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School Transport – Contracting Review
Resourcing Division
Ministry of Education
PO Box 1666, Thorndon
**Wellington**

Dear Sir / Madam

## School Transport – Bus Contracting Review: Working Paper

This submission is from the:

Auckland Regional Council
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The contact person in respect of this submission is:

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Thank you for the opportunity to provide comment on the working paper entitled *School Transport – Bus Contracting Review November 2005.*

The Auckland Regional Council (ARC) is very supportive of any opportunities or initiatives to improve the vehicle fleet performance and considers that your review is very timely given:

- Emissions from motor vehicles contribute between 50-80% of the various air pollutants in the Auckland region, with heavy duty diesel vehicles (i.e. buses and trucks) being responsible for the majority
- The rapidly mounting body of epidemiological evidence showing a causal link between vehicle emissions and human health, particularly in susceptible individuals such as children and the elderly
- The legislative requirement for local, regional and central government agencies to give effect to the *New Zealand Transport Strategy* and implement policies that:
    - ensure environmental sustainability, and
    - protect and promote human health

## The Problem – Motor Vehicle Emissions and Health Effects

Motor vehicle pollution is a serious health issue in the Auckland Region. Research undertaken by the Ministry of Transport in 2002 estimated that fine particulate less than 10µm ($PM_{10}$) emitted by motor vehicles in Auckland alone causes around 250 premature deaths every year[1]. Since then the epidemiological evidence demonstrating significant health effects due to particulate matter (PM) emissions has exploded worldwide.

Recently, both the United States Environmental Protection Agency (USEPA)[2] and the United Kingdom Department of Environment, Food and Rural Affairs (DEFRA)[3] have released substantive reports showing the true public health significance of PM emissions. The key findings are:

- Particulate from traffic and coal combustion sources have the greatest impacts on mortality
- Several biological mechanisms have been proposed for how PM causes health effects
- PM has a sustained impact on health rather than just affecting those for whom death is imminent.

In Auckland, diesel vehicles are estimated to be responsible for 91% of the $PM_{10}$ emitted from all motor vehicles, despite making up only 17% of the fleet based on mileage. Approximately half of this contribution comes from heavy duty trucks and buses. Consequently, we believe that initiatives designed to target these vehicles in particular will yield the best improvement for Auckland's air quality and minimise the associated health costs.

Health researchers believe that children are more susceptible than adults to the adverse effects of air pollution for a number of reasons[4]. Compared to adults, children have a higher lung volume to body size, higher respiration rates and spend more active time in a polluted environment. Fine particles have been linked in medical studies to serious health impacts in children and adolescents such as:

- Slowed lung function growth
- Increased emergency room visits
- Increased incidences of asthma and bronchitis, and
- Crib death

Children are exposed to elevated levels of particulate and fumes as a result of the build up of diesel exhaust inside school buses – especially with windows closed[5].

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[1] Fisher GW *et al* (2002). Health Effects of Motor Vehicle Air Pollution in New Zealand. Report to the Ministry of Transport, January 2002. Available at www.transport.govt.nz

[2] USEPA (2004). The EPA Particulate Matter Research Program: What Have We Learned About PM Since 1997? Report EPA 600/S-04/057, July 2004. Available at www.epa.gov/pmresearch

[3] DEFRA (2004). Particulate Matter in the United Kingdom. Draft report for comment prepared by the Air Quality Expert Group for DEFRA, August 2004. Available at www.defra.gov.uk/corporate/consult/particulate-matter

[4] Wiley, J.A., Robinson, J.P., Cheng, Y.T, Piazza, T., Stork, L., and Pladsen, K., Study of Children's Activity Patterns, Final Report Contract No. A733-149, Survey Research Center, University of California, Berkeley, (September 1991);
Snodgrass, W.R., Physiological and Biochemical Differences Between Children and Adults and Determinants of Toxic Response to Environmental Pollutants, in Guzlean, et al., Similarities and Differences Between Children and Adults: Implications for Risk Assessment, 1151 Press, Washington, DC. (year unknown);
Thurston, G. D., "Particulate Matter and Sulfate: Evaluation of Current California Air Quality Standards with Respect to Protection of Children," California Air Resources Board, Office of Environmental Health Hazard Assessment, (September 1, 2000), Available at www.arb.ca.gov/ch/ceh/airstandards.htm

[5] Hill, L.B., Zimmerman, N.J., and Gooch, J., A Multi-City Investigation of the Effectiveness of Retrofit Emissions Controls in Reducing Exposures to Particulate Matter in School Buses, Clean Air Task Force Report, (2005). Available at: www.catf.us/publications/reports/CATFPurdue_Multi_City_Bus_Study.php

The adverse health impacts of air pollution are considerable. Fine particle ($PM_{10}$) emissions from motor vehicles cause a wide range of sub-lethal health problems, in addition to an estimated 250 premature deaths and 435,000 restricted activity days per year in Auckland. Restricted activity days are days when sensitive individuals (such as children, the elderly, and people suffering from cardio-pulmonary disorders) feel too unwell to undertake their usual activities (such as attending school, gardening outside, or going to work). A preliminary health impact assessment, still in progress, suggests that the current health cost of $PM_{10}$ emissions from motor vehicles in the Auckland region could be as high as $750 million per annum.

## The Solution – Diesel Emissions Reduction Strategies

A significant proportion of the health risk posed by diesel exhaust can be eliminated through the practice of emission control strategies[6], principally focussing on "Repair, Retrofit, and Replace". In response, both the US and Japan have adopted nation-wide policies for eliminating diesel emissions from school buses because of the increased susceptibility of children.

Over the past three years, the ARC has been investigating a number of options to reduce the exhaust emissions from the Auckland urban bus fleet. A workshop for operators and key stakeholders was held in May 2004 to showcase the latest developments in fuel, technology and emissions management[7]. Subsequently, a Bus Emissions Prediction Model (BEPM) was developed to estimate the total emissions per year from a bus fleet based on input of the fleet composition, vehicle kilometres travelled, and the level of emissions technology[8].

The performance of the baseline fleet can then be compared against various emissions reduction scenarios, such as:

- changing diesel fuel specifications (primarily sulphur content), or using advanced fuel technologies such as water blend emulsion fuel (WBF)
- developing and applying targeted maintenance practices
- replacing diesel buses with new technology diesel buses, gas fuelled buses (CNG or LPG), or hybrid electric buses (HEV)
- retrofitting exhaust after-treatment technology such as diesel oxidation catalysts.

The costs of implementing these options are also estimated and a cost per tonne of pollution reduction calculated.

Worldwide, school buses have historically tended to be the oldest in any country's bus fleet and New Zealand is no exception. Across the Auckland region, buses in the commercial fleets currently have a maximum age limit of 20-25 years at which point most enter into school bus fleets where they continue to operate for another five years.

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Wargo, J., and Brown, D., Children's Exposure to Diesel Exhaust on School Buses. Environment and Human Health Inc., (February 2002), p. 76. Available at: www.ehhi.org/pubs/children_diesel.html;
Natural Resources Defense Council, No Breathing in the Aisles. Diesel Exhaust Inside School Buses (2001). Available at: www.nrdc.org/air/transportation/schoolbus/sbusinx.asp;
California Air Resources Board, "Characterizing the Range of Children's Pollutant Exposure During School Bus Commutes," (2003). Available at: www.arb.ca.gov/research/schoolbus/schoolbus.htm

[6] Clean Air Task Force, Diesel and Health in America: The Lingering Threat (2005). Available at: www.catf.us/goto/dieselhealth

[7] Auckland Regional Council (2004). Bus Emissions Reduction Workshop, CD of the proceedings of the workshop held in Auckland, 21 May 2004, Auckland. Available on request

[8] Auckland Regional Council (2005). Bus Emissions Prediction Model, CD of the working model, Auckland, 31 May 2005. Available on request

Pollution discharges vary significantly with emission control technology as shown in Table 1, where a 25 year old bus emits nearly 10 times the amount of particulate matter (PM) than a five year old bus. **In reality, this means that unfortunately the worst emitting buses (school buses) are often matched with the most sensitive receptors (school children).** However, overseas experience has shown that these older buses can continue to operate if cost-effectively retrofitted with diesel oxidation catalysts, which deliver a 30% reduction in harmful emissions.

**Table 1. Comparison of the typical emissions of various pollutants depending on the bus emissions technology, in grams per kilometre travelled**

| 1.0 Diesel | | CO | NMHC | CH4 | NOx | PM | CO2 |
|---|---|---|---|---|---|---|---|
| 1.1 European | | | | | | | |
| Title | Model yrs' | | | | | | |
| (i) Pre-Euro | < '88 | 16.61 | 6.07 | 0.00 | 17.22 | 2.11 | 1067.0 |
| (ii) Euro 0 | 88-91 | 7.73 | 1.54 | 0.00 | 13.55 | 0.96 | 1083.3 |
| (iii) Euro I | 92-95 | 3.25 | 1.24 | 0.00 | 10.87 | 0.57 | 1090.4 |
| (iv) Euro II | 96-99 | 2.61 | 1.04 | 0.00 | 9.85 | 0.35 | 1068.0 |
| (v) Euro III | 00-04 | 1.99 | 0.51 | 0.00 | 6.51 | 0.24 | 1005.3 |
| (vi) Euro IV | 05-07 | 1.53 | 0.39 | 0.00 | 4.63 | 0.11 | 978.0 |
| (vii) Euro V | >'08 | 0.97 | 0.42 | 0.00 | 4.59 | 0.04 | 969.0 |

The BEPM has already been used by the Auckland Regional Transport Authority (ARTA) to evaluate the environmental performance of contracted bus services as part of the usual tender evaluation criteria. Competing operators provide details on the likely fleets to be used on the routes, outlining the level of emissions control technology (e.g. Euro 0) and estimated annual mileage. The model then calculates the total emissions and overall environmental rating of the fleet. All operators have been given the model to enable them to do their own evaluations and modify their fleet management strategies to get an improved rating.

In addition, the latest Regional Land Transport Strategy for Auckland[9] specifically addresses the management of bus emissions in policy 1.8.2:

> *Accelerate environmental performance improvements in reducing air emissions from heavy duty diesel vehicles in the region, such as the public bus and commercial trucking fleets.* ***(ARC, ARTA)***
>
> **Example Activities**
>
> - *Work with bus and truck fleet operators to raise their awareness of the environmental impacts of vehicle emissions*
> - *Ensure tender and contracting procedures give credit in the awarding of passenger transport service contracts to quiet, low emission vehicles*
> - *Develop minimum emissions standards for all passenger transport vehicles operating on contracted services*
> - *Encourage bus and truck fleet operators to trial and implement retrofitting of exhaust treatment devices, e.g. diesel oxidation catalysts and particle traps*
> - *Require minimum emissions standards for heavy duty vehicles in "hot spot" traffic corridors where large numbers of people are potentially exposed to poor air quality*

Both the BEPM and policies from the Auckland Regional Land Transport Strategy could be used by the Ministry of Education to address the enhanced requirements for ensuring environmental sustainability and protecting human health in their contracted services. The

[9] Auckland Regional Council (2005). Auckland Regional Land Transport Strategy, Auckland, November 2005. Available at: www.arc.govt.nz/arc/publications/transport-publications/

ARC would be more than happy to provide copies of the relevant documentation and offer technical assistance for training Ministry staff.

## Recommendations

The ARC appreciates that, historically, environmental criteria were not considered in any tender evaluations for any bus contracts – neither regional passenger transport services nor school bus services. This means that the Ministry's review is a golden opportunity to make some significant improvements in environmental quality and student safety through improved health outcomes.

We strongly urge the Ministry to support some or all of the following to address environmental sustainability and the protection of human health as follows:

1. The Ministry adopt the Bus Emissions Prediction Model (BEPM) as a means to evaluate and compare the environmental performance of school bus fleets in the tender process.
2. The Ministry include specific clauses in their tender documents requiring operators to supply the information required for the BEPM evaluation.
3. The Ministry set a minimum emissions performance for any tender (it could be based on the environmental rating already calculated in the BEPM) and that this is reviewed regularly to guarantee on-going improvements and achieve the desired environmental and health outcomes.
4. The Ministry require all buses older than 1988 (pre-Euro) to be retrofitted with diesel oxidation catalysts to minimise emissions by up to 30% and consider imposing a maximum age limit in future.

The ARC would like to re-iterate than we would be more than happy to provide copies of any relevant documentation and offer technical assistance to Ministry staff. Please feel free to contact the relevant Council officers should you wish to discuss our comments further.

Thank you again for the opportunity to provide comment on your review and we look forward to working with you to achieve a better environmental and health outcome for all.

Yours faithfully,

Dianne Glenn
**Chair, Auckland Regional Council Environment Committee**

Cc: Peter Clark, Passenger Transport Planning Manager, ARTA
Anna Percy, Sustainability Manager, ARTA

Attach: Bus Emissions Prediction Model CD
Bus Emissions Reduction Workshop CD