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Particulate Matter (PM_{2.5} targets) in the Environment Act: Monitoring Assessment Methods

The 25 Year Environment Plan sets out our goal of achieving cleaner air, to reduce the environmental and health impacts of air pollution. In addition, the Clean Air Strategy, published in 2019, outlined a comprehensive suite of actions required across all parts of Government to improve air quality and maximise public health benefits. As part of this, the Environment Act 2021 was established, and this required long-term targets to be set for fine particulate matter (PM_{2.5}). These have been set through the Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 and are as follows:

- Annual Mean Concentration Target ('concentration target') – a target of 10 micrograms per cubic metre ($\mu\text{g m}^{-3}$) to be met across England by 2040.
- Population Exposure Reduction Target ('exposure reduction target') – a 35% reduction in population exposure by 2040 (compared to a base year of 2018).

There is a legal requirement for the targets to be achievable and also objectively measurable.

Existing data quality objectives for PM_{2.5} monitoring

A range of PM_{2.5} air quality monitoring instruments are currently deployed on the UK network to assess the concentrations of PM_{2.5} in England and these data are routinely provided on UKAIR (<https://uk-air.defra.gov.uk/data/>). The following Data Quality Objectives apply to such data:

- Data capture of 85%. This means that the instrument must be operational (and have valid data) for 85% of the period over which the concentration is being assessed (i.e. 85% of the year for an annual mean).
- Measurement uncertainty of 25% (at the limit value). This means that there is an acceptable level of uncertainty to allow for the natural measurement fluctuations that can occur when monitoring, but also acts as a minimum performance criterion for instruments.

PM_{2.5} Standard Methods

The European Committee for Standardisation (CEN) has produced a series of Standard Methods for monitoring air pollutants. These form part of the British Standards Institution (BSI) standards documentation, and they outline minimum performance requirements for analysers in order to ensure measurement methods comply with the Data Quality Objectives (DQO) and Air Quality Limit Values as set out in Air Quality Standards Regulations 2010 (and amending regulations). These also include the methodology for determining uncertainty.

For PM_{2.5} and PM₁₀ these are as follows:

- **BS EN12341:2014 Ambient Air.** Standard gravimetric measurement method for the determination of the PM₁₀ or PM_{2.5} mass concentration of suspended particulate matter – the "Reference Method".
- **BS EN16450:2017 Ambient Air.** Automated measuring systems for the measurement of the concentration of particulate matter (PM₁₀; PM_{2.5})

The "Reference method" describes the operating methodology for gravimetric samplers. However, gravimetric samplers require laboratory weighing of filters before and after exposure. Due to the time required to weigh the exposed filters and analyse the results, these data cannot be used for wider purposes such as providing near real time, hourly information to the public. The second standard above (BS EN16450) sets the minimum performance requirements and test procedures for the type testing of these more automated continuous measurement systems for particulate matter which are able to provide near real time data. It also includes the evaluation of its equivalence with respect to the reference method.

This means that alternative techniques can be used where "equivalence" with the reference method can be demonstrated in accordance with the requirements for automated measuring systems. These alternative techniques are determined through an exercise of undertaking comparisons between its preferred method (a "candidate" method) with that of the "reference" method. A procedure for the demonstration of this equivalence has previously been defined and provides the principles and methodologies to be used, and is set out in the Guide to the Demonstration of Equivalence of Ambient Air Monitoring Methods

(<https://circabc.europa.eu/ui/group/cd69a4b9-1a68-4d6c-9c48-77c0399f225d/library/17ef508b-3aab-450e-b511-72f8a9892d48/details>). (GDE 2010) as well as BS EN16450 for certification. This includes the performance of a series of field tests for confirmation of the findings of the laboratory tests in which the candidate method is tested side-by-side to the reference method.

In addition to GDE 2010, Defra has developed in partnership with the Environment Agency an additional level of certification through the MCERTS scheme which requires all instruments to demonstrate equivalence in a representative particulate matter pollution climate for the UK. This certification is called "MCERTS for Particulate Matter UK (<https://www.gov.uk/government/publications/mcerts-performance-standards-for-ambient-monitoring-equipment/mcerts-performance-standards-for-ambient-monitoring-equipment>)". The following provides information on the Environment Agency Certification process and lists those instruments that have demonstrated equivalence to date and therefore have received approval from Defra for use in the UK Certification - MCERTS for UK Particulate Matter - Defra, UK. (<https://uk-air.defra.gov.uk/networks/monitoring-methods?view=mcerts-scheme>)

Monitoring for the purposes of the 2023 Regulations

For the purposes of assessing with respect to the Environmental Targets (Fine Particulate Matter) (England) Regulations 2023, it is recognised that these systems will need to evolve. However, this will take time and therefore, Defra will ensure that the above standards, continue to be applied but should be read with the following in mind:

- a) any reference to a competent authority is to be read as a reference to the Secretary of State;
- b) any reference to a member State is to be read as a reference to England;

Future proposals for equivalence

BS 12341, BS 16450 and the GDE are all in the process of redevelopment and will be revised in due course. In the meantime, the equivalence framework will continue as above to maintain consistency in support the requirements of the new PM_{2.5} Target legislation but these will be reviewed in the future to ensure ongoing suitability. This is so that the programme can be adapted to reflect the performance of the instruments and expanded uncertainty once assessed with respect to the new target levels as well as in response to the changing nature of PM_{2.5} (i.e. reducing levels and changes in composition) in England over time.

Accuracy and precision of measurements / Quality Assurance

To ensure the accuracy and precision of measurements in relation to the assessment of ambient air quality it is important that appropriate competent bodies are appointed to approve measurement systems (methods, equipment, networks and laboratories); ensure the accuracy of measurements (traceable in accordance with the requirements set out in Section 6.5 of the BS EN ISO/IEC 17025:2017).

Air Quality Monitoring Methods (<https://uk-air.defra.gov.uk/networks/monitoring-methods>)

Standard Methods for monitoring and UK Approach (<https://uk-air.defra.gov.uk/networks/monitoring-methods?view=eu-standards>)

Particulate Matter (PM_{2.5} targets) in the Environment Act: Monitoring Assessment Methods (<https://uk-air.defra.gov.uk/networks/monitoring-methods?view=PM-Environment-Act-MonitoringMethods>)

Certification - MCERTS for UK Particulate Matter (<https://uk-air.defra.gov.uk/networks/monitoring-methods?view=mcerts-scheme>)

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