Interaction of Metrology and the Assessment of Health Effects
Particle metrology and the assessment of health effects

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john.mcaughey@aeat.co.uk

Structure

- Particles and Health
  - causality of PM$_{10}$ exposure
  - causality of VPE exposure
  - economics
- Measurement Programmes
  - emissions data
  - ambient data
  - alternative metrics
- Legislation
  - timeline
  - metrology community input
## Studies of Health Effects

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## Causality of PM$_{10}$ Exposure

- Strong case for causality on public health grounds versus Bradford Hill criteria
- 8 500 early deaths per year in UK from 430 000 deaths (epidemiology calculation)
- Similar magnitude of response in WHO study in Austria, Switzerland and France
- Health costs 1.7% of GDP
Causality of VPE exposure

Current
- Currently calculated on %PM$_{10}$ attributed to vehicle emissions
- 30% vehicle contribution typical measured or calculated (UK, WHO)
- no discrimination of particle size and composition differences

New studies
- new epidemiology studies accounting for direct VPE exposure in progress
- Wichmann studies in Erfurt and other European centres
- Pershagen, Sweden
- associations observed with VPE components

US National Research Council (1998)
- Priorities for research programme on PM health effects
- 10 year plan
- $450M budget
- Announcement of 5 US ‘Centres of Excellence’ this year
Legislation

Emissions timeline
- Euro III, IV, V and equivalent legislation world-wide projected forward to 2008
- Reviews in 2002/2003
- Role of after-treatment
- Is particle number legislation?:
  - relevant
  - necessary - if so, when?
  - practical - if so, how?

Ambient timeline
- 'New' PM$_{10}$ and PM$_{2.5}$ legislation under review
- Review process in 2002/2003
- Forward projections to 2010 imply cleaner air but from emissions reductions
- Need for discriminated, epidemiology and toxicology mechanisms

Measurement comparison
- 'Informal' to date
- 2 x annual meetings of 'users' in Zurich to exchange data (1997/98)
  - multiple presentations
- EC DG3 programme to establish e-network of metrology experts
- Questionnaire
Key uncertainty factors

**Emissions**
- Dilution & Ageing
- Size Range
- Sample Residence Time, T, RH & system build
- Sampling
- Instrument Choice
- Data Processing
- Pre- and post tailpipe factors
- Composition

**Ambient**
- Dilution effects
- Ageing effects
- Loss of Volatiles
- Dispersion effects
- Environment Factors (T, RH, wind speed)
- Attribution of VPEs to particle mix

Conclusions

- PM$_{10}$ exposure is effectively causal wrt reported health effects; evidence for VPEs is indirect only; but new studies underway
- Improved metrology knowledge of particle sizing and composition
- Plausible mechanistic hypotheses under active investigation
- Particle metrology skills (size and composition) important across research areas
- Scope for e-network of metrology experts via questionnaire, then WWW site