New developments in the methodology for Cost-Benefit Analysis

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Benefits analysis: Methods

- Developed since 1991 – ExternE project and follow on work
- Policy analysis since 1996
  - Acidification Strategy
  - Ozone, NEC Directives
  - Daughter Directives on air quality
  - Clean Air For Europe / Thematic Strategy
  - UNECE – CLRTAP Protocols
  - etc.

Benefits analysis: Pollutants considered

- Effects of releases of NH_3, SO_2, NOx, VOCs, PM on concentrations of…

- …primary and secondary particles, ozone, SO_2, etc.

Specific effects of trace elements not explicitly accounted for

Benefits analysis: Receptors considered

- Earlier work:
  - Human health (primary and secondary particles and ozone)
    - Mortality
    - Morbidity
  - Materials (SO_2)
  - Crops (O_3)
  - Ecosystem effects quantified only in terms of exceedance of critical loads and levels for nutrients and acidity

For this presentation we focus on developments in:

- Mortality assessment
  - Provides the largest benefits
- Ecosystem assessment
  - The most significant omission from past analysis

Mortality assessment (1)

- Long term exposure to fine particles
  - Metric: annual average $PM_{2.5}$ with no threshold
  - Risk factor: 6% change in mortality rate / $10 \mu g.m^{-3}$
  - Quantified for population over 30 years
  - Analysis based on life table methods
  - Result in terms of life years lost and associated deaths

Mortality assessment (2)

- Short term exposure to ozone
  - Metric: SOMO35
  - Risk factor: 0.3% change in mortality rate / $10\mu g.m^{-3}$
  - Quantified against all cause mortality
  - Analysis based directly on mortality rate
  - Result in terms of associated deaths

Mortality assessment (3)

- Infant mortality from PM exposure
  - 1 month<children<1 year
  - Metric: annual average $PM_{2.5}$ with no threshold
  - Risk factor: 4% change in mortality rate / $10 \mu g.m^{-3}$
  - Analysis based directly on mortality rate
  - Result in terms of associated deaths

Long term exposure and mortality: Alternative models investigated

- Long term exposure to $PM_{2.5}$ linked to all cause mortality
  - CAFE-CBA, EC4MACS to date, USEPA, ExternE, old WHO Global Burden of Disease

- Long term exposure to $PM_{2.5}$ and ozone linked to cause specific mortality
  - $PM_{2.5}$: lung cancer and cardiovascular mortality
  - Ozone: respiratory mortality
    - New WHO Global Burden of Disease

Proposal for NEC and Gothenburg revisions

- Continue with CAFE model based on all-cause mortality

- Sensitivity analysis using cause-specific mortality
  - Proposal accepted by TFH
  - Could show a greater role for ozone than previously described

Other issues considered

- Mortality
  - Conversion of the cause-specific data into usable response functions for our work
  - Lag between exposure and effect
  - Effect of variation in population structure in different countries, at different times
  - Differentiation between particle types
- Morbidity functions
  - Recent European research (Sapaldia, etc.)

Valuing mortality

- CAFE position
  - 2 estimates for VOLY (€52k, €120k)
  - 2 estimates for VSL (€0.98, €2M)

- Recent work
  - EC-DG Research funded NEEDS Project
  - New estimate for VOLY of €40k

Position agreed with Commission

- Retain CAFE-CBA position
- Apply €40k estimate in additional sensitivity analysis

Treatment of uncertainty

- Well developed already for the benefits component of the CBA

- Further work on uncertainties generally across related models being undertaken this year under the EC4MACS Project

Treatment of ecosystems

- Still no great progress in valuing damage to ecosystems

- Focus on moving analysis closer together and on making ecosystem effects more visible as part of the analysis

Examples

- New approaches from CCE Status Report 2009:
  - Quantification of risks to Natura 2000 sites
  - Development of relationships with ecosystem service indicators
  - Use of species diversity indicators
  - etc
- Use of photographic evidence to highlight the type of damage occurring

Summary of progress

- Consideration given to new health response functions

- Short cut methods being developed for materials and crop damage

- Moving towards better integration of ecosystem effects (though full incorporation of them into CBA remains some distance away)

- Development of more integrated uncertainty assessment via EC4MACS

Effect on results

- Core analysis:
  - Results will not change a great deal
  - Some higher emphasis on ecosystem effects, but still not monetised
- Sensitivity analysis
  - Potentially greater role for ozone via cause-specific mortality analysis