



Stocktake of Transport Related Air Pollution (TRAP) Research in NZ

Version 2

**Report prepared for
NZ Transport Agency**

by

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1. Introduction

The NZ Transport Agency (NZTA) is a Crown entity established on 1 August 2008, under the amended Land Transport Management Act 2003, to provide an integrated approach to transport planning, funding and delivery.

The NZTA is responsible for, among other things:

- promoting an affordable, integrated, safe responsive, and sustainable land transport system
- managing the state highway system, including planning, funding, design, supervision, construction, maintenance and operations
- managing funding of the land transport system
- managing regulatory requirements for transport on land

Regarding the state highway system, NZTA manages 10,894 kilometres of state highways. These account for about 12 per cent of New Zealand's roads and around half of the 36 billion vehicle kilometres New Zealanders travel each year¹.

Road transport emits a range of air pollutants such as fine particulate (PM₁₀), nitrogen dioxide (NO₂), carbon monoxide (CO), carbon dioxide (CO₂) and volatile organic compounds (VOCs). Some of these pollutants (such as PM₁₀ and NO₂) contribute to harmful effects on human health whilst others (such as CO₂) are significant greenhouse gases.

The NZTA is committed to improving the contribution of state highways to the environmental and social well being of New Zealand and identifies a number of objectives in its Environmental Plan², regarding air quality and climate change³, as follows:

- understand the contribution of vehicle traffic to air quality
- ensure new state highway projects do not directly⁴ cause national environmental standards for ambient air quality to be exceeded
- contribute to reducing emissions where the state highway network is a significant source of exceedances of national ambient air quality standards
- collect and analyse information on greenhouse gas (GHG) emissions to support decision making
- mitigate activities associated with the construction, operation and maintenance of state highways to effect a net reduction of GHG from transport

¹ NZTA (2009). Facts taken from the NZTA website, www.nzta.govt.nz, updated 6 August 2009

² Transit (2008). *Environmental Plan*, Version 2, Transit New Zealand, June 2008

³ There are strong linkages between air quality and climate change in terms of the emission sources, the base datasets and models, and potential mitigation strategies. Therefore there are considerable benefits in considering these together.

⁴ In most locations, vehicle emissions from the State Highway Network are not the only contributor to air pollution and therefore do not usually cause an exceedance of the national environmental standards by themselves.

In order to achieve these objectives, a key question that needs to be addressed is:

Key Question: What applied research needs to be funded to better manage the air quality impacts of transport in NZ?

The objective of this report is to take the first step towards answering this question by developing a Transport-Related Air Pollution Research Action Plan (known as the TRAP Research Plan) which:

- undertakes a stocktake of relevant applied research to date, both in New Zealand and overseas;
- identifies critical knowledge gaps where current understanding is unable to adequately address key transport objectives; and
- recommends priorities for future end-user research funding.

This report has been produced primarily to inform the Environment Team of NZTA's State Highway and Network Operations (HNO) group about existing research, information, and needs that may be of relevance when developing operational air quality policy. It is intended to be a working document for NZTA to review regularly in order to deliver a better air quality outcome from the state highway network in New Zealand.

This report focuses principally on addressing air quality impacts but does identify research that will also assist with managing greenhouse gases, and is structured as follows:

- Chapter 2 outlines the primary **objectives and indicators** of transport-related air quality and climate change impacts
- Chapter 3 discusses the **methodology utilised for the stocktake** of transport-related air pollution research
- Chapter 4 presents the stocktake **results, gap analysis and recommendations**
- Chapter 5 highlights the most pressing **priorities for future research funding** based on the current state of knowledge

2. Transport-Related Air Pollution Objectives and Indicators

This section briefly summarises the key objectives for transport-related air pollution in New Zealand - covering harmful emissions (which local air quality and human health) as well as greenhouse gases (which impact global air quality and climate change).

Objectives exist in the NZTA's Statement of Intent⁵ and Environmental Plan⁶, the Ministry of Transport's New Zealand Transport Strategy⁷ and the Government Policy Statement on Land Transport Funding⁸. The last two are supported by a set of indicators in the Transport Monitoring Indicator Framework⁹.

2.1 NZTA Statement of Intent

The Minister of Transport has identified four long term outcomes or goals for the transport sector which link to the government's overall goal to grow the New Zealand economy.

The government's long term outcomes for transport include:

- A. An efficient transport system that supports high levels of economic productivity, provides strong international connections for freight, business and tourism, and meets international obligations.
- B. A sustainable funding basis for transport infrastructure investments and use
- C. A high-quality transport system for Auckland, the nation's largest economic hub
- D. An accessible and safe transport system that contributes positively to the nation's economic, social and environmental welfare

The NZTA's Statement of Intent 2010-2013 reflects these long-term outcomes in the identification and development of its strategic objectives and priorities, and in the design and delivery of all outputs.

The likely contribution of NZTA's activities to these sector-wide outcomes is assessed against a set of eight transport sector impacts, of which the two most relevant to transport-related air pollution are:

- reduction in adverse environmental effects from land transport (outcomes C & D)
- more efficient vehicle fleets (outcomes A & D)

⁵ NZTA (2010). *Statement of Intent 2010-2013*, New Zealand Transport Agency, July 2010

⁶ Transit (2008). *Environmental Plan*, Version 2, Transit New Zealand, June 2008

⁷ MoT (2008). *The New Zealand Transport Strategy 2008*, Prepared by the Ministry of Transport, 2008

⁸ Minister of Transport (2009). *Government Policy Statement on Land Transport Funding 2009/10-2018/19*, May 2009

⁹ MoT (2009). *Transport Monitoring Indicator Framework 2009*, Version 2, Prepared by the Ministry of Transport, 2009

2.2 NZTA Environmental Plan Objectives

The NZTA is committed to:

- being socially and environmentally responsible; and
- improving the contribution of state highways to the environmental and social well-being of New Zealand

The NZTA's Environmental Plan for improving environmental sustainability and public health in New Zealand has the following objectives for air quality and climate change:

- A1 understand the contribution of vehicle traffic to air quality
- A2 ensure new state highway projects do not directly¹⁰ cause national environmental standards for ambient air quality to be exceeded
- A3 contribute to reducing emissions where the state highway network is a significant source of exceedances of national ambient air quality standards
- C2 collect and analyse information on greenhouse gas (GHG) emissions and the impact of climate change to support decision making
- C3 mitigate activities associated with the construction, operation and maintenance of state highways to effect a net reduction of GHG from transport

The current Environmental Plan was prepared in May 2008 and is due to be revised in late 2010 or early 2011.

2.3 NZ Transport Strategy Objectives

The government's vision for transport in 2040 is that:

"People and freight in New Zealand have access to an affordable, integrated, safe, responsive and sustainable transport system."

That vision is supported by five objectives, of which the two most relevant to transport-related air pollution are:

- protecting and promoting public health; and
- ensuring environmental sustainability.

The New Zealand Transport Strategy (NZTS) has a series of targets that support the delivery of the transport objectives and provide a basis for measuring progress, as follows:

- PH reduce the number of people exposed to health endangering concentrations of air pollution in locations where the impact of transport emissions is significant

¹⁰ In most urban locations, vehicle emissions from the State Highway Network are not the only contributor to air pollution and therefore do not usually cause an exceedance of the national environmental standards by themselves.

- ES halve per capita greenhouse gas emissions from domestic transport by 2040 (relative to 2007)
- ES become one of the first countries in the world to widely use electric vehicles
- ES reduce the km travelled by single occupancy vehicles, in major urban areas on weekdays, by 10 percent per capita by 2015 (relative to 2007)
- ES reduce the rated CO₂ emissions per km on combined average new and used vehicles entering the light fleet to 170g CO₂ per km by 2015, with a corresponding reduction in fuel used per km

2.4 Government Policy Statement Impacts

The Government Policy Statement on Land Transport Funding (GPS) outlines the government's desired outcomes and funding priorities for the use of the National Land Transport Fund (NLTF) to support activities in the land transport sector. Under the Land Transport Management Act 2003, the NZTA must take account of the GPS when approving funding for activities.

The priority of the current GPS, which covers the period 2009/10 to 2018/19, for investment in land transport is to increase economic productivity and growth in New Zealand. It details a series of specific short to medium impacts the government expects to be achieved through the use of the NLTF that contribute to economic growth and productivity, but also includes other impacts such as:

- reductions in adverse environmental effects from land transport; and
- contributions to positive health outcomes

2.5 Transport Monitoring Indicator Framework

The Transport Monitoring Indicator Framework (TMIF) was developed by the Ministry of Transport to provide a national framework for the robust and consistent monitoring of the New Zealand transport system.

The framework:

- measures progress against the objectives, sector outcomes and targets in the NZTS 2008 and the GPS; and
- is a tool for informing and evaluating transport-related policies and strategies.

The TMIF contains a large set of transport sector-related head-line indicators. MoT updates indicator data on an on-going basis and publishes annual reports based on the information provided within the framework.

The public health effects of transport (PH) indicator set shows how transport contributes to the noise levels and air quality that impact on public health. The air quality indicators are as follows:

- PH005 emissions of particulates (PM_{10} and $PM_{2.5}$), nitrogen oxides (NO_x , NO and NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), benzene (C_6H_6) and 1, 3 butadiene (C_4H_6) by mode (road, rail, maritime, aviation)
- PH006 social cost of transport-related air pollution to human health
- PH007 the number of occasions that ambient concentrations of particulates (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), carbon monoxide (CO) and sulphur dioxide (SO_2), measured in areas where the impact of transport emissions is significant, are in excess of the relevant standards and guidelines specified: in the National Environment Standard for Air Quality, in the Ministry for Environment Ambient Air Quality Guidelines, by the World Health Organization
- PH008 percentage of the total population residing in areas where the impact of transport emissions is significant, and the exposure to ambient concentrations of particulates (PM_{10} and $PM_{2.5}$) nitrogen dioxide (NO_2) carbon monoxide (CO) and sulphur dioxide (SO_2) is in excess of the relevant standards and guidelines specified: in the National Environment Standard for Air Quality, in the Ministry for Environment Ambient Air Quality Guidelines, by the World Health Organisation

The environmental impact of transport (EI) indicator set includes climate change emissions, and information on energy use, land use, water quality and waste management. The climate change indicators are as follows:

- EI001 tonnes of CO_2 equivalent emissions from domestic transport (road, rail, maritime, aviation)
- EI002 grams of CO_2 per kilometre driven for new vehicles entering the light fleet
- EI003 tonnes of CO_2 and tonnes of CO_2 equivalent emitted from domestic transport per vehicle kilometre driven (road, rail, maritime, aviation)
- EI004 tonnes of CO_2 equivalent emitted from domestic transport per capita (road, rail, maritime, aviation)
- EI005 tonnes of CO_2 and tonnes CO_2 equivalent emitted from domestic transport per tonne-km (road, rail, maritime, aviation)
- EI006 tonnes of CO_2 and tonnes of CO_2 equivalent emitted from domestic transport per person-km (road, rail, maritime, aviation)
- EI007 total emissions of methane (CH_4) and nitrous oxide (N_2O) (road, rail, maritime, aviation)

3. Methodology Used for the Stocktake and Gap Analysis

This section describes the methodology used to develop the inaugural TRAP Research Plan.

The approach taken utilised a panel of transport emissions experts. Each was asked to make a list of relevant published guidance, tools and applied research, with the focus on (but not restricted to) NZ and Australia. The panel then met to compile their lists, workshop gaps, suggest funding categories and to recommend priorities. This panel produced a draft TRAP Research Plan that was further refined to include the latest progress made by other research providers and to reflect priorities from the NZTA State Highway Network and Operations group.

The TRAP Research Plan has been produced primarily to inform the Environment Team of NZTA's State Highway and Network Operations (HNO) group about existing research, information, and needs that may be of relevance when developing operational air quality policy.

3.1 Panel of Transport Emissions Experts

The panel of transport emissions experts asked to develop a draft TRAP Research Plan comprised:

- Jeff Bluett (NIWA)
- Dr Gerda Kuschel (Emission Impossible Ltd)
- Assoc Prof Robert Raine (University of Auckland)
- Kevin Rolfe (Independent Consultant)

The lead responsibility for delivery of the TRAP Research Plan was shared by Jeff Bluett and Gerda Kuschel.

The panel members were selected based on their considerable experience in transport emissions research in New Zealand and because they represented the full spectrum of applied research providers, ranging from universities through to consultants.

Brief bios for the panel members are attached in Appendix 1 of this report highlighting the relevant experience of each member.

3.2 Stocktake Workshop

The panel was convened for a workshop, held on 28 September 2009 at the offices of NIWA in Auckland, to address the question:

What applied research needs to be funded to better manage the air quality impacts of transport in NZ?

Input was sought on the following research topic headings:

1. Ambient air quality standards and good practice guides
2. Air quality monitoring datasets
3. Emission inventories
4. Vehicle emissions measurements
5. Vehicle emission models
6. Fleet information
7. Traffic information
8. Dispersion modelling
9. Exposure assessment
10. Health/social costs
11. Reverse sensitivity
12. Assessment of effects
13. Indicators
14. Mitigation of effects

All feedback was discussed and then compiled into a master list. Following the workshop, the panel members made further refinements and produced the first draft of the TRAP Research Plan in early December 2009. The first draft was originally intended to be used in the evaluation of proposals to the NZTA 2010/12 Research Programme funding round in late 2009 and early 2010.

However, in February 2010, an announcement¹¹ was made that requests for proposals (RFPs) would be confined to five high priority areas - freight, economic productivity, passenger transport, asset management and safety - to reflect the changes in land transport priorities signalled in the GPS. Funding for research to facilitate or understand the management of adverse environmental effects from land transport was allocated a medium priority and was therefore outside the current funding round.

3.3 Further Refinement

Although environmental research is not a high priority funding area for the current NZTA 2010/12 Research Programme, other parts of the NZTA require research to be undertaken in order to address adverse effects from major projects, particularly those involving roads of national significance.

Therefore, subsequent to the NZTA Research Programme announcement, the first draft of the TRAP Research Plan has been updated to include the latest progress from relevant research providers on research outputs and priorities from the NZTA State Highway Network and Operations group.

¹¹ NZTA (2010). *Update 3 - NZTA's Research Programme - 10 February 2010*, available from <http://www.nzta.govt.nz/resources/research/docs/update-3.pdf>

3.4 Prioritisation

The panel has identified priority areas for future funding (see section 5) based on the ability of the various proposed initiatives to:

- address recurring technical issues/problems the panel members experience in their day to day work as transport air quality experts; and
- assist NZTA HNO group with their strategic objectives for improving air quality outcomes from the state highway network

The priorities come from the panel and are intended to be recommendations for NZTA to consider in future.

WORKING

4. TRAP Research Stocktake Results and Gap Analysis

This section presents the results of the Transport-Related Air Pollution Research stocktake and highlights the knowledge gaps identified to date. These gaps are prioritised in the next section, with the most pressing needs flagged for future funding.

The panel categorised the stocktake and gap analysis under 14 research topic headings, which are discussed in the next subsections.

WORKING

4.1 Ambient Air Quality Guidelines, Standards and Good Practice Guides

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	MfE GPG for Assessing and Managing the Environmental Effects of Dust Emissions, 2001	Good Practice Guide	good for road construction activities BUT needs to be updated www.mfe.govt.nz/publications/air/dust-guide-sep01.html
NZ	MfE Ambient Air Quality Guidelines, 2002	Air Quality Guideline	doesn't cover roadsides or tunnels i.e. short term exposure www.mfe.govt.nz/publications/air/ambient-air-quality-may02/index.html
NZ	MfE National Ambient Air Quality Standards, 2005	Air Quality Standard	doesn't cover roadside or tunnels i.e. short term exposure www.mfe.govt.nz/publications/rma/user-guide-draft-oct05/index.html <i>Note these are currently under review with proposed amendments due in 2011</i>
NZ	MfE GPG for Air Quality Monitoring and Data Management, 2009	Good Practice Guide	good for ambient monitoring BUT does not cover requirements for tunnel monitoring www.mfe.govt.nz/publications/air/good-practice-guide-air-quality-2009/index.html
NZ	NZTA Guidelines for the Management of Air Quality in and around Road Tunnels in NZ, 2010	Air Quality Guideline	publication pending - will be available from: www.air.nzta.govt.nz
UK	DoT Design Manual for Roads and Bridges: Volume 2, Part 9 Design of Road Tunnels, 1999	Guidance	covers siting of in-tunnel sensors www.standardsforhighways.co.uk/dmrb/vol2/section2/bd7899.pdf
UK	Office for Public Sector Information - The Air Quality Standards Regulations, 2007	Air Quality Standard	specifies monitoring and air quality requirements www.opsi.gov.uk/si/si2007/uksi_20070064_en_1
UK	DEFRA - QA/QC Data Ratification Report for the Automatic Urban and Rural Network, Oct-Dec 2008, & Annual Review for 2008	Good Practice Guide	Part B has air quality monitoring guidance www.airquality.co.uk/reports/cat05/0906180941_AURN_2008_Q4_Report_Issue_1.pdf
UK	DEFRA - QA/QC Data Ratification Report for the Automatic Urban and Rural Network, Jan-Mar 2009	Good Practice Guide	has air quality monitoring guidance www.airquality.co.uk/reports/cat05/0909231432_AURN_2009_Q1_Report_Issue_1_sep09.pdf
Need	Description	Potential Application	Limitations/Gaps/Comments
High	NZ GPG for Roadside and Tunnel Air Quality Compliance Monitoring	Good Practice Guide	could follow on from finalising various NZTA tunnel and roadside air quality monitoring reports
Med	NZ Guidance on Screening Monitoring Using Non-Standard Methods	Good Practice Guide	could follow on from finalising various NZTA tunnel and roadside air quality monitoring reports
Low	NZ Roadside and Tunnel Air Quality Standards	Air Quality Standard	could follow on from finalising various NZTA tunnel and roadside air quality monitoring reports

4.2 Air Quality Monitoring Datasets

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	NIWA Transport Emissions Study, 1997	Monitoring/Modelling Results	roadside CO measurements/modelling in Akl, Wgtn, and ChCh BUT dated www.mfe.govt.nz/publications/air/transport-emissions-study-sep97.html
NZ	NIWA Study of Hydrocarbon Emissions from Transport, 1998	Monitoring Results	roadside BTX plus other measurements in Akl BUT dated www.mfe.govt.nz/publications/air/hydrocarbon-emissions-transport-apr98.html
NZ	MfE Monitoring of PM ₁₀ in New Zealand, 2003	Monitoring Results	summary of PM and TSP results in NZ from 1988 to 2001 www.mfe.govt.nz/publications/air/air-quality-tech-report-40/index.html
NZ	MfE Monitoring of CO, NO ₂ , SO ₂ , ozone, benzene and benzo(a)pyrene in New Zealand, 2003	Monitoring Results	summary of various results in NZ from 1992 to 2002 www.mfe.govt.nz/publications/air/air-quality-tech-report-42-oct03/index.html
NZ	NZTA Air Quality Monitoring in the Terrace and Mt Victoria Tunnels, 2009	Monitoring/Modelling Results	Mt Vic, Terrace measurements for CO and NO ₂ BUT no PM available from www.air.nzta.govt.nz
NZ	NZTA Stocktake of Air Quality in and around State Highway Tunnels, 2010	Desktop Review	info on Homer, Lyttelton, Mt Vic, Terrace, & Johnstone's Hill available from www.air.nzta.govt.nz
NZ	NZTA Air Quality Monitoring at Johnstone's Hill Tunnels, pending	Monitoring Results	measurements of CO, NOx, PM, vis, speed, %HCV and met - report due Nov 2010, available from www.air.nzta.govt.nz
NZ	NIWA/NZTA Roadside Project, currently underway	Monitoring/Modelling Results	measurement dataset for calibrating various roadside models such as RCM, AusRoads ,SOSE, LUR, report due end 2011 contact Ian Longley (NIWA Akl) for more info
NZ	NZTA various ambient monitoring campaigns undertaken for State Highway AEEs	Monitoring Results	pre- and post-project monitoring for Manukau Crossing, Vic Park projects etc. BUT not yet collated into one database
NZ	Various Regional Council ambient air quality monitoring data from relevant sites	Monitoring Results	e.g. ARC NO ₂ , benzene etc. work at traffic-impacted sites available from individual regional councils
NZ	NZTA/Transit Air Quality Monitoring Library, current	Monitoring Results	currently a library of NO ₂ diffusion tube data for 80 national locations (monthly averages) available from www.air.nzta.govt.nz
Need	Description	Potential Application	Limitations/Gaps/Comments
High	NZ Database on Transport-Related Air Quality Monitoring (TRAM)	Monitoring Results Database	could build on the NZTA Air Quality Monitoring Library to include all relevant transport-related air quality monitoring both roadside and tunnel

4.3 Emission Inventories

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	NIWA Total Air Emissions Inventory for New Zealand, 1998	Inventory	done by TLA for PM ₁₀ , SO ₂ , NO _x , CO, VOC, CO ₂ BUT dated may be available from NIWA
NZ	MfE GPG for Preparing Emissions Inventories, 2001	Good Practice Guide	good BUT needs to be updated to reflect VEPM etc. www.mfe.govt.nz/publications/air/emissions-good-practice-guide-01.html
NZ	MfE Emission Inventories for PM ₁₀ in New Zealand, 2003	Inventory	summarises PM sources for 28 urban areas BUT dated www.mfe.govt.nz/publications/air/air-quality-tech-report-38-aug03/index.html
NZ	MfE Emissions Inventories for CO, NO _x , SO ₂ , ozone, benzene, B[a]P in New Zealand, 2003	Inventory	summarises various sources for 28 urban areas BUT dated www.mfe.govt.nz/publications/air/air-quality-tech-report-44-nov03/index.html
NZ	NIWA/FRST Gap Analysis: Enhancing PM ₁₀ Emissions Inventories in New Zealand, 2005	Review	www.niwa.co.nz/our-science/atmosphere/research-projects/all2/healthy-urban-atmospheres/air-quality/reports
NZ	NIWA/FRST GIS-Based National Pollutant Inventory, pending	Inventory	CO, NO _x , PM, VOCs web accessed in development - Wgtn example live at - wrenz.niwa.co.nz/webmodel/emissions3
NZ	Various Regional Council air emissions inventories for various airsheds	Inventory	Akl, ChCh, Hamilton, Nelson etc. BUT not collated into one database available from individual regional councils
Australia	National Pollutant Inventory, current	Inventory	updated annually with emission estimates for 93 toxic substances and the source and location of these emissions www.npi.gov.au/
UK	DEFRA Air Quality Pollutant Inventories for England, Scotland, Wales & Northern Ireland: 1990 - 2007	Inventory	www.airquality.co.uk/reports/cat07/0910211141_DA_AQ_Inv_enty_Report_2007_maintext_Issue1.pdf
UK	NAEI Emissions of Air Pollutants in the UK, 2008	Inventory	2008 inventory of GHGs and air quality pollutants www.naei.org.uk/
UK	DEFRA Review of Bus Fleet Compositions & Implications for Emissions Reduction Strategies, 2009	Inventory	www.airquality.co.uk/reports/cat05/0906110919_Bus_Emissions_Report_Final_220409.pdf
Need	Description	Potential Application	Limitations/Gaps/Comments
Med	NZ Database on Transport-Related Air Emissions Inventories (TRAIN)	Inventory Database	compiling all of the previous & current inventories

4.4 Vehicle Emission Measurements

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	Various councils - ECan, Waitakere City and Hamilton City, approx. 1995 onwards for a few years	Emissions Testing	voluntary static testing undertaken as part of WoF contact Andy Campbell (Fuel Technology) for more info
NZ	SMF Vehicle Exhaust Emissions, 1997	Emissions Testing	various measurements for Project 5034 www.mfe.govt.nz/withyou/funding/smf/results/5034.pdf
NZ	MoT Vehicle Testing for VFECS, 1997	Emissions Testing	dynamometer testing for CO, CO ₂ , PM ₁₀ , NO _x etc. contact Iain McGlinchy (MoT) for more info
NZ	ARC/NIWA/NZTA Remote Sensing Campaigns for 2003, 2005, 2009	Remote Sensing	light and heavy campaigns (Port of Akl) www.arc.govt.nz/environment/air-quality/aucklands-air-quality/publications-and-documents.cfm
NZ	ARC Bus Emissions Testing, 2004-05	Emissions Testing	pre- & post-cats, biodiesel, normal in-service, static & dyno www.arc.govt.nz/environment/air-quality/aucklands-air-quality/publications-and-documents.cfm
NZ	MoT Pilot Study for Emissions Screening, 2005	Emissions Testing	static & dyno testing www.transport.govt.nz/research/Pages/VehicleEmissionsPilotProjectReport.aspx
NZ	NIWA/Wgtn Remote Sensing 2006	Remote Sensing	light duty campaign report available from Tamsin Mitchell, Greater Wellington Regional Council or Jeff Bluett, NIWA ChCh
NZ	MoT Vehicle Scrappage Trials	Emissions Testing	“recycle your ride” pilot in Akl in 2007 then further trials in Wgtn and ChCh in 2009, involving static testing www.transport.govt.nz/ourwork/Land/Pages/RecycleYourRide.aspx
NZ	VTNZ/NZTA Border Emissions Testing Database	Emissions Testing	border emission testing data is not currently archived BUT it would be a good idea
NZ	ARC/NIWA Road Dust Pilot Study, pending	Investigation	publication of the ARC study pending a new method to measure road dust has been trialled in the FRST HUA programme (results pending) and further work is planned contact Jeff Bluett (NIWA ChCh) for more info
NZ	Zero Emissions Vehicle testing Database	Emissions Testing	Database of static measurements undertaken as part of WoF contact Keith Wood (Zero Emissions) for more info
Australia	National In-Service Emissions Study (NISE) Motor Vehicle Pollution in Australia, 1996	Emissions Testing	standard dynamometer measurements www.infrastructure.gov.au/roads/environment/emission/str-national-in-service.aspx
Australia	Diesel National Environmental Protection Measure (DNEPM), 2001	Emissions Testing	mobile chassis dynamometer measurements of diesel vehicles www.ephc.gov.au/taxonomy/term/69

Australia	Australian Government Biofuels Taskforce Report, August 2005	Emissions Testing	measurements of bioethanol-fuelled vehicles www.soe-townsville.org/data/biofuel_pm_report.pdf
Australia	2 nd National In-Service Emissions Study (NISE2) - Light Duty Petrol Vehicle Emissions Testing, 2009	Emissions Testing	standard dynamometer measurements of petrol vehicles www.environment.gov.au/atmosphere/transport/nise2.html some work being undertaken with FRST HUA programme to link NISE2 and RSD results, publication pending
Japan	JAMA and others	Emissions Testing	data available but not always in an easily accessible format contact Iain McGlinchy (MoT) for more info
Need	Description	Potential Application	Limitations/Gaps/Comments
High	NZ Fleet Emission Testing Strategy to address transport emission model knowledge gaps	Emissions Testing	priority framework for investing resources in RSD, on-board & dyno testing
High	NZ Measurements of Truck Emissions to improve quantification of this sector to overall emissions	Emissions Testing	important given the growth in road freight
Med	To understand the relationship between remote sensing and dynamometer emission test data	Emissions Testing	use of VSP parameter to correlate
Med	NZ Measurements of Non-Tailpipe Emissions	Emissions Testing	e.g. brake linings, tyre wear, evaporative emissions
Med	Study of primary NO _x from diesels	Emissions Testing	e.g. N ₂ O, NO ₂
Med	Effect of removal of emission control equipment	Emissions testing	in terms of what fraction of the fleet affected and likely increases in emissions
Low	NZ Emissions Testing for Alternative Fuels	Emissions Testing	testing the new standard alternative fuels e.g. biodiesel blends and 10% bioethanol
Low	NZ Emissions Testing of Non-Criteria Pollutants	Emissions Testing	e.g. benzene, 1,3-butadiene, aldehydes, PAHs, heavy metals, black carbon
Low	On-Board Emissions Testing Campaign	Emissions Testing	

4.5 Vehicle Emission Models

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	MoT Impacts of Rail Transport on Local Air Quality, 1999	Emissions Model	dated and not compatible with modern PCs may be available on CD from Ministry of Transport
NZ	MoT NZ Traffic Emissions Rates (NZTER), 2000	Emissions Model	dated and not compatible with modern PCs may be available on CD from Ministry of Transport
NZ	ARC Bus Emission Prediction Model (BEPM), 2004	Emissions Model	speed dependent model for CO, NMHC, CH ₄ , NO _x , PM, CO ₂ & FC for various bus emission standards, retrofit options and fuel choices BUT limited data for Euro4 & 5 and does not include Euro6 available on CD from Auckland Regional Council
NZ	ARC Vehicle Emission Prediction Model (VEPM) v3.0, 2009	Emissions Model	speed dependent model for CO, CO ₂ , VOC, NO _x , PM tailpipe and brake/tyre wear, FC for various fleet emission standards of light and heavy duty vehicles in the fleet BUT does not include Euro5, biofuel blends or effect of gradient available on CD from Auckland Regional Council
NZ	MoT Review of Vehicle Emission Modelling and the Issues for NZ, 2009	Review	Paper presented at the ATRF 2009 conf by Haobo Wang & Iain McGlinchy www.cmsl.co.nz/assets/sm/4490/61/paper88-Wang.pdf or contact Haobo Wang (MoT) for more info
NZ	NZTA Economic Evaluation Model, 2008 & 2009	Emissions Model	needs to be consistent with VEPM, VFEM etc. - www.nzta.govt.nz/resources/economic-evaluation-manual/volume-2/index.html contact Sandy Fong (NZTA) for more info
NZ	NZTA/NIWA/ARC Trends in NZ's Light Duty Vehicle Emissions 2003-2009, pending	Investigation	remote sensing field programme complete Nov 2009. report and workshop due Sep & Oct 2010
Australia	PAE/Griffith University High Resolution Traffic Emissions and Fuel Consumption Model, under development	Emissions Model	NO _x and CO ₂ emissions for light duty vehicles
Need	Description	Potential Application	Limitations/Gaps/Comments
High	Truck Emissions Model including payload	Emissions Model	ARC commissioned a feasibility report with Uniservices (completed in early 2010) which could be used as a basis for this
High	Update VEPM with latest fleet stats & projections, align with VFEM	Emissions Model	

High	Validate emission models e.g. VEPM	Investigation	this is due to happen as part of the NZTA Roadside project with final report due end Dec 2011 contact Ian Longley (NIWA Akl) for more info could also use the on-road vehicle emission datasets collected for Akl and Wgtn contact Jeff Bluett (NIWA ChCh) for more info
Med	Upgrade VEPM to include biofuels, gradient, latest emissions stds	Emissions Model	
Low	When to apply microscale vs macro scale emission models	Guidance	
Low	Emission factors from non-roadway vehicles, including trains, planes and ships	Emissions Model	

WORKING

4.6 Fleet Information

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	MoT/MED Vehicle Fleet Emission Model, current	Fleet/VKT Model	great resource BUT doesn't go back to 1990, no regional breakdowns, inconsistent with vehicle classes in VEPM contact Iain McGlinchy (MoT) for more info
NZ	MoT NZ Fleet Statistics, current	Fleet Statistics & Trends	information on New Zealand's vehicle fleet using the government's Landata information as a key source www.transport.govt.nz/research/newzealandvehiclefleetstatistics/
NZ	NZTA Motor Vehicle Register, current	Fleet Registrations	actual current data on the fleet www.nzta.govt.nz/resources/motor-vehicle-registration-statistics/index.html
NZ	MoT Japanese Emissions Build Standards Database, current	Fleet Statistics & Trends	Emission build data available for Jap-imported vehicles using chassis no. contact Iain McGlinchy (MoT) for more info
Need	Description	Potential Application	Limitations/Gaps/Comments
High	Regional Vehicle Fleet Models with future projections	Fleet Model	regional fleet registration data (actuals) now available through the MVR, could be based on VFEM

4.7 Traffic Information

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	NZTA Traffic Monitoring of State Highways Manual SM052, 2004	Good Practice Guide	current methodology for traffic monitoring, the technology involved, conventions, survey guidelines, calculations and an overview of the software system to provide reliable information about the road users in terms of traffic volumes, vehicle mix and traffic loading BUT does not cover speed www.nzta.govt.nz/resources/traffic-monitoring-state-highways/docs/traffic-monitoring-state-highways.pdf
NZ	NZTA State Highway Traffic Volumes 1975-2009	Traffic Counts Database	lists annual average daily traffic and heavy duty splits (where available) for 1,500 sites across NZ BUT does not cover speed www.nzta.govt.nz/resources/state-highway-traffic-volumes/
NZ	MRC/NZTA Impact of Urban Form on Economic Outcomes and Land Transport, pending	Landuse/Transport Model	investigate various urban form configurations and assess impacts, report pending later in 2010 contact Stuart Donovan (McCormick Rankin Cagney) for info
NZ	Univ of Akl Vision and Backcasting for Transport (VIBAT) Study, pending	Transport & Carbon Simulator	pilot study currently being undertaken for Akl to repeat what has been done for UK, Canada and India, results due Oct 2010 contact Patricia Austin (School of Architecture & Planning, Akl Univ) for info or check out www.vibat.org
NZ	NIWA FRST TOTUS Programme, pending	Landuse/Transport Model	model to translate urban form into travel patterns, including exposure and energy related impacts, report due 2012 contact Gustavo Olivares (NIWA Akl) for more info
NZ	MoT/MED Vehicle Fleet Emission Model, current	Fleet/VKT Model	covers fleet and VKT stats available from MoT/MED
NZ	ARC ART Model, current	Traffic Model	for Auckland only, other regional councils also have these ART available from ARC contact Tantri Tantrigama (MoT) for more info on a stocktake of regional transport models
NZ	Various TLA Traffic Count Databases, current	Traffic Counts	can be used for fleet information (heavy:light split), esp. Akl City Council on-line
Need	Description	Potential Application	Limitations/Gaps/Comments
High	Monitoring of Vehicle Average Speed Information	Good Practice Guide	Critical for links to VEPM
High	Database of Vehicle Average Speed Information	Vehicle Speed Database	Critical for links to VEPM similar to NZTA State Highway Traffic Volumes report
Med	Improved Understanding and Implications of Traffic Flow on emissions	Investigation	Critical for assessing wide-scale impact of roadway development Strong links to VEPM and other emission models

4.8 Dispersion Modelling

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	MfE GPG for Atmospheric Dispersion Modelling, 2004	Good Practice Guide	provides expert and well-debated guidance on dispersion modelling through a series of recommended protocol www.mfe.govt.nz/publications/air/atmospheric-dispersion-modelling-jun04/index.html
NZ	Various Regional Council Meteorological Datasets	Met Dataset	for use in dispersion modelling available from various regional councils e.g. ARC
NZ	ARC/NZTA Meteorological datasets for the Auckland region	Met Datasets/Users Guide	provides advice on the use of met datasets to be used for air quality assessments of industrial or transport projects in the Auckland region. Technical report TR2010/022 available from www.arc.govt.nz/albany/main/plans/technical-publications/technical-reports/technical-reports-2010/technical-reports-1-50.cfm
Australia	AusRoads	Dispersion Model	Becoming more commonly used in NZ. Uses same format for met sets as AUSPLUME. No validation studies undertaken in NZ yet but pending in the NZTA Roadside project
Finland	CAR-FMI	Dispersion Model	Developed by Finnish Meteorological Institute. User friendly. Not widely used in NZ but potentially very useful for providing a comparison with simple plume models.
UK	ADMS-Urban	Dispersion Model	Expensive. Not widely used in NZ. Model has many features not available in other roadway models e.g. fully integrated with GIS software. Potentially very useful for providing a comparison with simple plume models.
US	CAL3QHC and CALINE	Dispersion Model	Most commonly used roadway model n NZ. Limited validation in NZ. Intersection model (CAL3QHC) requires specific emission factor not currently available inn VEPM.
Need	Description	Potential Application	Limitations/Gaps/Comments
High	More regional met datasets	Met Dataset	especially for locations near roads of national significance if no met data currently available
Med	Validation of various dispersion models for NZ conditions	Refinement	This is happening in the NZTA Roadside project but for AusRoads only

4.9 Exposure Assessment

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	ARC Environmental Exposure Analysis of Air Pollution from MVs in Auckland, 2003	Report	preliminary use of composite mapping for exposure analysis may be available from ARC
NZ	NIWA/NZTA Tools for Assessing Exposure to Land Transport Emissions, pending	Roadside and In-Vehicle Exposure Models	Roadside Corridor Model (RCM) for annual average CO, NO _x , PM, VOCs and In-Vehicle Exposure Model, report due June 2010, contact NIWA for details
NZ	NIWA/NZTA/FRST Commute Study, pending	Multi-Model Exposure	CO, PM ₁₀ , PM _{2.5} , PN for an 8km trip by cycle, car, bus, train report pending, contact NIWA for details
NZ	NIWA/NZTA Roadside Project, currently underway	Monitoring/Modelling Results	measurement dataset for calibrating various roadside models <ul style="list-style-type: none"> - RCM for annual averages - AusRoads for short term averages - SOSE for CO, NO_x, PM₁₀ anytime averages - LUR for NO₂ annual averages report due end 2011 contact Ian Longley (NIWA Akl) for info
NZ	NIWA/HRC Projects - CO levels in Roadway Exposed Populations, pending	Measurements?	Done for early childhood education centres etc. Investigation complete and summary report finished. Conference and journal papers pending. contact Ian Longley (NIWA Akl) for info
Need	Description	Potential Application	Limitations/Gaps/Comments
Med	Method to identify hot spots where the impact of transport emissions is significant	Model	already happening at some extent as part of the NZTA Roadside Corridor Model
Med	Guidance on Standard Method for Exposure Assessment	Good Practice Guide	needs to be efficient and cost-effective, also cover city-wide and the number of people

4.10 Health/Social Costs

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	MoT Health Effects due to Motor Vehicle Air Pollution in New Zealand, 2002	Health Effects/Costs	initial study done by NIWA et al focussing on vehicle emissions only in NZ www.transport.govt.nz/research/Pages/HealthEffectsofVheicleEmissions.aspx
NZ	MfE Health Effects of PM ₁₀ in New Zealand, 2003	Health Effects	considers the literature and provides an indication of the extent to which existing concentrations of PM ₁₀ in NZ may adversely affect human health www.mfe.govt.nz/publications/air/air-quality-tech-report-39/index.html
NZ	MfE Health Effects of CO, NO ₂ , SO ₂ , ozone, benzene and benzo(a)pyrene in New Zealand, 2003	Health Effects	considers the literature and provides an indication of the extent to which existing concentrations of air contaminants in NZ may adversely affect human health www.mfe.govt.nz/publications/air/air-quality-tech-report-43/index.html
NZ	MfE/MoT/HRC Health and Air Pollution in New Zealand: Christchurch Pilot Study, 2005	Health Effects/Costs	a pilot study carried out to test the methodology the researchers used in the final phase of the project to analyse the health impacts of air pollution in the whole of NZ www.hapinz.org.nz/
NZ	NIWA/FRST Transport Cost analysis: A Case Study of the Total Costs of Private and Public Transport in Auckland.	Total Costs	www.niwa.co.nz/our-science/atmosphere/research-projects/all2/healthy-urban-atmospheres/air-quality/reports
NZ	MfE/MoT/HRC Health and Air Pollution in New Zealand (HAPINZ) Study, 2007	Health Effects/Costs	study carried out across 67 urban areas of NZ for 2001 BUT dated and methodology issues www.hapinz.org.nz/
NZ	NZIER Updated Cost Benefit Analysis for the Review of the Air Quality National Environmental Standards, 2009	Health Costs	updates the cost benefit analysis of the AQNES undertaken in 2004, especially the value per case www.mfe.govt.nz/publications/air/national-air-quality-standards-nzier/index.html
NZ	Landcare/FRST Review of NZ Particulate Toxicology Results, pending	Health Effects	being undertaken as part of the HUA programme prelim investigation underway
Europe	WHO Health Costs due to Road Traffic-related Air Pollution, 1999	Health Effects/Costs	the report that HAPINZ was based on Künzli, N., R. Kaiser, et al. (1999). Health Costs due to Road Traffic-related Air Pollution - An impact assessment project of Austria, France and Switzerland. The Third Ministerial Conference for Environment and Health London 1999, London
Europe	Externe (Externalities of Energy) Updated Methodology, 2005	Health Costs	a detailed description of the methodology for generating external costs www.externe.info

Europe	WHO Health Effects of Transport-Related Air Pollution, 2005	Health Effects	lists the results of a systematic literature review and comprehensive evaluation of the health risks of such pollution, and suggests steps to reduce them the review focuses on air pollution related to road transport (mostly from urban and suburban passenger and freight transport) and the risks to human health www.euro.who.int/_data/assets/pdf_file/0006/74715/E86650.pdf
US	HEI Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, & Health Effects	Health Effects	the most comprehensive review to date of the literature on emissions, exposure, and health effects from traffic-related air pollution, including conclusions about the populations exposed around major roads, the associations between exposure to air pollution from traffic and human health, and important remaining data gaps pubs.healtheffects.org/view.php?id=334
Need	Description	Potential Application	Limitations/Gaps/Comments
High	Updated HAPINZ Study incorporating latest population and air quality data	Health Effects	need to standardise health effects and costs considered for all air pollution CBAs so can compare “apples with apples” also need to consider both acute and chronic effects <i>Note this update has just been funded through HRC as a joint venture between NZTA/MoT/MfE with support from ARC/MoH and the revised report covering 2006 will be available in July 2011</i>

4.11 Land Use and Transport Planning

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	NZTA Planning Policy Manual - Appendix 5D. Reverse Sensitivity, 2007	Good Practice Guide	covers air quality and noise buffers www.nzta.govt.nz/resources/planning-policy-manual/docs/planning-policy-manual-appendix-5D.pdf
NZ	NIWA/NZTA Roadside Corridor Model, pending	Exposure Model	this model enables separation distances to be established to minimise significant effects and will be covered in the final project report due July 2010 contact Ian Longley (NIWA Akl) for details
US	CARB Air Quality & Land Use Handbook: A Community Health Perspective, 2005	Guideline	provides recommendations for appropriate separation distances between sources of air pollution and sensitive land uses, such as residences www.arb.ca.gov/ch/handbook.pdf
Canada	MfE Environmental Best Management Practices for Urban & Rural Land Development in BC, 2006	Guideline	provides recommendations on appropriate separation distances from major roadways with specific concern for places where people spend large amounts of time (seven to eight hours per day) and which house vulnerable populations (infants, children, pregnant women, the elderly and those who are ill). www.cher.ubc.ca/PDFs/BAQS_feb16_06.pdf
Need	Description	Potential Application	Limitations/Gaps/Comments
Med	Guidelines for Separation Distances from Major Roadways and Mitigation Options	Guideline	

4.12 Assessment of Effects

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	PHAC New Zealand Evidence For Health Impacts of Transport, 2002	Report	covers both the health promoting and health damaging effects of land transport and identifies any health inequalities that might be associated with land transport, with particular reference to any differential impact between Māori and non-Māori www.phac.health.govt.nz/moh.nsf/indexcm/phac-evidence-health-impacts-transport
NZ	PHAC A Guide to Health Impact Assessment, 2 nd Edition, 2005	Good Practice Guide	generic GPG with a suite of supporting documents available, there are more recent examples for transport applications only www.phac.health.govt.nz/moh.nsf/indexcm/phac-guide-hia-2nd
NZ	LTNZ Draft Health Risk Assessment Toolkit for Roadway Air Pollution, 2006	Health Impact Model	dated (based on 2001 data and old EFs) and was never finalised, is currently being revamped as part of the AQ Assessment Screening Tool mentioned later
NZ	PHAC New Opportunities for Health Impact Assessment in New Zealand Public Policy & Planning, 2007	Guidance	encourages policy makers to carry out a health impact assessment (HIA) as a routine part of policy making, with a suite of supporting documents available, www.phac.health.govt.nz/moh.nsf/indexcm/phac-idea-whose-time-has-come
NZ	MfE GPG for Assessing Discharges to Air from Land Transport, 2008	Good Practice Guide	promotes a three-tiered approach to separate the simple from the complex and covers all elements of environmental assessment - not just those pollutants included in the Standards BUT a new info (esp. VEPM) now available www.mfe.govt.nz/publications/air/assessing-discharges-land-transport-jun08/
NZ	NZTA Standard for Producing Air Quality Assessments for State Highway Projects, pending	Process Standard	provides specific guidance on how to assess the air quality impacts resulting from the operations and construction of state highway projects in NZ and links the technical requirements with NZTA's business practices, due to be finalised in Sept 2010 will be available on www.air.nzta.govt.nz
NZ	NZTA Air Quality Assessment Screening Tool, pending	Screening Tool	evolved from the draft health risk assessment toolkit estimates the air quality impacts of a roading project as part of the SES (Tier 1) and SEA (Tier 2) stages of NZTA's assessment process, due to be finalised in Sept 2010 will be available on www.air.nzta.govt.nz

NZTA	NZTA/NIWA A Regression Approach to Assessing Urban NO ₂ from Passive Monitoring - Application to the Waterview Connection, pending	Guidance	referred to in the AEE for Waterview publication pending contact Ian Longley (NIWA Akl) for info
NZ	NIWA/FRST A Review of Regional and Natural Background PM ₁₀ in New Zealand, pending	Guidance	publication pending contact Jeff Bluett (NIWA ChCh) for info
NZ	NZTA various assessment of effects reports prepared for State Highway projects	Example Reports	Previous AEEs that could be used as examples to inform best practice etc. for Manukau Crossing, Vic Park projects etc. BUT not yet collated into one database
UK	WLAQG Best Practice Guide for Assessment of Traffic and Air Quality Impacts, 2005	Good Practice Guide	intended to provide Transport Professionals an overview of key air quality assessment issues www.westlondonairquality.org.uk/uploads/documents/BestPracticeGuide/WLA_Best_Practice_Air_Quality_and_Transport_Guide_20051.pdf
UK	DoT Design Manual for Roads and Bridges: Volume 11 Section 3 Environmental Assessment Techniques - Air Quality , 2007	Guidance	covers air quality assessments www.standardsforhighways.co.uk/dmrb/vol11/section3/ha20707.pdf
Need	Description	Potential Application	Limitations/Gaps/Comments
High	Good Practice Guide on How to Deal with Background/Baseline Concentrations	Good Practice Guide	could incorporate the NIWA NO ₂ and PM ₁₀ work plus ARC is currently preparing a guide for industrial applications
Med	NZ Database on Transport-Related Air Quality AEEs (TRAX)	AEE Database	compiling all of the previous & current AEEs highlighting best examples

4.13 Indicators

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	MoT Transport Monitoring Indicator Framework v2, 2009	Indicators	provides a national, and regional where possible, framework for robust and consistent monitoring of the NZ transport system and measures progress against the objectives, sector outcomes and targets in the NZTS and GPS www.transport.govt.nz/ourwork/TMIF/Pages/default.aspx
NZ	MfE Environmental Indicator and Report Card on Road Transport, current	State and Trends	the pressure road transport places on the environment is assessed by measuring the distance travelled (also known as vehicle kilometres travelled, or VKT) by motorised vehicles on NZ roads www.mfe.govt.nz/environmental-reporting/transport/ www.mfe.govt.nz/environmental-reporting/report-cards/transport/2009/index.html
NZ	MoT New Zealand Vehicle Fleet Statistics, current	Fleet Statistics and Trends	provides information on NZ's vehicle fleet by using the government's Landata information as a key source info is updated quarterly and published annually www.transport.govt.nz/research/newzealandvehiclefleetstatistics/
NZ	NZTA Environmental Plan v2, current	Indicators	contains a performance indicators in the air quality and climate change chapters www.nzta.govt.nz/resources/environmental-policy-manual/docs/environmental-plan.pdf
NZ	NZTA Statement of Intent, current	Indicators	contains primary indicators to measure success against the desired outcomes www.nzta.govt.nz/resources/statement-of-intent/
Need	Description	Potential Application	Limitations/Gaps/Comments
Med	Review the data requirements for the full suite of indicators	Review	not all indicators are able to be easily measured and are therefore inferred by proxy e.g. the NZTA objective regarding the number of people exposed

4.14 Mitigation of Effects

Stocktake	Description	Potential Application	Limitations/Gaps/Comments
NZ	MED Petroleum Products Specifications Amendment Regulations 2003-2007	Legislation	significant and progressive improvements in benzene and sulphur levels in NZ petrol and diesel, includes * Petroleum Products Specifications Amendment Regulations 2003 (SR 2003/346) * Petroleum Products Specifications Amendment Regulations 2007 (SR 2007/88) * Petroleum Products Specifications Amendment Regulations 2006 (SR 2006/350) www.legislation.govt.nz/all/results.aspx?search=ts_all%40act%40bill%40regulation_petroleum-products_noresel&p=1
NZ	ARC Benefits and Costs of Emissions Reduction Strategies for a Bus Fleet, 2005	Review	presents the results of a scenario study to determine the most cost effective technology and policy options to reduce particulate matter emissions from a bus fleet representative of those in the Auckland region contact ARC for details (report available on BEPM CD)
NZ	NZTA Land Transport Rule: Vehicle Exhaust Emissions 2007	Legislation	aimed at achieving improvements in air quality by reducing the levels of harmful emissions from motor vehicles that are required to be certified for entry into, or operation in, service covers rolling schedules for emissions standards, banning the removal of emission control equipment and visible smoke rule www.nzta.govt.nz/resources/rules/vehicle-exhaust-emissions-2007-index.html
NZ	NZTA Management of Vehicle Emissions from Tunnels, 2008	Review	compares the proposed SH20 Waterview tunnel emission management design against that of international overseas practice will be available on www.air.nzta.govt.nz
NZ	NZTA Standard for Producing Air Quality Assessments for State Highway Projects, pending	Process Standard	has some guidance on mitigation options for roading projects, due to be finalised in Sept 2010 will be available on www.air.nzta.govt.nz
Australia	NSW RTA Review of Emission Treatment Systems & Technologies - Road Tunnel Applications, 2004	Review	a review of international developments in emission treatment systems in road tunnel applications undertaken for the M5 East roading project www.rta.nsw.gov.au/constructionmaintenance/downloads/2004_10_childrepfiltration_dl1.html

US	USEPA The Role of Vegetation in Mitigating Air Quality Impacts from Traffic Emissions, Workshop Proceeding, 2010	Review	brought together government agencies, academia, and environmental advocacy groups with expertise in air quality, urban forestry, and policy to review the current science and identify future activities for the potential role of vegetation in mitigating near-road air pollutant concentrations www.epa.gov/nrmrl/appcd/nearroadway/workshop.html
PIARC	Guide to Road Tunnels Air Quality Impact, 2008	Guidance	publications.piarc.org/en/technical-reports/road-tunnels.htm
Need	Description	Potential Application	Limitations/Gaps/Comments
High	Cost-benefit analysis of emission control technology retrofitting for the NZ fleet	Investigation	some work has already been done as part of ARC's 2005 bus fleet emission reduction report
High	More detailed review and evaluation of options to mitigate impacts at the macro and micro scale	Guidance?	Including traffic demand management, building filtration, retrofitting emission control equipment etc.
Med	Evaluation of effectiveness of inspection & maintenance programmes	Investigation	
Med	Relationship and linkages between management/mitigation of vehicle noise and air pollution	Investigation	

WORKING DRAFT

5. Key Priorities for Future Research Funding

This section recommends the high priority items to be considered for future applied research funding, based on their ability to:

- address recurring technical issues/problems practitioners experience in their day to day work as transport air quality experts; and
- assist NZTA HNO group with their strategic objectives for improving air quality outcomes from the state highway network

The most pressing items recommended for consideration in the short-term are:

Research Need	Application
NZ GPG for Roadside and Tunnel Air Quality Compliance Monitoring	Good Practice Guide
NZ Database on Transport-Related Air Quality Monitoring (TRAM)	Monitoring Results Database
NZ Fleet Emission Testing Strategy	Emissions Testing
NZ Measurements of Truck Emissions	Emissions Testing
Truck Emissions Model including payload	Emissions Model
Update VEPM with latest fleet stats & projections, align with VFEM and include intersections	Emissions Model
Regional Vehicle Fleet Models with future projections	Fleet Model
Monitoring of Vehicle Average Speed Information	Good Practice Guide
Database of Vehicle Average Speed Information	Vehicle Speed Database
More regional met datasets	Met Dataset
Updated HAPINZ Study incorporating latest population and air quality data*	Health Effects
Good Practice Guide on How to Deal with Background/Baseline Concentrations	Good Practice Guide
Cost-benefit analysis of emission control technology retrofitting for the NZ fleet	Investigation
More detailed review and evaluation of options to mitigate impacts at the macro and micro scale	Guidance?

* Note at time of writing HRC had released an RFP for this update - the report is due July 2011

Appendix 1: Panel Member Bios

Jeff Bluett is the Manager of the Air Quality and Resource Management group based in Christchurch. Jeff has a great depth of experience in the field of air quality science. He has been a Project Leader for over 100 projects, a significant portion of these in the vehicle emission sector. Jeff is a senior member of NIWA's urban air quality team and is currently an objective leader in the 2008-2016 "Healthy Urban Atmospheres", a \$1.4M pa Foundation for Research Science and Technology programme. Jeff was instrumental in the purchase, commissioning, training, successful deployment of NIWA's vehicle emission measurement instrumentation. Jeff is also a science advisor for both NIWA's National Centre for Climate and Energy Solutions and NIWA-Australia.

Jeff is a leading air quality scientist and consultant in New Zealand, with over 100 publications in aspects of transport, air quality monitoring, air quality management plans, dispersion modelling and impact assessment statements. He has been involved in research, consultancy and advice to government and industry. Jeff has formed excellent networks within the New Zealand and Australian air quality communities. His profile has been developed mainly through frequent presentation of papers at conferences and his duties as the Chairperson of Clean Air Society of Australian and New Zealand (CASANZ) Training Activities Committee (2004-2008).

Gerda Kuschel is a co-director and founder of Emission Impossible Ltd - a consultancy formed in late 2008 to specialise in the improved management of air quality and vehicle emissions. Prior to that, she worked for the Auckland Regional Council for five years in a variety of roles including coordinating the regional response to climate change and energy issues, advising on sustainable transport initiatives, and developing air quality policies and emissions reduction management strategies. She has been active in air quality since 1995 and initially developed her expertise by working as an air quality researcher and senior science manager with NIWA (the National Institute of Water & Atmospheric Research Ltd) for nine years.

Gerda is the immediate past President of the Clean Air Society of Australia and New Zealand and has published more than 250 technical research papers, workshops proceedings, reports, general articles, submissions and public appearances on air quality and environmental sustainability issues, mostly relating to vehicle emissions.

Robert Raine is an Associate Professor in the Department of Mechanical Engineering at the University of Auckland, and also Associate Director of the Energy and Fuels Research Unit. Associate Professor Raine received his PhD from the University of Southampton and was appointed to the University of Auckland in 1977 with main interests in thermodynamics and internal combustion engines.

In addition to lecturing, he is an Associate Director of the Energy and Fuels Research Unit (EFRU) with research interests in internal combustion engines, exhaust emissions and fuel consumption of vehicles, specifically in relation to alternative fuels. He has been closely involved in many of the projects undertaken by the EFRU.

Kevin Rolfe is a Chartered Chemical Engineer and a Chartered Scientist with 37 years of environmental management experience in various capacities, in New Zealand and overseas, especially in air quality management and related fields. From 1978 to 1991 he was the Regional Air Pollution Control Officer, Department of Health, for the northern half of the North Island; from 1991 to 1995 he was the Air Quality Management Specialist with the World Health Organization; and from 1995 to 1998 he was Chief Executive of Environmental Services Australia, the commercial arm of the Environment Protection Authority of Victoria, during which he was Project Director of many, large development assistance projects.

Now, as a consultant, he carries out independent reviews of the environmental performance of major industry, peer-reviews and mentors the work of others, and is frequently engaged as an independent Resource Management Act hearings Commissioner for regional councils. Particular areas of expertise are the potential environmental impacts of various types of industrial processes, institutional strengthening and capacity building, and the multi-disciplinary aspects of motor vehicle emission control strategies.