

Air Pollution and Vehicles



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TOPICS

- 1 What's HOT and what's NOT in NZ**
- 2 Air quality indicators and trends**
- 3 Relevance and effects of air pollution**
- 4 New air quality issues**
- 5 Standards and guidelines**
- 6 Dilemmas and complexities (as if we need reminding!)**
- 7 Things we DO know, and things we DON'T**
- 8 What's NIWA doing?**
- 9 What else is happening?**
- 10 Future scenarios**

1. What's Hot (and Not!)

HOT

- NO₂
- CO
- PM_{2.5}
- BENZENE
- SMOKE

NOT SO

- PM₁₀
- SO₂
- O₃
- Pb

WATCH FOR

- PAH
- PM_{1.0}
- HCHO
- VOCS
- H₂S

NZ is different!

2. Air Quality Indicators

Category	Measured Value
Action	Exceeds the guideline
Alert	Between 66% and 100% of the guideline
Acceptable	Between 33% and 66% of the guideline
Good	Between 10% and 33% of the guideline
Excellent	Less than 10% of the guideline

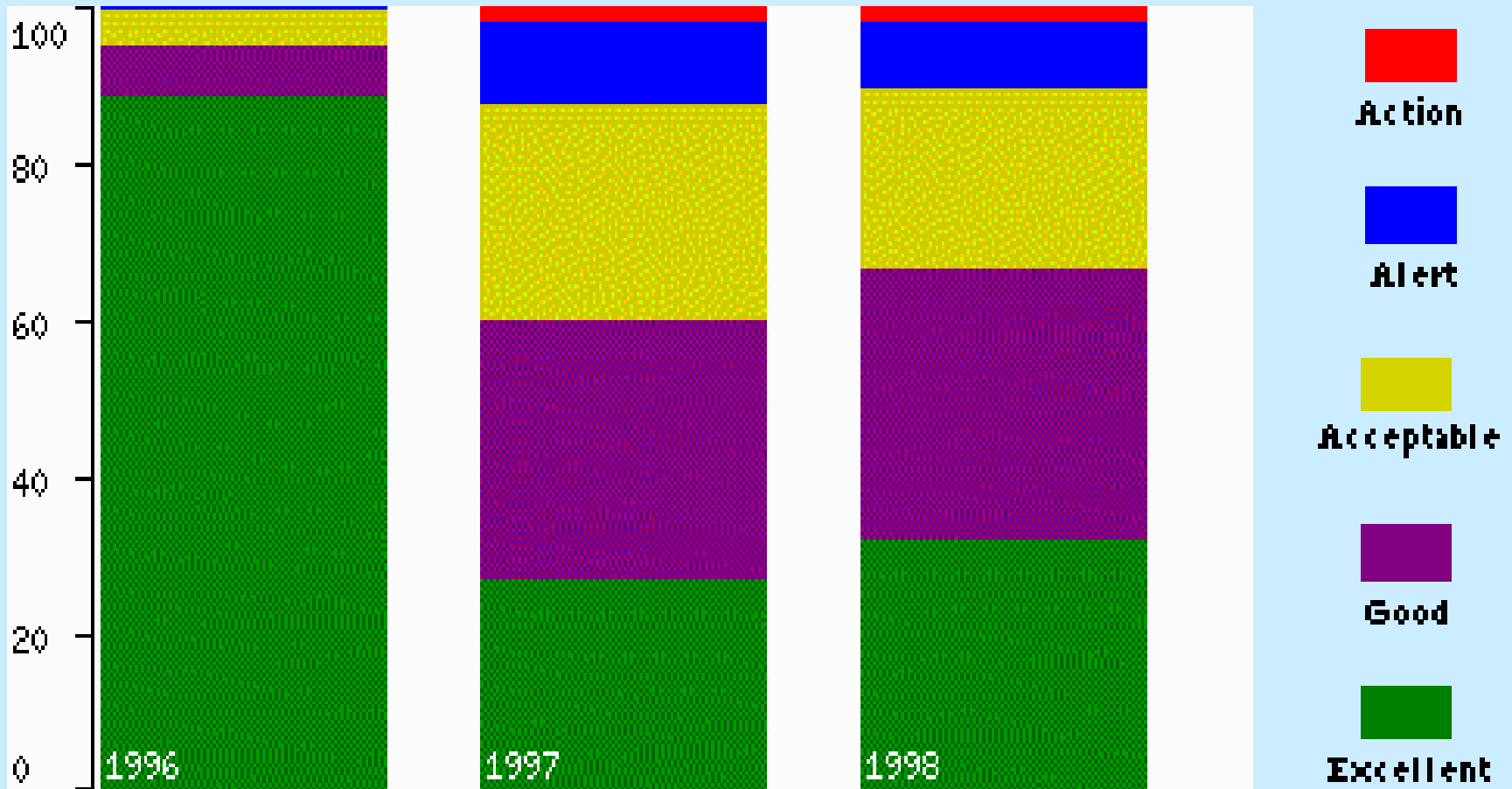
Indicators are Good!

- + simple terminology and easy to understand**
 - + being adopted as a formal tool by many Regional Councils**
 - + can be quickly revised and updated**
 - + concise and easy to obtain**
- don't have enough of them (eg transport)**
 - need work and resources to maintain**
 - can be difficult / expensive (eg congestion)**
 - sometimes don't meet specific requirements**

Air Quality Indicators show some good trends, and some bad ones.....

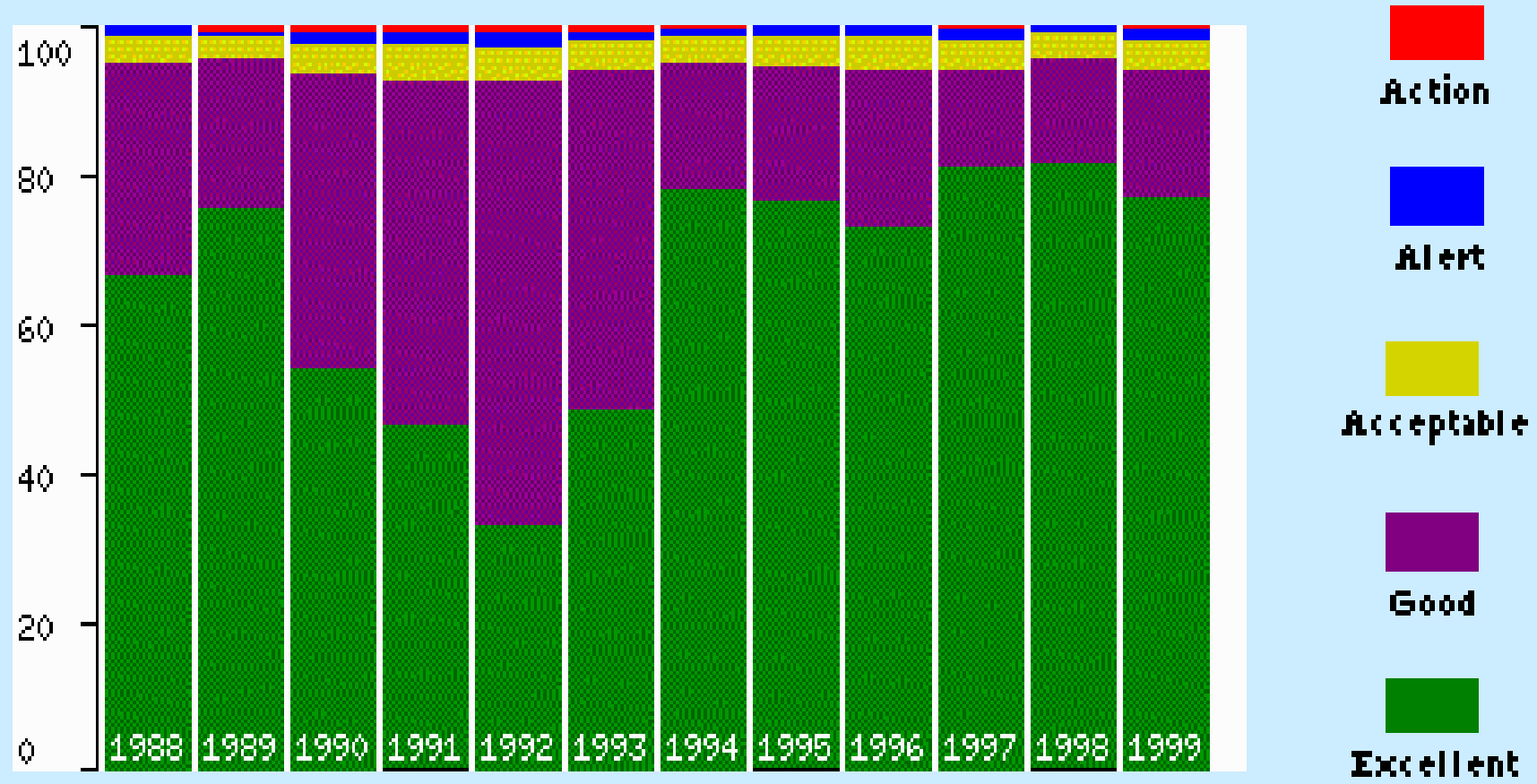
Carbon Monoxide (CO)

CO 8hr at Khyber Pass Rd



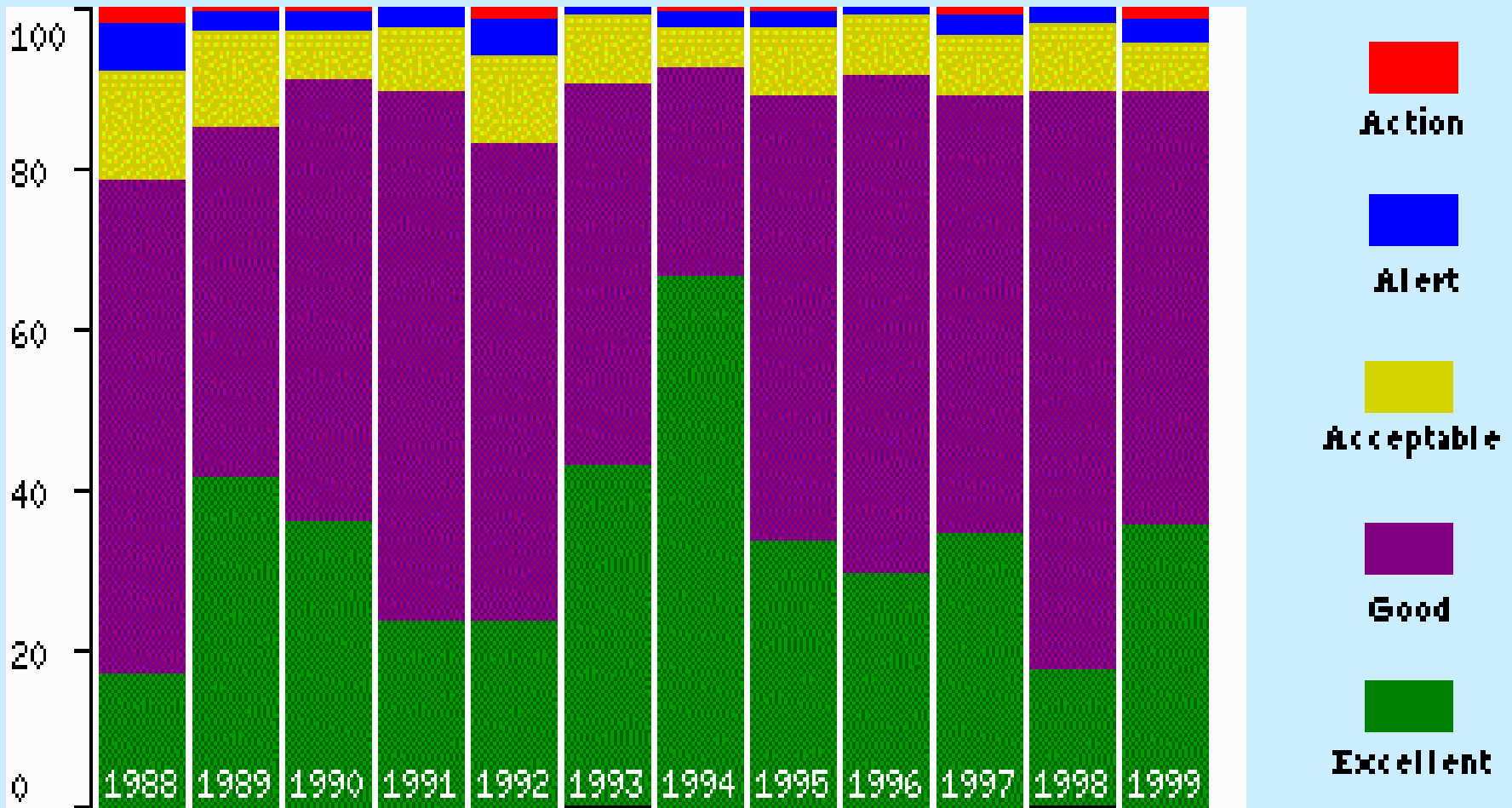
Carbon Monoxide (CO)

CO 8hr at St Albans



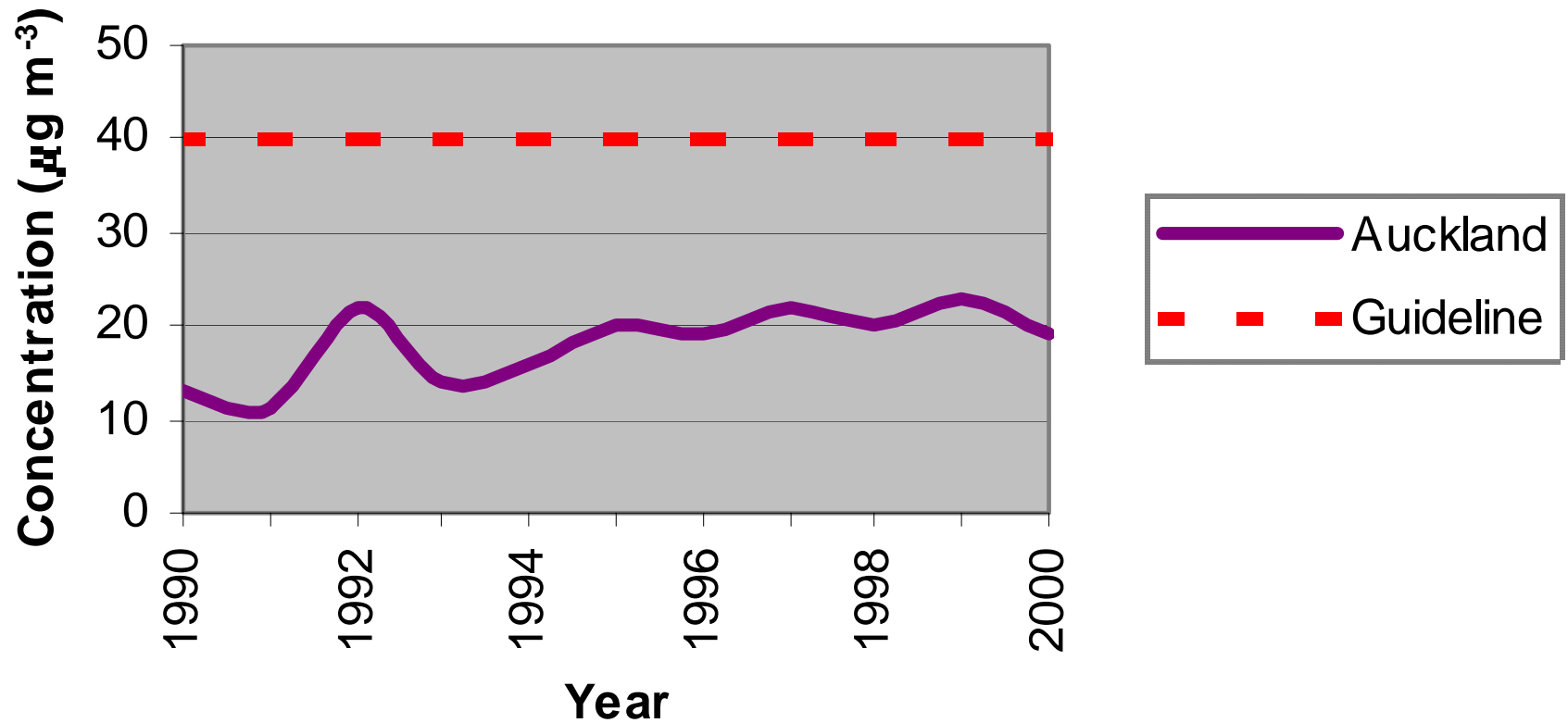
Particulates (PM10)

PM10 24hr at St Albans



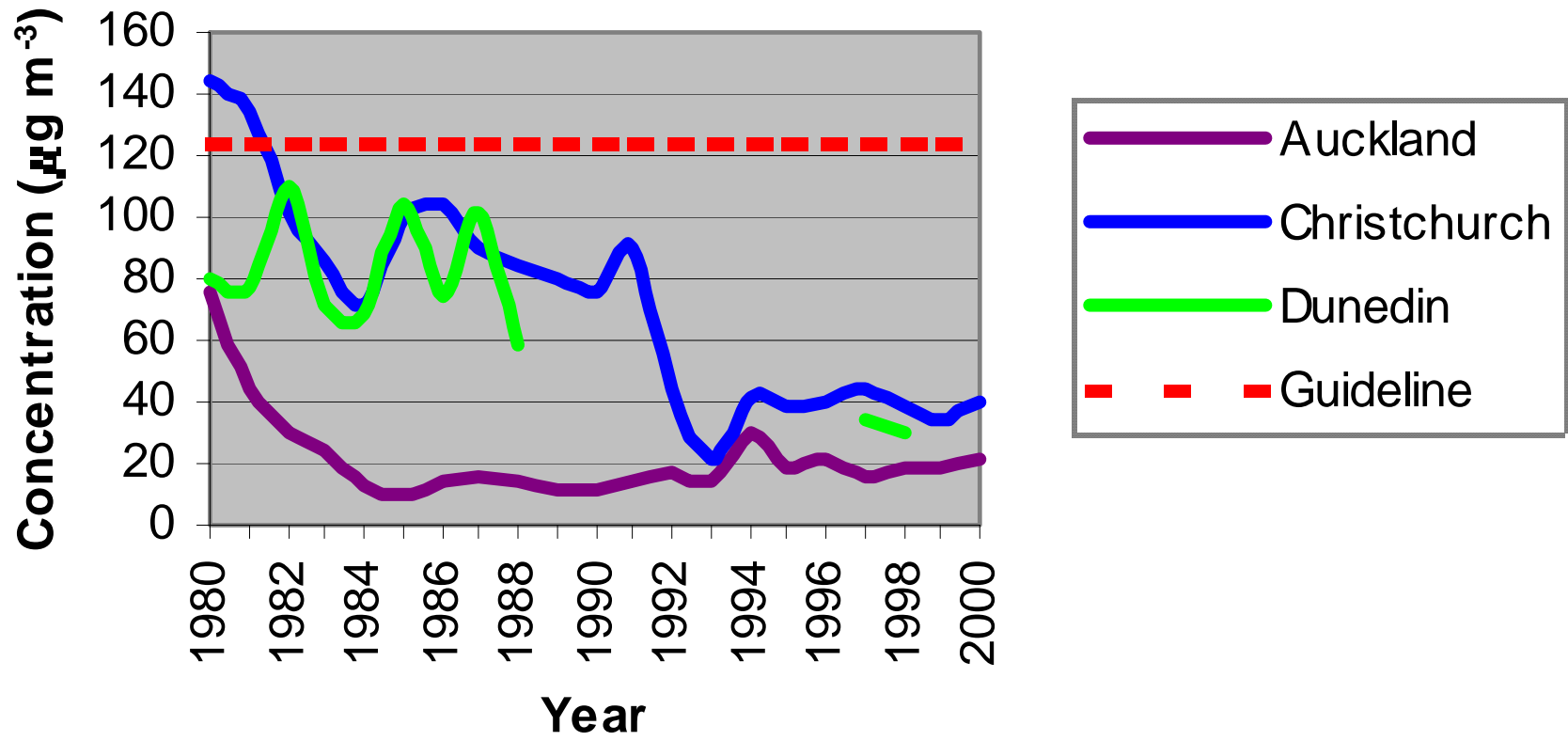
Nitrogen Dioxide (NO₂)

Average Nitrogen Dioxide (Annual)



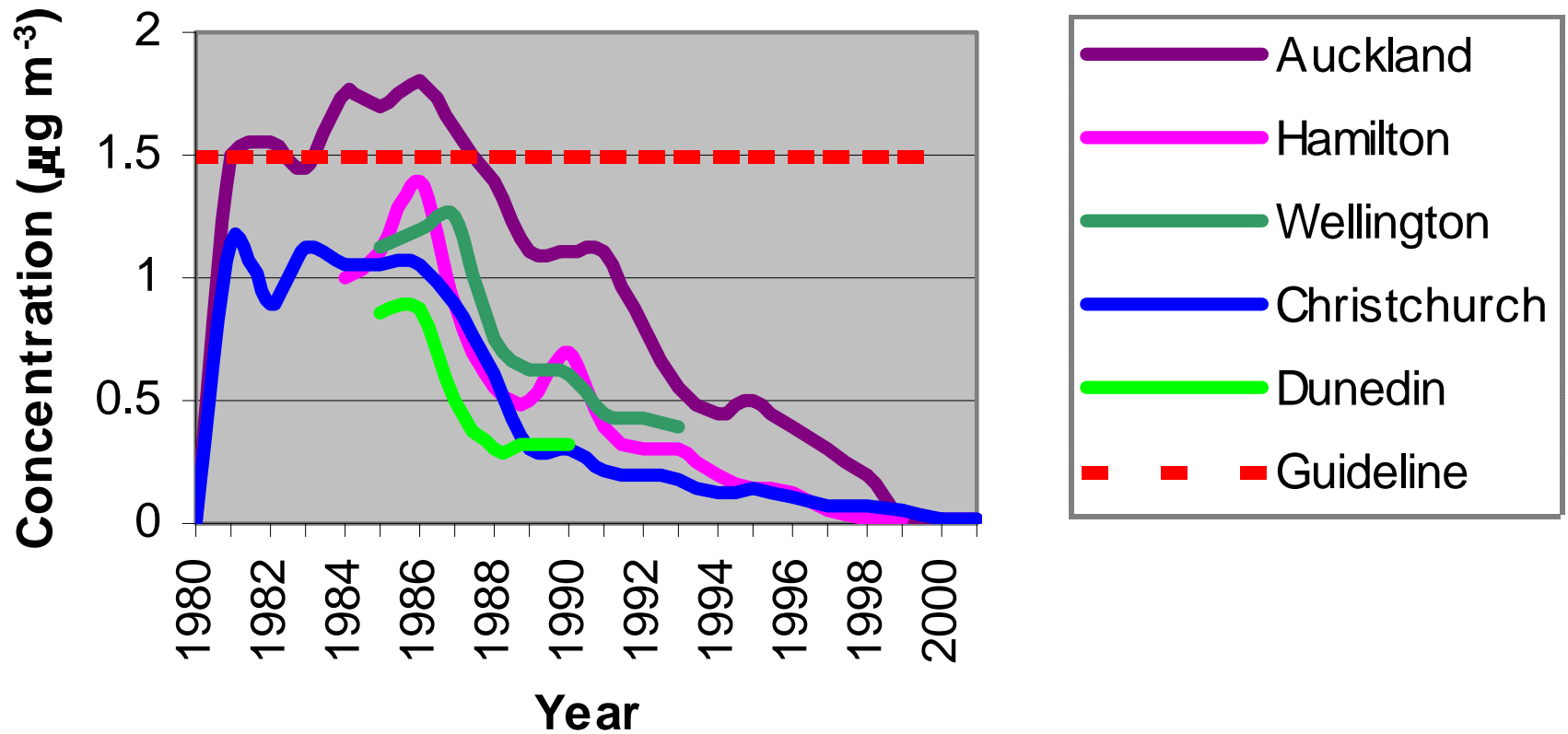
Sulphur Dioxide (SO₂)

Peak Sulphur Dioxide (24 Hours)



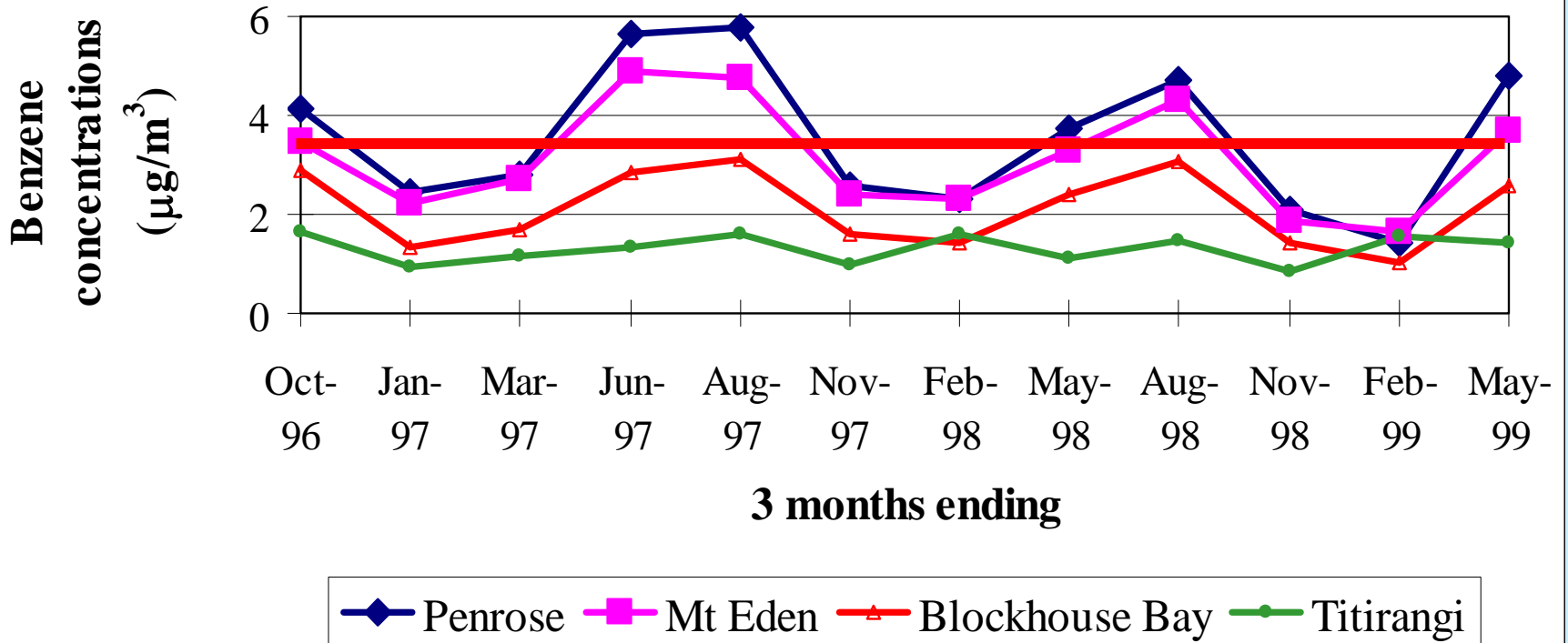
Lead (Pb)

Peak Lead (3 Months)



Benzene

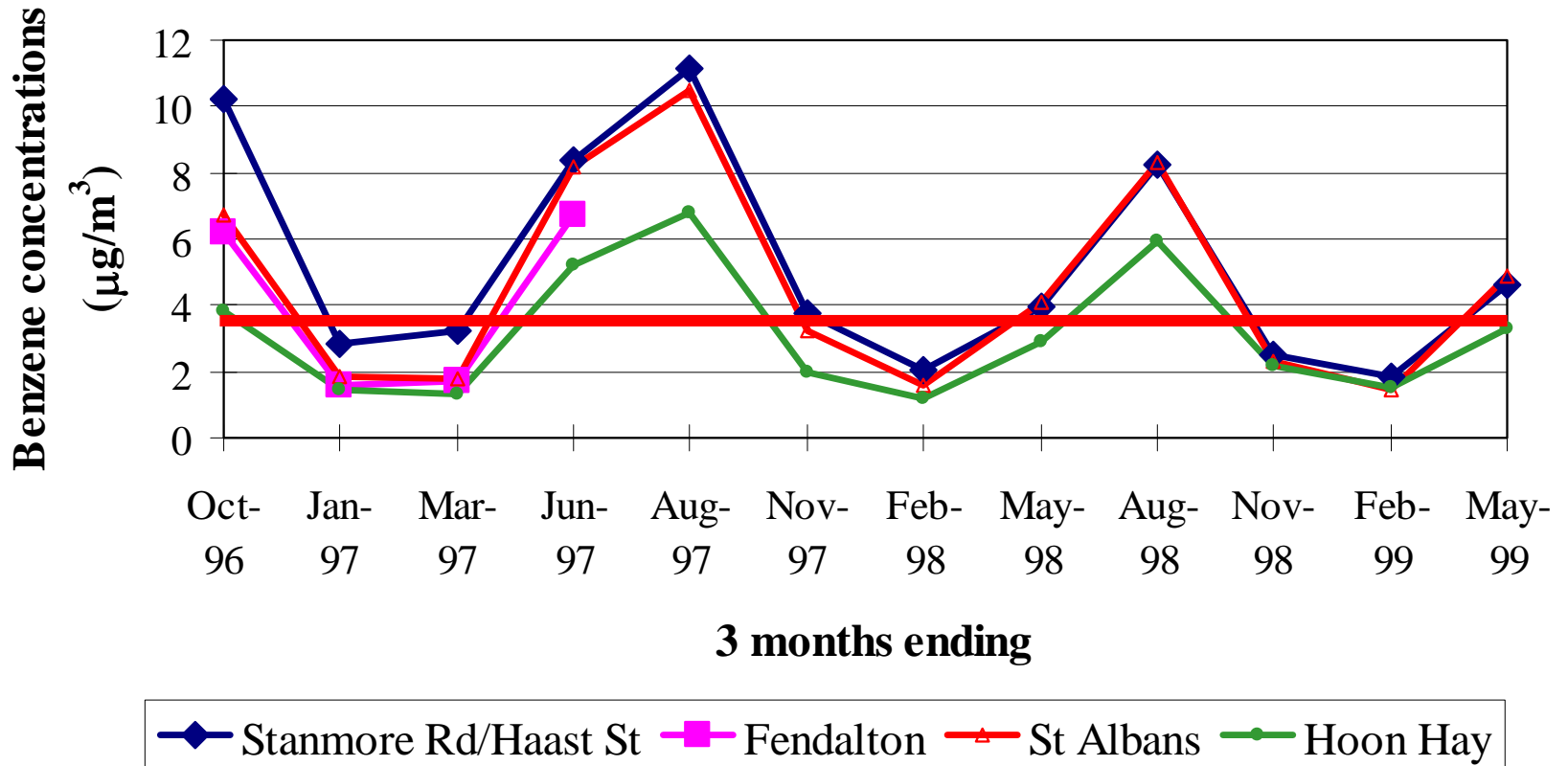
Auckland Outdoor Residential Sites



— Guideline proposed for 2010

Benzene

Christchurch Outdoor Residential Sites



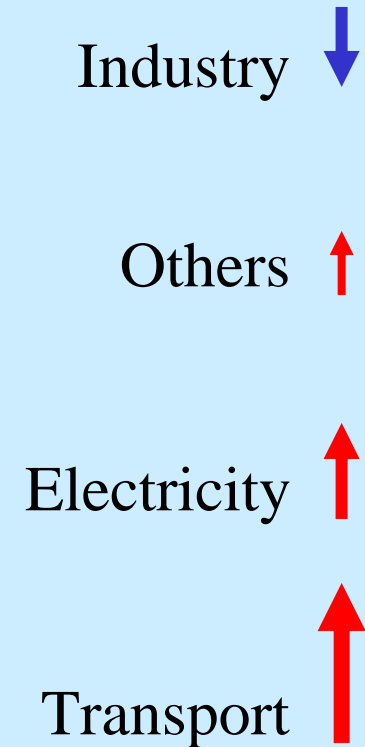
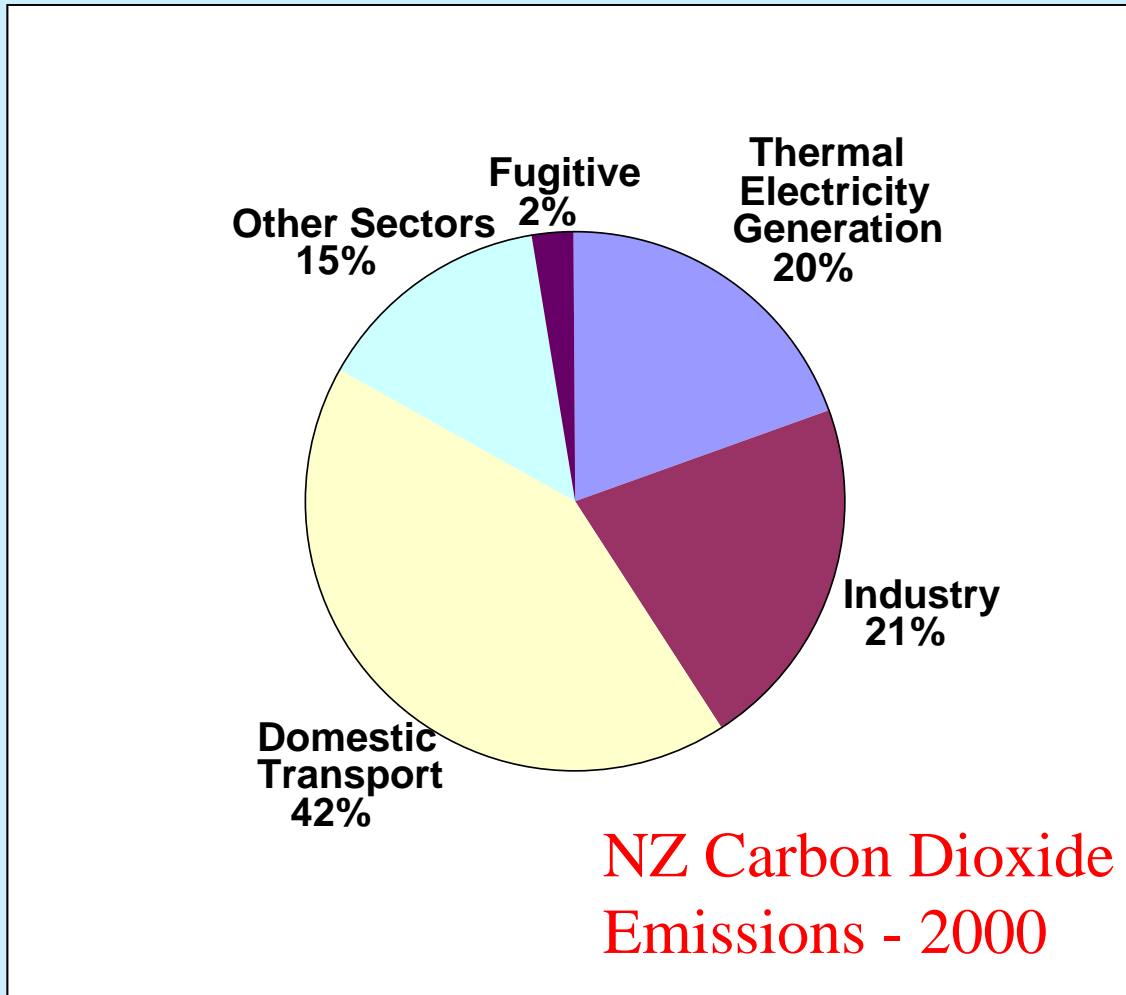
— Guideline proposed for 2010

3. Relevance /Effects of Air Pollution?

- Nuisance vs health (or both?)
- 70% due to vehicles in most places
- 90% of time indoors (or in vehicles)
- China deaths due to air pollution - 700,000
- Perceived risk connected with ‘choice’ of exposure (and peoples’ risk perception is notoriously flaky)

And what about Global Warming?.....

Greenhouse Gases



Different picture for methane and other greenhouse gases

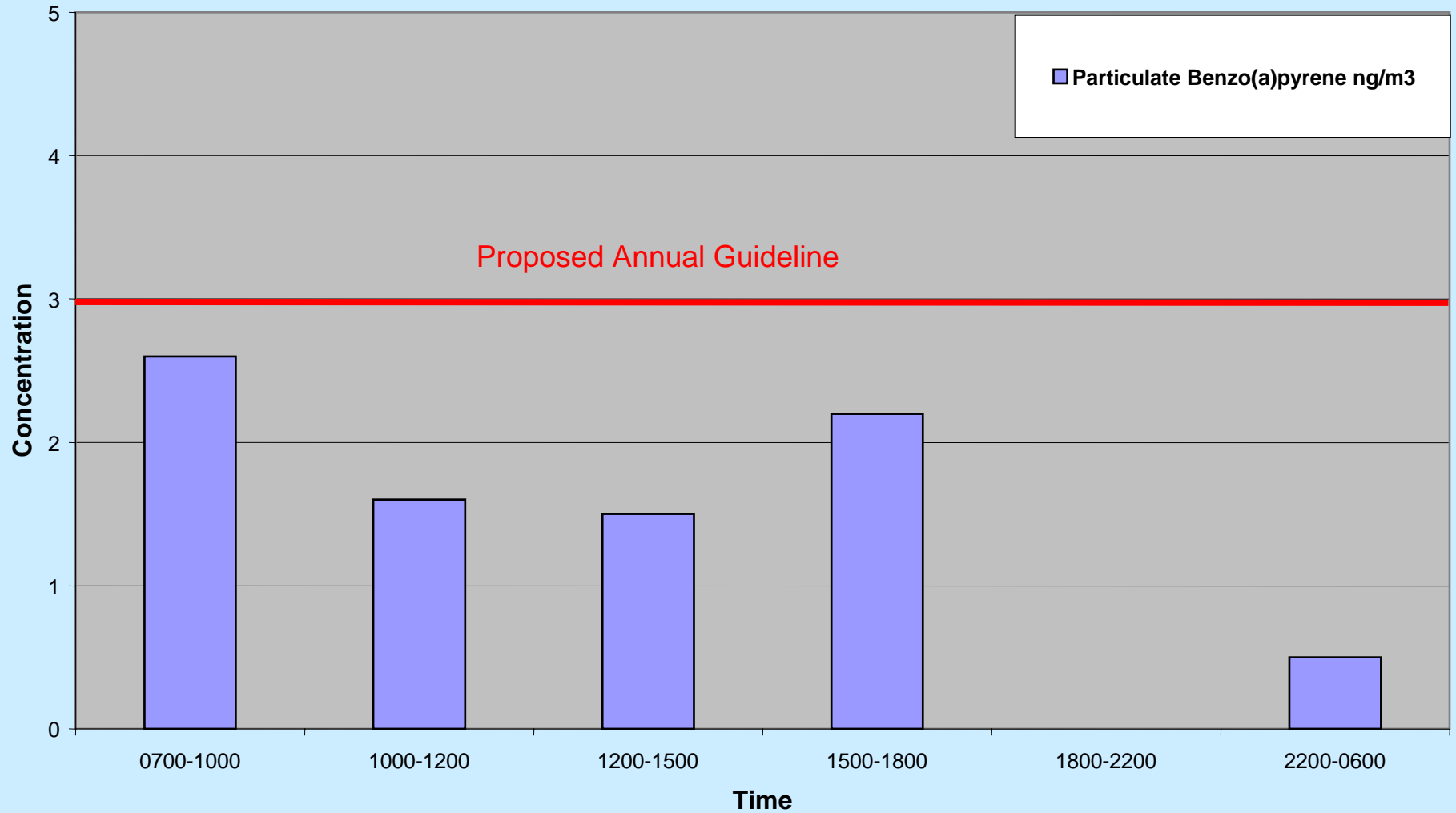
4. New Issues

- **PM1.0 (Fine Particulates)** – Research now showing much of the health effects likely due to even finer particles
- **VOCS (Volatile Organics)** – These are becoming of more concern in urban areas, and are pre-cursors of ozone formation
- **HCHO (Formaldehyde)** – Getting it out of wallboards and houses, but also emitted from vehicles
- **H₂S (Hydrogen Sulphide)** – US / Europe concerns at long term values of 1 $\mu\text{g m}^{-3}$, (but Rotorua regularly has 1000 $\mu\text{g m}^{-3}$!)
- **PAHs (Polycyclic aromatic hydrocarbons)** →

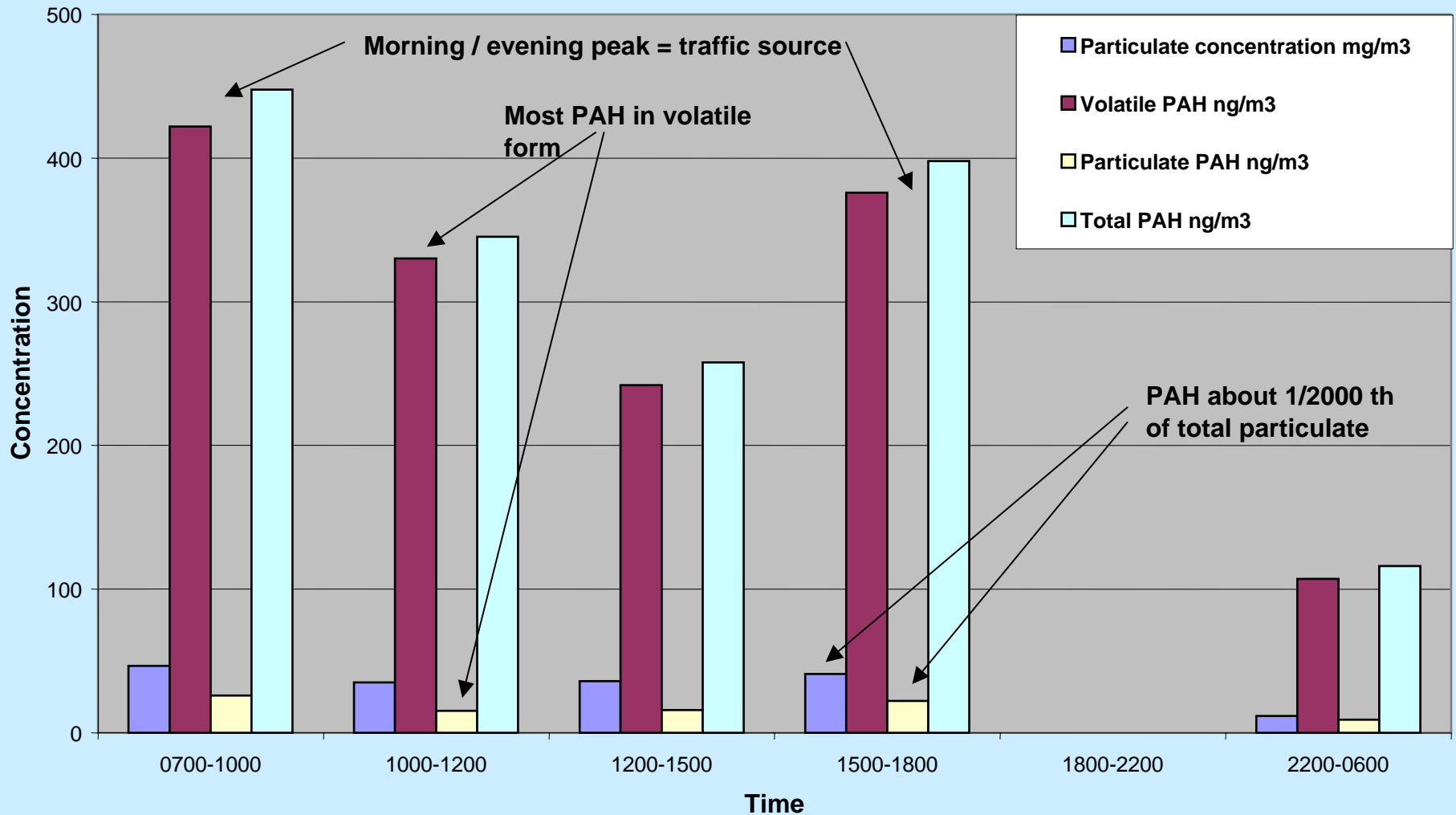
PAHs

- **New guidelines proposed.**
- **Carcinogenic effects, of increasing international concern.**
- **Monitoring in NZ cities showing high concentrations.**
- **Traffic sources are significant (as well as other forms of combustion.)**
- **Results for busy Auckland intersections could be approaching guideline.**

Atmospheric polycyclic aromatic hydrocarbons in Khyber Pass Road, 6/8/98



Atmospheric polycyclic aromatic hydrocarbons in Khyber Pass Road, 6/8/98




5. Standards and Guidelines

- **In practical terms the same – but legislatively very different.**
- **NZ only has Guidelines (for Air Quality)**
- **Review on at present – probably end up with more guidelines.**
- **Standards for air quality probably several years away – if at all.**

Reviews

Review of the Ambient Air Quality Guidelines



Ministry for the Environment
Manatū Mō Te Taiao

Review of the Ambient Air Quality Guidelines

Proposals for Revised and New Ambient Air Quality Guidelines for New Zealand

Working Draft 1

Prepared by the Ministry for the Environment

January 2000

Air Quality Report No. 16

**Submissions closed,
and Proposed
Revisions should be out
soon**

www.mfe.govt.nz

Proposed Air Quality Guidelines for the Protection of Human Health

Contaminant	Value	Averaging time
Particles - PM10 Particles - PM2.5	50 $\mu\text{g}/\text{m}^3$ 25 $\mu\text{g}/\text{m}^3$	24 hour 24-hour
Carbon monoxide	30 $\mu\text{g}/\text{m}^3$ 10 mg/m^3	1 hour 8 hour
Ozone	150 $\mu\text{g}/\text{m}^3$ 100 $\mu\text{g}/\text{m}^3$	1 hour 8 hour
Nitrogen dioxide	200 $\mu\text{g}/\text{m}^3$ 100 $\mu\text{g}/\text{m}^3$	1 hour 24 hour
Sulphur dioxide	350 $\mu\text{g}/\text{m}^3$ 120 $\mu\text{g}/\text{m}^3$	1 hour 24 hour
Lead content of PM10	0.5 $\mu\text{g}/\text{m}^3$	3-month moving, calculated monthly

Proposed Evaluation Criteria for Hazardous Air Contaminants

Contaminant	Monitoring Criteria µg/m³ Annual Average	Modelling Criteria µg/m³ 1-hour Average
Benzene (2000-2010)	10	22
Benzene (after 2010)	3.6	na
Toluene (odour based)	190	500
Xylene (odour based)	950	1,000
1,3 Butadiene	2.4	15
Formaldehyde	15	20
Acetaldehyde	30	45
Benzo(a)pyrene	0.003	na
Mercury-inorganic	0.33	20
Mercury-organic	0.13	0.8
Chromium-VI	0.0011	0.0067
Chromium-other forms	0.11	0.67
Arsenic-inorganic	0.0055	0.033
Arsenic-arsine	0.05	0.33

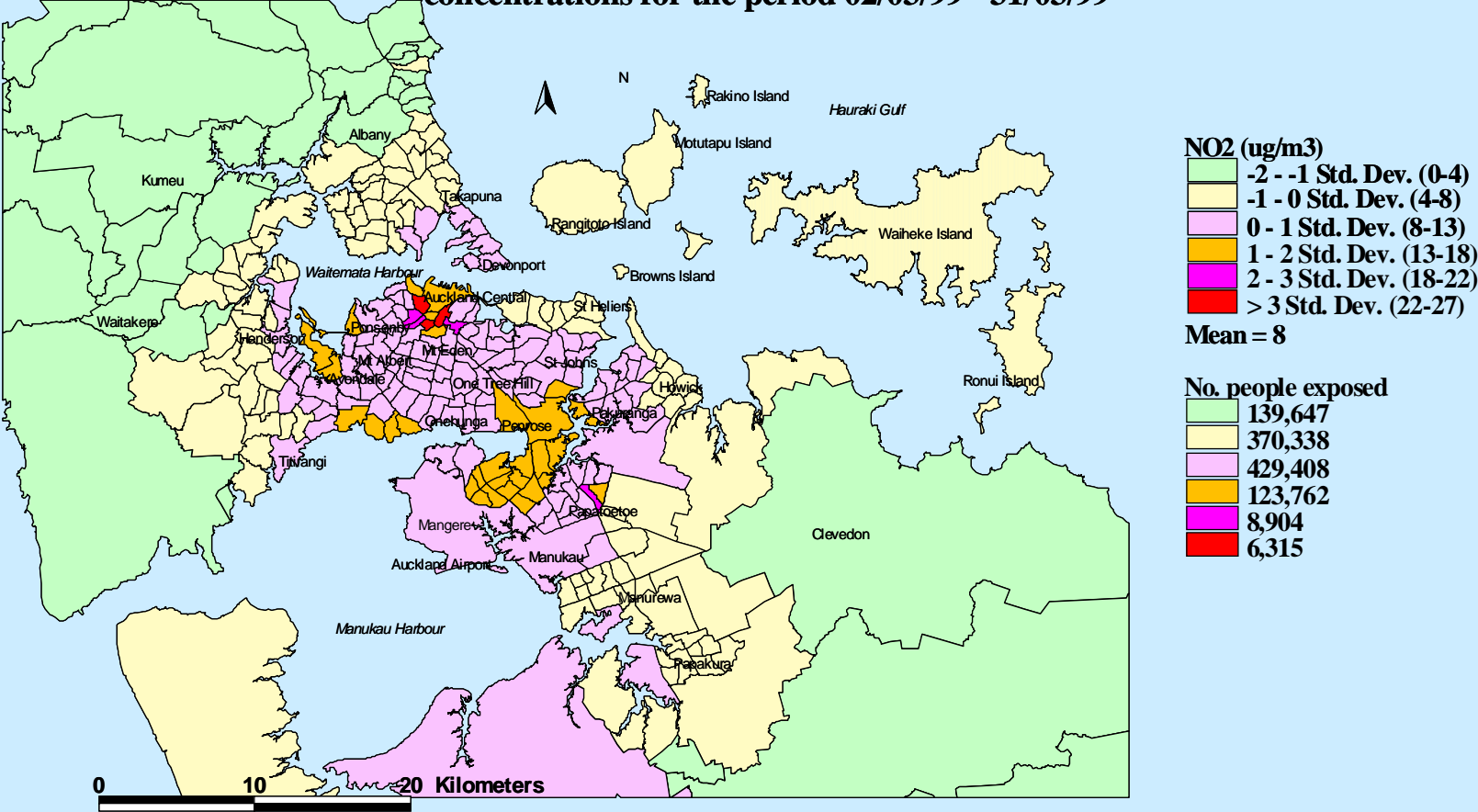
6. Dilemmas and Complexities

- **Atmospheric processes are very complex – e.g can we forecast the weather yet?**
- **Air-shed effects vs. local effects – e.g. hydrocarbons important for ozone formation**
- **Life-cycle costs to consider**
- **Tune engines for low NO_x – could be higher CO**
- **Mitigation costs to consider**
- **Regional differences – e.g. case for controls in Auckland, but same for West Coast?**

Lots of issues for us all to think about!

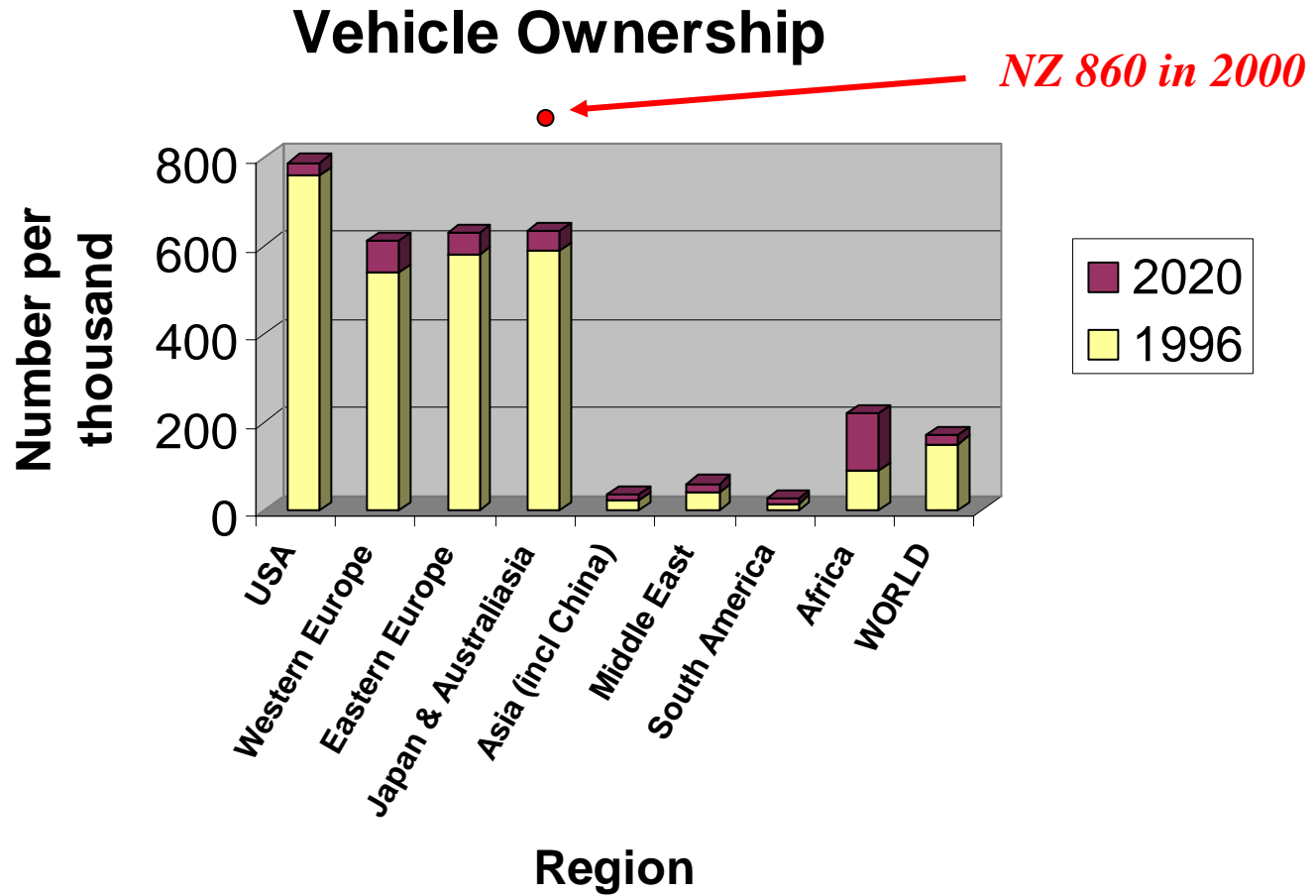
Airsheds are Complex

Map of Auckland region showing monthly average NO₂ concentrations for the period 02/03/99 - 31/03/99



“Red’ areas may not be getting ‘redder’ – but there are more of them

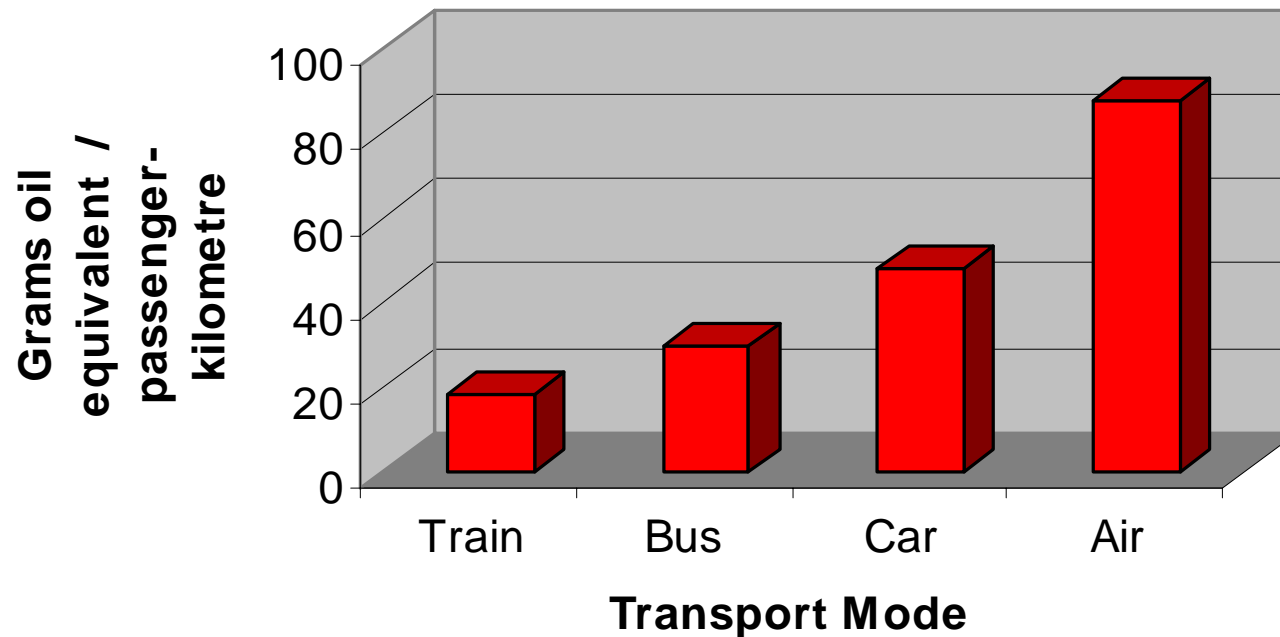
We Own a Lot of Cars!



And we're getting more.....!

Energy Use

Energy Consumption by Transport Mode



Sometimes not obvious – need to include life-cycle costs

7. What We DO Know

- **Vehicle emissions ARE a significant source of air pollution (in NZ and throughout the world).**
- **There ARE a number mitigation measures (but they mostly cost more than we want!)**
- **We basically have to use fossil fuels LESS (or much more efficiently).**

Pretty obvious really!

7. What We DON'T Know

- **Whether technology improvements will be fast enough to overcome worsening effects from increasing numbers and congestion.**
- **Exact details of exposures and effects (never ending demands for more research!)**
- **Real effects of some of the mitigation measures, because our tools aren't good enough (more research again!)**

But we're getting there!

8. What's NIWA doing?

Measuring
monitoring projects
throughout NZ (\$1M pa)

Research
urban air quality, transport
effects, etc (\$0.8M pa)

Effects Assessments
health, nuisance, surveys,
industrial developments,
new motorways

Modelling
dispersion, airshed,
emissions, inventory

Collaborating
CRI's, universities,
schools, overseas

Training
courses, workshops,
lectures

Advisory Committees
government, local bodies, universities

8. What's NIWA Really Doing?



In the field testing new technologies!

9. What Else is Going On?

Huge amount of air quality/transport work internationally – problem is that much is at the ‘city’ level, and difficult to find out about

Also – much is very location specific. Local geography. Local weather. Local vehicles and fuel. Local regulations. Local politics. Availability of resources highly variable

But – lots happening in NZ too!

Regional Programmes

- Auckland – Air Plan, Smokey
- Canterbury – Electric buses, “Sparky”

“I wish WE had some of these!”



- Waikato – Testing programmes
- Bay of Plenty – Targetting gross emitters
- Wellington – Special monitoring
- Many others – inventories, monitoring, public education

Motorway Consenting

Many major roads now undergoing resource consents

- **Central Wellington Motorway / Mt Victoria tunnel**
- **SH1 Paramata**
- **SH1 Pukerua Bay**
- **SH18 Greenhithe**
- **SH2 Petone**
- **SH1 Meremere**
- **Southern Link Nelson**
 - More....?

Wacky ideas?

Destroying NO_x

Where Japanese inventors cover buildings and roads with specially activated surfaces for sucking up NO_x.

NO_x Eating Plants

Where we cover our cities in Rock Lilies or similar, which love NO_x.

Licensing

All new roads subject to Resource Consents.

Regional Controls

Where local Councils decide what transport emissions are acceptable – and enforce them.

Energy Efficiency

Where we actually use our transport systems efficiently – if the ‘market’ allows!

10. Scenarios for NZ?

- **Status Quo** *=> pollution...*  ?
 - Hands off, market forces
- **Grim and Grimy** *=> pollution.....* 
 - Unfettered growth, old technology, cheap and dirty fuel, no regulation
- **Clear and Clean** *=> pollution.....* 
 - Rapid uptake of new technology, emissions controls, progressive network management