Enhancing integrated management of atmospheric pollutants within the Local Air Quality Management and Local Pollution and Prevention and Control regimes - using nitrogen dioxide as a focus.

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Abstract

Management of local air quality in Wales is undertaken by 22 local authorities under the Local Air Quality Management (LAQM) regime. Similarly local authorities regulate the majority industrial installations under Local Pollution Prevention and Control regime (Local PPC). The national government of Wales, the Welsh Government, is responsible for overseeing the operation of these. Their successful implementation is crucial to it meeting its European Union obligations under the Air Quality and Integrated Pollution Prevention and Control Directives.

The current approach under LAQM manages air pollutants individually, implementing actions where necessary to achieve statutory ambient air concentration thresholds. However, many pollutants are intrinsically interrelated. Such interactions can be either via direct chemical relationships or through indirect knock-on effects from implemented management measures. Nitrogen dioxide (NO_2) is one such pollutant and its ambient concentrations exceed thresholds in many locations across Wales. This thesis explores the direct and indirect interrelationships between NO_2 ozone (O_3), volatile organic compounds (VOCs) and particulate matter (PM) using a numerical dispersion modelling based method. It also explores how the effectiveness of existing local management regimes could be improved by accounting for and incorporating pollutant interactions into their frameworks.

The research identifies the potential for enhancing LAQM by developing measures to reduce concentrations of NO_2 on an integrated basis. All potential influences on NO_2 concentrations are identified as a series of 'impact pathway parameters'. A series of modelling scenarios that are representative of Welsh local air quality environments are used to investigate the extent to which each impact pathway parameter affects NO_2 concentrations whilst also of the directly interrelated pollutants of O_3, VOCs and indirectly interrelated PM. Results illustrate increases of up to 70.56% and decreases of up to 49.56% in NO_2 concentrations for individual impact pathway parameters are applied. Similarly increases of up to 102.91%, 2316.25% and 3.52% and decreases of up to 16.79%, 100.00% and 25.66% are observed for O_3, VOCs and PM respectively.

Outputs from the modelling assessment are then used as a basis to develop outline management options for reducing NO_2 concentrations. However, these options also consider potential effects on the O_3, VOCs and PM. Of particular significance is the development of local management options focused on

reducing emissions of ‘primary’ NO_2 (*f*-NO_2) for the first time. Reducing PM emissions from road vehicles is linked with substantial increases in *f*-NO_2 and there are benefits in trying to reduce these as a method to also reduce NO_2 concentrations. Options are described in terms of their effect on NO_2 and O_3/VOCs/PM as ‘win-wins’ or ‘trade-offs’. Interactions between pollutants are therefore incorporated into the development of actions to reduce concentrations of NO_2. This approach moves LAQM from managing individual pollutants in silos to an integrated approach.

An options framework providing a mechanism for introducing an integrated approach to the action planning aspect of LAQM is developed. This is considered to be a viable alternative the current approach. It includes consideration of how individual scenario characteristics may influence the effectiveness of derived options. It also outlines that policy, statutory and procedural changes in the management of local air quality in Wales are required to facilitate the uptake of an integrated approach. A key aspect of this is the recommended amalgamation of LAQM and Local PPC into one seamless local management regime.