training (that is, run through all OHandS procedures, facility on site procedures, and steps to collect the data).
- Litter collectors maintain the schedule of sites for litter collection.
- A suitable site for sorting is selected.
- During sorting all materials are correctly classified and recorded. When sorting is complete the Supervisor should perform a final check on the materials to verify the integrity of the sorting process.
- All Occupational Health and Safety procedures are put in place and are strictly followed and monitored.
- All caution is taken to prevent incidents from occurring.
- That staff record information accurately and the entries are checked daily (in the field and the office).
- Any problems experienced throughout a survey are resolved immediately.
- Calculations are correct.
- Data are entered correctly into the templates provided and verified.

Appendix H: Occupational Health and Safety

Introduction

A Health and Safety Plan for the manual collection, handling and sorting of materials for material composition data collection should be prepared prior to commencement of the survey. The aim of the plan is to prevent the occurrence of injury and/or reduce severity of injuries and require those undertaking surveys to identify, assess and control any risks.

There are many hazards when sorting litter such as chemical exposure, fire/explosion, biological and physical (from sharp objects including needles, wood sticks, glass and nails) risks. Awareness of any possible hazards and an occupational health and safety plan will prevent incidents from occurring.

Worker safety is the responsibility of employers, supervisors and workers. Specific plans are needed to reflect specific circumstances, places and times. This document is not an Occupational Health and Safety Plan. It merely provides some guidance for the development of such a plan.

Preparation of the Occupational Health and Safety Plan

The objectives of the plan are:

- to prevent the occurrence of injury and/or reduce the severity of injuries resulting from manual handling tasks in work places; and
- to require employers to identify, assess and control risks arising from manual handling activities in workplaces.

The Plan should include the following six requirements:

1. Identification of personnel undertaking litter collection or manual sorting and the implementation of the Pre-employment Screening Program as part of the total Medical Monitoring Program. This program would ensure and monitor each worker's health and fitness; determine the adequacy of worker protection; provide emergency and other treatment as needed. Accurate records should be kept for future reference.
2. Development of Contingency Safety Plans in case of accidents (e.g. exploding gas cylinder, fire). The plan would include details of exits, extinguishers, emergency numbers, first aid available and closest hospital.
3. A safety Induction Course for all staff prior to on site training and carrying out of litter collection or sorting. The course should include hygiene practices (no eating, drinking, or smoking during or after sorting until decontamination is complete); identification of all hazardous materials and their appropriate handling; identification of potential hazards involved in sorting, knowledge of contingency safety plan actions and decontamination procedures.
4. Inoculation of all personnel involved in manual litter collection or sorting for Hepatitis-B, Hepatitis-A and Tetanus prior to participating in any litter sorting activities. Note that vaccination for Hepatitis-A and B may not necessarily result in total immunity. For this reason all members should have their immunity status established by a registered pathologist/medical practitioner prior to sorting litter.

5. Appropriate Personal Protection Equipment should be worn/used for the type of litter being collected or sorted. The clothing should be sized to fit the worker.
6. Specific needs of the collection and sorting processes should be addressed in the plan.

The following equipment should be available and worn/used by all workers where appropriate:

- Air purifying equipment, such as chemical cartridge respirators fitted with mechanical filter respirators, provide protection against some organic gases but should not be relied upon where concentration exceeds 2,000 ppm. They offer protection against dusts, fumes, mists or smoke and can be designed as a full-face piece or a half-mask.
- Overalls with good quality cotton overall inside to prevent grime and heat stress and polyethylene apron on outside to prevent splashing of corrosives.
- Hand protection e.g. PVC gloves on the outside to prevent corrosive substances, leather ones inside to prevent sharp objects. The provision of tongs to sort litter will also prevent injuries to hands.
- Protective Footwear e.g. PVC or leather knee-high boots for protection of sharp objects and splashing of chemicals. Steel capped boots are another alternative.
- Eye Protection e.g. goggles to prevent dust, fumes, vapours, chemicals and sharp objects damaging eyes.
- Hard hat for protection.
- Wide brimmed hat and sunscreen for sun protection.
- High visibility safety vest.

The appropriateness of specific equipment needs to be determined for the situation, e.g. the hard hat and air purifying masks may be omitted unless litter handling methods or the site conditions indicate these would be appropriate. Note that at some facilities and sites hard hats and the wearing of safety vests are compulsory and must be worn by all workers. There are absolutely no excuses or reasons for exception if this is the case.

All Safety Equipment must be available and in working order prior to commencing each collection of litter and each sorting event (i.e. gas cartridges and dust masks must be renewed).

On the completion of collecting and sorting, all protective clothing must be placed in an appropriate disposal container or sent to a suitable industrial cleaning.

Implementation of the Health and Safety Plan

The Supervisor is responsible for the health and safety of staff. All personnel are to be fully equipped and wearing personal safety equipment at all times during litter collection and sorting.

All personnel involved in sorting should consider changing overalls and washing exposed skin immediately after each sorting program prior to carrying out any other activities such as eating lunch or having a predetermined break. Note that a sorting program is defined as sorting a particular number of samples. This should be determined before sorting commences each day. For example, sorting five 240 litre bins before having a meal break. To avoid dehydration, liquid should be consumed every half to one hour.

To prevent any possibility of cuts arising from broken glass, needle pricks or contact with any hazardous materials, tongs should be used to spread out the sample and pick up any hazardous materials during the sorting process. Sorters should examine the contents to determine if there are any hazardous items, such as syringes, that should be picked out with tongs and deposited into a sharps container.

In the case of litter collection, all staff lifting materials into trucks must take care to ensure no back, neck or shoulder injuries occur. It is recommended that a lift truck be used where possible or alternatively two collectors must lift the litter from the bottom at ground level to a person in the truck. All staff should wear overalls, safety boots, safety vests and gloves when collecting litter.

It is imperative that all workers are supervised during sorting. A supervisor must be present at all times. If any person experiences any accident, such as a cut from broken glass or a "needle stick" type injury, then immediate health or safety measures should be implemented to treat the injury. Improve the site safety conditions if an accident occurs. This will limit any likely further incidents or ongoing risk of injury.

The supervisor is responsible for ensuring all personnel who are likely to be involved in litter collection and sample sorting undertake a safety demonstration course covering all aspects of safety when dealing with litter prior to commencing litter collection or litter sorting. Confirmation that this safety orientation has taken place must be recorded on the appropriate recording data log sheets (see Appendix E Occupational Health and Safety Plan).

The supervisor should confirm the following safety measures have been fully implemented and recorded before the sorting of any litter commences:

- Names of personnel undertaking the litter separation;
- On site safety induction course prior to the commencement of the on site training and of the litter collection, handling and sorting activities;
- Additional safety induction course to be provided immediately prior to the commencement of litter sorting;
- Inoculation of all personnel involved in sorting to be confirmed and recorded in accordance with inoculation requirements; and
- Necessary equipment is available and worn/used as appropriate.

