

Solid Waste Analysis Protocol

Summary Procedures

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The Solid Waste Analysis Protocol is structured in two volumes:

- 1 The *Solid Waste Analysis Protocol*, which provides the full information that protocol users will require to design and implement a survey to meet specific objectives or to gain a better understanding of the protocol procedures.
- 2 This *Solid Waste Analysis Protocol Summary Procedures*, which should be referred to for a short description of the procedures to be followed in carrying out a protocol survey. This volume is also included as Appendix 1 in the full *Solid Waste Analysis Protocol* document.

It is not intended that users rely solely on this *Solid Waste Analysis Protocol Summary Procedures*. Protocol users should also refer to the contents of the full protocol document.

References given in these summary procedures refer to the full *Solid Waste Analysis Protocol* document unless otherwise stated.

1 Overview

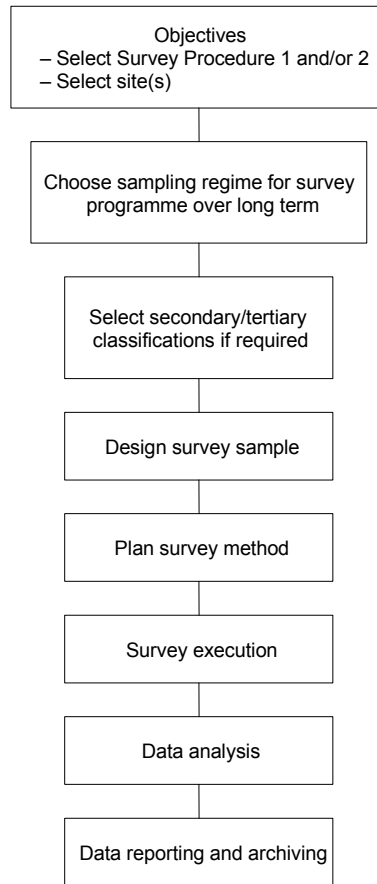
The protocol consists of:

- a classification system for component materials in the waste stream
- two survey procedures:
 - Procedure One – Classification of domestic wastes at source
 - Procedure Two – Classification at disposal facility
- Guidance on Sampling Regimes, the long term programme for surveying using Procedures One and Two.

Other supporting information and guidance is also included.

The two survey procedures are stand-alone methodologies. The procedures can be used separately, or both may be carried out to provide a wider survey of the waste stream. While the two procedures address major sectors of the solid waste stream, they do not address all pathways for solid waste, for example recycled material, waste treated and disposed of at source are not likely to be measured in the survey procedures described. Other methods of measurement are needed in these cases.

The process in carrying out a protocol survey is summarised in the following figure.



2 Sampling Regime

SWAP composition surveys should be done within an overall regime for sampling over time. A single SWAP survey will only provide information on what happened in that survey period.

There are essentially two different methods of sampling:

- continuous sampling of a low fraction of waste
- more intensive sampling carried out over one or more relatively short time periods.

As a method of estimating the amount and composition of waste over a complete year, statistical reliability strongly favours continuous sampling. However, practical considerations, including cost, mean that the latter method has to be considered. Compromises between the two methods are possible to some extent. This is discussed in more detail in Section 3 of the full *Solid Waste Analysis Protocol* document.

As a minimum, surveys should collect data covering a period of one week. This will allow for measurement of variation of refuse within cycles over a day and week.

To take account of changes over monthly, seasonal, and yearlong periods it is necessary to either:

- repeat the survey at different times to account, or
- spread the survey period over a longer time.

The following approach is recommended for the overall sampling regime.

- Surveys should be carried out over a minimum period of one week.
- Seasonal variation should be allowed for by repeating the survey at different times of the year. This would generally best be done over a week in the middle of each of the four seasons, but local variations such as circumstances over holiday periods may mean this needs to be modified.
- Where baseline data is required, four surveys of one week each should be done in each season over a single year.
- Where monitoring of longer-term trends is needed, a single-week survey should be done every year, in each season over a four-year cycle.
- More accurate continuous monitoring should be done in preference to single one-week blocks if possible.
- As a minimum the survey should consider waste composition (12 primary classifications) and waste source (business or residential).

Further information on sampling regimes, and the design of alternative regimes, is given in section 3 of the *Solid Waste Analysis Protocol* document. Users must recognise the limitations and risks of adopting less representative sampling regimes, and of applying survey data outside the period over which it was collected.

3 Procedure One: Survey Methodology – Classification of Domestic Wastes at Source

The purpose of this procedure is to obtain a quantitative estimate of the composition of solid wastes arising from domestic premises in the survey area. This procedure can be used to assess composition of the domestic waste stream or, in conjunction with a Procedure Two survey, to provide data on the domestic waste stream as part of the overall waste stream.

The Procedure One method broadly consists of:

- collecting refuse put out for municipal collection from selected 'households' or properties, and transporting to a sorting station
- sorting the refuse from each household into 12 primary categories
- weighing and recording of data
- statistical analysis and reporting.

A Procedure One survey should be undertaken in the following four stages. Additional information to assist in carrying out the Procedure is contained, under the same headings, in Section 6 of the Solid Waste Analysis Protocol document.

3.1 Stage 1: Survey design

- Define the survey objectives:
 - Is the survey for total waste stream data or for planning specific initiatives such as composting?
 - What components of the waste stream are of interest?
 - Is data sought on one sector of the community?
 - Is seasonal variation a concern?
 - What level of accuracy is needed?
- Define the sampling strategy – a systematic sampling method is recommended as a practical measure, where every “*i*th” household is selected, and the number is chosen to give the required total number of samples. Cluster sampling, stratified sampling, or tiered sampling may also be appropriate to focus on particular waste sources or waste categories.
- Select the secondary classifications to be used – waste should be sorted into at least the primary classifications according to section 5 of these summary procedures. Additional secondary classifications may be used where more specific information is sought on parts of the waste stream.
- Select the sample size – sample size will generally be dictated by the required accuracy for the least common constituent of interest. Practical sample sizes are generally 300–500 households, to yield around 10% precision for the main waste categories.

See Section 4.3 and Appendix 12 of the *Solid Waste Analysis Protocol* document for further information on survey design.

3.2 Stage 2: Set-up and training

- Identify the sorting area: ideally this should be covered and paved. The area should be at least 7 m x 4 m, with further area for storing refuse before and after sorting. The area should be accessible by collection vehicles.
- Obtain and set up equipment – a list of recommended equipment is given in section 4.4.1 of the *Solid Waste Analysis Protocol* document.
- Recruit personnel.
- Plan health and safety procedures during the survey.
- Train the survey staff – one day of training (including a practical trial sorting) is generally sufficient, covering the purpose of the survey, health and safety issues, survey methods and classification.

See section 4.4 of the *Solid Waste Analysis Protocol* document for further information on set-up and training.

3.3 Stage 3: Survey execution

- Collect the refuse samples and transport these to the sorting site. Collection should be just ahead of the normal refuse collection. Label refuse bags when they are collected to separate refuse by household (e.g. a consecutive number for each household). Where a household uses more than one bag, label each bag and tape the bags together. Where bags are not used as part of the collection service, empty the refuse from the containers used (e.g. MGBs) into strong plastic bags provided for the survey.
- Weigh the refuse bags collected from a household and record this weight. Example survey forms are in Appendix 10 of the *Solid Waste Analysis Protocol* document.
- Break open the bags from this household and sort the refuse into the primary categories, putting the sorted refuse into separate containers.

- Weigh each waste category and record the weight to the nearest 10 g. Refuse should then be similarly sorted and weighed by secondary categories, where applicable.
- Check the sum of the sorted weights against the total bag weight. Reweigh if required. Where any errors cannot be corrected, those measurements should not be included in the survey data.
- Dispose of sorted refuse and file the completed survey record for later analysis.
- Repeat the sorting and weighing for all households in turn.

See section 4.5 of the *Solid Waste Analysis Protocol* document for further information on survey execution.

3.4 Stage 4: Data analysis and reporting

- Enter results from the survey into a suitable computer database. Make cross-checks of total weights to verify correct data entry. Data should be entered and retained for each household.
- Total the weights and determine the percentage composition for each constituent.
- Calculate confidence intervals as an indication of the precision of the results. The basic statistical unit is the household (not the bag). Analysis and reporting is based on weight (not volume). Estimates of precision achieved in the survey are usually made from the variation between the basic statistical units (within strata in a stratified design). In anything but a simple random sample, statistical advice should be sought on methods of obtaining confidence intervals.
- Compile a report summarising the survey procedures, results and analysis. As a minimum the report should identify the quantities by weight and the proportions for each of the primary classifications, and the precision of the results.
- Archive the raw survey data in a form that allows it to be retrieved for future use.

See section 4.6 and Appendix 12 of the *Solid Waste Analysis Protocol* document for further information on data analysis and reporting.

4 Procedure Two: Survey Methodology – Classification of Wastes at Disposal Facility

The majority of solid waste generated in New Zealand is transported to transfer stations or landfills. The purpose of this procedure is to obtain a quantitative estimate of the composition of solid waste that arrives at the disposal facility in bulk. This procedure can be used to assess the composition of the waste stream or, in conjunction with a Procedure One survey, to provide data on the domestic waste stream as part of the overall waste stream.

In broad terms Procedure Two consists of:

- weighing all or most large vehicle loads entering the site and a proportion of smaller vehicle loads
- sampling a proportion of incoming loads in each category and sorting and weighing a sample of refuse from these into 12 primary categories
- statistical analysis and reporting.

A Procedure Two survey should be undertaken in the following four stages. (Additional material/technical information to assist in carrying out the procedure is contained, under the same headings, in section 5 of the *Solid Waste Analysis Protocol* document).

4.1 Stage 1: Survey design

- Define the survey objectives:
 - Is the survey for total waste stream data or for planning specific initiatives?
 - What components of the waste stream are of interest?
 - Is seasonal variation in data a concern?
 - What accuracy is required?
- Select the survey duration and regime – attention should be paid to the time dimension. It is important to determine whether you need data that relates to a particular point in time, or is representative of a substantial time period (e.g. a particular season or calendar year). Refer to section 3 of the *Solid Waste Analysis Protocol* document.
- Identify the disposal facilities within the study area and obtain permission from operators. Also identify the refuse haulers that use the facilities and obtain their co-operation.
- Derive a breakdown of expected vehicle arrivals at the disposal facility on a daily basis, with an indication of peak hourly rates.
- Estimate the number of vehicles of each type to be sampled – a systematic method of sampling (as opposed to random) is recommended as a practical measure. This requires estimating the number of loads of each vehicle type. Sample selection depends on the required accuracy of results, and the variability of any constituent of the waste stream. Practical sample sizes are generally 300–500 vehicles to achieve precision for the main waste components of 10–20%. However, a larger sample size will provide more accurate data. Sorting and weighing of all sampled loads is recommended. Further information is provided in section 5 and Appendix 12 of the *Solid Waste Analysis Protocol* document.
- Select the secondary classifications to be used – waste should be sorted into at least the primary classifications, as explained in section 5 of these summary procedures. Additional secondary classifications may be used where more specific information is sought on parts of the waste stream.

Refer to section 5.2 and Appendix 12 of the *Solid Waste Analysis Protocol* document for further information on survey design.

4.2 Stage 2: Set-up and training

- Identify the vehicle weighing area – where there is a weighbridge at the site, this can be used for vehicle weighing. Otherwise a temporary vehicle weighing area will be needed, conveniently located in an area just inside the entrance to the disposal site. The area should be adjacent to the vehicle access road, so that access is easy but vehicles that are not to be weighed are not delayed. It should also be accessible to vehicles entering and leaving the disposal site (so that full and empty weights can be measured), or separate weighing areas established for entering and exiting vehicles. The vehicle weighing area must be level to ensure that the weigh is accurate.
- Identify the waste sorting area – ideally this should be covered and paved. The area should be at least 10 m x 10 m, with further area available for storing refuse before and after sorting. The area should be accessible by refuse vehicles.
- Obtain and set up equipment – a list of recommended equipment can be found in section 5.3.1 of the *Solid Waste Analysis Protocol* document.
- Recruit personnel.
- Develop health and safety planning procedures for the survey.
- Train the survey staff. One day of training (including practical trial sorting) is generally sufficient, covering the purpose of the survey, health and safety issues, survey methods and classification.

Refer to section 5.3 of the *Solid Waste Analysis Protocol* document for further information on set-up and training.

4.3 Stage 3: Survey execution

Two simultaneous survey activities occur when undertaking the procedure:

- weighing a high proportion of loads entering the facility
- sorting a smaller proportion of the loads and weighing the separate refuse categories.

To weigh vehicles arriving at the site, the following procedure is recommended.

- Stop each vehicle entering the facility, explain that a survey is being undertaken, ask for co-operation, and place a form under the wiper blade of small vehicles or hand it to the driver.
- Weigh the vehicle (either all or a sample according to the survey programme) and record gross weight on the form.
- Determine the source of the load and vehicle type. Visually estimate the constituents of the load by weight and record this on the form (e.g. domestic bags 20%, garden putrescibles 30%, rubble/concrete 50%). Hand the form to the driver and direct the vehicle back to the weigh station when empty. If the truck's tare weight is known, record this and retain the form.
- If the tare weight is not available, reweigh the empty vehicle as it leaves the site, record this on the form, and retain the form.

The following procedure is recommended for a sort-and-weigh of sampled loads.

- Select the next available vehicle matching the survey plan for vehicle type after vehicles have been weighed as they arrive at the site, and direct the vehicle to the sorting area.
- Discharge the contents and direct the vehicle back to the weigh station when empty.
- Sub-sample for sorting (if the load is greater than 500 kg) if required, sort the refuse into the primary categories, putting the sorted refuse into separate containers or piles.

- Weigh each waste category and record the weight to the nearest 10 g. Similarly sort and weigh by secondary categories where applicable.
- Dispose of the sorted refuse.

Refer to section 5.4 of the *Solid Waste Analysis Protocol* document for further information on survey execution.

4.4 Stage 4: Data analysis and reporting

- Enter results from the survey into a suitable computer database. Cross-checks of total weights should be made to verify correct data entry. Data should be entered and retained for each load.
- Total the weights and determine the percentage composition for each constituent.
- Calculate confidence intervals as an indication of the precision of the results. The basic statistical unit is the vehicle load. The primary method of analysis and reporting is by weight (not by volume). Further detail is available in section 5.5 and in Appendix 12 of the *Solid Waste Analysis Protocol* document. In anything but a simple random sample, statistical advice should be sought on the method of obtaining confidence intervals.
- Reporting – as a minimum the report should identify the quantities by weight and proportions arriving at the disposal site from each of the primary classifications and the statistical reliability of the results, expressed as confidence interval (e.g. paper 37% ± 3% by weight at 95% confidence interval).
- Archiving – whatever software is used in the analysis, one copy of the raw data should be made in some commonly available format such as a spreadsheet, text or csv file. Items of data should be accurately described, and the survey methods by which the data were collected should be documented. Take particular care to avoid future access to the data being reliant on rare, expensive or unreliable proprietary products.

Refer to section 5.5 and Appendix 12 of the *Solid Waste Analysis Protocol* document for further information on data analysis and reporting.

5 Waste Classifications

Primary classification:	Secondary classification:	Examples:
1 Paper*	<ul style="list-style-type: none"> * Paper (excluding newsprint and magazines) * Paper (newsprint) * Paper (magazines and printed materials) * Paper board (corrugated cardboard) * Paper board (including cereal and shoe boxes) * Paper board (liquid cartons and multi material) 	<ul style="list-style-type: none"> e.g. photocopy paper e.g. newspapers e.g. advertising brochures e.g. waxed cartons, foil lined cartons
2 Plastics*	<ul style="list-style-type: none"> PET – Code 1 HDPE – Code 2 PVC – Code 3 LDPE – Code 4 PP – Code 5 PS – Code 6 Multi-material – Code 7 	<ul style="list-style-type: none"> e.g. soft drink bottles e.g. milk bottles, retail bags e.g. cups, shower curtains, binders e.g. retail carry bags e.g. foam meat trays, foam cups
3 Putrescibles*	<ul style="list-style-type: none"> * Putrescibles (excluding garden) * Putrescibles (garden) 	<ul style="list-style-type: none"> e.g. food scraps, dead animals e.g. grass clippings, weeds, trees
4 Ferrous metals*	<ul style="list-style-type: none"> * Ferrous (excluding steel cans) * Ferrous (steel cans) 	<ul style="list-style-type: none"> e.g. car body, roofing iron, appliance body e.g. baked bean can, soup can
5 Non-ferrous metals*	<ul style="list-style-type: none"> * Non-ferrous (excluding aluminium cans) * Non-ferrous (aluminium cans) 	<ul style="list-style-type: none"> e.g. copper pipe, aluminium windows e.g. soft drink can
6 Glass*	<ul style="list-style-type: none"> * Glass (brown bottles) * Glass (clear bottles) * Glass (green bottles) * Glass (jars) * Glass (excluding bottles and jars) 	<ul style="list-style-type: none"> e.g. jam jar, gherkin jar e.g. window glass
7 Textiles*	<ul style="list-style-type: none"> * Non-leather * Leather 	<ul style="list-style-type: none"> e.g. carpet, curtains
8 Nappies and sanitary*		<ul style="list-style-type: none"> e.g. disposable nappies, sanitary napkins
9 Rubble, concrete, etc	<ul style="list-style-type: none"> Rubble and rocks Concrete Plasterboard Fibre cement products Fibreglass Soil/clay Other 	<ul style="list-style-type: none"> including bricks e.g. gip board e.g. hard planks, shakes e.g. topsoil, sand
10 Timber	<ul style="list-style-type: none"> Lengths and pieces Pallets and crates Fabricated Sheets Sawdust/shavings Debris/other 	<ul style="list-style-type: none"> e.g. framing timber, boards, sawn timber e.g. joinery, beds, cabinets e.g. plywood, particle board, MDF
11 Rubber	<ul style="list-style-type: none"> Tyres Rubber products 	<ul style="list-style-type: none"> e.g. rubber pipes, mats
12 Potentially hazardous	<ul style="list-style-type: none"> Household hazardous waste Special and treated waste Medical waste Untreated hazardous waste Debris/other 	<ul style="list-style-type: none"> e.g. cleaning agents, aerosols, wax products, glues, cosmetics, medicines, batteries, lighters, paint and ink, agriculturals e.g. prescription medicines, animal remedies e.g. contaminated soil

Guide to Common Objects: Alphabetical Listing

How to use this listing

The first column identifies “waste items”. These are listed in alphabetical order. The second column identifies the primary classification and the third column, secondary classifications.

This list contains common wastes found during SWAP surveys and can be added to and developed over time.

Waste item	Primary classification	Secondary classification
A		
Advertising brochures	Paper	Paper: magazines and printed materials
Aerosols	Potentially hazardous	Household hazardous waste
Agrichemicals	Potentially hazardous	Household hazardous waste
Animal faeces	Putrescibles	Putrescibles (excluding garden)
Appliances	Ferrous metals	Ferrous (excluding steel cans)
Ash	Rubble, concrete, etc	Other
Asphalt	Rubble, concrete, etc	Rubble and rocks
B		
Baked bean can (empty)	Ferrous metals	Ferrous (steel can)
Baked bean can (full)	Putrescibles	Putrescibles (excluding garden)
Bark chips	Timber	Sawdust/shavings
Batteries	Potentially hazardous	Household hazardous waste
Batts	Rubble, concrete, etc	Fibreglass
Beer can (empty)	Non-ferrous metals	Non-ferrous (aluminium cans)
Books	Paper	Paper: magazines and printed materials
Bricks	Rubble, concrete, etc	Rubble and rocks
C		
Cable drums (wooden)	Timber	Pallets and crates
Cardboard boxes	Paper	Paper board (corrugated cardboard) or paper board (including cereal and shoe boxes)
Carpet	Textiles	Non-leather
Cereal box	Paper	Paper (including cereal and shoe boxes)
Chemicals	Potentially hazardous	Household hazardous waste
Chippie packet	Plastics	Multi-material – Code 7
Clay	Rubble, concrete, etc	Soil/clay
Cleaning agents	Potentially hazardous	Household hazardous waste
Clothes	Textiles	Non-leather
Cosmetics	Potentially hazardous	Household hazardous waste

Waste item	Primary classification	Secondary classification
Cups (foam)	Plastics	PS – Code 6
Cups (plastic)	Plastics	PVC – Code 3
D Dust/dirt	Rubble, concrete, etc	Soil/clay
E Electronics	Non-ferrous metals	Non-ferrous (excluding aluminium)
F Fats Fax paper Fibreboard Fibrolite Foodbag Fruit	Putrescibles Paper Timber Rubble, concrete, etc Paper Putrescibles	Putrescibles (excluding garden) Paper (excluding newsprint and magazines) Sheets Fibre cement products Paper (excluding newsprint and magazines) Putrescibles (excluding garden)
G Gibboard Glues Grass clippings	Rubble, concrete etc Potentially hazardous Putrescibles	Plasterboard Household hazardous waste Putrescibles (garden)
H Hardie planks	Rubble, concrete, etc	Fibre cement products
I		
J		
K		
L Leaflets	Paper	Paper: magazines and printed materials
M Magazines Meat Medicines MDF Milk bottles (plastic) Milk bottles (glass)	Paper Putrescibles Potentially hazardous Timber Plastics Glass	Paper: magazines and printed materials Putrescibles (excluding garden) Medical waste Sheets HDPE Code 2 Glass (clear bottle)
N Nappies (disposable) Newspapers	Nappies and sanitary Paper	Paper (newsprint)
O		
P Paint Particleboard Phone books Photocopying paper Plywood	Potentially hazardous Timber Paper Paper Timber	Household hazardous waste Sheets Paper (newsprint) Paper (excluding newsprint and magazines) Sheets

Waste item	Primary classification	Secondary classification
Q		
R		
Raro sachets	Paper	Paper board (liquid cartons and multi material)
Retail carry bags	Plastics	LDPE Code 4
Rock	Rubble, concrete, etc	Rubble and rocks
Rockwool	Rubble, concrete, etc	Other
S		
Sanitary napkins	Nappies and sanitary	
Sawdust	Timber	Sawdust/shavings
Shoes	Textiles	Leather
Softboards	Timber	Sheets
Soft drink bottles	Plastics	PET Code 1
Soft drink can	Non-ferrous metals	Non-ferrous (aluminium cans)
Soil	Rubble, concrete, etc	Soil/clay
Solvents	Potentially hazardous	Household hazardous waste
Sweepings	Rubble concrete, etc	Other
T		
Tetra paks	Paper	Paper board (liquid cartons and multi material)
Timber frames (new and used)	Timber	Lengths and pieces
Tyres	Rubber	Tyres
U		
V		
W		
Window frames	Timber	Fabricated
Wood (mixed)	Timber	Debris/other
Wood (rotten)	Timber	Debris/other
X		
Y		
Z		

Typical Domestic Waste Sorting Layout

