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                           assessment under the Air Quality Standards
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Non-technical Annex on UK supplementary modelling assessment under the Air Quality Standards Regulations 2010 for 2023

Introduction

This note provides a short summary of modelling methods that have been used within the assessment of air quality in the UK for 2023.

Legislation

The United Kingdom (UK) is required to undertake an air quality assessment on an annual basis by the Air Quality Standards Regulations 2010 (AQSR) (*Legislation.Gov.Uk*, 2010). This assessment takes the form of comparisons of both measured and modelled air pollutant concentrations with the various threshold concentrations that are set out in the regulations (limit values, critical levels, target values and long-term objectives).

The air quality assessment includes assessments for:

- sulphur dioxide (SO_2)
- nitrogen dioxide (NO_2)
- particles (PM_{10})
- lead (Pb)
- benzene (C_6H_6)
- carbon monoxide (CO)
- fine particles ($PM_{2.5}$)
- ozone (O_3)
- arsenic (As)
- cadmium (Cd)
- nickel (Ni)
- benzo(a)Pyrene (B(a)P).

Modelling methods and inputs used

The national modelling methodology varies between pollutants. Modelling has been carried out at a 1 km x 1 km resolution for all of the pollutants apart from carbon monoxide, for which modelling is not required. For some pollutants concentrations are higher close to busy roads. Modelling of roadside concentrations has therefore been included for NO_2, PM_{10}, $PM_{2.5}$ and benzene. The models have been designed to assess compliance at locations defined by the AQSR as relevant for air quality assessment.

The 1 km x 1 km background maps are made up of several components, which are modelled separately and then added together to make the final map of concentrations across the UK. These individual components (supplemented by some additional components for certain pollutants) are:

- Large point sources (such as power stations, steel works and oil refineries),

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- Small point sources (such as boilers in town halls, schools or hospitals and crematoria),
- Distant sources (characterised by the rural background concentration),
- Local area sources (such as road traffic, domestic (homes) and commercial (shops offices and factories) combustion and agriculture).

The ADMS air dispersion model is used to calculate concentrations of pollutants in the air from the rates of emissions. For many pollutants the models are calibrated to ensure good agreement with measurement data from the national air quality monitoring networks.

Roadside concentrations are calculated as the sum of the background concentration and a contribution from the emission from the local road. The ADMS-Roads air dispersion model is used to calculate concentrations of pollutants close to roads from the emissions from traffic on these roads.

Key input data for the modelling include:

- Estimates of emission rates from the UK National Atmospheric Emissions Inventory.
- Meteorological (weather) data from a numerical weather prediction model.

Sources of pollutants

Road transport is the dominant source for NO_2 at most locations.

SO_2 concentrations are most strongly influenced by industrial emissions.

PM_{10} and $PM_{2.5}$ include contributions from a range of sources. These include contributions from particles formed in the air as a result of chemical reactions (secondary aerosols) and wind-blown dusts. Domestic combustion, traffic (exhaust emissions, brake wear, tyre wear and road abrasion) and industry also contribute in urban areas.

For the heavy metals (As, Cd, Ni, Pb) the main sources are regional background, resuspension of dust and industry. Domestic combustion is an important source for Ni as are specific industries.

The dominant sources for B(a)P is domestic combustion, with contributions from some specific industries.

Results of the air quality assessment

The UK has been divided into 43 zones for air quality assessment. The comparison of the concentrations in each zone with the threshold concentrations was published in September 2024 and is summarised here.

Nine zones have not achieved compliance with the annual NO_2 limit value in 2023 (Greater London, West Midlands, Greater Manchester, West Yorkshire, Liverpool, Nottingham, Bristol, Coventry/Bedworth and South East).

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For Ozone the target values for health and for vegetation were met in all zones. The long-term objective for health was exceeded in forty two zones and the long-term objective for vegetation was exceeded in thirty zones in 2023.

Three zones (Sheffield, South Wales and Yorkshire & Humberside) have not achieved full compliance with the annual target value for Ni. Two zones (Swansea and South Wales) have not achieved full compliance with the annual B(a)P target value in 2023.

For the remaining pollutants (PM_{10}, $PM_{2.5}$, SO_2, CO, Benzene, Arsenic, Cadmium and Lead) there were no exceedances of the target values, critical levels, limit values or exposure concentration obligation in 2023.