

Presentation to Hearing for proposed Canterbury Air Regional Plan.

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In our submission, Sir David and I have commented on many points in the air plan. Today we would like to present the principles and evidence which substantiate these submissions. They fall into four areas:

1. The importance of exposure to cold.
2. The scientific evidence about air pollutants.
3. The application of the science in policy formulation.
4. The Economic and Social consequences of the Air Plan.

1. THE IMPORTANCE OF EXPOSURE TO COLD

This section details our concerns underlying submissions on: P1-4 para 6
P2-3 para 7
P2-4 para 2

In the maintenance of good health the control of air pollution is postulated to be important and this provides the rationale for New Zealand's National Environmental Standards for Air Quality and regulations derived from them. In our submission we have drawn attention to the importance of exposure to cold and the evidence indicates that it probably has a greater impact on health.

In England and Wales there have been more than 25,000 excess winter deaths a year. Excess winter deaths of people aged 65 or over were more than 20,000 a year for 11 years.

In New Zealand, there were 1600 excess winter deaths each year between 1980 and 2000. The winter mortality rate was 18% higher than non-winter rates and was 2% higher than the mean for 14 European countries.

Why should the UK and New Zealand have excessive winter health problems? Countries with the mildest winter climates in Europe, have been found to have the highest increases in winter mortality. Poor insulation of housing is thought to be important. People in the north of Finland protect themselves so well that they had no more winter mortality than London or Athens.

Changes in the airways when cold make them more prone to infection. The cilia which move secretions out of the lungs do not function as well. There is also constriction and congestion of the airways, and increased mucus production. Viral infections can be complicated by bacterial infections, bronchitis and pneumonia. In the elderly or those with chronic lung or heart disease this can cause cardiac or

respiratory failure. In infants, because of the small calibre of the airways, it can more rapidly be life-threatening.

Cold is an important trigger for asthma.

The 2014 update on the impact of respiratory disease from the Asthma Foundation and University of Otago showed that hospitalisation rates have increased for bronchiectasis, childhood bronchiolitis and total respiratory disease.¹ They described as a “most relentless and disturbing pattern the high degree of inequality, across both the socio-economic spectrum and different ethnic groups.”

Because of improved control of influenza by vaccination, approximately half excess winter deaths are now due to coronary artery disease. These deaths rise sharply in cold weather and peak about two days after peak cold.

Patients with angina have been advised for years not to walk against a cold wind. The inhalation of very cold air provoked angina in coronary disease patients at rest and in others, when their heart rate was paced, angina developed earlier in cold conditions. Coronary artery or arteriole constriction was not seen on angiography.

It seems likely that arterioles too small to be seen on angiograms may constrict when a person is exposed to cold and lead to myocardial ischaemia, arrhythmia or infarction.

Other mechanisms induced by cold can lead to an increased risk of clotting and infarction. Increase in noradrenaline levels elevates blood pressure and thus increases work for the heart.

In summary, we have a higher rate of excess winter deaths overall than comparable countries, and those with low incomes fare particularly badly in New Zealand. The evidence supports the measures to upgrade the insulation of houses that has been part of the Ministry for the Environment’s programme. On the other hand, the controls in relation to PM₁₀ have jeopardized the security and affordability of home heating and in doing so have threatened health.

We cannot stress too much the over-riding importance of cold exposure if changes to energy policy diminish people’s ability to adequately heat their homes.

2. THE SCIENTIFIC EVIDENCE ABOUT AIR POLLUTANTS.

This details the basis for our statements on sections:

- P1-1 para 4
- P1-2 para 6/7
- P1-2 para 1
- P1-2 para 6
- P1-3 para 5/6
- P1-6
- P3-2 para 4

We should first like to give you our credentials to address the scientific issues. I was a member Medicines Assessment Advisory Committee of the Ministry of Health and for 20 years assessed the scientific evidence for every significant new drug seeking entry to New Zealand. Whether an agent is ingested by mouth, or inhaled in our breath, it is handled by the same mechanisms and the evidence for safety and risk requires equally demanding assessment.

Sir David Hay has had a long involvement with the anti-smoking movement. As past Chairman of the New Zealand section of the Australia and New Zealand Society of Cardiology he took a leading role in arguing for the health benefits that would accrue from cessation of smoking.

In the 1952 London smogs about 4,000 deaths were attributed to coal fires and motor vehicle exhausts which produced sulphur dioxide, nitrogen oxides and black carbon.

Air pollutants became an important area of research. As well as chemical pollutants which damage the lung, interest in small particles developed.

The statistical strength of the association between raised PM₁₀ levels and increased mortality is low; the relative risk found by Pope was 1.06, that by Laden 1.16. By comparison the relative risk of cancer with cigarette smoking is about 7. Several U S experts have expressed the view that a relative risk of at least 4 is required to consider public health intervention for a noxious agent. At 1.06 and 1.16 we have a very low statistical risk, regarded by some to be too low to be of biological significance.

In a 2006 review by Pope and Dockery, two of the main protagonists for the theory that PM₁₀ is an important cause of ill-health, the various statistical manipulations of the data were detailed. The need for these multiple manipulations raises concern about the validity of the evidence. Pope and Dockery acknowledged the 'scepticism about these studies' and that 'uncertainties in estimating such small effects legitimately create some doubts or concerns regarding the validity or accuracy of these estimates.' That statement is important not only because the effects are so small but because it acknowledges that much of the assessment was based on estimates rather than measured observations.

To claim that an observed association of an agent with disease is causative it is necessary to have support from biological evidence and other criteria.

There have been many biochemical, physiological, genetic and toxicology studies of the effects of PM₁₀ but any question of danger to human health has been marginal. For example, in a study of acute effects, in those at risk of allergy and bronchospasm, no effect on lung function measurements was found with exposure to wood smoke in a concentration of 400micrograms/m³ for 3 hours in a climate chamber.

Chronic effects are more difficult to attribute to a single cause and careful epidemiological studies supported by valid clinical findings are needed. The problems with the studies that have been done in relation to PM₁₀ include:

1. The criteria for causation have not been met.
2. Most studies have tried to link PM₁₀ levels, usually measured at a single site, with mortality statistics for a wider area. This is open to huge error.

3. The quality of medical and pathological diagnoses in individuals is open to criticism.
4. The statistical significance in the studies has been weak, and often dependent on estimates.

Despite these issues and doubts the Ministry for the Environment adopted severe standards and regulations.

There have been a large number of epidemiological studies of varying quality, relevance and significance over several years. Assessment of these is complicated and technical and since this has been carried out by the World Health Organisation's expert group, we would suggest that their conclusions should be accepted by this review.

The '**Review of evidence on health aspects of air-pollution**' was published in 2013. It was overseen by nine acknowledged world experts, with the help of 29 expert authors and 29 external reviewers. It represents the most authoritative current statement about air pollutants and health derived from the best current evidence. It helps to overcome the confusion of information that exists, partly due to assumptions, estimates, and extrapolations used in many studies. The review is clear that $PM_{2.5}$ is a more appropriate indicator of the general level of air pollution than PM_{10} . It has four main conclusions concerning factors that cause harmful air pollution:

1. Most evidence accumulated so far is for an effect of motor vehicle exhausts especially diesel.
2. Coal combustion results in sulphate-contaminated particles for which there is strong evidence of adverse effects.
3. Exposure to residential wood combustion only **may** be associated with respiratory and cardiovascular health.
4. **Long-term** (years) of exposure to $PM_{2.5}$ is required for association with mortality and morbidity. Whilst this exposure requirement makes its toxic significance rather weak, the authors state that the evidence is even weaker for PM_{10} .

It is likely that if air contaminants reach a significant level, those most likely to cause health problems are the well-recognised agents: nitrogen oxides, sulphur dioxide, ozone and polycyclic aromatic hydrocarbons; and photochemical reactions between them. Unfortunately, preoccupation with PM_{10} diverted attention from these agents.

The other issue is that where these noxious agents are produced is critically important as their effect is local and their persistence in the air relatively short-lived.

The continuing assertion by Environment Canterbury that PM_{10} causes ill-health is surprising given the W.H.O. review. The W.H.O. experts are clearly not impressed by the lack of strength of the association, the use of estimates, possible confounding factors or the biological plausibility of the theory. The W.H.O. Review puts PM_{10} more in the position of an innocent bystander.

In our view, the best current evidence makes untenable the claims by Environment Canterbury that PM₁₀ is a serious danger to human health.

3. THE APPLICATION OF THE SCIENCE IN POLICY FORMULATION.

This statement explains our submissions on: P1-1 para 6
P1-4 para 6
P1-5
P1-6
P6-1 para 4
6.22 P6-2
P2-3 para 7

The Prime Minister's Chief Science Advisor, Sir Peter Gluckman has stated three conditions necessary for policy formulation based on science: First, public trust in the process, secondly that the process has established incontrovertible fact and third that there is complete separation of scientific advice and policy judgement.

Public trust has been compromised in relation to air quality management in Christchurch by the heavy-handed 'public relations' campaigns in the Press and through the mail. When there was public concern about domestic heating, Environment Canterbury took out three full-page advertisements on consecutive days and then advertised several times a week to try to convince people of its position. The refusal to allow replacement wood burners to be installed in the new houses of those whose homes had been destroyed by earthquake caused significant distress. Parents of young children with chronic respiratory disease, for example cystic fibrosis and asthma, were very anxious. There is concern about being dependent on one source of heating. There is doubt about the reasonableness of the strategy. The invitation for neighbours to inform on a neighbour with a smoking chimney did not increase the general sense of trust in the process.

Acceptance by citizens that the policies are based on incontrovertible fact is complicated. On the one hand, with all the propaganda, people have come to feel that they have no option but to agree. On the other, there is concern about whether the policies exhibit common sense. The evidence about the underlying science which we have submitted shows that the policies are not consistent with the most authoritative international understanding and are not based on incontrovertible fact.

There is real concern that interpretation of the scientific evidence has been clouded by policy considerations. The policies were formulated by the Ministry for the Environment in 2003, and it has claimed that the causal role assigned to PM₁₀ was based on a 'weight of evidence' approach. Whilst 'weight of evidence' may be appropriate for many policy decisions it is not usually adequate in science. As Popper so elegantly argued, the scientific method is not about reassuring yourself that you are right but confirming that you are not wrong. Any valid single piece of evidence can disprove an assumed fact and thus demand a new paradigm.

Popper also pointed out that it is more productive in policy formulation to take a moderate approach initially. This allows the policy to either be strengthened or

softened according to early outcomes, to avoid the sort of situation that has developed in relation to PM₁₀ in New Zealand.

It is unfortunate that the Ministry for the Environment took an uncompromising position in 2004, imposing extreme standards for a 24-hour average limit for PM₁₀. These air quality standards (the NESAQ) were based on a scientific misconception in relation to PM₁₀. **Probably the most serious policy error was to convert a WHO guideline into a legal standard.** The arguments used to support this decision included: greater certainty, giving greater ease for regional councils to develop regional plans, giving greater status to air quality as an environmental issue, increasing leverage for the Ministry over other departments, and achieving a favourable international view of New Zealand's seriousness towards environmental management.² Was it reasonable or ethical to resort to considerations of power and status to gain support for NESAQ?

To define a standard creates the illusion that there is greater accuracy than in fact exists and that regulations deriving from it can encompass all places and situations. The measurement of an agent can be reasonably accurate for a local site. It does not represent the concentration of the agent over a wider area.

In 2009 Dr Smith, the Minister, announced a Review of the regulations "prompted by concerns with the stringency of the standard, a lack of equity for industrial air pollution sources and to difficulty in achieving the target." In the subsequent report "Clean Healthy Air for All New Zealanders" he signed a foreword which included the statement: "The challenge for government - both local and central - is how to **compel** people to take action to improve the quality of their air." Environment Canterbury, as a regional administration, was expected to prosecute the regulations and this statement by the Minister will have influenced its approach to its programme.

We have tried on numerous occasions to bring the accumulating scientific evidence to the attention of Environment Canterbury officers, beginning with Dr Brian Jenkins in 2007 and 2010. Unfortunately this appears either to have been given little credence or considered inconsequential in the face of the Ministry's position. It is bewildering that the World Health Organisation's 'Review of the Health Aspects of Air Pollution' has had no impact on Environment Canterbury's plan. This Review was brought to the attention of the Commissioner and the chief author at an early stage of development of this plan.

Environment Canterbury has had difficulty facing the issues because it is not only subservient to the Ministry for the Environment but the Commissioners have a special loyalty to central government. They should now take note of the decision by the Auckland Council to take no further action on wood-burning until the National Environmental Standards for Air Quality have been reviewed, as suggested by the Parliamentary Commissioner for the Environment. Auckland's demonstration of unwillingness to comply with diktats based on inadequate assessment of the science, may be a portent.

4. ECONOMIC AND SOCIAL CONSEQUENCES OF THE AIR PLAN.

This presentation deals with our submissions on: P1-4 para 6
P1-5
P6.28 – 6.33 P6-3
P2-4 para 2
P4-68

The social consequences of the proposed Canterbury air plan are pervasive, the economic consequences to the community are large and for a significant number of individuals they are profound. When such proposals were mooted they should have been underpinned by thorough, detailed, health and economic impact assessments.

The negative effects of strict standards and legal regulations derived from them include: loss of security in home heating, creation of a serious economic situation for the less affluent, endangering the health of the elderly, the very young, and those with chronic disorders, waste of taxpayer and ratepayer funds, and important opportunity costs.

Whilst reduction in wood-smoke may have an aesthetic appeal to some, its health benefits are minimal. We have detailed the evidence that exposure to cold is a much more important health problem. The important air pollutants are sulphur dioxide, nitrogen dioxide, ozone, polycyclic hydrocarbons and metals such as arsenic and lead. These are what lead to the toxic atmosphere in some large cities. Obsession with PM₁₀ has misled efforts away from them.

The concentration on PM₁₀ has mistakenly directed energies against wood burners when they should have been directed at motor vehicle emissions and the burning of coal. The policy of trade-offs for industry, based on the PM₁₀ concept, will allow the production of dangerous chemicals in areas which are populated. For example, the Canterbury District Health Board has decided to install coal-fired burners in its new energy centre, that will burn 11,900 tonnes/year. The imposition of this impact in a populated area would best have been avoided. Environment Canterbury gave Resource Consent with 'guidelines' limiting the sulphur content of the coal and the emission levels of sulphur dioxide. The Emissions Trading Scheme opened the way for such permission.

Whilst this decision made economic sense to the Board, it makes no sense for the long-term health of the community. The fact that provision at additional cost is being made for future options to convert to wood chip or biomass fuel suggests that the Board was uneasy about the health and environmental implications of its decision. This case illustrates the dilemmas that ensue when confused interpretation of scientific evidence is elevated into legislation.

We are not in a position to make an adequate economic assessment of the proposed Canterbury Air Regional Plan, but some things are clear. The removal and disposal of older wood-burners has been an unnecessary expense. The health impact assessment by the Canterbury Health Board group pointed out the severity of fuel poverty in Christchurch and the likelihood that this would be made worse. Orion in 2007 predicted a 10% increase in the price of electricity due to increased generation and line costs as Christchurch converted to electricity. Given the expense of conversion

from wood burners to alternative heating and the increased running costs, the outcomes predicted by the health impact assessment have occurred. Some people have been unable to afford sufficient heating to keep warm.

In June and July the news media made us aware of people with inadequate draughty housing who have been at great risk because they cannot afford to pay for electricity. Some elderly people were staying in bed for up to three days to keep warm.

There have been significant outages of electricity due to storms. These events put people at risk of cold exposure. Because of restrictions on the installation of heating appliances, people living in new housing developments are now at greater risk of cold exposure if outages occur.

The opportunity costs of Environment Canterbury's programme have been significant. They include the loss of effective input into transport, housing and industrial reconstruction for the new Christchurch. The energy and effort consumed by the irrational regulations could have been spent more positively contributing to the aim for the city to be a place in which to "live, work, play, learn and visit." Attempted justifications of the PM₁₀ theory have led to the need for expensive public relations campaigns. This has also wasted efforts of staff.

Given the direct costs and the opportunity costs that have been incurred in implementing the current National Environmental Standards for Air Quality, Environment Canterbury and the Ministry for the Environment may well feel they have a compelling reason not to change their position. Be that as it may, the future repercussions of continuing with the current approach to PM₁₀ will lead to even worse problems and greater unnecessary costs.

RECOMMENDATIONS:

1. That approval of the proposed Canterbury Air Plan be deferred and that restrictions on the use of wood-burners be suspended.
2. That Environment Canterbury joins the Auckland Council to ask for a thorough, independent review of air pollutants and NESAQ.
3. That the concept of a standard is discarded and an annual average guideline for PM_{2.5} is adopted as an indicator of the general level of air-pollution in a locality.
4. That PM_{2.5} is measured at reliable and representative monitoring sites.
5. That monitoring of specific noxious chemicals such as sulphur dioxide and nitrogen oxides is undertaken at localities of risk.
6. That the regulations requiring the replacement of older wood burners be suspended and regulations affecting new homes are made more flexible.
7. That the overriding importance of exposure to cold should be acknowledged in any new regulations.

References:

1. The Asthma Foundation "2014 Update on the Impact of Respiratory Disease." 2015
2. Review of the New Zealand Ambient Air Quality Guidelines Consultation Meetings, Wellington, March 2000. Ministry for the Environment.

