



Ministry for the
Environment
Manatū Mō Te Taiao

Revised
National Environmental Standards
for Air Quality

Evaluation under Section 32
of the Resource Management Act

This report may be cited as:

Ministry for the Environment. 2011. *Revised National Environmental Standards for Air Quality – Evaluation under Section 32 of the Resource Management Act*. Wellington: Ministry for the Environment.

Published in April 2011 by the
Ministry for the Environment
Manatū Mō Te Taiao
PO Box 10362, Wellington 6143, New Zealand

ISBN: 978-0-478-37215-1

Publication number: ME 1041

© Crown copyright New Zealand 2011

This document is available on the Ministry for the Environment's website:
www.mfe.govt.nz



Contents

1	Introduction	1
1.1	The Regulations	1
1.2	Section 32 RMA 1991	2
2	Statement of the Issues	4
2.1	Issues to be addressed by the changes	4
3	The Options	8
3.1	Status quo (existing regulations)	8
3.2	Option 1: Split Targets	8
3.3	Option 2: Set and Review	9
3.4	Option 3: Interim Targets	10
3.5	Option 4: Strict Compliance	10
4	Agreed Approach in Response to Consultation	12
4.1	Permitted exceedances and exceptional events	12
4.2	Remove current industry restrictions	13
4.3	Mandatory offsets	14
4.4	New split targets	15
4.5	Ban new open fires in polluted airsheds	15
4.6	Non-regulatory assistance to compliance	16
5	Assessment of the Most Appropriate Option	17
5.1	Overview	17
5.2	Summary of cost benefit analysis methodology	18
5.3	Assumptions	19
5.4	Assessment of efficiency	19
5.5	Assessment of effectiveness	20
5.6	Uncertain information: sensitivity to changes	22
5.7	Choosing the most appropriate option	25
6	Conclusions	26
	Appendix 1 Assumptions	27
	Glossary	34
	References	35

Tables

Table 1:	Current restrictions on granting resource consents	8
Table 2:	Summary of status quo and new options	11
Table 3:	Cost-benefit analysis summary	20
Table 4:	Comparative public exposure	21
Table 5:	Sensitivity testing of discount rate	23
Table 6:	Sensitivity testing of compliance costs for industry	24

Figures

Figure 1:	Wintertime PM ₁₀ emissions in New Zealand	5
Figure 2:	Airsheds unlikely to meet current 2013 target compliance date	7
Figure 3:	PM ₁₀ trend in Christchurch and Nelson, 2001–2010	12

1 Introduction

On 29 November 2010, Cabinet agreed to amend the National Environmental Standards for Air Quality and introduce non-regulatory tools which help compliance (CBC(10)114). The National Environmental Standards for Air Quality have the force of regulation and are contained in the *Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins and Other Toxics) Regulations 2004* (referred to as the Regulations in this document).

This document presents an analysis of the agreed amendments to the Regulations and additional non-regulatory instruments, in accordance with section 32 of the Resource Management Act 1991 (RMA).

1.1 The Regulations

The Regulations contain 14 standards:

- seven standards banning activities that discharge significant quantities of dioxins and other toxics into the air
- five standards for ambient (outdoor) air quality (relating to carbon monoxide, nitrogen dioxide, sulphur dioxide, ozone and PM₁₀)
- a design standard for new wood burners installed in urban areas
- a requirement for landfills over one million tonnes of refuse to collect greenhouse gas emissions.

The Regulations further introduced restrictions on granting resource consent for discharges of PM₁₀ to encourage compliance with the ambient standard for PM₁₀ by 1 September 2013. A copy of the Regulations can be found at www.legislation.govt.nz.

In June 2009, the Minister for the Environment notified his intent to review three aspects of the Regulations relating to PM₁₀:

- whether disallowing industry consents (as required by the Regulations after 2013) is equitable when industry contributes a relatively small proportion of pollutants
- whether the current number of permitted exceedances of the ambient PM₁₀ standard is appropriate for New Zealand
- whether the 2013 timetable is achievable, and whether it has the suitable cost/benefit balance.

Further, the review was to be consistent with the Government Statement on Regulation: Better Regulation, Less Regulation.¹ The overall objective of the review therefore, was to

“ensure that the Regulations provide the maximum net benefit to New Zealanders taking into account the economic, social and environmental benefits and costs of air pollution.”

The Minister subsequently appointed a technical advisory group (TAG) to provide him with an independent report. The TAG reported in November 2009 with a number of recommendations.

¹ <http://www.treasury.govt.nz/economy/regulation/statement>

Some of the TAG's recommendations were not feasible within the current structure of the RMA, so the Ministry for the Environment (the Ministry) developed alternative options which would achieve similar outcomes sought by the TAG's recommendations.

A discussion document containing five options, including the TAG's recommendations and two options preferred by the Minister, was published by the Ministry in June 2010 and submissions invited by 9 July 2010. A summary of the 114 submissions received by the Ministry is available on the Ministry's website.²

Based on the feedback received, four new options were developed. A regulatory impact analysis was undertaken, as required for regulatory options put forward to Cabinet, and the regulatory impact statement published on the Ministry's website.³ The agreed amendments to the Regulations are based on Option 1 (Split Targets). This includes both amendments and non-regulatory options, notably the development of a National Air Quality Compliance Strategy.

1.2 Section 32 RMA 1991

Section 32 of the RMA requires an evaluation to be carried out, before a national environmental standard is made (or amended) as follows (emphasis added):

- (3) *An evaluation must examine:*
- (a) *the extent to which each objective is the most appropriate way to achieve the purpose of this Act; and*
 - (b) *whether, having regard to their efficiency and effectiveness, the policies, rules, or other methods are the most appropriate for achieving the objectives.*
- (4) *For the purposes of this examination, an evaluation must take into account:*
- (a) *the benefits and costs of policies, rules, or other methods; and*
 - (b) *the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the policies, rules, or other methods.*

National environmental standards, being regulations, do not have objectives within the standard. However, the Government pursues policy objectives through regulations and these may be considered the relevant objectives for a Section 32 analysis. The policy objectives behind the Regulations in 2004 were to:

- give industry greater certainty by providing a “level-playing field” which clarifies environmental expectations prior to the resource consent process
- support protection of public health and the environment by providing a bottom-line standard that should not be breached
- provide greater certainty in resource consent decision-making and regional plan preparation at the local level.

² <http://www.mfe.govt.nz/publications/air/national-air-quality-standards-report-on-submissions/index.html>

³ <http://www.mfe.govt.nz/laws/standards/air-quality/review/ris-air-quality-standards.pdf>

Cabinet reconfirmed these objectives when the review began in June 2009. It is therefore unnecessary to evaluate the extent to which each objective is the most appropriate way of achieving the purpose of the RMA (as required by section 32(3)(a)).⁴

However, the requirements of Section 32(3)(b) and 32(4) still need to be met. Section 32(3)(b) requires consideration of whether other methods than the current regulations are more appropriate for achieving the objectives. Section 32(4) requires that in so doing you have regard to efficiency and effectiveness as well as taking account of the costs and benefits and the risks of acting or not acting.

Determining the relative *efficiency* of various alternatives involves an estimate of costs and benefits. The greater the net benefit (the sum of the benefits minus the sum of the costs), the more efficient the option. Assessing *effectiveness* involves assessing how well something might work. An option may be efficient but if it does not work then it is not effective.

The current regulations are highly relevant here. When introduced in 2004, the Regulations were assessed as *efficient*, with an estimated benefit to cost ratio of 3.9:1. In 2011, with the benefit of hindsight, the Regulations may be considered *ineffective* because an estimated 15 airsheds will not comply with the PM₁₀ standard by the original target compliance date of 2013. This ineffectiveness is one of the triggers for the review of the Regulations.

The following chapters within this document present this section 32 analysis as follows:

- chapter 2 discusses the issues triggering the review (ie, what has changed since 2004 and why the agreed changes are necessary)
- chapter 3 outlines four options, in addition to the status quo (no change to existing regulations), that may be the most appropriate for achieving the policy objectives (Section 32(3)(b))
- chapter 4 presents the chosen option in relation to the issues and how it was shaped by submissions during consultation. The chosen option includes both amendments and non-regulatory tools. This is not a specified requirement of Section 32. This section is included to provide public transparency and accountability over the agreed changes
- chapter 5 reviews the efficiency and effectiveness of all options to assess which is the most appropriate for achieving the policy objectives (Section 32(3)(b) and 32(4)).

⁴ <http://www.mfe.govt.nz/publications/air/nes-air-standards-analysis/index.html>

2 Statement of the Issues

2.1 Issues to be addressed by the changes

Three problems were identified with the air quality standards that required review:

- equity with respect to compliance costs
- perceived stringency of the PM₁₀ standard
- target compliance date of 2013.

These are discussed in turn below.

2.1.1 Equity

Regulations 17–19 will have the most impact on industry. These impose restrictions on the issue of resource consents for the discharge of PM₁₀. Neither the RMA, nor most regional plans, require resource consent for discharges from the domestic sector so the burden of these restrictions falls on industry, which does require consent.

Regulations 17 and 18 restrict resource consent depending on three things:

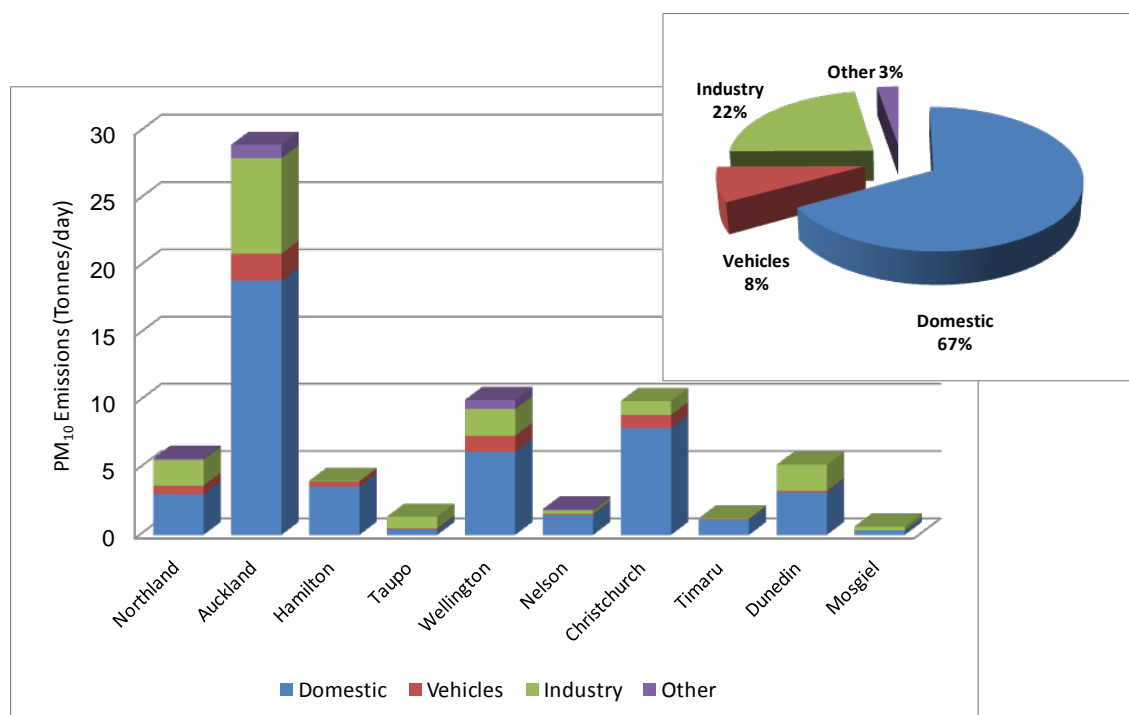
- a. the state of air quality in an airshed (ie, whether or not air quality already breaches the PM₁₀ standard)
- b. whether the impact of the discharge to be permitted is significant and/or
- c. whether the discharge is from an existing industry or is new.

Regulations 17 and 18 effectively require a path to compliance with the PM₁₀ standard by 1 September 2013. If compliance is not on track then emissions from the activity must be ‘offset’ by reductions elsewhere in the airshed. In some cases consent may not be granted at all – for example an application for a new significant discharge in a polluted airshed which is not on track to compliance by 2013.

After 1 September 2013, Regulation 19 requires that councils must not issue any consent to discharge PM₁₀ in a non-compliant airshed, nor issue any consent for a PM₁₀ discharge if it is likely to cause the airshed to exceed the PM₁₀ standard. This applies to **all** applications for resource consents for discharges of PM₁₀ – there is no test of significance.

The problem is that *domestic* solid-fuel combustion, not industry, is typically the primary source of PM₁₀ pollution during winter, as shown in Figure 1. The Regulations are therefore not considered equitable.

Figure 1: Wintertime PM₁₀ emissions in New Zealand



Source: MfE, 2003. Pie chart contains composite wintertime emissions for all listed regions/cities.

2.1.2 Perceived stringency of the PM₁₀ standard

The ambient PM₁₀ standard is currently 50 micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) as a 24-hour average, with one permitted exceedance per year. The World Health Organisation (WHO) global guideline for PM₁₀ is 50 $\mu\text{g}/\text{m}^3$ as a 24-hour average, with three permitted exceedances per year. There is concern, therefore, that the New Zealand standard may be too stringent.

WHO guidance notes that, when setting standards, countries must balance the acceptability of risk factors and the need to protect vulnerable population groups against issues of feasibility and the anticipated costs of compliance (WHO, 2006). Different jurisdictions take different approaches to compliance criteria.

- The European Union 2008 directive on air quality has a target for PM₁₀ of 50 $\mu\text{g}/\text{m}^3$ as a 24-hour average with 35 exceedances permitted each year. Countries that breach the target, or fail to prepare plans to achieve compliance, may be subject to prosecution. At the time of writing, the European Commission is taking proceedings against 10 member states (Cyprus, Estonia, Germany, Italy, Poland, Portugal, Slovenia, Spain, Sweden and the UK) for failure to comply with the air quality standard for PM₁₀.⁵
- Australia has a national environmental protection measure for PM₁₀ of 50 $\mu\text{g}/\text{m}^3$ as a 24-hour average to be met by 2007. The measure explicitly permits five exceedances each year for bushfire hazard reduction burning. There are, however, no sanctions for non-compliance. The measure is currently under review.

⁵ The Treaty on European Union gives the Commission powers to take legal action against a member state that is not respecting its obligations.

- The US has moved towards an ambient air quality standard for PM_{2.5} (while retaining an older PM₁₀ standard), with different compliance criteria for each pollutant.⁶ States that fail to reach the standards are required to prepare plans to achieve compliance. There is further detailed guidance on the exclusion of ‘exceptional events’ (incidents such as bushfires, volcanic eruptions, etc).

The Regulations contain sanctions in the form of resource consent restrictions as outlined above. Currently, the Regulations are silent on how to deal with exceptional events such as bushfires and volcanic eruptions (ie, whether to count these events as exceedances or not).

2.1.3 Target compliance date of 2013

The air quality standards were promulgated in 2004 with the intent of achieving compliance with the PM₁₀ standard by 2013. However, the Ministry estimates that in 2013 there will be 15 airsheds (containing around 44 per cent of New Zealand’s population) which will not comply with the PM₁₀ standard. These airsheds are shown in Figure 2.

Figure 2 illustrates the frequency of pollution (annual number of exceedances of the PM₁₀ standard), the intensity of pollution (second highest PM₁₀ concentration), and public exposure (airshed population) in non-compliant airsheds over the period 2005 to 2009. The graph only shows non-compliant airsheds (the bubbles for complying airsheds would be located below 50 µg/m³ on the y-axis).

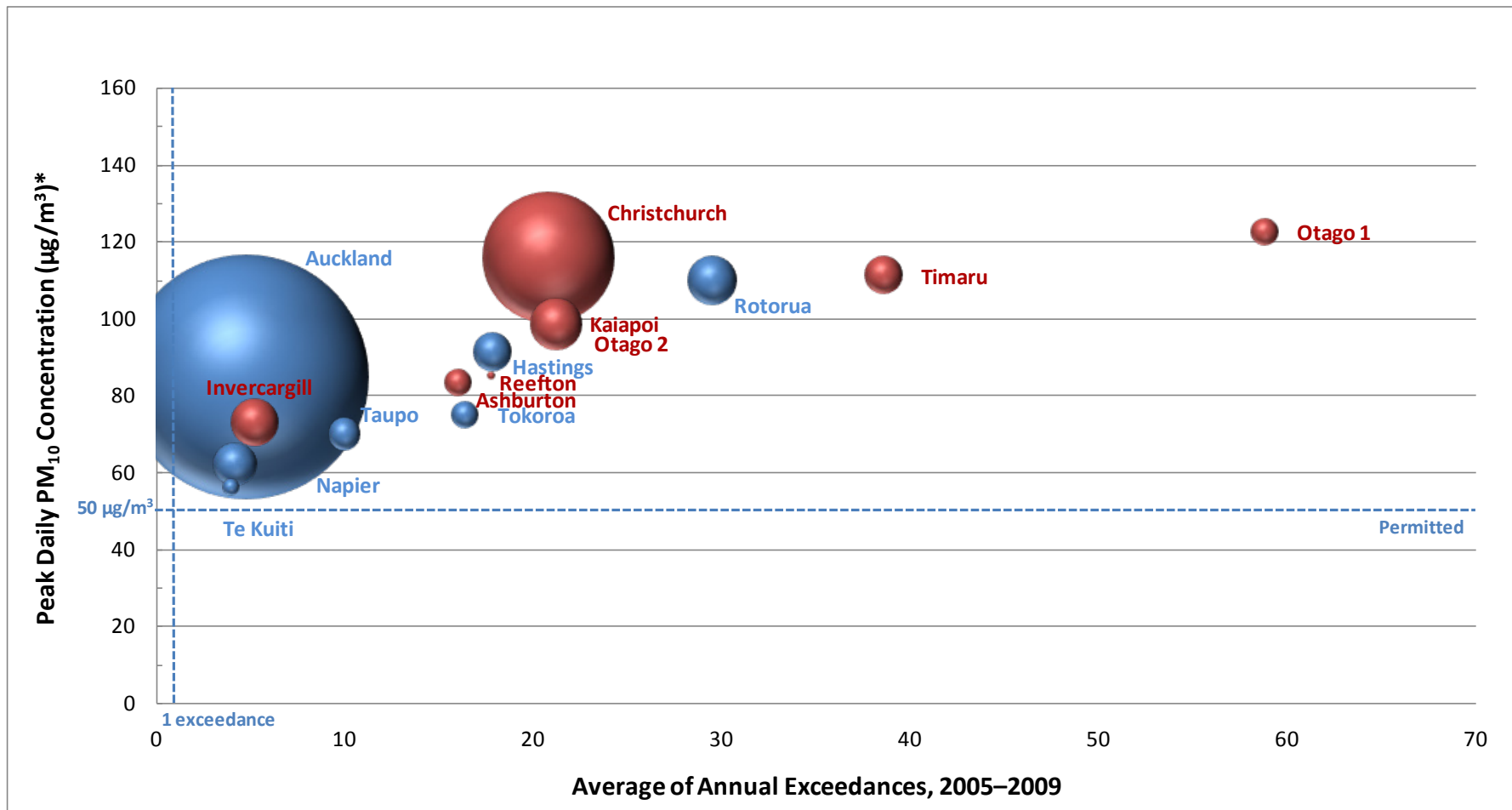
The size and the location of the bubbles on the graph’s axes indicate public exposure to air pollution. Airsheds to the top right of the graph experience higher levels of air pollution, more frequently. Airsheds to the bottom left of the graph experience lower levels of air pollution, less frequently.

Importantly, Figure 2 highlights the importance of Auckland where a significant proportion (29 per cent) of New Zealand’s population lives. While the air pollution in Auckland is not as high or as frequent as elsewhere in New Zealand, the large population of the airshed indicates its relative importance in terms of public exposure.

The concern is that the timeline of 2013 contained in the current regulations is not realistic, and that the resulting restrictions required by the Regulations will impose high costs on the economy, with the burden of this falling on industry. Auckland, the engine room for the economy, would be disproportionately affected.

⁶ PM_{2.5} standard is 35 µg/m³, as a 24-hour, three-year average of the 98th percentile. The 1987 PM₁₀ standard is 150 µg/m³, as a 24-hour average, not be exceeded more than once per year on average over three years.

Figure 2: Airsheds unlikely to meet current 2013 target compliance date



Source: Data courtesy regional councils, compiled by the Ministry for the Environment

Notes: *Peak refers to second highest PM₁₀ concentration as a 24-hour average; data presented are average for all years 2005–2009. Bubble area represents population of each airshed. North Island airsheds are blue, South Island airsheds are red.

3 The Options

3.1 Status quo (existing regulations)

The status quo is the current regulatory regime. As such, status quo may be considered the ‘do nothing’ option. The relevant aspects of the current regulations, relating to PM₁₀, are:

- an ambient PM₁₀ standard of 50 µg/m³, as a 24-hour average, with one permitted exceedance per year
- resource consents for significant discharges to be declined or offset if the PM₁₀ concentration is, or will be, above a path to compliance with the ambient standard by 1 September 2013 as shown in Table 1
- *all* discharge consents to be declined from 1 September 2013, if the PM₁₀ concentration is, or will be, above the ambient standard (ie, in a polluted airshed).

Table 1: Current restrictions on granting resource consents

Concentration of PM ₁₀ in the airshed at the time the application is decided	Application for renewed discharges causing significant increase in concentration	Application for new discharges causing significant increase in concentration
Tracking below path	Can be granted if increase in PM ₁₀ offset by amount equivalent to increase above path	Can be granted if increase in PM ₁₀ offset by amount equivalent to increase above path
Tracking on path	Can be granted if increase in PM ₁₀ offset by amount equivalent to increase above path	Can be granted if increase in PM ₁₀ offset by amount equivalent to increase above path
Tracking above path	Can be granted only if discharges fully offset	Must be declined, no ability to offset

Notes: The Regulations do not define a ‘significant’ increase in concentration.

3.2 Option 1: Split Targets

Option 1 (Split Targets) retains the current ambient PM₁₀ standard in its entirety (ie, the ambient PM₁₀ standard remains at 50 µg/m³ as a 24-hour average with one permitted exceedance per year) but introduces split target compliance dates depending on the existing level of pollution. Option 1 further revises industry and domestic PM₁₀ emission controls and uses non-regulatory measures to help compliance.

The amendments in Option 1 are:

- introduce split target compliance dates depending on the level of PM₁₀ pollution such that:
 - a. highly polluted airsheds (those currently with 10 or more exceedances of the PM₁₀ standard) to have no more than three exceedances per year by 1 September 2016
 - b. polluted airsheds (those currently with less than 10 exceedances of the PM₁₀ standard) to have no more than one exceedance per year by 1 September 2016
 - c. all airsheds to meet the PM₁₀ standard with no more than one permitted exceedance by 1 September 2020

- make provision for exceptional events so that they are excluded from the measurement of exceedances
- remove all current restrictions on industry consents for significant discharges of PM₁₀
- require offsets for resource consents for significant **new** PM₁₀ discharges in non-compliant airsheds (ie, airsheds not meeting the ambient PM₁₀ standard) from 1 September 2013, applying until the airshed is compliant for five consecutive years
 - d. new industry (for the purposes of mandatory offsets) is an industry that applies for consent for new emissions to the airshed
 - e. a significant discharge is one that results in an increase in the concentration of ambient (ie, outdoor, off-site) PM₁₀ at a particular location of more than 2.5 µg/m³ over a 24-hour period, based on measurements and/or calculations
- prohibit, from 1 September 2012, discharges from new, solid-fuel burning open fires in homes in non-compliant airsheds, the prohibition applying in perpetuity.

Offsets are mitigation measures included in a proposal to ‘offset’ predicted impacts so that emissions from the new activity are ‘offset’ by emission reductions elsewhere in the airshed. An example would be an industrial development helping to reduce emissions from a hospital boiler located nearby. The reduced PM₁₀ emissions from the hospital boiler offset the proposed industrial discharges of PM₁₀. Multiple, real-life examples of offsets are provided in the Ministry discussion document.⁷

Option 1 further includes non-regulatory approaches:

- regional councils to provide information on airshed implementation plans
- mandatory annual reporting of PM₁₀ monitoring data
- development of a national compliance strategy to monitor and follow-up non-compliance and promote the use of best practice
- ministerial oversight of non-compliance
- revision of the national ambient air quality guideline for PM_{2.5} and consideration of future standards for annual PM₁₀ and PM_{2.5}.

3.3 Option 2: Set and Review

Option 2 (Set and Review) requires all non-compliant airsheds to achieve an initial target of the PM₁₀ standard with no more than three exceedances in a 12-month period by 1 September 2016. At that stage, the target will be reviewed. Option 2 further revises industry and domestic PM₁₀ emission controls and uses non-regulatory measures to help compliance.

Amendments in Option 2 were:

- the ambient PM₁₀ standard remains at 50 µg/m³, as a 24-hour average, but with **three** permitted exceedances per year
- introduce a new target compliance date of 1 September 2016 after which date the PM₁₀ standard will be reviewed again

⁷ <http://www.mfe.govt.nz/publications/air/national-air-quality-standards-discussion-document/index.html>. (Appendix H).

- make provision for exceptional events so that they are excluded from the measurement of exceedances
- remove all current restrictions on industry consents for significant discharges of PM₁₀
- require offsets for resource consents for significant new PM₁₀ discharges in non-compliant airsheds (ie, airsheds not meeting the ambient PM₁₀ standard) from 1 September 2013, applying until the airshed is compliant for five consecutive years⁸
- prohibit, from 1 September 2012, discharges from new, solid-fuel burning open fires in homes in non-compliant airsheds, the prohibition applying in perpetuity.

Option 2 further incorporates all non-regulatory approaches outlined in Option 1.

3.4 Option 3: Interim Targets

Option 3 (Interim Targets) retains the current ambient PM₁₀ standard in its entirety but introduces an interim target compliance date of 2016 for **all** airsheds (to meet three exceedances) and extends the date for full compliance (to meet one exceedance) to 2020. Option 3 further revises industry and domestic PM₁₀ emission controls and uses non-regulatory measures to help compliance.

Amendments in Option 3 were:

- introduce an **interim** target for compliance:
 - a. **all** airsheds to meet the PM₁₀ standard with no more than three exceedances by 1 September 2016
 - b. all airsheds to meet the PM₁₀ standard with no more than **one** permitted exceedance by 1 September 2020
- make provision for exceptional events so that they are excluded from the measurement of exceedances
- remove all current restrictions on industry consents for significant discharges of PM₁₀
- require offsets for resource consents for significant new PM₁₀ discharges in non-compliant airsheds (ie, airsheds not meeting the ambient PM₁₀ standard) from 1 September 2013, applying until the airshed is compliant for five consecutive years⁹
- prohibit, from 1 September 2012, discharges from new, solid-fuel burning open fires in homes in non-compliant airsheds, the prohibition applying in perpetuity.

Option 3 further incorporates all non-regulatory approaches outlined in Option 1.

3.5 Option 4: Strict Compliance

Option 4 (Strict Compliance) retains the current ambient PM₁₀ standard in its entirety and introduces a new target compliance date for all airsheds of 1 September 2016. Option 4 further revises industry and domestic PM₁₀ emission controls and uses non-regulatory measures to help compliance.

⁸ New industry and significant discharges defined as in Option 1.

⁹ As above.

Amendments in Option 4 were:

- introduce a new target date for compliance of 1 September 2016
- make provision for exceptional events so that they are excluded from the measurement of exceedances
- remove all current restrictions on industry consents for significant discharges of PM₁₀
- require offsets for resource consents for significant new PM₁₀ discharges in non-compliant airsheds (ie, airsheds not meeting the ambient PM₁₀ standard) from 1 September 2013, applying until the airshed is compliant for five consecutive years¹⁰
- prohibit, from 1 September 2012, discharges from new, solid-fuel burning open fires in homes in non-compliant airsheds, the prohibition applying in perpetuity.

Option 4 further incorporates all non-regulatory approaches outlined in Option 1.

Table 2 summarises the status quo and the four options.

Table 2: Summary of status quo and new options*

Description	Status Quo	Option 1 Split Targets	Option 2 Set & Review	Option 3 Interim Targets	Option 4 Strict Compliance
Permitted exceedances and target compliance date(s)	All airsheds meet 1 by 2013.	Heavily polluted airsheds meet 3 by 2016. Polluted airsheds meet 1 by 2016. All airsheds meet 1 by 2020.	All airsheds meet 3 by 2016 and then review.	All airsheds meet 3 by 2016. All airsheds meet 1 by 2020.	All airsheds meet 1 by 2016.
Provision for exceptional events	X	✓	✓	✓	✓
Prohibit all industrial consents post 2013	✓	X	X	X	X
Mandatory offsets for significant industry in non-compliant airsheds	All new industry plus existing industry in airsheds not on track to compliance	New industry from 2012	New industry from 2012	New industry from 2012	New industry from 2012
National domestic controls	National wood burner standards	National wood burner standards and prohibit new solid-fuel burning open fires in non-compliant airsheds post-2012	National wood burner standards and prohibit new solid-fuel burning open fires in non-compliant airsheds post-2012	National wood burner standards and prohibit new solid-fuel burning open fires in non-compliant airsheds post-2012	National wood burner standards and prohibit new solid-fuel burning open fires in non-compliant airsheds post-2012

Notes: *All options further include non-regulatory tools: National Air Quality Compliance Strategy, mandatory reporting, ministerial oversight of non-compliance, revised national ambient air quality guideline for PM_{2.5}, and consideration of future standards for annual PM₁₀ and PM_{2.5}.

¹⁰ New industry and significant discharges defined as in Option 1.

4 Agreed Approach in Response to Consultation

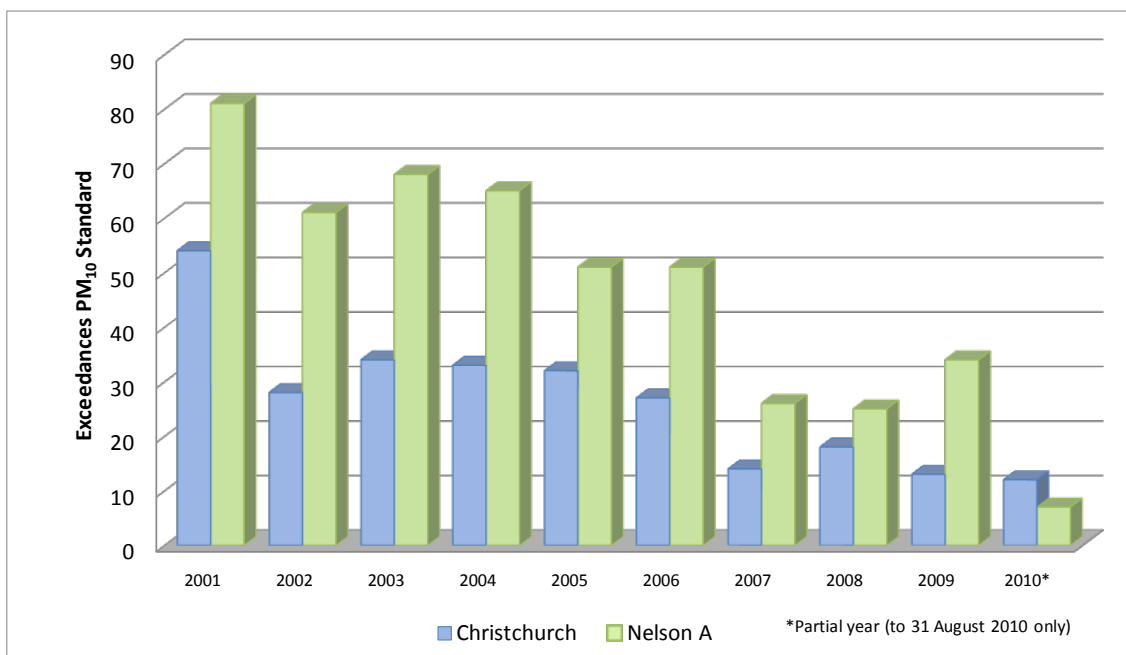
On 29 November 2010, Cabinet agreed to Option 1 (Split Targets) (CBC(10)114). This option retains the current ambient PM₁₀ standard in its entirety and introduces split target compliance dates depending on the existing level of pollution. It further revises industry and domestic PM₁₀ emission controls and uses non-regulatory measures to help compliance. This chapter discusses the agreed changes, in relation to the issues, and how they were shaped by submissions during consultation.

4.1 Permitted exceedances and exceptional events

The current ambient PM₁₀ standard is to remain unchanged (ie, 50 µg/m³, as a 24-hour average, with one permitted exceedance in a 12-month period).

Figure 3 shows the reductions in annual exceedances of the PM₁₀ standard in Christchurch and Nelson between 2001 and 2010. These reductions show the significant progress made by these councils to reduce PM₁₀ emissions in these airsheds.

Figure 3: PM₁₀ trend in Christchurch and Nelson, 2001–2010



Decreasing the stringency of the standard (by increasing the number of permitted exceedances) directly impacts on the benefits that compliance would bring – particularly in terms of health outcomes. Rather than change the bottom line, the amendments will introduce split target dates for compliance and require an ‘equivalence of effort’ from all parties charged with implementation.

This approach carefully balances the level of health protection the standard affords against the need to reduce compliance costs and the very real issue of feasibility.

Some exceedances are beyond the control of air quality plans developed by councils because they are due to exceptional events such as volcanic activity, bushfires or Australian dust-storms. Such events could, however, push an airshed into non-compliance. Consequently, the Regulations will be amended to provide for the exclusion of exceptional events from the measurement of exceedances.

Response to submissions

A key objective of the Regulations is to provide support for public health protection and the establishment of bottom-line standards that should not be breached. A number of submitters were strongly opposed to decreasing health protection by increasing the number of permitted exceedances.

In particular, the Patuharakeke Te Iwi Trust Board noted that increasing the number of permitted exceedances would result in increased premature mortality from air pollution. Given the over-representation of Māori in current health statistics, relaxing the PM₁₀ standard is likely to disproportionately affect Māori health. It is further noted that other health-compromised individuals, such as those with physical disabilities, would similarly be disproportionately adversely affected by any relaxation of the PM₁₀ standard.

In addition to the moral questions posed by increased premature mortality and the disproportionate nature of these impacts, there would be a large cost burden associated with increased adverse health impacts caused by a less stringent PM₁₀ standard. This factor was instrumental in the decision not to increase the number of permitted exceedances of the PM₁₀ standard.

4.2 Remove current industry restrictions

Existing restrictions on resource consents for significant discharges (refer Table 2) will be repealed from the date at which the amended regulations come into effect. This means applications for renewed discharges into non-compliant airsheds will not be subject to restrictions arising from the Regulations. They will still be subject to any restrictions imposed by the regional council, however, through normal resource consent processes.

Response to submissions

The current regulations impose significant compliance costs on industry despite the primary source in most airsheds being domestic heating. There was strong agreement across multiple stakeholders that the current regulations are inequitable.

4.3 Mandatory offsets

The prohibition on all PM₁₀ discharge consents in non-compliant airsheds from 1 September 2013 will be replaced with a requirement for significant new industry PM₁₀ discharges to be offset in non-compliant airsheds (a 'mandatory offset'). The intent is that the requirement for mandatory offsets will apply until the airshed is compliant for five consecutive years, as an assurance that compliance with the PM₁₀ standard has been achieved.

Mandatory offsets will apply from 1 September 2012 and are not linked to the new (split) target compliance date(s). This reflects the intention that mandatory offsets are a tool to ensure the new target compliance dates are met, rather than a 'penalty' for failing to meet the target.

Response to submissions

Submitters articulated a range of points concerning the technical details of mandatory offsets, particularly with respect to the definition of 'significant'. There did not, however, appear to be a shared appreciation of the proposal's intent to only target *new* industry with significant discharges of PM₁₀ in non-compliant airsheds.

In order to ensure consistency in the application of this regulation, a new definition of significant will also be introduced. This will be based on an existing, effects-based definition provided in the *Good Practice Guide for Assessing Discharges to Air from Land Transport*.¹¹ The intent is that a significant discharge is one that results in an increase in the concentration of ambient (ie, outdoor, off-site) PM₁₀ at a particular location of more than 2.5 µg/m³, over a 24-hour period, based on measurements and/or calculations.

Similarly, *new* industry (for the purposes of mandatory offsets) will be defined as an industry that applies for consent for new emissions to the airshed. This may be a new industry that is proposing to establish itself or an existing industry that is proposing to increase emissions.

The Ministry does not intend to regulate in detail how councils are to manage offsets because councils are in the best position to determine how to effectively and efficiently manage offsets in their own airsheds. The Regulations will continue to set out only what is to be achieved. The value of offsets will be determined by the market and may be undertaken by the party seeking consent or another party on its behalf (eg, a council).

Where practical, the requirement for offsets would be based on a five-year average to smooth the inter-annual effects of meteorology.¹² For example, an airshed that has exceeded the standards for five years would be deemed non-compliant and hence must implement mandatory offsets for new, significant industry discharges. Similarly, once compliance is assured (ie, an airshed has attained compliance for five consecutive years), offsets would no longer be required. Technical details like these will be explained in a national compliance strategy to be prepared by the Ministry.

¹¹ Ministry for the Environment, June 2008.

¹² In the case of airsheds with less than five years monitoring data, what data is available can be used to assess compliance.

4.4 New split targets

The existing target compliance date of 1 September 2013 (by which regional councils are expected to achieve compliance with the PM₁₀ ambient standard) is to be extended as follows:

- highly polluted airsheds (those currently with 10 or more exceedances of the PM₁₀ standard) to have no more than three exceedances per year by 1 September 2016
- polluted airsheds (those currently with less than 10 exceedances of the PM₁₀ standard) to have no more than one exceedance per year by 1 September 2016
- all airsheds to meet the PM₁₀ standard with no more than one permitted exceedance by 1 September 2020.

Response to submissions

The majority of submitters (60) supported the proposal to extend the target compliance date to 2018. There was also, however, reasonable support (20) for retaining the existing date of 2013. Local Government New Zealand (LGNZ), on behalf of all regional councils in New Zealand, requested a new target compliance date of 2016. LGNZ also, however, sought an amendment to the Regulations that allowed each region to have control over its target compliance date.

The Split Targets approach adopts the target compliance date of 1 September 2016, suggested by LGNZ, while also providing flexibility for heavily polluted airsheds. In doing so, it balances the level of health protection the standard affords against the need to reduce compliance costs and the very real issue of feasibility.

4.5 Ban new open fires in polluted airsheds

The Regulations already impose some restriction on domestic emissions through national emissions and efficiency standards for new woodburners in urban areas. From 1 September 2012, there will be a prohibition on new solid-fuel burning open fires in non-compliant airsheds. This prohibition will apply in perpetuity (ie, it will not be lifted even when the airshed subsequently complies with the PM₁₀ standard). This is to provide certainty (otherwise airsheds could be in a state of flux with respect to compliance) and to ensure that all householders in an airshed are treated equally.

Open fires that do not use solid fuel (eg, natural gas open fires) will not be affected.

Response to submissions

A number of submissions from regional councils called for increased domestic emission restrictions in the Regulations. In this regard, a national standard is more efficient and effective than changes to multiple regional plans. Regional councils may (and many do) have stricter rules on domestic burners in their regional plans.

4.6 Non-regulatory assistance to compliance

While the Regulations set national standards, they are not sufficient on their own to achieve compliance with the PM₁₀ standard. The review suggested the need for a range of non-regulatory tools to assist with compliance. Non-regulatory requirements that will be introduced are:

- regional councils that are not expected to meet the standard by 2013 will be required to produce 'airshed implementation plans', setting out how they intend to comply with the new split targets. Councils will provide the Minister with information on the plans and their performance against the plans
- all regional councils will be required to report their PM₁₀ monitoring data from 1 September 2013 to the Minister and the public, to improve transparency and accountability.

To further support compliance with the Regulations, the Ministry will prepare a national compliance strategy in 2011. It will set out the practices that regional councils should adopt in order to meet the standard and provide information on the non-regulatory measures outlined above. The strategy will include:

- education on the health impacts of PM₁₀
- guidelines for airshed implementation plans and managing mandatory offsets
- the use of best practice, including best available technology
- escalating steps the Minister and the Ministry will take in the event of non-compliance, up to the Minister's residual powers under the RMA.

Response to submissions

Two other suggestions made in submissions will also be adopted:

- an update of the national ambient air quality guidelines to include particulate matter less than 2.5 microns (PM_{2.5}) and to consider potential future standards for annual PM₁₀ and PM_{2.5}. promotion of the use of best practice, including best available technology, by industry.

5 Assessment of the Most Appropriate Option

5.1 Overview

This section evaluates which option is the most appropriate for achieving the Government's objectives. The relevant objectives are:

- provision of greater certainty for industry by providing a “level-playing field” that clarifies environmental expectations prior to the resource consent process
- support for the protection of public health and the environment by providing a bottom-line standard that shall not be breached
- provision of greater certainty in resource consent decision-making and regional plan preparation at the local level.

In doing so, the efficiency and effectiveness of all options is examined.

5.1.1 Efficiency

Efficiency considers the benefits and costs of a policy intervention. An intervention is efficient if the total benefits exceed the total costs, as demonstrated through a cost benefit analysis. Net benefit is the sum of the benefits minus the sum of the costs.

Because benefits and costs may arise at different times, they must be discounted back to their value at the present time to allow them to be compared. A discount rate is used that reflects the “social rate of time preference”. The choice of discount rate is important when costs and benefits occur at different times. For example, if costs are incurred in the short term, while the benefits are achieved in the longer term, a higher discount rate further reduces the value of the benefits compared to the costs. The appropriate discount rate is a matter of government policy. The approach used in this analysis is the Treasury default discount rate of 8 per cent with additional sensitivity analysis on 5 per cent and 10 per cent.

The present value of the sum of the benefits minus the present value of the sum of the costs is called the net present value. This is the measure used in assessing the efficiency of a policy option. An alternative measure of efficiency is the ratio of (present value) benefits to (present value) costs.

5.1.2 Effectiveness

Policy interventions, such as regulations, are judged to be effective if they contribute to the achievement of their objectives. In the context of the Regulations, the key measure of effectiveness is compliance with the ambient PM₁₀ standard in all airsheds.

5.2 Summary of cost benefit analysis methodology

In 2004, the Ministry prepared a cost-benefit analysis for the Section 32 assessment for introducing the standards [MfE, 2004]. It found the principal benefit from air quality standards is a reduction in adverse health effects that would otherwise have been caused by poor air quality. Health effects included in the analysis were premature mortality, hospitalisations and restricted activity days (RADs) caused by high levels of atmospheric pollution. These health effects were estimated up to 2020 and linked to the wider benefits to the economy over the same period.

The methodology used in this report is the same as that discussed in the regulatory impact statement.¹³ This used, as a starting point, an analysis undertaken by NZIER in 2009 which, in turn, was based largely on the original analysis undertaken in 2004.^{14,15}

Since that time, however, evidence that breathing particulate matter air pollution is harmful to human health has continued to grow through studies relating fine particle exposure to morbidity and mortality from different physiological causes (see, for example, Pope and Dockery, 2006.) There is now a large body of evidence indicating that short-term exposure to high levels of air pollution increases mortality and that long-term exposure to lower levels of pollution also increases mortality by inducing or accelerating the progress of chronic disease.

There are three important points of note with respect to these studies:

- no PM₁₀ concentration threshold has been observed, below which no adverse health impacts are observed
- rises in mortality are **not** due to “mortality displacement” of those who would otherwise die soon, but represent increased mortality
- plausible biological mechanisms by which particulate matter may **cause** adverse health impacts have been advanced.

For the purposes of this cost-benefit analysis, the health benefits attributed to the agreed changes must be compared to a ‘base case’. In this analysis, the costs and benefits of the proposed changes are compared with the do nothing option of retaining the existing regulations.

The benefits of the changes are calculated in monetary terms based on estimates of increased or decreased health impacts (ie, the number of the people who would be affected by delayed compliance through the value of each premature death not avoided, the cost of each hospitalisation not avoided, and the value of lost output on each RAD not avoided).

The value of each premature death avoided is given as a social cost, rather than the direct costs that result from a premature death. The value of avoiding the pain, grief and suffering caused by premature death is measured by the amount people who are willing to pay to reduce the risk of premature death. This is called the Value of Statistical Life (VOSL) and is derived from the VOSL calculated by the Ministry of Transport for use in transport appraisals. NZIER has provided detailed comment on this value in its report [NZIER, 2009]. The costs of

¹³ <http://www.mfe.govt.nz/laws/standards/air-quality/review/ris-air-quality-standards.pdf>

¹⁴ <http://www.mfe.govt.nz/publications/air/national-air-quality-standards-nzier/index.html>

¹⁵ <http://www.mfe.govt.nz/publications/air/nes-air-standards-analysis/index.html>

hospitalisation and of RADs are given as direct costs, estimated from New Zealand data. No indirect, social costs have been included.

The 2004 Cost Benefit Analysis also considered the effect on New Zealand's promotional image as a potential benefit of air quality standards. It was unable to estimate the value of this effect, but considered it was likely to be small, based on stated preferences for New Zealand produce and the fact that international tourism peaks in the summer months when air quality issues are generally less noticeable. The current analysis assumes this to still be the case, although there is a risk that lowering air quality standards may impact on investment in the "100% Pure New Zealand" campaign.

The costs of the air quality standards fall into two categories: the costs to central and local government in implementing and administering the standards, and the cost to different sectors of complying with them. The latter category includes costs to industry arising from resource consent restrictions and costs to households in complying with the standard for woodburners. These costs can be directly estimated, under assumptions described in the next section.

There are no costs imposed on the transport sector, as it was not directly impacted by either the original regulations or the agreed changes.

5.3 Assumptions

The assumptions used in this analysis are the same as those discussed in the regulatory impact statement and are reproduced in Appendix 1.

5.4 Assessment of efficiency

Using the assumptions outlined above, all options are compared to status quo (ie, do nothing by retaining the current regulations). In each case, benefits and costs have been calculated for the period 2008 to 2020 inclusive and expressed in 2008 dollars using the Treasury discount rate of 8 per cent.

Table 3 presents a comparative cost-benefit analysis for all options against status quo. Three options: Option 1 (Split Targets), Option 3 (Interim Targets) and Option 4 (Strict Compliance) are found to be efficient, in that the present value of their benefits exceed the present value of their costs. Two of these, Option 1 and Option 4, stand out with net present values in excess of half a billion dollars.

Option 1 has reduced (present value) benefits of \$165 million compared with status quo. This is largely due to the increased social costs from premature mortality, which would not be avoided, due to full compliance taking longer to achieve (ie, heavily polluted airsheds have extension from 2016 to 2020 to achieve one exceedance).

Option 1 has, however, significantly reduced (present value) costs of \$671 million – primarily to industry but also to households. Costs to government (both local and central) rise slightly (\$1 million). These cost reductions are, however, sufficiently large that Option 1 has a positive net present value of \$507 million when compared with the status quo.

Table 3: Cost-benefit analysis summary*

\$2008 million (2008–2020 inclusive)	Status Quo	Option 1 Split Targets	Option 2 Set & Review	Option 3 Interim Targets	Option 4 Strict Compliance
Description	1 exceedance by 2013	1 or 3 exceedances by 2016, 1 exceedance by 2020	3 exceedances by 2016 then review	3 exceedances by 2016, 1 exceedance by 2020	1 exceedance by 2016
PV Combined Benefits	0	–165	–943	–588	0
Present Value Costs	0	–671	–707	–696	–662
Net Present Value	0	+507	–237	+108	+662
B:C Ratio	2.2	8.9	6.0	7.7	9.3
<i>PV Costs Industry</i>	0	–663	–662	–662	–664
	78%	8%	10%	10%	7%
<i>PV Costs Government</i>	0	+1	+1	+1	+1
	1%	6%	7%	7%	6%
<i>PV Costs Households</i>	0	–10	–45	–35	0
	21%	86%	82%	84%	87%

* As compared with base case of status quo.

Option 4 (Strict Compliance) has the same benefits as status quo because compliance is assumed to be achieved within the same timeframe. This option has reduced (present value) costs of \$662 million, nearly all of which are avoided costs to industry with the removal of resource consent restrictions after 2013. Option 4 has the highest (positive) net present value of \$662 million when compared with status quo.

Both Options 1 and 4 have significantly higher benefit-to-cost ratios (which is another measure of efficiency) than status quo. As well, both options have a higher proportion of costs borne by households (which are the primary cause of PM₁₀ pollution).

5.5 Assessment of effectiveness

The key measure for evaluating effectiveness of the different options is achievement of compliance with the PM₁₀ standard. Table 4 presents a rough estimate of public exposure for each option based on assumed compliance with target dates. (Status quo is assumed to achieve full compliance by 2016 following industry closures under the current regulations).

Table 4: Comparative public exposure*

Description	Status Quo	Option 1 Split Targets	Option 2 Set & Review	Option 3 Interim Targets	Option 4 Strict Compliance
	1 exceedance by 2013	1 or 3 exceedances by 2016 1 exceedance by 2020	3 exceedances by 2016 then review	3 exceedances by 2016 1 exceedance by 2020	1 exceedance by 2016
Population living in non-compliant airshed in 2016	0	553,923	1,778,167	1,778,167	0
Percentage of NZ population living in non-compliant airshed in 2016	0%	14%	44%	44%	0%

* As compared with base case of status quo.

Table 4 is rather crude because it does not present either the intensity (ie, how high concentration levels are) or the frequency (ie, how often air pollution is experienced) of PM₁₀ pollution. In addition, it does not show the dramatic improvements necessary to achieve this level of compliance. For example, currently Rotorua has around 24 days a year when it exceeds the PM₁₀ standard – reducing this to only 1 or 3 exceedances a year represents a dramatic improvement. This dramatic improvement is not apparent in Options 1, 2 or 3 of Table 4.

Further, Table 4 is slightly conservative in that some councils (eg, Nelson City Council and Otago Regional Council) have stated they will continue to pursue the original target compliance date of 2013. Despite these limitations, Table 4 is helpful when making a comparative assessment with status quo.

Table 4 has two stand-out options when evaluating effectiveness compared with status quo: Option 1 (Split Targets) and Option 4 (Strict Compliance).

Table 4 is, however, based on assumed compliance. A true consideration of effectiveness should take into account the feasibility of all councils achieving these dramatic reductions in air pollution within the timeframes specified. While Option 1 is considered feasible, considerable uncertainty exists as to whether or not compliance through Option 4 could, in practice, be achieved.

This lack of certainty is largely due to concerns over implementation. Achieving compliance with the PM₁₀ standard will require councils to work cooperatively with households and industry stakeholders. To do so, councils must manage both their statutory processes (which take time) and their constituencies. Option 1 is significantly more flexible than Option 4 (which is more of an ‘all or nothing’ ultimatum) and provides more scope for compliance to be realised.

The Ministry’s best advice, in the regulatory impact statement, was that Option 1 is the most feasible of all options considered. Option 1 is therefore, similarly, considered the most effective.

5.5.1 New regulation

The proposal to ban new open fires in polluted airsheds means introducing a new regulation, rather than amending a current one. The *Government Statement on Regulation* provides that a regulatory decision should be taken only when “the problem cannot be adequately addressed through private arrangements and a regulatory solution is required in the public interest.” In this instance, the alternative approach to banning new open fires is through changing each regional plan. A new national regulation is more efficient and effective than changes to multiple regional plans.

There are zero direct costs associated with this change because it only relates to new sources. People who have built new houses that include new solid-fuel burning open fires would suffer some utility loss (mainly derived from aesthetics), but this would be partly offset by the lower operating costs of more efficient heating (eg, modern wood burners, heat pumps, flued gas heaters and electrical heaters).

5.6 Uncertain information: sensitivity to changes

A number of assumptions have been made about future trends and costs. Changing these assumptions may significantly alter the estimated costs and benefits of the agreed option. This, in turn, impacts directly on the efficiency of various options.

5.6.1 Value of statistical life

NZIER commented at length on its choice of value of statistical life (VOSL) in Appendix C of its report to the Ministry [NZIER, 2009]. In particular, it dismissed the suggestion that only the change in life expectancy should be considered, and concluded the use of VOSL estimated from traffic risk-based studies did not overestimate the social cost of air pollution effects. Rather NZIER noted there is, in fact, a likelihood that the use of VOSL underestimates the social cost.

The Ministry notes that the National Environment Protection Council of Australia (NEPC) recommends a value of \$AUD 6 million for the value of a statistical life *specifically for the purpose of setting air quality standards* [NEPC, 2009]. As such, the choice of \$3.35 million appears rather conservative in that it will not overestimate benefits. The NEPC further recommends sensitivity testing using values ranging from \$3.7 million to \$8.1 million. Given the Ministry’s choice of value is already less than the NEPC’s lower estimate of \$3.7 million, sensitivity testing on the value of a statistical life was not considered necessary.

5.6.2 Levels of PM₁₀

NZIER found that estimates of PM₁₀ levels under the base case could be lower than those assumed by 8 per cent, part of which could be due to some actions already taken by councils. If so, the estimates of social costs, and the benefits of avoiding them, should also be lowered by a similar percentage. This would reduce the net present value of all options, but not dramatically.

5.6.3 Variation in discount rate

The assumed discount rate is 8 per cent, but for sensitivity analysis 5 per cent and 10 per cent discount rates can also be used. At lower discount rates, both benefits and costs are higher. Conversely, at higher discount rates, both benefits and costs are lower. The timing of these costs and benefits, however, becomes ever more important. A higher discount rate gives greater weight to the present, thus decreasing the impact of delayed compliance. Conversely, a lower discount rate gives greater weight to the future, thus increasing the impact of delayed compliance.

Table 5 provides the estimated benefits and costs of all options, for discount rates of 5 per cent and 10 per cent, compared with status quo.

Table 5: Sensitivity testing of discount rate*

Discount Rate (%)	Status Quo	Option 1 Split Targets	Option 2 Set & Review	Option 3 Interim Targets	Option 4 Strict Compliance
		1 exceedance by 2013	1 or 3 exceedances by 2016 1 exceedance by 2020	3 exceedances by 2016 then review	3 exceedances by 2016 1 exceedance by 2020
\$2008 million					
5%					
PV Benefits	0	-569	-2,495	-2,031	0
PV Costs	0	-815	-850	-839	-806
NPV	0	246	-1,645	-1,193	806
10%					
PV Benefits	0	44	-141	158	0
PV Costs	0	-592	-627	-616	-583
NPV	0	637	486	775	583

* As compared with base case of status quo.

Table 5 shows that only Option 4 (Strict Compliance) and Option 1 (Split Targets) have a positive net present value, compared with status quo, for a discount rate of 5 per cent.

Interestingly, however, a higher discount rate of 10 per cent puts Option 3 (Interim Targets) in the lead, followed by Option 1 (Split Targets) and then Option 4 (Strict Compliance). In this case (ie, higher discount rate) the timing of the decreased industry costs significantly improves the overall net present value.

5.6.4 Increased social costs

The hospitalisation and RAD costs applied in the calculations used only direct costs and did not include the social costs of loss of life quality or the indirect costs of loss of income. Thus the social costs may have been underestimated. An increase in the social costs would increase the net benefits under both options, and hence their net present value.

5.6.5 Changes in specific costs

Crude assumptions have to be made in estimating the future costs for industry and households, both in the number of changes that need to be made and the specific costs of each change.

The Ministry considers that, while it has taken a generous approach to the number of changes that may be required for industry (including the number of industries that will relocate or close down), it may have underestimated some of the specific costs, including the costs of relocation and the compliance costs. For a sensitivity analysis, the Ministry has looked at the case of relocation and offsets costs being a factor of 10 greater than assumed.¹⁶ Table 6 presents the results.

Table 6: Sensitivity testing of compliance costs for industry*

Industry compliance costs	Status Quo	Option 1 Split Targets	Option 2 Set & Review	Option 3 Interim Targets	Option 4 Strict Compliance
		1 exceedance by 2013	1 or 3 exceedances by 2016 1 exceedance by 2020	3 exceedances by 2016 then review	3 exceedances by 2016 1 exceedance by 2020
NPV \$2008 million					
As assumed	0	+507	-237	+108	+662
10 x assumed relocation	-710*	NA	NA	NA	NA
10 x assumed offsets	0	+480	-264	+80	+647

* As compared with base case of status quo.

NA = not applicable in this comparative analysis; no relocation required for remainder of options and no offsets required for status quo.

The net present value of status quo is significantly lower under 10 x higher assumed relocation costs for industry. This is due to an increase of \$400 million in each of the three years 2013 to 2016 inclusive from the assumption that each of 45 relocations will cost \$10 million, rather than \$1 million. While \$10 million may be a reasonable figure for some major relocations, it seems unrealistically high for an average.

The net present values for all other options are, however, only slightly reduced if offset costs are 10 x higher. This is due to the fact that only new industry is affected. Both Option 1 (Split Targets) and Option 4 (Strict Compliance) retain positive net present values for significantly increased compliance costs. This shows that costs would have to be grossly underestimated to have a significant impact on the overall analysis.

¹⁶ That is cost of industry forced to relocate due to prohibition on consents post-2013 is \$10 million (previously assumed to be \$1M) and average cost of mandatory offsets of \$4 million (previously assumed to be \$400K).

5.7 Choosing the most appropriate option

An examination of efficiency and effectiveness reveals two stand-out options: Option 1 (Split Targets) and Option 4 (Strict Compliance).

Sensitivity analysis of benefits and costs show that the benefit-to-cost ratio is sufficiently robust to withstand large changes to both without altering the overall positive net present value of either option. Both options incorporate regulatory and non-regulatory tools and may be considered to be an appropriate mix.

While Option 4 is the most efficient, Option 1 is considered more effective. This evaluation of effectiveness is based on concerns over implementation. In simple terms, Option 4 is not considered as feasible as Option 1. The benefits of Option 4 are, therefore, less likely to be realised in practice.

Given the current regulations are equally judged to be efficient, but not effective, it would be prudent to give more weight to effectiveness. In this regard, Option 1 (Split Targets) is considered the most appropriate method for achieving the objectives.

6 Conclusions

A review of the National Environmental Standards for Air Quality relating to PM₁₀ began in June 2009 from which a set of agreed changes to the standards has been formulated. Four options are evaluated in detail in this report and compared with the current regulations (status quo).

Three options – Option 1 (Split Targets), Option 3 (Interim Targets) and Option 4 (Strict Compliance) – are found to be efficient, in that the present value of their benefits exceed the present value of their costs. Two of these, Option 1 and Option 4, stand out, with net present values in excess of half a billion dollars. Of these, Option 4 is the most efficient with a benefit to cost ratio of 9.3:1. The difference is, however, small with Option 1 being nearly as efficient with a benefit to cost ratio of 8.9:1.

If full compliance with proposed target dates is assumed, an evaluation of effectiveness would indicate that Option 4 and, to a lesser extent, Option 1 are the most effective. Considerable uncertainty exists, however, as to whether compliance through Option 4 could, in practice, be achieved. In simple terms, Option 4 is not considered as feasible as Option 1. This is because Option 4 could be perceived as an ‘all or nothing’ ultimatum, and face the same compliance problems as the current regulations. The benefits of Option 4 are, therefore, less likely to be realised in practice. Option 1, the more flexible option, is therefore evaluated as the most effective of all options considered.

The above results are insensitive to a wide range of assumptions and variables with both Option 1 and Option 4 retaining positive net present values through sensitivity analysis.

This evaluation concludes that while Option 4 (Strict Compliance) is evaluated as the most efficient, Option 1 (Split Targets) is considered the most effective. Having particular regard to the achievability of compliance and taking all of the above into consideration, Option 1 (Split Targets) is considered the most appropriate method for meeting the Government’s objectives.

Appendix 1 Assumptions

This section reproduces the relevant sections of the Regulatory Impact Statement (page 9–11, Appendix 1) [Ministry for the Environment, 2010].

Status Quo

Status quo is the current regulatory regime prior to the May 2010 Cabinet decision discussed above i.e. what would happen if the current regulations continued with no amendments (one permitted exceedance, prohibition on all industry consents after 2013 in over-allocated airsheds, etc). Based on current air quality monitoring data and an assessment of current regional plan provisions, the Ministry estimates that status quo would unfold as follows:

- Fifteen airsheds will still be non-compliant in 2013. Importantly this includes Auckland which is responsible for nearly 30% of New Zealand's population. These non-compliant airsheds are listed in Table 2.
- As a result of non-compliance, **all** industrial consents for PM₁₀ discharges will be declined in non-compliant airsheds. If this eventuates, the Ministry assumes:
 - Three industries will be forced to relocate and one industry will completely close down, in each of the 15 over-allocated airsheds, each year between 2013 and 2016. This is a total of 180 industries affected which is broadly similar to the actual number of consents due for renewal over that period (we estimate around 160).
 - The (one-off) costs of relocation are assumed to average \$1 million per site.
 - The cost of industry closing down and being lost to a region is estimated to be \$22 million per site, per year, based on a review of industry with significant PM₁₀ discharges in the Auckland Regional Council Industry Economic Model.
- Councils will take severe action on domestic emissions following the decline of industrial consents so that compliance with the PM₁₀ standard (with one permitted exceedance) will be achieved at the end of 2016. The choice of date for the status quo scenario is a matter of judgement. Arguably, given Local Government New Zealand's undertaking that all councils could comply by 2016 with no severe sanctions (albeit with three exceedances), it would be harder to justify any later date.
- The benefits of complying by end of 2016 have been interpolated from those calculated for 2013 and 2020 scenarios (NZIER, 2009). These include avoided premature deaths, reduced hospitalisations and restricted activity days due to improved air quality.

- The base case number of deaths attributable to air pollution each year has been scaled from the original modelling (Wilton, 2003), which included only some urban areas in New Zealand, using the *ARC Review and Update of HAPINZ* (ARC, 2010) to include 67 urban areas in New Zealand. This was further scaled from 2001 census data to 2008 population estimates.
 - As an example, the original modelling estimated 730 deaths per year in 2008 attributable to air pollution. Based on scaling from the ARC Review and update of HAPINZ and increase in population this has increased to 1,688 deaths per year in 2008.
 - Based on this modelling, meeting the PM₁₀ standard at the end of 2016 will avoid around 990 premature deaths (between 2008 and 2020).
- Except where noted here, status quo has the costs and benefits outlined in the NZIER 2009 report. This analysis estimates that approximately 300,000 solid fuel burner retrofits will be necessary to comply with the PM₁₀ standard (with one permitted exceedance).¹⁷ These retrofits incur a present value cost of around \$178 million. The NZIER report further assumes the value of a statistical life to be \$3.35 million, the cost of hospitalisation is \$8,404 per visit and restricted activity days are valued at \$46.50 (NZIER, 2009).

An updated analysis of the costs and benefits of status quo (as compared with a base case of no regulation) is presented in Table A-3.

Table A-3 Updated Cost Benefit Analysis for Status Quo*

2008 – 2020 inclusive	\$M (2008 dollars)
Present Value Combined Benefits	1,911
Present Value Costs	867
Net Present Value	1,044
B:C Ratio	2.2
Direct cost to industry	679
Industry % total costs	78%
Direct cost to government	10
Govt % total costs	1%
Direct cost to households	178
Household % total costs	21%

* As compared with base case of no regulation

¹⁷ Assuming no change to the number of exceedances, the total number of burners requiring retrofitting does not change. Present value costs to households are, however, highly sensitive to the chosen target compliance date. This is because natural attrition assumes a 15-year turnover of burners that, depending on the chosen date, impacts on the marginal costs of the proposed amendments. Costs incurred in later years as a result of an extended compliance date are similarly less expensive in present value terms.

It should be noted that compared with the previous regulatory impact statement, the updated health modelling results in benefits increasing from \$685 million to \$1.9 billion. This means that there would be approximately \$1.9 billion (in \$2008) of benefits to the New Zealand economy over the period 2008 – 2020 if the PM₁₀ standard was met by 2016 (due to the current regulations). This is primarily from avoided premature deaths due to air pollution over that period.

The New Zealand Institute of Economic Research has commented at length on their choice of value of statistical life in Appendix C of their report to the Ministry (NZIER, 2009). The Ministry notes that the National Environment Protection Council of Australia recommends a value of \$AUD 6 million for the value of a statistical life *specifically for the purpose of setting air quality standards* (NEPC, 2009). As such, the choice of \$3.35 million appears rather conservative in that it will not overestimate benefits. The NEPC further recommends sensitivity testing using values ranging from \$3.7 million to \$8.1 million. Given our choice of value is already less than the lower estimate of \$3.7 million, sensitivity testing on the value of a statistical life is not considered necessary.

It should be noted that the previous regulatory impact statement did not explicitly include the costs of industry relocation and/or loss due to consents being declined as required by the current regulations. These have been included in the updated modelling using the assumptions described above. This results in present value costs increasing from \$438 million to \$867 million (\$2008 over period 2008 – 2020 as compared with base case of no regulation).

Another important feature of the status quo scenario is the heavy burden borne by industry with estimated present value costs of \$679 million. This is due to industry relocations and closures due to non-compliance in 15 airsheds after 1 September 2013.

Appendix 1 of RIS

Except where noted here, the costs and benefits outlined in the NZIER 2009 report have been used. Benefits have been scaled for increased population and three exceedances (where appropriate). The following assumptions were also made in assessing the new options:

- Option 1 Split Targets (1 or 3 exceedances by 2016, 1 exceedance by 2020)
- Option 2 Set and Review (3 exceedances by 2016 then review)
- Option 3 Interim Targets (3 exceedances by 2016, 1 exceedance by 2020)
- Option 4 Strict Compliance (1 exceedance by 2016)

Government Costs – All Options

- 15 airsheds will each incur one-off costs of \$50K to prepare airshed action plans to reach compliance by the new target compliance date(s).
- Reporting costs will be \$5K per council per year for all 16 councils. These are only reporting costs *additional* to reporting already undertaken by councils, as a direct result of the regulations.

- The preparation of a national compliance strategy will incur one-off, external costs of \$150K in 2011.
- Preparation of best practice guidance (including Good Wood scheme) will incur one-off, external costs of \$75K in 2013.
- Ministerial oversight will incur external costs of \$100K per annum 2014 – 2016.
- The prohibition on new open fires in over-allocated airsheds is assumed to have zero direct cost because it only relates to new sources. People who would have built new houses including new solid-fuel burning open fires would suffer some utility loss (mainly derived from aesthetics), but this will be partly offset by the lower operating costs of more efficient heating (e.g. modern wood burners, heat pumps, flued gas heaters, electrical heaters).
- Revision of the national ambient air quality guidelines will incur external costs of \$75K in 2012 and 2013 (delayed due to preparation of national compliance strategy).
- The direct costs of exceptional events (e.g. volcanic eruptions, wild fires) are not specifically included in the cost benefit analysis. This is because they cannot be controlled and will occur regardless of the regulations. Hence including their costs serves no useful role in a cost benefit analysis of regulatory approaches. However, their indirect costs will be addressed through council plans for managing air quality, which will be the same under both options.

Benefits – Option 1 (Split Targets)

- The following airsheds were assumed to be polluted based on less than 10 exceedances per year as averaged between 2005 and 2009; Auckland (5), Blenheim (4), Geraldine (5), Gore (4), Hamilton (2), Invercargill (5), Napier (4), Otago 3 (7), Putaruru (2), Rangiora (7), Te Kuiti (4), Waimate (9), Wairarapa (3). These airsheds contain approximately 1.5 million people which is 72% of people living in over-allocated airsheds in New Zealand.
- Polluted airsheds are assumed to reach one exceedance per year by end of 2016. The benefits for this were calculated from a pro-rata calculation of the benefits for status quo (which similarly assumes achieving one exceedance by end of 2016) based on population in these airsheds (i.e. 72% of \$1.9 billion).
- The following airsheds were assumed to be heavily polluted based on more than 10 exceedances per year as averaged between 2005 and 2009; Ashburton (16), Christchurch (21), Hastings (18), Kaiapoi (21), Nelson A (37), Nelson B (13), Otago 1 (59), Otago 2 (21), Reefton (18), Richmond (27), Rotorua (30), Taupo (10), Timaru (39), Tokoroa (16). These airsheds contain approximately 580,000 people which are 28% of people living in over-allocated airsheds in New Zealand.
- Heavily polluted airsheds are assumed to reach the PM₁₀ standard with three exceedances by end of 2016 and then reach the PM₁₀ standard with one exceedance by 2020. The benefits for this were estimated from a pro-rata calculation of the benefits calculated for Option 3 (Interim Targets which similarly

reaches 3 exceedances by 2016 and then 1 by 2020) based on the population in these airsheds (i.e. 28% of \$1.3 billion).

- The present value benefits for both polluted and heavily polluted airsheds reaching one exceedance by end 2020 were then summed to total present value benefits.

Industry Costs – Option 1 (Split Targets)

- As under status quo, fifteen airsheds will still be non-compliant in 2013. The difference now, however, is that existing industry has had all consent restrictions repealed. New industry, and existing industry that wish to increase emissions, must use offsets to gain consent in over-allocated airsheds.
- It is assumed that two industries will be required to offset emissions each year from 2012 – 2016 (when Auckland achieves compliance). Between 2016 and 2020, one industry will be required to offset emissions each year.
- The (one-off) cost to each industry of doing so will average \$400K based on an average of 5 tonnes of PM₁₀ discharged per year and a mix of open fires and older wood burners being replaced.

Household Costs – Option 1 (Split Targets)

- Costs to households were calculated from summing pro-rata calculations of the costs for status quo (which assumes achieving one exceedance by 2016), and the costs for interim targets (which achieves one exceedance by 2020 with interim target of three exceedances by 2016), based on population in these airsheds (i.e. 72% of \$178 million and 28% of \$144 million).

Benefits – Option 2 (Set and Review)

- The benefits of compliance with **three** exceedances by end 2016 are reduced from the benefits for compliance with **one** exceedance by end 2016. This is due to adverse health impacts that will *not* be prevented because compliance will be achieved to a less stringent standard. New Zealand monitoring data shows that annual levels of PM₁₀ are directly correlated with the number of exceedances of the PM₁₀ standard each year. The adverse health impacts of PM₁₀ (including premature mortality) are also directly correlated with annual levels of PM₁₀. It can be assumed, therefore, that the number of exceedances is directly correlated with adverse health impacts. Appendix 2 of the previous regulatory impact statement estimated that increasing the number of permitted exceedances of the PM₁₀ standard from one to three would result in an increase of 3.8% in annual PM₁₀, resulting in around 470 deaths that would not be avoided (over the period 2008 – 2020) when compliance is achieved at the end of 2016.
- The annual 3.8% increase in mortality, hospitalisations and restricted activity days was calculated for each year commencing in 2011 (for NZIER 2013 scenario), and commencing in 2016 (for NZIER 2020 scenario) with staggered increases prior to this (0.8% in 2012, 1.6% in 2013, 2.3% in 2014 and 3.0% in

2015). Benefits were then interpolated, as before, between the 2013 and 2020 scenarios for a new target compliance date of 2016. The estimated present value benefits of compliance with the PM₁₀ with three exceedances by end of 2016 are \$967 million (cf present value benefits of compliance with the PM₁₀ with one exceedance by end of 2016 of \$1.91 billion).

Industry Costs – Option 2 (Set and Review)

- As under status quo, fifteen airsheds will still be non-compliant in 2013. The difference now, however, is that existing industry has had all consent restrictions repealed. New industry, and existing industry that wish to increase emissions, must use offsets to gain consent in over-allocated airsheds.
- It is assumed that two industries will be required to offset emissions each year from 2012 – 2020.
- The (one-off) cost to each industry of doing so will average \$400K based on an average of 5 tonnes of PM₁₀ discharged per year and a mix of open fires and older wood burners being replaced.

Household Costs – Option 2 (Set and Review)

- The Ministry has assumed one quarter fewer retrofits (75,000) will be needed nationally to comply with three permitted exceedances than with one permitted exceedance. In reality, however, the impacts of this will differ between locations:
 - there is likely to be little or no impact on airsheds already on track to meet the current standard of one exceedance;
 - many of those airsheds that are heavily over-allocated (i.e. more than 20 exceedances) have quite small populations and could achieve compliance at comparatively low cost by retrofitting wood burners – there is likely be little difference in cost between meeting 1 or 3 exceedances in these airsheds;
 - the majority of avoided retrofits are likely to occur in Auckland. Auckland has approximately 140,000 solid fuel burners (including around 30,000 open fires).

Benefits – Option 3 (Interim Targets)

- The benefits of compliance with the PM₁₀ standard with three exceedances by end 2016 are as per those calculated for Option 2 (Set and Review).
- The additional benefits of compliance with one exceedance by 2020 are estimated from the difference between the NZIER 2020 scenario scaled for one exceedance and the NZIER 2020 scenario scaled for three exceedances (\$356 million). These benefits are for years 2017 – 2020 only.

Industry Costs – Option 3 (Interim Targets)

- As under status quo, fifteen airsheds will still be non-compliant in 2013. The difference now, however, is that existing industry has had all consent restrictions repealed. New industry, and existing industry that wish to increase emissions, must use offsets to gain consent in over-allocated airsheds.
- It is assumed that two industries will be required to offset emissions each year from 2012 – 2020.
- The (one-off) cost to each industry of doing so will average \$400K based on an average of 5 tonnes of PM₁₀ discharged per year and a mix of open fires and older wood burners being replaced.

Household Costs – Option 3 (Interim Targets)

- The costs for Option 3 assume the same present value costs as Option 1 plus costs from the last four years of wood burner costs for the NZIER 2020 scenario to meet 1 permitted exceedance (\$11 million).

Benefits – Option 4 (Strict Compliance)

- The benefits of compliance with the PM₁₀ standard with one exceedance by end 2016 are as per those calculated for status quo (which similarly assumes compliance with one exceedance by end 2016).

Industry Costs – Option 4 (Strict Compliance)

- As under status quo, fifteen airsheds will still be non-compliant in 2013. The difference now, however, is that existing industry has had all consent restrictions repealed. New industry, and existing industry that wish to increase emissions, must use offsets to gain consent in over-allocated airsheds.
- It is assumed that two industries will be required to offset emissions each year from 2012 – 2016. After this date all airsheds achieve compliance and so no further offsets will be required.
- The (one-off) cost to each industry of offsets will average \$400K based on an average of 5 tonnes of PM₁₀ discharged per year and a mix of open fires and older wood burners being replaced.

Household Costs – Option 4 (Strict Compliance)

- The costs to households for complying with the PM₁₀ standard with one exceedance by end 2016 are as per those calculated for status quo (which similarly assumes compliance with one exceedance by end 2016).

Glossary

This glossary is specific to this report.

Airshed	An area gazetted in the Government Gazette as an airshed for the purposes of the national environmental standards for air quality (ie, air quality management). Typically airsheds reflect metropolitan or urban boundaries. Maps of all airsheds may be found here: http://www.mfe.govt.nz/environmental-reporting/air/air-quality/pm10/nes/
Ambient air	Outside air.
Concentration	The level of pollutant, in mass amount per unit of volume, in ambient air.
Emission	The mass amount of a pollutant that is emitted to atmosphere.
Exceedance	An occurrence in which a pollutant exceeds a standard or permissible measurement. For PM ₁₀ , this equates to a day on which the measured daily concentration of PM ₁₀ exceeds 50 µg/m ³ .
Exceptional Event	An event that may not be reasonably predicted, or controlled, that results in an exceedance of the PM ₁₀ standard. For example, bushfire, volcanic eruption or dust storm.
NPV	Net present value, the difference (in present value) between benefits and costs.
Offset	A required reduction in emissions from one source so that another source may be granted consent with the intent on maintaining (or reducing) overall airshed emissions.
PM₁₀	Particulate matter less than 10 microns in diameter.
PM_{2.5}	Particulate matter less than 2.5 microns in diameter.
NES	National environmental standard – regulations made under the Resource Management Act.
Target Compliance Date	Date by which compliance (ie, achievement of the PM ₁₀ standard) should be achieved.
TAG	Technical advisory group set up to provide advice to the Minister for the Environment on the review of the air quality standards.
VOSL	Value of a statistical life being the amount people are willing to pay to reduce the risk of premature death.

References

- Auckland Regional Council. 2010. *A Review and Update of HAPINZ for the Auckland Region*. Auckland. Auckland Regional Council.
- Fisher et al. 2007. *Health and Air Pollution in New Zealand*. Available at www.hapinz.org.nz
- Ministry for the Environment. 2003. *Emission Inventories for New Zealand*. Wellington. Ministry for the Environment. Available at: <http://www.mfe.govt.nz/publications/air/air-quality-tech-report-38-aug03/index.html>
- Ministry for the Environment. 2004. *Proposed National Environmental Standards for Air Quality Resource Management Act Section 32: Analysis of Costs and Benefits*. Wellington. Ministry for the Environment. Available at: <http://www.mfe.govt.nz/publications/air/nes-air-standards-analysis/index.html>
- Ministry for the Environment. 2008. *Good Practice Guide for Assessing Discharges to Air from Land Transport*. Wellington. Ministry for the Environment. Available at: <http://www.mfe.govt.nz/publications/air/assessing-discharges-land-transport-jun08/>
- Ministry for the Environment. 2010. *Regulatory Impact Statement – Amending the PM₁₀ Air Quality Standards Final Recommendations*. Wellington. Ministry for the Environment. Available at: <http://www.mfe.govt.nz/laws/standards/air-quality/review/ris-air-quality-standards.pdf>
- Ministry of Transport. 2008. *The Social Cost of Road Crashes and Injuries June 2008 Update*. Wellington. Ministry of Transport. Available at: [http://www.transport.govt.nz/research/Documents/Social%20Cost%20June%202008%20update%20\(final\).pdf](http://www.transport.govt.nz/research/Documents/Social%20Cost%20June%202008%20update%20(final).pdf)
- National Environment Protection Council. 2009. *An Australian Approach to Setting Air Quality Standards, Consultation draft*. Adelaide. National Environment Protection Council. Available at: http://www.ephc.gov.au/sites/default/files/AAQSS_ConsultPpr__An_Australian_Approach_to_Setting_Air_Quality_Standards_Consultation_Draft__20091123.pdf
- New Zealand Institute of Economic Research. 2009. *The value of air quality standards, Review and update of cost benefit analysis of National Environmental Standards on Air Quality*. Wellington. New Zealand Institute of Economic Research. Available at: <http://www.mfe.govt.nz/publications/air/national-air-quality-standards-nzier/index.html>
- Pope CA, Dockery DW. 2006. *Health Effects of Fine Particulate Air Pollution: Lines that Connect*. J Air and Waste Management Association, Volume 56, June 2006.
- World Health Organisation. 2006. *Air Quality Guidelines Global Update 2005 Particulate matter, ozone, nitrogen dioxide and sulfur dioxide*. Copenhagen: World Health Organisation. Available online at http://www.euro.who.int/__data/assets/pdf_file/0005/78638/E90038.pdf