Description of the Problem

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Workshop on Current Issues Regarding NO_2

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Description of the problem

- Nitrogen dioxide is one the classical outdoor air pollutants
- A wide range of effects on health have been found by epidemiological studies to be associated with NO_2
- WHO has recommended both short- and long-term guidelines which have been translated into standards
- The annual average Limit Value (40µg/m^3, annual average) is difficult to meet, at least at some sites

Description of the problem

And yet, NO_2 has faded a little, from current thinking about the effects of air pollutants on health.

We focus on particles and on ozone.

Sulphur dioxide and carbon monoxide are now less of an outdoor problem than they were.

Description of the problem

In the UK: policies are cost-benefit tested

This requires coefficients that are firmly based on associations regarded as causal.

And here is a problem: how many of the coefficients linking NO_2 and effects on health do we regard as causal?

Description of the problem

Nitrogen dioxide may have:

Primary effects: the effects of exposure to NO_2, per se.

Secondary effects: the effects of ozone and nitrate particles: formation dependant on NO_2

And may be associated with "effects" by virtue of its acting as a **surrogate, an index or marker**, for other pollutants.

Here is the central problem:

What evidence do we have for these primary, secondary and surrogacy effects?

Description of the problem

Primary effects: if true, we should control emissions of NO_2 or, perhaps, exposure to NO_2

Secondary: if true, we have options: there may be better ways of controlling the production of ozone and fine particles than by controlling emissions of NO_2.

> This conceals a further problem: to what extent do nitrate particles contribute to the toxicity of the aerosol we monitor as $PM_{2.5}$

Surrogacy: if NO_2 is a non-toxic surrogate for some other pollutant (or pollutants), then controlling NO_2 will only lead to a **predictable** reduction in effects on health if the ratio of NO_2 to the active component(s) remains constant.

Why has NO_2 faded from our research thinking?

- In part due to the focus on particles.
- In part due a belief in the efficacy of reducing surrogates.
- In part: NO_2 is difficult: the exposure-response curve defined in chamber studies does not suggest effects at low concentrations with the certainty we would like.
- Funding for work on NO_2 has been less generous than for work on particles?

The problems of standard setting

Consider the WHO AQG for long-term average concentrations of NO_2

- Difficult meetings over many years!!! (It seemed easier years ago!!!)
  - IPCS 1997 report leant heavily on evidence from studies of indoor concentrations and effects on respiratory infections in children.
    - WHO unable to do any better
      - Recognised the IPCS recommendation
        - Repeated visitations failed to improve on this
          - EC adopted the WHO AQG
            - LV: 40µg/m^3 annual average

Broad questions

1. How much benefit to health does conformation with the annual average Limit Value confer?

2. How cost-efficient is conformation with this Limit Value?

3. What research do we need to put in hand to answer these questions?

More focused questions (1)

1. What does the evidence say about the primary effects on health of long term exposure to NO_2?
2. What does the evidence say about the effects of intermittent exposure to long-term average concentrations of NO_2?
3. What does the evidence say about the likely causality of associations between effects on health and long term average concentrations of NO_2?
4. What research do we need to disentangle the possible primary effects of NO_2 from the effects of particles?
5. How reliable is the surrogacy argument as a basis for improving health by reducing long term average concentrations of NO_2?

More focused questions (2)

6. Does the evidence point to sub-groups of greater than average sensitivity or susceptibility to NO_2?
7. What is the relationship between reducing concentrations of NO_2 (as monitored for compliance with the Limit Value) and reducing exposures to NO_2?
8. Would it be possible to improve monitoring with a view towards improving the link between exposure and long term average concentration and thus improving the prediction of benefits?
9. What research do we need to do to be able to calculate the benefits to health of reducing the annual average concentration of NO_2 (as monitored to assess compliance with the annual average Limit Value).

More focused questions (3)

10. What is the likelihood of our answering these questions by taking only studies of the effects of outdoor exposure to NO_2?
11. Has any new evidence appeared since the last WHO AQG review that suggests the current long term AQG might be usefully revised?