Ministry for the Environment
Manatū Mō Te Taiao

The 1998/1999 National Landfill Census Report

Published in March 2000 by Ministry for the Environment
PO Box 10-362, Wellington, New Zealand

ISBN 0-478-09078-1

This document is available on the Ministry for the Environment's web site:
http://www.mfe.govt.nz

ME number 335

Foreword

The first Landfill Census Report in 1995 highlighted a number of very real concerns about the implications of landfills on people and the environment.

This second National Landfill Census has identified some definite improvements in landfill management practice, but not enough has been done. If we are to protect the environment and safeguard our reputation more definitive action is required to remedy unsatisfactory situations. The time is gone when we can accept a continuance of landfill burning, poor operating practices, substandard landfills and a significant degree of non-compliance with resource consents.

I would like to see all new landfills meeting good industry practices such as:

- systems for leachate collection and treatment;
- provision for gas collection and management;
- incorporating liners of a standard that give adequate control over the wastes being disposed at each landfill; and
- high levels of management, including operator training, controls over the acceptance of wastes (particularly hazardous wastes), full costing of disposal and specific attention to what happens when the landfill closes.

I want to see, within 10 years, the closure of substandard landfills or their upgrading to meet the requirements of good industry practice. I am aware that this will present a substantial challenge to some local authorities, but these aims have already been achieved in some parts of New Zealand and others have plans in place that would achieve them. This challenge can be met only with support from industry and the community and with central and local government working closely together.

Based on the findings from this census, the Ministry for the Environment has identified several priority issues for government action. These include:

- development of a landfill classification system and acceptance criteria for the disposal of hazardous waste;
- guidance on consent conditions for landfills;
- an education strategy aimed at the public to halt the incidence of landfill burning;
- guidance on closed landfill management;
- landfill operator training; and
- revision of the Landfill Full Costing Guide.

The Ministry for the Environment is also supporting, through the Sustainable Management Fund, the Centre for Advanced Engineering in revising the engineering guidelines for landfill management.

Landfills will remain an important element of an overall waste management strategy for some time to come. But this Government is committed to improve the performance of landfill management and to work towards significantly reducing the waste stream. I am looking forward to turning this commitment into reality.

I have asked the Ministry for the Environment to communicate widely the results of the Census and to consult with local government, industry and communities to work through how the objectives for landfill management outlined in this report can be achieved within a reasonable period of time.

Hon Marion Hobbs
MINISTER FOR THE ENVIRONMENT

Executive Summary

The 1998/99 National Landfill Census is the second national landfill census undertaken by the Ministry for the Environment since the introduction of the Resource Management Act in 1991.

The 1995 *National Landfill Census* (Ministry for the Environment, March 1997) demonstrated that regional councils, territorial local authority landfill operators and private operators needed to significantly improve their landfill management practices to control adverse effects. The 1995 census found that:

- there was a varied approach to landfill consents around the country, with a number of territorial local authorities yet to receive resource consent applications for operating landfills
- hazardous wastes were poorly managed at most landfills throughout the country
- the practice of open burning at landfills was common in both rural and urban areas
- more landfill operator training was needed to improve performance
- further work was necessary on the impact of economic incentives and charging practices.

In the course of preparing this report the Ministry established a set of objectives for effective landfill management. Progress towards these objectives, as indicated by the Census data, serve as the basis for the Ministry's judgements on the current status of landfill management practice.

The objectives are:

- all landfills to be consented and compliant with consent conditions
- landfill consent conditions to reflect nationally consistent standards of environmental management
- the practice of open burning to end
- all landfills to be managed by appropriately trained operators
- hazardous wastes to be effectively managed and controlled
- closed landfill sites to be monitored and effectively managed
- the true cost of landfill management to be met through the correct pricing of waste disposal.

The 1998/99 National Landfill Census indicates that improvements in landfill practice have occurred since the last census but that practice still falls considerably short of the Ministry's objectives for landfill management.

In brief, the census results indicate:

- an improvement in the number of consented landfills. Although 50 landfills out of 221 landfills identified by Regional Councils are currently operating without the necessary consents, 46 of these have already lodged resource consent applications with the relevant consent authority
- a significant level of non-compliance, with one-third of landfills having breached their resource consents since 1995
- a poor performance by some landfill operators in managing hazardous wastes, particularly in a lack of appropriate documentation for receipt of hazardous wastes and no consistent definition of what hazardous wastes are received
- a decrease in open burning at landfills. However, burning still occurred at 24 percent of landfill sites in the past 12 months
- a small improvement in landfill operator training
- a considerable variation in quality of consent conditions throughout the country
- evidence of inadequate management of closed landfills.

Please note: while every effort was made to collect accurate data problems were encountered, for example: some respondents appeared to have misunderstood some of the questions, many respondents failed to answer all questions and in some cases it is evident that an inappropriate person has completed the Census questionnaire. The Census questionnaire and methodology will be reviewed prior to the next survey to try and minimise these issues. The problems found in the data do not invalidate the conclusions reached.

Contents

1 Introduction

The *Environment 2010 Strategy (E2010)* (Ministry for the Environment (MfE), 1995) provides a statement of the Government's strategy on the environment and takes a long-term view of New Zealand's environmental priorities and how the Government regards them. The vision contained in the strategy supports "a clean healthy and unique environment, sustaining nature and people's needs and aspirations" (MfE, 1995, p 7). In support of this vision, 11 goals or priority areas have been identified, including one to ensure the effective management of pollution, waste and hazardous substances. This goal is:

> ***to manage (pollution and) waste, and thereby reduce risks to environmental quality and public health to levels that are widely agreed to be socially acceptable (MfE, 1995, p 44)***

The framework for the management of waste in New Zealand is the Government's 1992 Waste Policy. The Policy adopts a voluntary approach to the management of waste and ensures that:

- as far as practicable, New Zealand's waste generators meet the costs of the waste that they produce
- the implementation of the internationally recognised hierarchy of reduction, reuse, recycling, recovery and residual management is undertaken by all involved in waste generation and management in New Zealand.

Landfills are the traditional means of disposing of the majority of wastes in New Zealand. Prior to the Resource Management Act 1991 (RMA), there was a lack of controls on the disposal of waste to landfill. There was little consideration of the environmental effects from waste disposal, with many old "tips" sited in estuarine areas or on riverbanks. Often these tip sites were poorly managed, and there was a lack of control on the acceptance of hazardous wastes.

Since the introduction of the RMA and more stringent environmental controls, many older tip sites have closed down. Some councils are now working with neighbouring authorities to establish regional landfills. Other disposal methods, such as incineration, are also being considered as an alternative to landfill disposal.

Waste reduction or waste minimisation activities such as Zero Waste and cleaner production initiatives like Target Zero are also being adopted by communities, local councils and businesses.

1.1 RMA Framework

The RMA instituted a change to the "traditional" approach to landfill management and practice. The purpose of the RMA is to manage natural and physical resources in a sustainable manner by avoiding, remedying and mitigating environmental effects. The main means for controlling the environmental effects of landfills are resource consents under the RMA.

Regional Policy Statements (RPSs) set the framework for achieving the sustainable management of the environment by providing an overview of the resource management issues of a region. RPSs outline policies and methods to achieve integrated management of natural and physical resources. Regional and district plans set rules for managing natural and physical resources and managing environmental effects.

Consents enable certain activities to be undertaken as long as environmental effects are properly controlled and managed. Landfills require a variety of consents under the RMA from both regional and territorial authority councils. Regional councils are responsible for the issuing of discharge consents, and coastal and water permits. Land use consents are the responsibility of territorial local authorities.

Section 9 of the RMA specifies that a land use consent is required to undertake landfill activity unless it is provided for under the District Plan or the landfill is a designated site under section 168. A Minister of the Crown or a local authority can assign a designation (ie, a provision made in a district plan to give effect to a requirement made by a Requiring Authority). A designation can include the operation of a landfill in a specified site.

Section 15 of the RMA defines the consents needed for the discharge of contaminants to water, air and land. A resource consent is usually required unless such discharges are provided for in a plan.

From 2 September 1996, under section 418(1c) of the RMA, no landfills can discharge contaminants to land unless:

i the discharge is expressly allowed by a rule in a proposed regional plan, or

ii an application for a permit to discharge the contaminant has been lodged with the regional council.

Water permits are provided for under section 14 of the RMA and are required for taking, using, damming and diverting water. Diversion of, for example, stormwater around a landfill will require a water permit unless provided for in a plan or subject to section 20. Section 20 allows for the continuation of certain activities that were formerly permitted activities.

1.2 Landfill Guidelines

Apart from the consenting provisions under the RMA, landfills in New Zealand are not subject to specific regulations. Guidance is provided through the *Landfill Guidelines* (MfE, 1992) which recommend best industry practice for key aspects such as landfill siting, design, operation and monitoring. These Guidelines were developed after a review of international approaches and were based on the UK model of landfills as "waste treatment" facilities (bioreactors). In the absence of good understanding of environmental effects, the Guidelines adopted a cautious best practice approach and need to be adapted to suit individual sites. E2010 specifically mentions the need for all regional and territorial authorities to adopt the *Landfill Guidelines* to achieve high standards of waste disposal.

The Centre for Advanced Engineering (CAE), University of Canterbury is currently reviewing the *Landfill Guidelines* in a project supported by the Sustainable Management Fund. The sections on hazardous waste management and landfill engineering need updating to reflect changes in the waste management industry and the development of case law and technology. The Guidelines will be available for use by interested parties in February 2000. The original guidelines have also been supplemented by the inclusion of the *Landfill Full Cost Guide* in 1996 and the *Hazards of Burning at Landfills* in 1997.

1.3 Landfill Management Aims and Objectives

In 1999, the Ministry for the Environment established aims and objectives for landfill management to provide a basis against which current landfill practice can be measured and assessed. The aim is the adequate management by landfill operators and regional councils of environmental risk through:

- controlling adverse and potential environmental effects from open and closed landfills
- managing landfills in an efficient and effective manner.

Its objectives are:

- all landfills to be consented and compliant with consent conditions
- landfill consent conditions to reflect nationally consistent standards of environmental management
- the practice of open burning to be banned
- all landfills to be managed by appropriately trained operators
- hazardous wastes to be effectively managed and controlled
- closed landfill sites to be monitored and effectively managed
- the true cost of landfill management to be met through the correct pricing of waste disposal.

These aims and objectives are used to assess current landfill management practice in this report.

1.4 The 1995 National Landfill Census

In 1995, the Ministry for the Environment conducted the first national census of landfills in New Zealand since the introduction of the RMA. The census findings showed that:

- there was a varied approach to landfill consents around the country, with a number of territorial local authorities yet to receive resource consent applications for operating landfills
- hazardous wastes were poorly managed at most landfills throughout the country
- the practice of open burning at landfills was common in both rural and urban areas
- more landfill operator training was needed to improve performance
- further work was necessary on the impact of economic incentives and charging practices.

To monitor trends and to see if landfill management practice was improving, the Ministry's report on the census recommended that a further census be conducted after two to three years.

1.5 The 1998/99 National Landfill Census

In order to fulfil the recommendation of the 1995 Landfill Census, the aims and objectives for the 1998/99 Landfill Census were as follows:

Aims

- to assess the effective management of landfills in New Zealand
- to identify any further actions required to improve performance.

Objectives

- to determine any change in performance since the last census was conducted in 1995
- to monitor the uptake of the *Landfill Guidelines*
- to monitor compliance with the RMA
- to provide baseline information on landfill management so that future trends can be measured and monitored
- to provide information on landfill management for international reporting requirements.

1.6 Outline of Report

Section 2 of this report provides details of the methodology used in the Landfill Census. The questionnaires used are reproduced in the Appendices.

Section 3 presents the results from the census questions. Comparisons with the results from the 1995 census are incorporated throughout the text.

Section 4 details the conclusions reached in this census.

The Appendices contain the results of the questionnaires, the regional council and landfill operator questionnaires, lists of operating landfills, abbreviations used in the text of this document, and a list of definitions.

2 Methodology

2.1 Questionnaire

Planning for the 1998/99 National Landfill Census began in mid 1998 with the revision of the 1995 landfill census questionnaires. This was undertaken by a peer review group of five people comprising representatives from two territorial local authorities, a private operator, a regional council and Statistics New Zealand. The person from Statistics New Zealand provided comment on the statistical robustness of the questionnaires; the people from the local authorities and the private operator's comments ensured that the questions would provide meaningful and accurate information.

As regional councils and landfill operators have different responsibilities, two questionnaires were developed. These are provided in Appendix 6.

In September 1998, regional councils were asked to provide a list of landfill operators in their region, and this information was used to compile a database of landfill operators.

The census covered:

- operating municipal landfills (taking waste from a range of generators and operated both by territorial local authorities and private enterprises)
- operating dedicated landfills, for example, landfills that accept timber waste only
- operating cleanfills
- closed municipal landfills, closed dedicated landfills and closed cleanfills.

In early November 1998, all regulators and operators were sent a postal questionnaire, instructions for the completion of the questionnaire, the aims and objectives of the 1998/99 landfill census, and a stamped addressed envelope to the Ministry for the Environment for the return of the completed questionnaire. In total, 209 census questionnaires were sent out to landfill operators and regional councils.

Completed replies were due back by 29 January 1999. Telephone and faxed requests were made to respondents who did not reply by the due date.

2.2 Analysis of Responses

Data from the questionnaires were entered into a Microsoft Access database in February and March 1999. The database was specifically designed for this census and enabled us to analyse specific questions, for example, those that required a statistical response. Text responses were analysed manually. Analysis of the questionnaires and compilation of this report took approximately seven months.

To make comparisons between quantities of wastes at different landfills, a conversion factor is needed to convert volume of waste to weight of waste. The factor used was one cubic metre to one-half tonne.

During analysis of responses, some findings were found to be distorted owing to the low response rate to some questions. Some respondents also appeared to have misunderstood some of the questions, thus possibly compromising the validity of some of the data. For example, terms such as residential and non-residential waste in Part B of the territorial local authority/private operator questionnaire need to be defined to obtain more accurate data. The problems found with the interpretation of some of the questions, however, do not invalidate the conclusions we have reached.

All questionnaire responses are confidential. Data have been aggregated to remove any specific mention of landfill operators or regional councils by name.

3 Results

In total, 209 landfill census questionnaires were sent out for response. Returns were received from 135 landfill operators and regional councils, giving a response rate of approximately 65 percent. All 16 regulators and 69 out of 74 territorial authority returned their questionnaires. However, only 50 private operators' responses were received.

The return rate for territorial local authorities was an improvement on the last census when 15 territorial authority landfill operators did not respond. Of those that did not respond this time, four represented rural areas and were located in both the South and North Islands. Consequently, the census data are incomplete for the Otago, Wellington, Manawatu-Wanganui and West Coast Regions.

With the assistance of regional councils, a more extensive database of operators of private dedicated landfills and cleanfills was compiled for this census compared with the 1995 census. However, overall there was a poor response from these operators.

The Landfill Census provided information on four groups:

- regulators (regional councils and unitary authorities) (16 of 16)
- landfills as identified by regulators (209)
- territorial local authorities and private operators (119). Some landfill operators operate more than one landfill
- detailed information from landfills managed by operators (177).

The results are presented in terms of general topic areas and in the order of the questionnaires where possible (see Appendix 6). The headings used are:

- the *Landfill Guidelines* and *Our Waste: Our Responsibility*
- plans
- resource management issues
- engineering issues
- monitoring issues
- landfill funding
- landfill management and aftercare
- landfill information
- hazardous wastes
- closed landfill sites.

3.1 The Landfill Guidelines and Our Waste: Our Responsibility

Regional councils and operators were asked a number of questions about the usefulness of the *Landfill Guidelines* (MfE, 1992) and *Our Waste: Our Responsibility* (CAE, 1992). All those involved in landfill management should be aware of and use these publications.

Most (14 out of 16) regional councils had read the Guidelines or *Our Waste: Our Responsibility*, with 10 using the Guidelines for establishing resource consent conditions in the past 12 months. However, only three regional councils identified that they had used the Guidelines in the past 12 months for identifying other landfill policy. Ten regional councils noted that the Guidelines were useful.

Only 57 percent (60) landfill operators had read the publication *Our Waste: Our Responsibility*, with 40 percent (42) who had not. More than two-thirds of landfill operators had read the Landfill Guidelines. This compares with 28 percent (30) who had not.

Just over half (57) of the landfill operators noted that they had used the Guidelines to improve operations at landfills. However, just over one-third (37) of the landfill operators had used the Guidelines for planning new landfills and 33 had used the guidelines for assessing the management of closed landfill sites.

Sources of other information for the management of landfills included:

- consultants
- past information on landfill management
- advice from regional councils and in regional plans
- RMA requirements.

One-quarter of landfill operators said the Guidelines could be improved, but nearly half of the responses did not know whether they could be improved or did not respond. More than half of the regional councils surveyed noted that the Guidelines needed improvement.

According to respondents, the Guidelines could be improved in a number of ways. Some comments included that:

- "more information is needed about the performance of New Zealand landfills. There are too many examples in the *Landfill Guidelines* using overseas examples"
- "the Guidelines are too focused on municipal landfills. More information is needed for dedicated landfills such as cleanfills"
- "more detail should be given on hazardous waste management, particularly handling, disposal, acceptance criteria and definition"
- "there is insufficient information on the aftercare of closed landfills and their integration into natural areas"
- "site selection and containment should be more clearly specified"
- "standards should be set and not guidelines, eg, a minimum standard for landfill design, containment and landfill construction similar to the USEPA subtitle D code"
- "low population/low cost solutions should be included"
- "more emphasis needs to be placed on waste diversion practices such as recycling and composting"
- "RMA issues should be given in more detail, particularly monitoring requirements"
- "better definitions are required, eg, for cleanfills".

This census has identified several key areas where the Guidelines need improvement. The Ministry expects that the Centre for Advanced Engineering will take on board these concerns and improve these areas in the current revision of the *Landfill Guidelines*. The revised Guidelines are due for publication in February 2000.

3.2 Plans

3.2.1 Regional Policy Statements and Regional Plans

All regional councils identified waste management as a significant issue in their RPSs. However, in general, this census found that some operators appear to have limited knowledge of the contents of RPSs and Regional Plans. Regional councils are also moving towards having rules on landfills in, for example, their Air Plans and Discharge to Land Plans. Few regional councils have one single integrated plan.

Eleven regional councils had produced under the RMA regional plans that included landfills. These included three operative plans and five notified plans. Two plans were currently proposed, and a further two ratified by council amendment last year. Three regional councils noted that they would not be producing plans that cover landfills, while the remaining two regional councils intended to prepare a Regional Plan. One of these councils intended to develop a Regional Plan that will be operative in 2001.

Just over half of the landfill operators indicated that their landfills were covered by a Regional Plan. However, operators noted that 28 percent of their landfills were not covered by a regional plan, and 14 percent did not know.

3.2.2 District Plans and Waste Strategies

Sixty percent (107) of landfill sites were covered by a district or city plan. A further 29 percent (53) of landfill operators said that their landfill was not covered by a district or city plan. Ten did not know, and six provided no response.

Thirty-four operator responses indicated that a waste strategy covered their landfill.

3.2.3 Local Government Amendment Act (No. 4) 1996

The Local Government Amendment Act (No. 4) 1996 (LGA) specifies that a waste management plan (WMP) is to be prepared by all territorial local authorities that includes the Five Rs (reduce, reuse, recycle, recovery and residual management) and treatment. This census found that there were a number of waste plans in preparation or waste strategies being adapted to fit the requirements of the LGA. There is still a need for many territorial local authorities to prepare WMPs.

Operators were asked if their landfill was covered by a WMP (including a draft) under the LGA. Twenty-seven percent of landfill operators stated that their landfill was covered by a WMP. The majority (54 percent) stated that no WMP had been prepared, with a further 12 percent noting that they did not know of any WMP under the LGA. Operators were also asked to name the WMP that applies to their landfill, and 13 specified the WMP that covered landfills in their area.

3.3 Resource Management Issues

3.3.1 Open/Operating Landfills

There has been a decrease in the number of operating landfills since the first landfill census was undertaken in 1995. According to regional council returns, 221 landfills are now operating throughout New Zealand. This is a significant decrease from the 327 identified in the 1995 census. Regional council returns, however, detailed only 209 landfills operating in their regions.

Eight regional councils maintain a register of open landfills in their areas, compared to six that did not, with no response from two. Regional councils provided information about 209 operating landfills in their questionnaire returns. There is no information about the 12 landfills that were included in the regional council count but not in the questionnaire returns.

Appendices 4 and 5 list when landfills were open by period and region and due closure date.

3.3.2 Resource Consents

Of the 209 operating landfills, 75 percent or 157 landfills were identified as having the necessary consents to operate. Regional councils identified approximately 25 percent or 50 landfills as not having the necessary consents (ie, consents lodged but not yet granted). At the time the census was conducted, landfills had not lodged resource consent applications.

Since the census was conducted in early 1999, more landfills have been granted the necessary consents to operate.

In general, there has been an improvement in the number of landfills with resource consents, with a lesser number of landfills holding a greater number of resource consents. However, this census did identify discrepancies between regional council responses and those provided by territorial local authorities and private landfill operators. This could be for a number of reasons including, for example, misinterpretation or lack of understanding of the issues, lack of knowledge in the area, or lack of record keeping.

3.3.3 Land Use Consents

According to landfill operator responses, 58 percent (103) of landfills had land use consents, compared with 38 percent (69) that did not. Regional council responses indicated, however, a lesser figure of 31 percent(49) with land use consents and 27 percent (43) without any land use consents.

Of those with consents, the majority identified that the land use consent was for operating a landfill for residential, commercial and industrial waste disposal. A number of landfills did not require consents because the sites were designated for refuse disposal under the District Plan.

3.3.4 Discharge Permits

According to landfill operators, 64 percent (114) of landfills had discharge permits, while 32 percent (57) of landfills did not. Regional council responses indicated a higher percentage, with 89 percent (140) of landfills holding discharge permits.

According to responses, discharge permits were for a variety of discharge activities. These included:

- contaminants (landfill gas, dust, odour) to air
- treated leachate to land
- treated leachate to groundwater
- stormwater to land
- stormwater to groundwater/water
- contaminants to land
- refuse to land.

The number of landfills with discharge permits had almost doubled, from 60 in 1995 to 113 in 1998/99.

3.3.5 Water Permits

According to landfill operator returns, just over one-quarter (51) of landfills had water permits, with 64 percent (114) of landfills having none. The number of landfills with water permits had more than doubled from 23 in 1995 to 49 this year. Regional council returns indicated a slightly lesser percent of 21 percent (33) with permits, while 57 percent (91) of landfills did not have them. Some landfill operators confused water permits with discharge permits. Most water permits at landfills were for:

- taking water
- diverting existing water courses, groundwater or stormwater
- damming water.

3.3.6 Other Consents

"Other" consents were held by 15 percent (27) of landfills. These included, for example:

- coastal permits to take sand for landfill cover
- trade waste consents.

The number of other consents had also increased from three in 1995 to 27 in this census.

3.3.7 Resource Consent Conditions

Resource consent conditions are set to ensure that environmental effects are properly managed and environmental risk is minimised. As in 1995, this census showed considerable variation in consent conditions in different regions. This could result in inconsistent and inappropriate management of environmental effects nationally.

A summary of consent conditions from regional council returns is contained in Appendix 1.

3.3.8 Breaches of Resource Consent Conditions

Breaches in resource consent conditions can cause unnecessary environmental risks and landfill operators need to ensure that consent conditions are enforced.

According to regional council responses, 31 percent (49) of consented landfills had breached their resource consent conditions since 1995. In total, there were 107 breaches of resource consent conditions.

Breaches occurred in a wide range of resource consent conditions. The most common breach was non-compliance with monitoring conditions, with 15 percent of the breaches identified by regulators. This included:

- not establishing a monitoring programme
- non-compliance with set conditions, eg, not supplying monitoring results.

The second most common breach was lack of cover material with over 10 percent of the breaches identified by regulators. Other regularly identified breaches included:

- lack of litter control
- the illegal discharge of contaminants
- odour
- burning of waste
- acceptance of prohibited waste
- lack of security
- no annual reporting.

There were no prosecutions by regulators against landfill operators who breached their resource consent conditions. In some areas, for example, Auckland, abatement and enforcement orders were used to ensure compliance.

3.4 Engineering Issues

3.4.1 Landfill Siting

Landfill siting can be significant in determining the risk a landfill poses to the environment. New landfill siting proposals can be controversial with significant opposition from local groups over issues such as leachate control, odour and noise from landfill operations. Landfills need to provide a high level of containment and should also be far enough away from communities to cause minimum disruption.

Landfill operators were asked to identify three key criteria in selecting current landfill sites. These included, for example, proximity to town or city, etc.

Landfill operators found it difficult to identify three criteria that were used in selecting current landfill sites. Ninety-nine out of 125 sites were opened prior to 1990, and, in general, operators did not have good records on site selection for these sites.

For older landfills, environmental concerns did not feature high on the criteria list when selecting a site for landfill development. As noted by one respondent, estuaries and low swamp areas were considered at the time to be suitable for landfill development.

Common reasons for the siting of landfills included:

- proximity to town/city and amenities
- good transport links
- access
- capacity
- availability of land. Most land is either council or industry owned.

3.4.2 Natural Material Underlying the Landfill

Operators were asked to identify the natural type of material underlying their landfill. Nearly one quarter of landfill operators identified gravel as the most common material. Other materials included:

- pumice
- clay
- silt
- sand and
- Taranaki ash.

3.4.3 Landfill Liners

The *Landfill Guidelines* and *Our Waste: Our Responsibility* specify that landfills require a liner suited to the specific site characteristics to ensure the appropriate containment of wastes. The Guidelines also specify liner thickness, liner material and permeability. Liners can be engineered using both synthetic and natural materials. Siting and landfill design is also important for the containment of wastes.

Forty-one percent (73) of landfills did not have a liner. This compared with 65 percent (177) of landfills that had no liner in 1995. Forty percent (71) of landfills had a liner of natural material, with a significantly smaller percentage of 11 percent (21) having engineered liners. The number of landfills with engineered liners had increased from 11 since the 1995 census.

3.5 Monitoring Issues

3.5.1 Leachate

All landfills generate leachate and monitoring enables leachate to be managed appropriately to minimise environmental effects. The *Landfill Guidelines* state that the monitoring and control of the composition of leachate is a good means of assessing the behaviour of a landfill. Monitoring will confirm the extent of attenuation processes and show the effectiveness of recirculation or any other treatment process. Monitoring can also alert operators to changes in the landfill and help identify problems with the control of leachate, which is important in the protection of water quality. Although there is an improvement from 1995, this census identified that there is still a need to increase monitoring, treatment and recirculation of leachate.

Operators were asked if their landfill has a leachate collection system. Thirty-five percent of responses indicated that they have a collection system. The majority, 63 percent, answered no, and two did not respond to the question. Thirteen percent of landfills had a leachate collection system in 1995.

Twenty-two percent of landfill operators stated that they have a leachate treatment system. This is an increase of 13 percent since 1995. A large number of responses, 76 percent, did not have a treatment system, and a further two did not respond.

Fifty-one percent of operators indicated that they have a leachate monitoring system. This is a significant increase from 17 percent in 1995. However, there is still a significant percentage of 46 percent who did not monitor leachate.

Operators were asked to indicate how often leachate monitoring was undertaken at their landfill sites. Twenty-four percent undertake leachate monitoring only "as required", with 19 percent of operators indicating that they undertake monitoring monthly. A further 16 percent monitor at six-monthly intervals. Twenty-four percent failed to respond to this question.

Leachate recirculation has been shown to offer significant benefits in reducing the strength of leachate (CAE, 1999, pp 4-59) Responses showed that only 7 percent have this system in place, with the majority of 89 percent, not having any recirculating system. Two-thirds of those landfills that did have leachate recirculating systems were opened after 1970, and a further three in the past nine years.

3.5.2 Stormwater

Controlling stormwater is essential in reducing the volume of leachate. The management of stormwater is also influenced by the design of the landfill and management regimes at the landfill site. Although there has been an improvement in this area, operators could still increase the number of stormwater treatment systems and the monitoring of stormwater.

Operators were asked to respond to a number of questions relating to the management of stormwater. Sixty-seven percent indicated that they have diversions for stormwater. This compared favourably with the results from 1995 that showed that 41 percent had stormwater diversion systems. Twenty-eight percent did not have stormwater diversions, four did not respond, and three said stormwater diversion was not applicable to their operation.

When asked about stormwater treatment systems, operators noted that 27 percent had these in place, an increase from 9 percent in 1995. Over 70 percent of respondents specified that their landfill did not have any stormwater treatment systems.

A significant number of operator responses showed that many landfills did not have a stormwater monitoring system, with only 23 percent having such a system in place. Seventy-four percent did not, and four operators did not respond to the question.

3.5.3 Landfill Gas

All landfills generate landfill gas at some stage in their life, and landfill gas monitoring is an integral part of landfill management. Landfill gas, predominantly methane and carbon dioxide, is generated from the breakdown of organic material within a landfill; both are major contributors to global warming. Methane production from landfills is the second largest source of methane in New Zealand (MfE, 1997, pp 5-32).

As in 1995, the 1999 census identified that the collection and monitoring of landfill gas were still a new phenomenon, although it was slowly increasing. Landfill gas monitoring and collection was predominantly undertaken at new, large or upgraded landfill sites throughout the country. This was still the case in this census.

Landfill gas was monitored in only 11 percent of landfills identified by operators. This was an increase from 3 percent from the last census, and 7 percent of landfills operated landfill gas collection systems.

Of those landfills who measure landfill gas, 142,748,094 m^3 of landfill gas was discharged over the past 12 months. A number of different methods were identified to measure discharged landfill gas. These included the USEPA gas monitoring model and continuous flow monitoring.

Fourteen landfills stated that they have a gas collection system. Of those, five landfills identified that they collect between 50 to 75 percent of gas discharged. Three landfills collect landfill gas for electrical generation, six landfills flare their gas and one landfill uses the gas for heat/industrial use. A number of respondents noted that collected gas was discharged into the atmosphere.

3.5.4 Quantity of Waste

Measuring waste quantity is important for operational control, future development of the landfill site, and long term planning strategies. It is done most effectively by weighing incoming refuse. Measuring quantity of waste disposed to landfills has also been identified as an Environmental Performance Indicator for Solid Waste (MfE, 1999).

This census indicates that although measurement of the quantity of waste was increasing, its uptake still needs to be encouraged. Generally, small rural sites or dedicated landfills such as cleanfills did not appear to measure the quantity of waste. Sixty-three percent (112) of landfills measured the quantity of waste deposited at their landfill sites but 35 percent (63) did not. This was an increase since the last census in which 61 percent (166) of landfills did not measure or monitor waste quantity.

Of those that undertook measurements, 31 percent did so by survey, followed by 23 percent who measured by volume and 22 percent by estimate. Twenty percent measured quantity by weight, an increase of only 1 percent from the 1995 census.

Measuring waste quantity, according to operator responses, was a consent condition for 9 percent of landfills. This is particularly true of Auckland landfills.

Sixty-three percent of operators measured waste. These figures were arrived at using a variety of methods and included:

- vehicle surveys
- best estimates
- waste analysis protocols
- weighbridge data
- visual surveys
- dumping dockets and operator tally sheets.

3.5.5 Cover Material

Cover material is used to contain waste, reduce dust, infiltration of rain and vermin and for fire protection. Questions on cover material were not asked in the 1995 census. Availability of adequate cover material is required during the full operating life of the landfill. Operators noted that cover material was infrequently used in 30 percent of cases. A further 25 percent used cover on a daily basis or more.

Gravel was used in a significant number of cases, and sand, soil, cleanfill and clay were also popular cover material. Taranaki ash and pumice were also used in certain regions. Untreated sawdust and green waste were used in a small number of cases. Operators identified that often more than one type of cover material was used.

3.5.6 Complaints

Environmental effects need to be controlled and contingencies should be put in place to avoid, where possible, complaints about landfill operations. Procedures for the recording of complaints and how they should be dealt with should also be established.

Operators were asked to identify any complaints made from the public about dust, noise, odour and litter and the number of complaints.

Complaints about odour were the most common, with 236 complaints about odour recorded from only 27 landfills. Most of these landfills were in large urban centres, where landfills are sited in close proximity to residential areas. Litter was the second most common complaint with 63 complaints recorded.

3.6 Landfill Funding

The *Landfill Full Cost Guide* (MfE, 1996) provides a model with all financial costs associated with a landfill and comparison of those costs over time. The 1995 census identified that landfill charges only covered a subset of the real costs incurred during the life of a landfill.

This census requested data on the methods used for cost recovery and the amounts charged to landfill users. Appendix 2 shows that user charges have increased in popularity for operators of municipal landfills since the last census was undertaken in 1995.

Anecdotal evidence suggested that councils do not accurately reflect the full environmental costs of landfill disposal. It is only when waste disposal at landfills is fully costed that the correct price incentives will be provided for recycling and recovery of waste.

3.6.1 Landfill Full Cost Guide

The *Landfill Full Cost Guide* (MfE, 1996) was developed to assist operators in assessing the full costs of the development, operation and aftercare of a landfill. The guide is an addition to the Ministry for the Environment's *Landfill Guidelines*, which only had a small section on economic instruments and appropriate methods of costing and pricing landfill services.

Sixty-three percent of landfill operators had read the *Landfill Full Costing Guide*. Of those who had read the Guidelines, 77 percent found them useful. Comments from operators who did not find the guidelines useful included:

- the Guidelines were not useful for commercial operators
- there is a need to relate airspace utilisation to financial performance
- consent costs should be recovered during the life of the landfill site
- the full cost guide did not adequately cover small-scale landfills
- the guidelines are overly complicated.

3.6.2 Funding Sources

Forty percent of landfills charged through general rates and 45 percent through user charges (or a combination of both). A summary of the most common forms of landfill funding is provided in Appendix 2.

3.6.3 Differential Charging System

Twenty-six percent of landfills operated a differential charging system for wastes at their landfill compared with 47 percent who did not. Twenty-six percent did not respond. Differential charging is used in particular for green waste, which is accepted at a lesser fee. According to the operator responses, green waste was often half of the usual price or free. This was also the case with recyclable material.

Responses also indicated that cleanfill material cost less to dispose of, whereas higher fees were charged for special or controlled wastes. The additional charge for special or controlled waste was consistent with the 1995 census.

Some of the responses indicated that the differential charging system was generally used to encourage the sorting of loads.

3.7 Landfill Management and Aftercare

The *Landfill Guidelines* states that landfill management plans or site management plans should cover all aspects of landfill operation from detailed descriptions of daily procedures to contingency measures for unforeseen or emergency situations. Generally, the responses indicated that the comprehensiveness of landfill management plans vary between landfills. Landfill management plans were a consent condition in 13 regions.

A significant number of operator responses indicated that they have a formal management plan for their landfill, with 76 percent stating that a formal plan was in place compared with 20 percent where there was none, and five who did not respond.

Operators were asked to specify the contents of their management plans. Some operators sent in a copy of their plans, while others listed the different types of information in their plans. Many of the plans were similar in content. The most common types of information included:

- site management
- landfill operation
- legislation
- consents
- aftercare
- hazardous wastes
- maintenance.

Some plans only contain basic information, while others are more comprehensive and contain information from site development to site rehabilitation.

3.7.1 Closure Plans

Closure plans should be developed for actual closure of the landfill site. Closure plans should outline how closure is to be undertaken and should include information such as:

- site/landfill stability
- long term leachate disposal
- gas investigation
- monitoring of groundwater
- hydrogeologic information.

Closure plans can be contained within the site management plans or as a separate document.

Forty-three percent of responses indicated that they have a closure plan for their landfill compared with 53 percent who did not and four who did not respond. The common elements of the closure plans included:

- final landform
- rehabilitation
- cover.

3.7.2 Aftercare or Post-closure Plans

Aftercare or post-closure plans should contain details about how a landfill should be managed once it has been closed to all waste.

Responses indicated that 27 percent of operators had an aftercare plan. Over 70 percent did not, with four who failed to respond. The majority of responses were similar to those listed in a closure plan, and four responses included aftercare in their management plan.

Operators were asked what elements were contained in their aftercare plans. Sixteen percent of the responses indicated that rehabilitation of the site was most common. Other types of information included:

- landscaping
- monitoring of surface cover
- site stability
- monitoring of surface water
- monitoring of groundwater.

In addition, 32 responses were made to "other" types of aftercare. These were most commonly pest control, fencing, roading, and stormwater control.

On average, 14 years were planned for aftercare, and the maximum was 50 years.

From a total of 154 responses, all indicated that the owner/operator was responsible for the aftercare of the landfill site. In the majority of cases, this was identified as the Territorial Local Authority.

3.8 Landfill Information

3.8.1 Burning at Landfills

Landfill fires are prohibited under the RMA without a consent. There are significant risks from landfill fires including uncontrolled burning, explosions and health and safety risks to workers and users of the landfill. Landfill fires are also a significant source of dioxin emissions. This census identified fewer landfill fires; however, considerable improvement is still needed to curb this practice in some regions.

The 1995 census identified that burning at landfills occurred in 52 percent of landfills operating throughout the country. This census identified a decrease in this practice, with 24 percent (42) of landfills responding that fires had occurred in the past 12 months.

There were approximately 116 accidental fires, and 56 fires were identified as intentional including malicious fires.

3.8.2 Landfill Operator Training

Well-trained operators are an important part of the overall management of a landfill site. It is essential to have appropriately trained operators who are knowledgeable of the waste present and of landfill controls. Landfill operator training has increased since the last census was conducted, although this practice needs to be continued.

Thirty-eight percent of landfills surveyed include have training in the site management plan, compared with 25 percent in the last census. Training in hazardous waste identification procedures has almost doubled from 17 percent to 33 percent. This would indicate that landfill operators are taking advantage of training courses that are being provided by consultants. Specific landfill training may also be specified as a consent condition or in the contract with the landfill operator.

3.9 Hazardous Waste

In general, although there has been an improvement since 1995 in the management of hazardous waste, this census has found that hazardous waste is still being inadequately managed by some landfill operators. This can result in adverse effects to the environment and pose a risk to communities.

3.9.1 Waste Acceptance

Eighty percent of operating landfills in New Zealand did not accept hazardous waste or special waste. This was a similar figure to the 1995 landfill census, where 77 percent of landfill operators indicated they did not accept hazardous waste.

The most common hazardous waste not accepted at landfill was explosives (132 responses). This was followed by:

- agricultural chemicals and timber treatment waste (113 responses each)
- acids, paints and solvents (106)
- medical/vet waste (105)
- used oil (102)
- tannery waste (95)
- sewage sludge and contaminated soil (93 each)
- batteries (92).

Landfill operators also identified a wide range of other wastes not accepted. These included, for example, asbestos, PCBs, drilling wastes, dangerous goods, anything radioactive or corrosive, flammable liquids or solids.

3.9.2 Definition of Hazardous Waste

This Landfill Census has found that there is no one consistent definition used for hazardous waste. Moreover, this question was poorly answered, with no response from 40 landfill operators.

Twenty-three percent of all landfills used the broad definition of hazardous waste from *Our Waste: Our Responsibility* (CAE, 1992). Although not as widely used, the definition of hazardous substances in the Hazardous Substances and New Organisms Act 1996 was also substituted for the definition of hazardous waste. A smaller number used the USEPA subtitle C definition, the OECD table Y definition, or the NZCIC definition. Others specified that they used the definitions from their regional or landfill management plans.

The Landfill Census also identified that in some instances no specific definition was used, or it was left to the discretion of the landfill operator. "Anything not cleanfill" was also given as a definition of hazardous waste.

3.9.3 Documentation

Thirty-three percent of landfills accepted hazardous waste with documentation, whereas 31 percent did not require any documentation to accept hazardous waste. There was a poor response to this question, with no response from 35 percent of landfill operators.

The most common documentation was a manifest form. Laboratory results from an Accreditation New Zealand registered laboratory were also used. Laboratory tests included component analysis and leaching tests and Toxic Characteristic Leaching Procedures (TCLP) tests.

Thirty-one percent of landfills that accept hazardous waste kept a record of what hazardous waste was accepted. However, 44 percent did not keep any records. Of those who identified that records were being kept, this was done in a number of ways including:

- manifest system
- by register or log book
- operator site burial records
- plotting on site survey plans
- photos
- applications/permits for disposal.

Recordings were undertaken for quantity, volume, composition, source and location of hazardous waste disposed to landfill.

3.9.4 Use of Guidelines for Hazardous Waste Management

This census has identified that landfill operators use a range of guidelines to manage hazardous waste.

Twenty-six percent of landfills did not use any form of guidance for hazardous waste management. Twenty-three percent had used *Our Waste: Our Responsibility*, and a further 9 percent used the USEPA TCLP specifications. There was no response from nearly one-quarter of landfill operators.

Seventeen percent noted that other forms of guidance were used. These included:

- regional plans
- consultants
- advice from regional council staff
- landfill management plans
- internal policy
- international standards such as those from the Environment Protection Authority in Victoria, Australian standards and UK standards
- MSDS toxicity data
- lease agreement
- asbestos regulations under the Health Act 1956
- groundwater contamination modelling
- consent conditions.

3.9.5 Facilities that Dispose of Hazardous Waste

Thirty percent of landfill operators identified facilities in their area that disposed of hazardous and/or special wastes. This was an increase from 11 percent from the last census in 1995. Fifty-three percent indicated there were no facilities in their area.

Similarly, 16 percent of landfills identified that there were facilities that treat, reuse or recycle hazardous waste in their area. Sixty-three percent said there were no facilities in their area that treat, reuse or recycle hazardous waste.

3.10 Closed Landfills

There is little information available on the environmental effects of closed landfills in New Zealand. This census has also identified that there is little understanding and analysis of closed landfills management nation wide. However, this census does provide some information on the operation and management of closed landfills in New Zealand.

Responses were mixed, with a small (although significant) number of discrepancies between regulator and operator responses.

Ten regional council responses said that they had a policy on closed landfills in their regions. Six did not have any closed landfill policy.

The exact number of closed landfills was unknown. Regional councils identified 914 closed landfills in their regions and operators identified 739. In 1995, regulators identified 856. Of those 914 closed landfill sites, regulators identified 151 with resource consents. An increase in the number of closed landfill sites in this census is due to the closure of many older tip sites.

3.10.1 Closed Landfill Registers

Operators were asked if they maintained a register of closed landfills in their area. Fifty-five percent had a register of closed landfills, compared with 44 percent who did not. Of those that did not have a register, 26 percent intended to develop one. Significantly, 53 percent of landfill operators did not have a register nor did they intend to develop one.

Eight regional councils indicated that they maintain a register of closed landfills in their region. One regulator commented that a register of "recently" closed landfills was kept. One regional council commented that a register of closed landfills was being developed and would be included in a hazard register in a proposed resource management plan.

The most common types of information recorded in closed landfill registers included:

- location
- assessment of environmental effects (AEE)
- monitoring
- resource consents and any conditions of these consents.

The closed landfill register is most often kept on 'file'. 34 responses were received to this question with little detail on what type of file except that it might be specific to the site or a general file. Registers were also kept in council reports and council plans, for example, district or waste management plans. Sixty-six percent said the public could view these registers.

3.10.2 Closure and Aftercare (Post-closure) Plans

Twenty-six percent of the operator responses indicated that their landfills had a closure plan for *all* of their closed landfills, with 25 percent indicating that *some* landfills had closure plans. However, 30 percent of closed landfills did not have a closure plan. This could reflect the fact that many of the older landfill sites were closed some time ago when closure plans were not identified as good practice.

There was a similar response for aftercare (post-closure) plans with 28 percent of closed landfills *all* having an aftercare plan and 25 percent having aftercare plans. Thirty-five percent of operators did not have aftercare plans for their closed landfills.

The *Landfill Guidelines* recommend 30 years as a minimum aftercare period. The responses in the census were that, on average, 22.5 years were planned for aftercare. One year was identified as the minimum and 50 years the maximum.

The organisation/company responsible for aftercare was, in all responses, the owner/operator of the site or operator only when the site was leased from a council or private landowners.

3.10.3 Resource Consents

Resource consents are based on rules in regional and district plans and the number and type of consents for closed landfills can vary from region to region. Regulators were asked about the types of resource consents required for closed landfills in their region. It is difficult to set consents and consent conditions when the environmental effects of closed landfills may not be evident for many years (for example, heavy metal contamination).

Nine regional councils said that closed landfills did not require a land use consent in their regions, while two did require landfills to have land use consents. Twenty-eight percent of operators failed to respond to this question.

Discharge permits were required by regional councils for closed landfills in twelve regions. One response said that a discharge permit was not required, and three provided no answer. Thirty-eight percent of operators noted that they had a discharge permit for their closed landfill sites.

Five regional councils required a water permit for closed landfills, with a further nine who did not and two who failed to respond. Seven operators had a water permit for their closed landfills sites while 43 did not.

Thirty-two percent of operators said their landfills had all the necessary consents, whereas 33 percent had only *some* of the necessary consents. Significantly, 25 percent of closed landfills did not have the appropriate resource consents.

Monitoring requirements may also be specified in the consent or in a landfill aftercare plan. The monitoring conditions for closed landfill sites are outlined in Appendix 3.

3.10.4 Landfill Gas

The collection of landfill gas was identified in the 1995 census as a significant issue. This census has also identified that the collection of landfill gas is not common place in New Zealand. Only one response from 68 indicated that they collect gas from their closed landfill.

3.10.5 Site Rehabilitation

Post-closure site rehabilitation is important to transform the site from a landfill. The 50 responses indicated that the most common forms of rehabilitation were:

- capping (37) – this may be in the form of an additional cap, impermeable cap or semi-impermeable cap
- landscaping including regrassing (18)
- neutralising contours (6)
- draining of the site (5)

3.10.6 Closed Landfills on Property Titles

Informing the public about potential environmental risks and liability when purchasing a property is essential. Sites can be identified as contaminated on a Land Information Memorandum (LIM) under the Local Government Official Information and Meeting Act 1987 and Property Information Memorandum (PIM) under the Building Act 1991. Contaminated sites can also be listed on property titles.

The majority of regional councils did not know whether closed landfill sites were recorded on property titles. Territorial local authority operators would have better answered this question. Regional council responses showed that in two regions a closed landfill was always noted on a property title. Significantly, 75 percent of responses said that they did not know how often closed landfills were noted on property titles.

4 Conclusions

Waste disposal using landfills is a feature of the New Zealand environment. Thus managing landfills well is important to maintaining and improving the state of the environment. The tool being used to determine the status of landfill management practice is a landfill census using questionnaires. The first census was reported on in 1997 (MfE, 1997).

In this second census undertaken by the Ministry for the Environment, the response rate has improved, with a greater number of council responses than in 1995. However, the lack of response from operators of private dedicated landfills and cleanfills has meant that data in some areas of the census are incomplete. The poor response to some questions by landfill operators was also disappointing.

4.1 Achievement of Census Aims and Objectives

The 1999 National Landfill Census had two aims:

- to assess the effectiveness of landfill management in New Zealand
- to identify any further actions required to improve performance.

The census has been successful in its first aim of assessing the effectiveness of landfill management in New Zealand. However, the census has shown that although there has been some improvement in landfill management practice since 1995, the results given in Section 3 indicate that best practice in landfilling is still not being widely achieved.

Considerable work is still needed to ensure that all landfills are effectively managed so that environmental risk is minimised and environmental effects controlled.

The second aim was to identify further actions to improve performance. The following issues were shown to be important:

- lack of national definitions for certain terms such as landfill, cleanfill and hazardous waste
- inconsistencies in requirements for landfill management, such as variations in landfill management and aftercare plans
- operators have an apparent lack of knowledge in certain aspects of landfill management, for example, knowledge of consent requirements
- data are not being collected adequately in some areas, such as data on waste quantity. In a small number of regions, data are being collected only by way of a resource consent requirement
- further cross-checking is required to determine more accurately the number of landfills operating in New Zealand
- existing publications on best landfill practice need to be more actively promoted and used.

More details on improvements in some of these areas are given in Section 4.3.

The objectives for the census were to:

- determine any change in performance since the last census was conducted in 1995
- monitor the uptake of the *Landfill Guidelines*
- monitor compliance with the Resource Management Act 1991
- provide baseline data on landfill management so that future trends can be measured and monitored
- provide information on landfill management for international reporting requirements.

In measuring the current performance against these objectives, the following results were found:

- there has been an improvement in overall performance since the last census, but further improvement is still needed
- the *Landfill Guidelines* are being used by most regional councils in setting resource consent conditions, but only half of the landfill operators used the guidelines to improve operations at their sites
- non-compliance with consent conditions occurred at 31 percent of landfill sites since 1995
- baseline information on landfill management has been collected and a database has been established, so future trends should be able to be measured and monitored
- information on landfill management is limited because of a lack of standard definitions and measurements.

Proposed actions to address some of these issues are found in Section 4.3.

4.2 Achievement of Landfill Management Aims and Objectives

The results of this census were also measured and assessed against the landfill management aims and objectives established by the Ministry for the Environment.

The Ministry's aims for landfill policy are the management of environmental risk by landfill operators and regional councils through:

- controlling adverse and potential environmental effects from open and closed landfills, and
- managing landfills in an efficient and effective manner.

The objectives are for:

- all landfills to be consented and compliant with consent conditions
- landfill consent conditions to reflect nationally consistent standards of environmental management
- the practice of open burning to be banned
- all landfills to be managed by appropriately trained operators
- hazardous waste to be effectively managed and controlled
- closed landfill sites to be monitored and effectively managed
- the true cost of landfill management to be met through the correct pricing of waste disposal.

The aims of adequate management of environmental risk by landfill operators and regional councils have not yet been met in every region. Some landfills are coming close to these aims but too many are not. In assessing the results of this census against the objectives, the Ministry finds that:

- 75 percent of all landfills are consented, with 50 landfills having lodged resource consent applications with the relevant consent authority
- 69 percent of all landfills were in compliance with consent conditions at the time of the census
- there is considerable variation in landfill consent conditions, so that there are no nationally consistent standards of environmental management
- the practice of open burning is still being carried out, with 24 percent of landfills having had fires
- only 38 percent of all landfills are managed by appropriately trained operators
- hazardous wastes are not being effectively managed and controlled
- many closed landfill sites are not being monitored and effectively managed
- the true cost of landfill management is not being met through the correct pricing of wastedisposal.

4.3 Meeting the Landfill Objectives

The following section outlines possible actions for achieving the stated landfill objectives.

4.3.1 The *Landfill Guidelines*

This census, as in 1995, raised questions about the usefulness of the *Landfill Guidelines*. The Ministry expects that some of the issues raised in the census findings, for example, the lack of definition for hazardous waste, will be addressed through the Ministry's Hazardous Waste Management Programme (HWMP). Others will also be incorporated into the revised *Landfill Guidelines*, due for publication in early 2000.

The census also identified that the Guidelines are not being used widely by landfill operators. This might reflect the widespread use of consultants in the obtaining of resource consents by landfill operators. Contractual arrangements between the landfill owner and contractor may also inhibit use of the Guidelines.

The Ministry would like to see the Guidelines made more relevant and used by landfill operators. Consultation on the draft Guidelines, particularly with territorial authority landfill operators, will assist in their future uptake by these operators.

4.3.2 Resource Management Issues

Overall, the census demonstrated that there are discrepancies (between operators and regional councils) over the type of resource consents reported to be held by landfill operators. This could be due, for example, to the wide spread use of consultants in obtaining resource consents for landfill operations.

This census showed that there was both non-compliance by landfill operators with their resource consent conditions and lack of enforcement of this non-compliance by regional councils. Adequate training of landfill operators needs to take place to ensure all operators are aware of the conditions on their consents and any environmental risks of non-compliance. Regional councils also need to take a more disciplined approach to enforcement of non-compliance. There are provisions under the RMA that can be used to ensure compliance such as enforcement orders and abatement notices.

There are also inconsistencies in the setting of resource consent conditions throughout the country. Resource consent conditions need to be consistent in their coverage of critical issues but also flexible enough to ensure the management of environmental risk on a site specific basis. The Ministry has identified this as a priority area for the coming year and, in consultation with local government, propose to develop guidance on a set of standard consent conditions for use by regional councils. Standard consent condition work will be further developed in the landfill classification and waste assessment criteria (WAC) work described below.

4.3.3 Closed Landfills

The census has identified that closed landfill management is being undertaken in an ad hoc manner throughout the country, particularly in relation to consents and consent conditions, appropriate record keeping and aftercare. The management of closed landfill sites is of increasing importance with many small rural tips closing or having closed in the last few years.

Therefore, with the assistance of local government, the Ministry proposes to develop guidelines on the management of closed landfills. This work should assist local authorities in implementing an international accounting standard which assesses landfill liability and the need for councils to address environmental liabilities in their financial statements (Controller and Auditor General, 1997, p 60).

4.3.4 Landfill Burning

Landfill burning has decreased by over half since the 1995 census. However, landfill fires are still a regular occurrence in some rural areas. As outlined in Section 3, landfill fires can cause uncontrolled burning, explosions and health and safety risks.

Regional councils should take a stronger approach to controlling landfill burning. There is a general provision under section 17 of the RMA to avoid, remedy and mitigate effects on the environment. Regional councils can also enforce landfill burning through section 15(1)(c), which specifies that no person may discharge any contaminant from any industrial or trade premise into air unless the discharge is allowed by a rule in a regional plan or resource consent.. The ability to use these provisions needs to be reinforced to landfill operators and regional councils.

Landfill operators need to be trained and the general public educated about the hazards of open burning at landfills. The Ministry proposes to work on an appropriate training and education programme.

4.3.5 Hazardous Waste

As in 1995, this census identified that there is a lack of controls for the acceptance of hazardous waste at landfills throughout the country. Inconsistent definitions and poor site management practice are still issues at many landfill sites.

The HWMP is currently developing a national waste acceptance criteria (WAC) and classification system for New Zealand's waste disposal facilities. As part of this work, the HWMP is currently undertaking a pilot project to develop WAC for hydrocarbon contaminated soils. It is also developing a methodology for a national classification of landfills. The classification will be based on performance criteria for a range of issues, including for example, site management, leachate and gas collection and liner permeability. The WAC will determine the type of wastes that can be accepted at a landfill based on the performance (classification) of that landfill. The classification and WAC will be provided through a National Environmental Standard (NES) under the RMA.

Any proposed acceptance criteria and landfill classification will have a much broader impact on landfill management than solely controlling the acceptance of hazardous waste. It will, for example, specify more targeted management, monitoring and consent conditions.

The HWMP is also developing a national definition of hazardous waste, and a draft definition for consultation is due for release at the end of 1999. Preliminary documents are available from the Ministry's web page, www.mfe.govt.nz/issues/waste/hazwaste.htm

4.3.6 True Cost of Waste Disposal

The application of user charges has increased in popularity since 1995. However, the questions in the questionnaires did not allow for a full assessment of whether environmental considerations were included in the cost of waste disposal. The development of an accounting standard in New Zealand will encourage local authorities to account for environmental liabilities in their financial statements. This means that local authorities will need to identify and assess the full costs of both currently operating and closed landfill sites.

Environmental liability for landfills that have already closed are more difficult to assess and may result in an amendment to the *Landfill Full Costing Guide* to take into account closure and post-closure costs. The Ministry will give further consideration to closed landfill costings in consultation with local authorities.

4.3.7 Local Government Amendment Act (No. 4) 1996

This census has identified that there are still very few operative waste management plans produced under the LGA. The LGA enables local authorities to develop WMPs that cover not just disposal or residual management but also reduce, reuse, recycle and recovery and treatment of waste. WMPs are a useful tool as they integrate waste policies and plans from a national, regional and local level.

Territorial local authorities need to develop and implement plans to ensure the effective management of waste. Two waste management projects supported by the Sustainable Management Fund, should assist territorial local authority decision makers. These are the:

- *Life Cycle Assessment Project* (Sustainable Management Fund Project 4137, MfE, 1999) examines all types and stages of waste management from production to disposal. The project aims to help decision-makers assess the environmental and economic costs of waste management options. The model will be flexible enough to address local circumstances and take into account transportation, kerbside collection, landfill prices, etc
- *Economics of Waste Management and Recycling in New Zealand* (Sustainable Management Fund Project Number 4143, New Zealand Institute of Economic Research and Woodward Clyde (NZ) Ltd, July 1999). This report investigated the factors that encourage waste recycling and recovery and the institutional barriers that are disincentives to effective waste management. Understanding the market will assist local councils plan their waste management programme and education strategies more effectively.

4.3.8 Emerging Issues

Some issues relating to landfill management were not covered by this census. One such issue is the management of transfer stations. The Ministry will be keeping a watching brief on this area in the next few years.

The Ministry is also aware of issues relating to the acceptance of non-cleanfill material at cleanfill sites.

4.3.9 Census Outcomes

This census has clearly shown that although improvements have been made, best practice is still not being met by regional councils and landfill operators.

Another census should be undertaken in five years' time. This will allow sufficient time for the recommended actions to be undertaken and to be acted on by both the regulators and operators.

5 Bibliography

Centre for Advanced Engineering 1992 (December). *Our Waste: Our Responsibility - Towards Sustainable Waste Management In New Zealand.* Project Report, University of Canterbury: Christchurch.

Centre for Advanced Engineering 1999 (June). *Draft Landfill Guidelines*. University of Canterbury: Christchurch.

Controller and Auditor General 1997. *Second Report for 1997*, Controller and Auditor General: Wellington.

Ministry for the Environment 1992a (August). *The Government Waste Policy*. Ministry for the Environment: Wellington.

Ministry for the Environment 1992b (November). *Waste Analysis Protocol*. Ministry for the Environment: Wellington.

Ministry for the Environment 1992c (November). *Landfill Guidelines*. Ministry for the Environment: Wellington.

Ministry for the Environment 1995 (September). *Environment 2010 Strategy: A Statement of the Government's Strategy on the Environment.* Ministry for the Environment: Wellington.

Ministry for the Environment 1996 (June). *Landfill Full Cost Guide*. Ministry for the Environment: Wellington.

Ministry for the Environment 1997a (March). *The 1995 National Landfill Census*. Ministry for the Environment: Wellington.

Ministry for the Environment 1997b. *The State of New Zealand's Environment*. Ministry for the Environment: Wellington.

Ministry for the Environment 1997c (May). *The National Waste Data Report*. Ministry for the Environment: Wellington.

Ministry for the Environment 1998 (October). *Environmental Performance Indicators for Waste and Hazardous Substances*. Ministry for the Environment: Wellington.

Ministry for the Environment 1999. *Environmental Performance Indicators: Proposals for Waste, and Hazardous Substances*. Ministry for the Environment: Wellington.

Opus International Consultants 1996. *Guidelines for the Assessment of Landfill Gas: Some Techniques Used in the Assessment of Landfill Gas (3 Site Trail)*. Sustainable Management Fund, Ministry for the Environment: Wellington.

Appendix 1: Consent Conditions by Region

Region (n=x)	Site Management Plan	Peer Review Panel	Bond	Aftercare Plan	Groundwater Monitoring	Surface Water Monitoring	Noise Level Monitoring	Odour Monitoring	Air Quality Monitoring	Waste Type Recording	Waste Quantity Monitoring	Leachate Manage Plan	Acceptance Criteria	Other
Auckland (n=5)	✔(5)	✔(4)	✔(4)	✔(5)	✔(5)	✔(4)	✔(2)	✔(4)	✔(4)	✔(5)	✔(5)	✔(4)	✔(5)	✔(2)
Bay of Plenty (n=6)	✔(6)			✔(4)	✔(6)	✔(4)			✔(1)	✔(2)	✔(3)		✔(3)	✔(1)
Canterbury (n=27)	✔(14)			✔(14)	✔(22)	✔(2)		✔(15)	✔(2)	✔(16)	✔(12)	✔(4)	✔(27)	✔(24)
Gisborne (n=1)	✔(1)	✔(1)		✔(1)	✔(1)	✔(1)	✔(1)	✔(1)			✔(1)	✔(1)	✔(1)	
Hawkes Bay (n=3)	✔(3)			✔(2)	✔(3)	✔(3)		✔(2)	✔(2)	✔(2)	✔(1)	✔(2)	✔(1)	
Manawatu Wanganui (n=17)	✔(5)			✔(1)	✔(11)	✔(17)		✔(15)	✔(15)	✔(4)	✔(4)		✔(3)	✔(2)
Marlborough (n=1)				✔(1)	✔(1)	✔(1)	✔(1)	✔(1)	✔(1)					✔(1)
Nelson (n=1)				✔(1)		✔(1)						✔(1)		
Northland (n=9)	✔(9)	✔(6)	✔(1)	✔(8)	✔(8)	✔(9)	✔(1)	✔(8)	✔(3)	✔(4)	✔(6)	✔(8)	✔(7)	
Otago (n=21)	✔(21)	✔(2)	✔(2)	✔(19)	✔(18)	✔(4)	✔(3)	✔(21)	✔(20)	✔(5)	✔(16)	✔(8)	✔(8)	✔(2)
Southland (n=20)	✔(5)			✔(6)	✔(11)	✔(8)				✔(2)	✔(17)	✔(20)		
Taranaki (n=15)	✔(15)				✔(7)	✔(15)		✔(15)	✔(15)			✔(15)	✔(15)	
Tasman (n=3)	✔(2)				✔(1)	✔(1)		✔(1)	✔(1)		✔(1)	✔(2)	✔(3)	
Waikato (n=2)	✔(2)			✔(1)	✔(2)	✔(1)					✔(2)	✔(1)	✔(2)	✔(1)
Wellington (n=11)	✔(9)		✔(1)	✔(7)	✔(10)	✔(10)		✔(4)	✔(2)	✔(11)	✔(11)	✔(7)	✔(6)	✔(6)
West Coast (n=2)	✔(1)				✔(1)	✔(1)								✔(2)
Total	**98**	**13**	**8**	**70**	**107**	**82**	**8**	**87**	**66**	**51**	**79**	**73**	**81**	**41**

Key

* Based on Regional Council returns

✔= Landfill with consent condition

(x) = Number of landfills with consent condition

n =x Number of landfills in region

Appendix 2: Funding Sources for Landfills

Region	Number of Responses	General Rates (%)	Waste Disposal Rates (%)	User Charges (%)	Other* (%)	No Answer
Auckland	7			100		3
Bay of Plenty	5	41	24	35		1
Canterbury	19	52	1	40	8	1
Gisborne	5	98		2		
Hawkes Bay	3	33	32	35		
Marlborough	1			100		
Manawatu-Wanganui	8	32	20	48	2	
Nelson	2			100		
Northland	9	76	2	21	0	
Otago	7	32	7	24	37	7
Southland	16	56	27	16	0	
Taranaki	8	50	20	29	2	
Tasman	3	50	7	43		
Waikato	12	11	30	59	1	
West Coast	19	93	4	3		1
Wellington	10	22	0	70	8	
Total	**134**	**647**	**173**	**724**	**56**	**13**
%		**40%**	**11%**	**45%**	**4%**	

Key

* Based on number of landfills (from operator responses) by region

Appendix 3: Monitoring Conditions for Closed Landfill Sites by Region

	Surface Cover	Surface Water	Ground-water	Gas	Odour	Surface Settling	Settle-ment	Aftercare Plan	Offsite Effects
Auckland	✔	✔	✔	✔			✔		✔
Bay of Plenty	✔	✔	✔	✔			✔	✔	✔
Canterbury			✔		✔			✔	
Gisborne	✔	✔	✔					✔	✔
Hawkes Bay	✔	✔	✔	✔	✔				
Marlborough	✔	✔	✔	✔	✔		✔	✔	
Manawatu-Wanganui	✔	✔	✔		✔				✔
Nelson*									
Northland	✔	✔	✔		✔			✔	✔
Otago	✔	✔	✔	✔	✔			✔	✔
Southland	✔	✔	✔						
Taranaki	✔	✔	✔	✔	✔	✔	✔	✔	✔
Tasman			✔					✔	
Waikato*									
Wellington		✔	✔	✔	✔				
West Coast*									
Total	**10**	**11**	**13**	**7**	**8**	**1**	**4**	**8**	**7**

Key

* No response
✔ Region with monitoring condition

Appendix 4: Landfill Opening by Period and Region

Regional Authority	Pre-1950s	1950s	1960s	1970s	1980s	1990s
Auckland	1	1	1	1	4	3
Canterbury	1		2	8	4	1
Bay of Plenty			2	2	2	1
Waikato		1	1	2	6	1
Gisborne				4	1	
Hawkes Bay				1	1	1
Manawatu-Wanganui	3			1	1	2
Marlborough						1
Nelson					1	1
Northland	2		1	3		1
Otago		2	1	3	1	3
Southland				5	1	5
Taranaki			1	3	3	1
Tasman					1	1
Wellington			4	4	2	2
West Coast		1		2	2	3
Total	**7**	**5**	**13**	**39**	**30**	**27**

Appendix 5: Landfill Closure by Year and Region

Regional Authority	1999	2000	2001	2002	2003	2004	2005 –2009	2010 –2019	2020 or later
Auckland	1		2	3	1	1	1		2
Canterbury	4	2	4	3	1		1		3
Bay of Plenty			1		1		2	2	2
Waikato	3	1	2		1		2		3
Gisborne	1			1					
Hawkes Bay									2
Manawatu-Wanganui		2				1	3	5	2
Marlborough									1
Nelson		1							1
Northland	2		1	1		1		1	2
Otago Regional	6						2	2	5
Southland	7	4		2	2		2	3	
Taranaki	1			1		2	1		2
Tasman	1								2
Wellington							3	5	4
West Coast		6		2		1	3	4	3
Total	**26**	**16**	**10**	**13**	**6**	**6**	**20**	**22**	**34**

Appendix 6
National Landfill Census 1998/99 - Regional Council, Unitary Authority Questionnaire, Part A

1. Have you read the Guidelines or the CAE Report?

Yes	14	87.50%
No	2	12.50%
Total	**16**	**100.00%**

2. During the last 12 months have you used the Guidelines for establishing landfill consent requirements?

Yes	10	71.43%
No	4	28.57%
Total	**14**	**100.00%**

3. During the last 12 months have you used the Guidelines for developing other landfill policy?

Yes	3	21.43%
No	11	78.57%
Total	**14**	**100.00%**

4. How useful were the Guidelines?

Not at all useful	1	7.14%
Not Very Useful	1	7.14%
Useful	10	71.43%
Very Useful	2	14.29%
Total:	**14**	**100%**

5. Do you think the Guidelines could be improved?

Yes	8	57.14%
No	6	42.86%
Total	**14**	**100.00%**

6. How do you think the Guidelines could be improved?

Text response only. See section 3.1

Plans

7. Is waste management identified as a significant issue in your Regional Policy Statement?

Yes	16	100.00%
Total	**16**	**100.00%**

8. Does your Regional Council/Unitary Authority have a Regional Plan(s) produced under the Resource Management Act 1991 that includes landfills?

Yes	11	68.75%
No	5	31.25%
Total:	**16**	**100.00%**

9. If yes, what is the name of the Regional Plan(s)?

Text response only. See section 3.2

10. When was/were this/these Plan(s) developed?

Text response only. See section 3.2.

11. If no, does your organisation intend to prepare a Regional Plan covering landfills?

Yes	2	12.5%
No	3	18.75%
Did Not Respond	11	68.75%
Total:	**16**	**100%**

12. When is the Regional Plan expected to become operative?

Text response only. See section 3.2.

Open Landfills

13. How many open landfills are operating?

221

14. Do you maintain a register of all open landfills in your region?

Yes	8	50%
No	6	37.5%
Did Not Respond	2	12.50%
Total:	**16**	**100%**

Closed Landfills

15. Does your Regional Council/Unitary Authority have a policy on closed landfills?

Yes	10	62.50%
No	6	37.50%
Total:	**16**	**100.00%**

16. Do you maintain a register of closed landfill sites in your region?

Yes	8	50.00%
No	7	43.75%
Did Not Respond	1	6.25%
Total:	**16**	**100.00%**

17. How many closed landfills are known by your Regional Council/Unitary Authority to exist in your region

914

18. How many closed landfill sites in your region have resource consents?

151

19. What consents do closed landfills require?

A. Land use consent(s)

Yes	2	12.50%
No	9	56.25%
Did Not Respond	5	31.25%
Total:	**16**	**100.00%**

B. Discharge permit(s)

Yes	12	75.00%
No	1	6.25%
Did Not Respond	3	18.75%
Total:	**16**	**100.00%**

C. Water permit(s)

Yes	5	31.25%
No	9	56.25%
Did Not Respond	2	12.50%
Total:	**16**	**100.00%**

D. Other consents.

Text response only. See section 3.3.

20. What monitoring conditions does your Regional Council/Unitary Authority require for consent holders of closed landfills?

See Table Three for a regional breakdown of monitoring conditions.

21. How often is the existence of a closed landfill noted on property titles in your region?

Never	1	6.25%
Sometimes	1	6.25%
Always	2	12.50%
Don't Know	12	75.00%
Total:	**16**	**100.00%**

Regional Council, Unitary Authority Questionnaire Part B

1-7. These responses relate directly to specific landfill sites.

8. Have resource consent applications for this landfill been submitted to your Regional Council/Unitary Authority?

Yes	205	98.09%
No	4	1.91%
Total:	**209**	**100.00%**

9. Does this landfill have the necessary consents to operate?

Yes	157	75.12%
No	50	23.92%
Did Not Respond	2	0.96%
Total:	**209**	**100.00%**

10. What consents does this landfill have?

A. Land use consent(s)

Yes	49	31.21%
No	43	27.39%
Did Not Respond	65	41.40%
Total:	**157**	**100.00%**

B. Discharge Consent(s)

Yes	140	89.17%
No	13	8.28%
Did Not Respond	4	2.55%
Total:	**157**	**100.00%**

C. Water Permit(s)

Yes	33	21.02%
No	91	57.96%
Did Not Respond	33	21.02%
Total:	**157**	**100.00%**

D. Other consents

Text response only. See section 3.3

11. Which of the following consent conditions does this landfill require?

See Table One consent conditions by region.

12. Since 1995, has this landfill ever breached its resource consent conditions?

Yes	49	31.21%
No	99	63.06%
N/A	1	0.64%
Did Not Respond	8	5.10%
Total:	**157**	**100.00%**

13. If yes, how many times?

107

14. What resource consent conditions were breached?

Text response only. See section 3.3

15. Since 1995, has this landfill ever been prosecuted for breaching resource consent conditions?

No	69	43.95%
Did Not Respond	88	56.05%
Total:	**157**	**100**

16. If yes, when did this occur?

No responses

17. How many times has a representative of your regional council visited this site during the last 12 months?

Average number of visits: 2

Maximum number of visits: 20

Territorial Local Authority, Private Operator, Unitary Authority Questionnaire Part A

1. Have you read the CAE report "Our Waste: Our Responsibility"?

Yes	60	57.14%
No	42	40.00%
Did Not Respond	3	2.86%
Total:	**105**	**100.00%**

2. Have you read the Ministry for the Environment "Landfill Guidelines"?

Yes	72	68.57%
No	30	28.57%
Did Not Respond	3	2.86%
Total:	**105**	**100.00%**

3. Have you used the CAE report and/or Landfill Guidelines for:

A. Improving operations at existing landfills?

Yes	57	54.29%
No	42	40.00%
Did Not Respond	6	5.71%
Total:	**105**	**100.00%**

B. Planning new landfills?

Yes	37	35.24%
No	54	51.43%
N/A	1	0.95%
Did Not Respond	13	12.38%
Total:	**105**	**100.00%**

C. Assessing the management of closed landfills?

Yes	33	31.43%
No	64	60.95%
Did Not Respond	8	7.62%
Total:	**105**	**100.00%**

4. If no what did your organisation use?

Text response only. See section 3.1

5. Do you think the Guidelines could be improved?

Did Not Respond	11	10.48%
Yes	26	24.76%
No	17	16.19%
Don't Know	39	37.14%
Not Aware of guidelines	12	11.43%
Total:	**105**	**100.00%**

6. How do you think the Guidelines could be improved?

Text answer only. See section 3.1

7. Have you used any other Ministry for the Environment publications to assist you in managing landfills?

Yes	27	25.71%
No	67	63.81%
Did Not Respond	11	10.48%
Total:	**105**	**100.00%**

8. If yes, what publication(s)?

This includes the:

- Waste Analysis Protocol (MfE 1992);
- Cleaner Production Guidelines (MfE 1992);
- National Landfill Census 1995 (MfE 1997);
- Landfill Full Costing Guide (MfE 1996);
- Health and Environmental Guidelines for Selected Treatment Chemicals (MfE and the Ministry of Health 1997); and
- Hazardous Waste Management Handbook (MfE 1994)

Territorial Local Authority, Unitary Authority, Private Operator Questionnaire Part B

1-9. Information relating to individual landfills

10. What year was this landfill open?

See Table Four

11. What year will this landfill close to all waste?

See Table Five

12. When siting this landfill, what were the three key criteria used in selecting the site. For example proximity to town, city.

Text response only. See section 3.4

13. What is the natural type of material underlying this landfill?

Did Not Respond	1	0.35%
Clay	49	17.25%
Silt	49	17.25%
Sand	44	15.49%
Gravel	70	24.65%
Rock	34	11.97%
Other	37	13.03%
Total:	**284**	**100.00%**

14. What type of liner does this landfill have?

Did Not Respond	12	6.78%
Unaltered natural material	71	40.11%
Engineered	21	11.86%
No Liner	73	41.24%
Total:	**177**	**100.00%**

Resource Consents

15. Does this landfill have any land use consents?

Did Not Respond	2	1.13%
Yes	103	58.19%
No	69	38.98%
Don't know	3	1.69%
Total:	**177**	**100.00%**

16. If yes, what is this land use consent(s) for?

Text response only. See section 3.3

17. Does this landfill have any discharge permits?

Did Not Respond	2	1.13%
Yes	114	64.41%
No	57	32.20%
Don't know	4	2.26%
Total:	**177**	**100.00%**

18. If yes, what are the discharge permits for?

Text response only. See section 3.3

19. Does this landfill have any water permits?

Did Not Respond	4	2.26%
Yes	51	28.81%
No	114	63.84%
Don't know	8	4.52%
Total:	**177**	**100.00%**

20. If yes, what are the water permits for?

Text response only. See section 3.3

21. Does this landfill have any other consents?

Did Not Respond	6	3.39%
Yes	27	15.25%
No	129	72.88%
Don't know	15	8.47%
Total:	**177**	**100.00%**

22. If yes, what are these consents for?

Text response only. See section 3.3

23. Which of the following consent conditions does this landfill have?

According to landfill operators (177), the following consent conditions applied to their landfill sites.

Did Not Respond	21
Site Management Plan	135
Waste Type Recording	40
Waste Quantity Monitoring	71
Leachate Management Plan	47
Acceptance Criteria	53
Other	32
Peer Review Panel	15
Bond	15
Aftercare Plan	62
Ground Water Monitoring	78
Surface Water Monitoring	75
Noise Level Monitoring	17
Odour Monitoring	34
Air Quality Monitoring	33

NB. Landfills can have more than one consent condition

24. Is this landfill covered by a:

A. Regional Plan?

Did Not Respond	6	3.39%
Yes	94	53.11%
No	51	28.81%
Don't know	26	14.69%
Total:	**177**	**100.00%**

B. What Regional Plans?

Text response only. See section 3.2

C. A District or City Waste Management Strategy or Plan?

Did Not Respond	6	3.39%
Yes	108	61.02%
No	53	29.94%
Don't know	10	5.65%
Total:	**177**	**100.00%**

D. What Strategy or Plan?

Text response only. See section 3.2

E. A Waste Plan (including draft) under the Local Government Amendment Act (No4) 1996?

Did Not Respond	9	5.08%
Yes	49	27.68%
No	97	54.80%
Don't know	22	12.43%
Total:	**177**	**100.00%**

F. If yes, what strategy or Plan?

Text response only. See section 3.2

Landfill monitoring

25. Does this landfill have a leachate collection system?

Yes	63	35.59%
No	112	63.28%
Did Not Respond	2	1.13%
Total:	**177**	**100.00%**

26. Does this landfill have a leachate treatment system?

Yes	39	22.03%
No	136	76.84%
Did Not Respond	2	1.13%
Total:	**177**	**100.00%**

27. Does this landfill have a leachate monitoring system?

Yes	91	51.41%
No	83	46.89%
Did Not Respond	3	1.69%
Total:	**177**	**100.00%**

28. Does this landfill have a leachate recirculating system?

Yes	13	7.34%
No	158	89.27%
Did Not Respond	6	3.39%
Total:	**177**	**100.00%**

29. How often do you undertake leachate monitoring?

Did Not Respond	45	25.42%
Weekly	8	4.52%
Monthly	35	19.77%
6 Monthly	29	16.38%
Yearly	17	9.60%
As Required	43	24.29%
Total:	**177**	**100.00%**

30. Over the last 12 months what was the total volume of leachate discharged from the landfill?

Text response only. See section 3.5

31. How was this figured arrived at?

Text response only. See section 3.5

32. Does this landfill have:

A. Any diversions for stormwater?

Yes	119	67.23%
No	51	28.81%
N/A	3	1.69%
Did Not Respond	4	2.26%
Total:	**177**	**100.00%**

B. A stormwater treatment system?

Yes	49	27.68%
No	124	70.06%
Did Not Respond	4	2.26%
Total:	**177**	**100.00%**

C. A stormwater monitoring system?

Yes	41	23.16%
No	132	74.58%
Did Not Respond	4	2.26%
Total:	**177**	**100.00%**

33. Does this landfill have a gas monitoring system?

Yes	20	11.30%
No	153	86.44%
Did Not Respond	4	2.26%
Total:	**177**	**100.00%**

34. Does this landfill have a gas collection system and/or extraction system?

Yes	14	7.91%
No	158	89.27%
Did Not Respond	5	2.82%
Total:	**177**	**100.00%**

35. Over the past 12 months what was the volume of gas discharged from this landfill?(n=9)

The average volume was 2, 549, 000 cubic metres. The maximum amount was 35, 000,000 cubic metres.

147 landfill operators did not respond to this question. Large, urban landfills appear to be the only landfills that monitor landfill gas volume. There was also a large variation in the amount of landfill gas discharged from landfill sites.

36. How was this figured arrived at?

A variety of methods were used including:

- Continuous flow monitoring;
- In pipe anemometres;
- USEPA gas monitoring model.

37. Over the past 12 months what percentage of the total gas discharged from the landfill was collected?

Only 5 landfill operators responded to this question. Of those that did respond, 50-75%of the total gas discharged from the landfill was collected.

38. What happens to the collected landfill gas?

Did Not Respond	153	86.44%
Electrical Generation	3	1.69%
Flared	6	3.39%
Burned for heat/industrial use other than electrical generation	1	0.56%
Other	14	7.91%
Total:	**177**	**100.00%**

39. Is the quantity of waste deposited at this landfill measured?

Yes	112	63.28%
No	63	35.59%
Did Not Respond	2	1.13%
Total:	**177**	**100.00%**

40. How is it measured at this landfill?

Did Not Respond	5	3.05%
By weight	34	20.73%
By volume	37	22.56%
By survey	51	31.10%
By estimate	37	22.56%
Total:	**164**	**100.00%**

41. What is the total weight or total volume of all waste that has been deposited at this site since its opening? (n=54)

Region	Tonnes	Estimated	Don't know
Auckland	8706000		1
Canterbury	1499829		12
Bay of Plenty	3976000		5
Waikato	1150000		7
Gisborne			1
Hawkes Bay	976472		0
Manawatu-Wanganui	1303472		6
Marlborough	45000		0
Nelson	739918		0
Northland	1071850	0	3
Otago	11975943	1200000	2
Southland	126132	140000	13
Taranaki	202100		1
Tasman	119000		0
Wellington	10328500	3300000	4
West Coast			0
New Zealand Total	**42220216**	**4640000**	**55**

Cubic metre responses have been converted to tonnes using the formula .5 tonnnes=1 cubic metre.

42. Is this figure based on a:

Did Not Respond	131
Surveyor estimate	15
Weighbridge measurement	17
Waste analysis protocol	5
Topographical survey	14
Vehicle survey	7
Other	11

43. By the time this landfill site closes, what is the total weight or total volume of all waste expected to be site? (n=56)

Region	Tonnes	No/ Don't know
Auckland	22054000	4
Canterbury	5686000	13
Bay of Plenty	1348000	2
Waikato	1800000	12
Gisborne		5
Hawkes Bay	4200000	1
Manawatu-Wanganui	18200000	10
Marlborough	1000000	
Nelson	6750000	1
Northland	1562500	3
Otago	4375000	10
Southland	2225000	17
Taranaki	305500	5
Tasman	850000	2
Wellington	39161000	7
West Coast	377000	15
New Zealand Total	**109894000**	**107**

Cubic metre responses were converted to tonne responses using the formula .5 tonne =1 cubic metre.

44. Over the last 12 months what was the total weight of waste deposited in this landfill?

Region	Tonnes	Don't Know
Auckland	911,500	2
Canterbury	322,353	1
Bay of Plenty	180,639	0
Waikato	172,100	7
Gisborne	20,000	4
Hawkes Bay	102,403	0
Manawatu-Wanganui	196,673	3
Marlborough	18,000	0
Nelson	52,794	1
Northland	70,570	0
Otago	98,199	8
Southland	180,738	5
Taranaki	9,313	4
Tasman	13,494	2
Wellington	416,244	1
West Coast		15
Total	**2,765,020**	**53**

Cubic metre response have been converted to tonnes using the following formula .5 tonne=1 cubic metre.

45. Over the last 12 months, what percentage of total waste deposited at the landfill was from residential/non residential sources

Region	No*	Residential	Non-residential	Don't Know	No response
Auckland	6	24%	77%	5	
Canterbury	17	69%	31%	5	
Bay of Plenty	5	42%	58%	4	
Waikato	5	37%	63%	8	
Gisborne	5	84%	16%		
Hawkes Bay	2	51%	49%	1	
Manawatu-Wanganui	7	33%	67%	5	
Marlborough				1	
Nelson	2	15%	85%		
Northland	6	89%	11%	2	
Otago	8	53%	47%	8	
Southland	9	19%	81%	13	
Taranaki	5	40%	60%	4	
Tasman	2	85%	15%		
Wellington	9	27%	73%	2	2
West Coast	18	96%	4.%	2	
TOTAL	**106**	**51%**	**49%**	**60**	**2**

* Number of responses per region

46. How were these percentages arrived at?

Text response only. See section 3.5

47. Over the last 12 months, what quantity of waste deposited at this landfill came from outside this locality (ie. outside tla area)

Region	Tonnes	No/ Don't know
Auckland	314000	4
Canterbury	8120	10
Bay of Plenty	1000	5
Waikato	19000	5
Gisborne		5
Hawkes Bay	0	0
Manawatu-Wanganui	0	6
Marlborough	0	0
Nelson	7000	
Northland	50	2
Otago	900	7
Southland	2525	5
Taranaki	0	6
Tasman	0	0
Wellington	2000	7
West Coast	0	1
New Zealand Total	**354595**	**63**

Cubic metre response have been converted to tonnes using the following formula .5 tonne=1 cubic metre.

48. Over the past 12 months, how often was waste covered at this landfill?

Did Not Respond	18	10.17%
Infrequently	53	29.94%
Weekly	29	16.38%
2-6 times per week	32	18.08%
Daily or More	45	25.42%
Total:	**177**	**100.00%**

49. What cover material was used?

Text response only. See section 3.5

50. In the past 12 months, has your organisation had any formal complaints about:

A. Dust from this landfill

Yes	11	6.21%
No	158	89.27%
Did Not Respond	8	4.52%
Total:	**177**	**100.00%**

Total number of complaints: 22
Number of landfills with complaints 11
Average 2 complaints per landfill

B. Noise from this landfill?

Yes	5	2.82%
No	164	92.66%
Did Not	8	4.52%
Total:	**177**	**100.00%**

Total number of complaints: 25
Number of landfills 5
Average 5 complaints per landfill

C. Odour from this landfill?

Yes	27	15.25%
No	142	80.23%
Did Not Respond	8	4.52%
Total:	**177**	**100.00%**

Total number of complaints: 236
Number of landfills 27
Average number of complaints 8 complaints per landfill

D. Litter from this landfill

Yes	63	35.59%
No	106	59.89%
Did Not Respond	8	4.52%
Total:	**177**	**100.00%**

Total number of complaints 63
Number of landfills 63
Average number of complaints 1

Landfill Funding

51. Have you read the Landfill Full Cost Guide produced for inclusion in the Landfill Guidelines?

Yes	112	63.28%
No	57	32.20%
Did Not Respond	8	4.52%
Total:	**177**	**100.00%**

52. If yes, did you find them useful?

Yes	87	77.68%
No	23	20.54%
Did Not Respond	2	1.79%
Total:	**112**	**100.00%**

53. If no how do you think they can be improved?

Text response only. See section 3.6

54. During the last financial year, what percentage of total landfill funding was derived from:

- General Rates
- Waste Disposal Rates
- User charges
- Other

See Table Two.

55. How much is charged including GST for these vehicles to deposit waste at this landfill?

This census identified a wide variation in landfill charges for all vehicles, from landfill to landfill and between different regions. Because of the wide variation, trends in vehicle charges cannot be fully identified.

56. If you use a weighbridge, how much do you charge per tonne (including GST)? Record amount in dollars per tonne.

Text response only. See section 3.6

57. Do you operate a differential charging system for example, lesser fees for green waste or recycling?

Yes	46	25.99%
No	84	47.46%
Did Not Respond	47	26.55%
Total:	**177**	**100.00%**

58. If yes, please comment below

Text response only . See section 3.6

Plans

59. Does your organisation have a formal management plan for this landfill?

Yes	135	76.27%
No	37	20.90%
Did Not Respond	5	2.82%
Total:	**177**	**100.00%**

60. If yes, what does this consist of?

Text response only. See Section 3.7

61. Does your organisation have a Closure Plan for this landfill?

Yes	77	43.50%
No	95	53.67%
Did Not Respond	5	2.82%
Total:	**177**	**100.00%**

62. If yes what does this consist of?

Text response only. See Section 3.7

63. Does your organisation have an Aftercare Plan for this landfill?

Yes	49	27.68%
No	124	70.06%
Did Not Respond	4	2.26%
Total:	**177**	**100.00%**

64. If yes, what does this consist of?

Text response only. See Section 3.7

65. Have any landfill fires occurred on this site during the past 12 months?

Yes	43	24.29%
No	130	73.45%
Did Not Respond	4	2.26%
Total:	**177**	**100.00%**

66. If yes, were these fires accidental or intentional?

Region	No. Accidental	No. Intentional
Auckland	2	3
Canterbury	9	1
Bay of Plenty	3	0
Waikato	9	1
Gisborne	50	0
Hawkes Bay	0	0
Manawatu-Wanganui	0	4
Marlborough	0	0
Nelson	0	0
Northland	7	0
Otago	16	0
Southland	14	34
Taranaki	1	0
Tasman	2	0
Wellington	0	0
West Coast	3	13
Total for New Zealand	**116**	**56**

67. Is this landfill open to the public?

Yes	83	46.89%
No	88	49.72%
Did Not Respond	6	3.39%
Total:	**177**	**100.00%**

68. Is this landfill staffed during all operating hours?

Yes	119	67.23%
No	53	29.94%
N/A	1	0.56%
Did Not Respond	4	2.26%
Total:	**177**	**100.00%**

69. Is this landfill site secure against unauthorised access for dumping outside opening hours?

Yes	130	73.45%
No	42	23.73%
Did Not Respond	5	2.82%
Total:	**177**	**100.00%**

70. Over the past 12 months, were landfill staff provided with any training in:
A. The site management plan

Yes	67	37.85%
No	100	56.50%
Did Not Respond	10	5.65%
Total:	**177**	**100.00%**

B. Hazardous waste identification procedures

Yes	60	33.90%
No	107	60.45%
Did Not Respond	10	5.65%
Total:	**177**	**100.00%**

C. Other landfill operations

Yes	60	33.90%
No	106	59.89%
Did Not Respond	11	6.21%
Total:	**177**	**100.00%**

"Other" included slope stabilisation, First Aid and Occupational Safety and Health issues.

71. Is there any requirement for formal operator training in any plan, contract or consent associated with this landfill?

Yes	44	24.86%
No	120	67.80%
Did Not Respond	13	7.34%
Total:	**177**	**100.00%**

72. If yes, what formal training is required?

This included for example, hazardous waste.

73. Who is responsible for Aftercare?

Text response only. See section 3.7

74. What does Aftercare consist of?

NB Aftercare at a landfill can consist of more than one component

Did Not Respond	51
Monitoring Groundwater	77
Monitoring Surface Water	74
Monitoring Odour	21
Monitoring Landfill Gas	35
Site Stability	79
Rehabilitation of the Site	105
Landscaping	96
Monitoring Surface Cover	79
Other	32

75. How much time is planned for Aftercare?

On average 14 years is planned for aftercare. 50 years is the maximum.

76. Are there any types of hazardous or special waste not accepted at this landfill?

Yes	143	80.79%
No	29	16.38%
Did Not Respond	5	2.82%
Total:	**177**	**100.00%**

77. Which hazardous and/or special wastes are not accepted?

Did Not Respond	6
Animal Waste	84
Tannery Waste	95
Incinerator Ash	63
Fluorescent and Halogen Lights	75
Acids, Solvents, Paints etc	106
Other Hazardous Waste	48
Medical/vet Waste	105
Agricultural Chemicals	113
Sewage Sludge	93
Contaminated Soil	93
Used Oil	102
Explosives	132
Batteries	92
Timber Treatment Waste	113

78. What is the definition of hazardous waste used at this landfill?

Text response only. See section 3.9.

79. Are any waste types restricted at this landfill? Eg. Special waste? Which ones?

Text response only. See section 3.9.

80. Do you require any documentation before you accept hazardous waste or any other restricted waste?

Yes	59	33.33%
No	55	31.07%
Did Not Respond	63	35.59%
Total:	**177**	**100.00%**

81. If yes, what documentation was required?

Text response only. See section 3.9

82. What guidelines are used at this landfill for managing hazardous waste or special waste?

Did Not Respond	47	23.62%
Centre for Advanced Engineering	46	23.12%
US EPA TCLP Specifications	18	9.05%
None	53	26.63%
Other	35	17.59%
Total:	**199**	**100.00%**

83. Are there facilities in this territorial local authority region, apart from this landfill, that dispose of hazardous waste/special waste?

Yes	53	29.94%
No	95	53.67%
Did Not Respond	29	16.38%
Total:	**177**	**100.00%**

84. If yes, what are the names of the hazardous waste facilities and what generic types of substance do they accept.

Text response only.

85. Are there facilities in this territorial local authority region that treat, reuse, or recycle hazardous waste/special waste?

Yes	29	16.38%
No	112	63.28%
Did Not Respond	36	20.34%
Total:	**177**	**100.00%**

86. If yes, please comment

Text response only. See section 3.9

87. Do you keep a record of what hazardous waste/special waste is accepted at this landfill?

Yes	55	31.07%
No	78	44.07%
Did Not Respond	44	24.86%
Total:	**177**	**100.00%**

88. If yes, how is this done?

Text response only. See section 3.9

Territorial Local Authority, Private Operator, Unitary Authority Questionnaire Part C

Register of Closed Landfills

1. How many closed landfills or "tip" sites does your organisation manage/take responsibility for?

739

2. Do you have a register of closed landfills or "tip" sites?

Yes	38	55.88%
No	30	44.12%
Total:	**68**	**100.00%**

3. If yes, what information is contained in this register?

Text responses only. See section 3.10

4. Where is this register kept? For example in a Plan, State of the Environment Report, etc.

Text response only. See section 3.10

5. Can the public view this register?

Yes	25	65.79%
No	11	28.95%
Did Not Respond	2	5.26%
Total:	**38**	**100.00%**

6. If no (Q2), do you intend developing a register?

Yes	8	26.67%
No	16	53.33%
Did Not Respond	6	20.00%
Total:	**30**	**100.00%**

Plans

7. Did these landfills have closure plans?

Yes - all had Closure Plans	18	26.47%
Yes - some had Closure Plans	17	25.00%
No - none	21	30.88%
Didn't respond	6	8.82%
Don't know	6	8.82%
Total:	**68**	**100%**

Number of landfills that have closure plans: 65
Number of landfills where some have closure plans 37

8. Do these landfills have Aftercare Plans?

Did Not Respond	5	7.35%
Yes all have Aftercare Plans	19	27.94%
Yes some have Aftercare Plans	17	25.00%
No - none	24	35.29%
Don't know	3	4.41%
Total:	**68**	**100.00%**

Number of landfills that have aftercare plans 80
Number of landfills where some have aftercare plans 37

9. What organisation or company is responsible for Aftercare?

Text response only. See section 3.10.

10. On average, how long is planned for Aftercare (Years)?

Minimum: 1 year
Average: 22 years
Maximum: 50 years

11. Do these closed landfills have resource consents?

Did not respond	5	7.35%
Yes they all have consents	22	32.35
Yes-some have consents	23	33.82
No-none have consents	17	25%
Don't know	1	1.47%
Total:	**68**	**100%**

Number with consents 53
Number where some have consents 75

12. What consents do these closed landfills have?

Resource Consents

A. Land Use consents?

Yes	21	30.88%
No	28	41.18%
Did not respond	19	27.94%
Total:	**68**	**100%**

B. Discharge permits?

Yes	38	55.88%
No	18	26.47%
Did not respond	12	17.65%
Total	**68**	**100%**

C. Water permits?

Yes	7	10.29%
No	43	63.24%
Did Not Respond	18	26.47%
Total:	**68**	**100.00%**

D. Other consents

Text response only. See section 3.10.

13. Do you monitor potential discharges from closed landfills?

Yes all sites are monitored	27	39.71%
Yes - some are monitored	5	36.76%
No	12	17.65%
Didn't response	4	5.88%
Total:	**68**	**100%**

Monitoring Requirements

14. What do you monitor?

Did not Respond	2
Surface Cover	25
other	6
Surface Water	34
Ground Water	37
Landfill Gas	13
Odour	7
Surface Setting	9
Settlement	21
Aftercare Plan	15
Off-site Effects	12
Total:	**181**

15. Do you collect landfill gas from these closed landfills?

Yes	1
No	65
Did Not	2
Total:	**68**

16. What happens to the collected landfill gas?

Only 1 landfill operator noted that collected landfill gas is flared.

17. If site rehabilitation is undertaken, what does this consist of?

Text response only. See section 3.10

Appendix 7: Glossary of Abbreviations and Terms

AEE	Assessment of Environmental Effects
CAE	Centre for Advanced Engineering
E2010	Environment 2010:A Statement of the Government's Strategy on the Environment
HWMP	Hazardous Waste Management Programme
LGA	Local Government Amendment Act (No.4)(1996)
LIM	Land Information Memoranda
MfE	Ministry for the Environment
MSDS	Material Safety Data Sheets
NES	National Environmental Standard under the Resource Management Act 1991
NZCIC	New Zealand Chemical Industry Council
OECD	Organisation for Economic Co-operation and Development
PIM	Project Information Memoranda
RMA	Resource Management Act 1991
RPS	Regional Policy Statement
SMF	Sustainable Management Fund
UK	United Kingdom
USEPA	United States Environmental Protection Agency
TCLP	United States Environmental Protection Agency Toxic Characteristics Leaching Procedure
WAC	Waste Acceptance Criteria
WAP	Waste Analysis Protocol
WMP	Waste Management Plan

Appendix 8: Definitions

"Landfill site" is defined in this census as "any waste disposal site used for the controlled deposit of solid wastes onto or into the land"(*Landfill Guidelines*, MfE, 1992).

"Cleanfill" is defined as "material that will have no harmful effects on the environment. This material is generally a natural material such as clay, soil and rock and other such materials as concrete, brick or demolition products that are free of hazardous combustible materials and are therefore not subject to biological or chemical breakdown" (*Standards Australia/Standards New Zealand 3831:1998, Waste Management – Glossary of Terms*).

"Industrial and trade premises" in relation to landfills are defined under the Resource Management Act 1991 as:

"(b) any premises used for the storage, transfer, treatment, or disposal of waste materials or for other waste management purposes, or used for composting organic materials".

"Use" in relation to landfills is defined in section 9(4)(d) of the Resource Management Act 1991 as being "any deposit of any substance in, on or under the land".

About the Ministry for the Environment

The Ministry for the Environment advises the Government on policies, laws, regulations, and other means of improving environmental management in New Zealand. The significant areas of policy for which the Ministry is responsible are: management of natural resources; sustainable land management; air and water quality; management of hazardous substances, waste and contaminated sites; protection of the ozone layer; and responding to the threat of climate change. Advice is also provided on the environmental implications of other Government policies.

The Ministry monitors the state of the New Zealand environment and the operation of environmental legislation so that it can advise the Government on action necessary to protect the environment or improve environmental management.

The Ministry for the Environment carries out many of the statutory functions of the Minister for the Environment under the Resource Management Act 1991. It also monitors the work of the Environmental Risk Management Authority on behalf of the Minister.

Besides the Environment Act 1986 under which it was set up, the Ministry is responsible for the Soil Conservation and Rivers Control Act 1941, the Resource Management Act 1991, the Ozone Layer Protection Act 1996 and the Hazardous Substances and New Organisms Act 1996.

Head Office

Grand Annexe Building
84 Boulcott Street
PO Box 10362
Wellington, New Zealand
Phone (04) 917 7400, fax (04) 917 7523
Internet http://www.mfe.govt.nz

Northern Regions Office

8-10 Whitaker Place
PO Box 8270
Auckland
Phone (09) 307 7093, fax (09) 377 9521

South Island Office

Level 3, Westpark Towers
56 Cashel Street,
PO Box 1345
Christchurch
Phone (03) 365 4540, fax (03) 353 2750