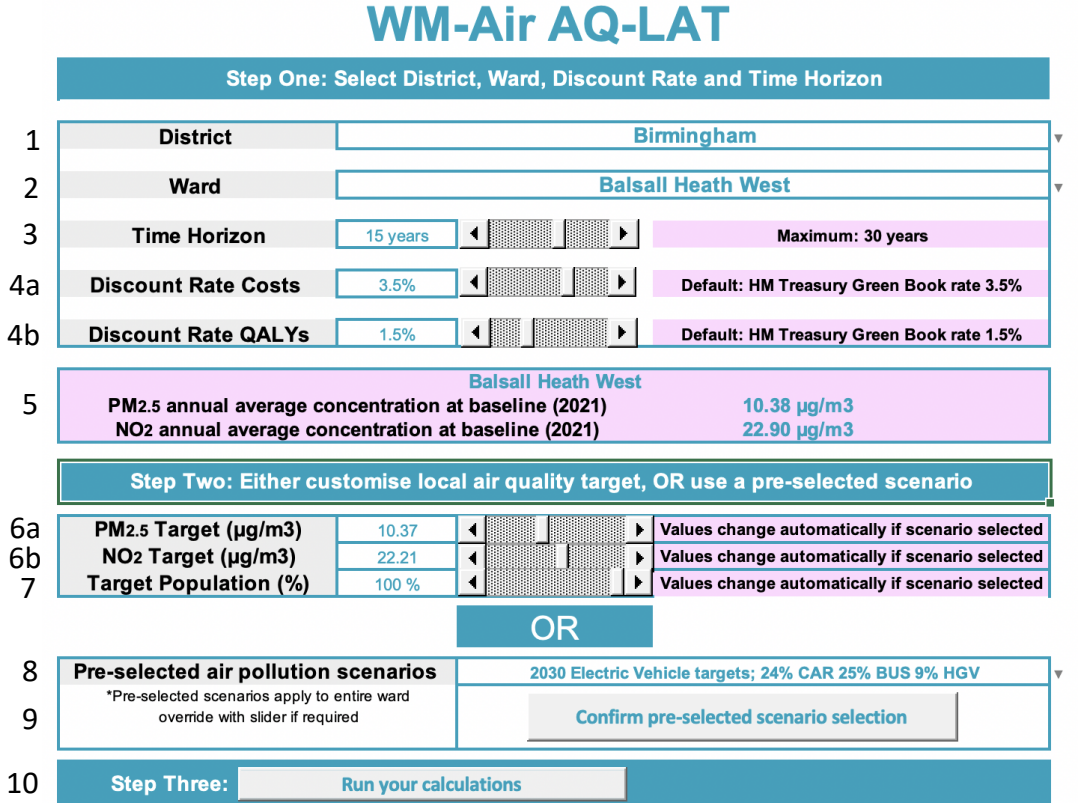
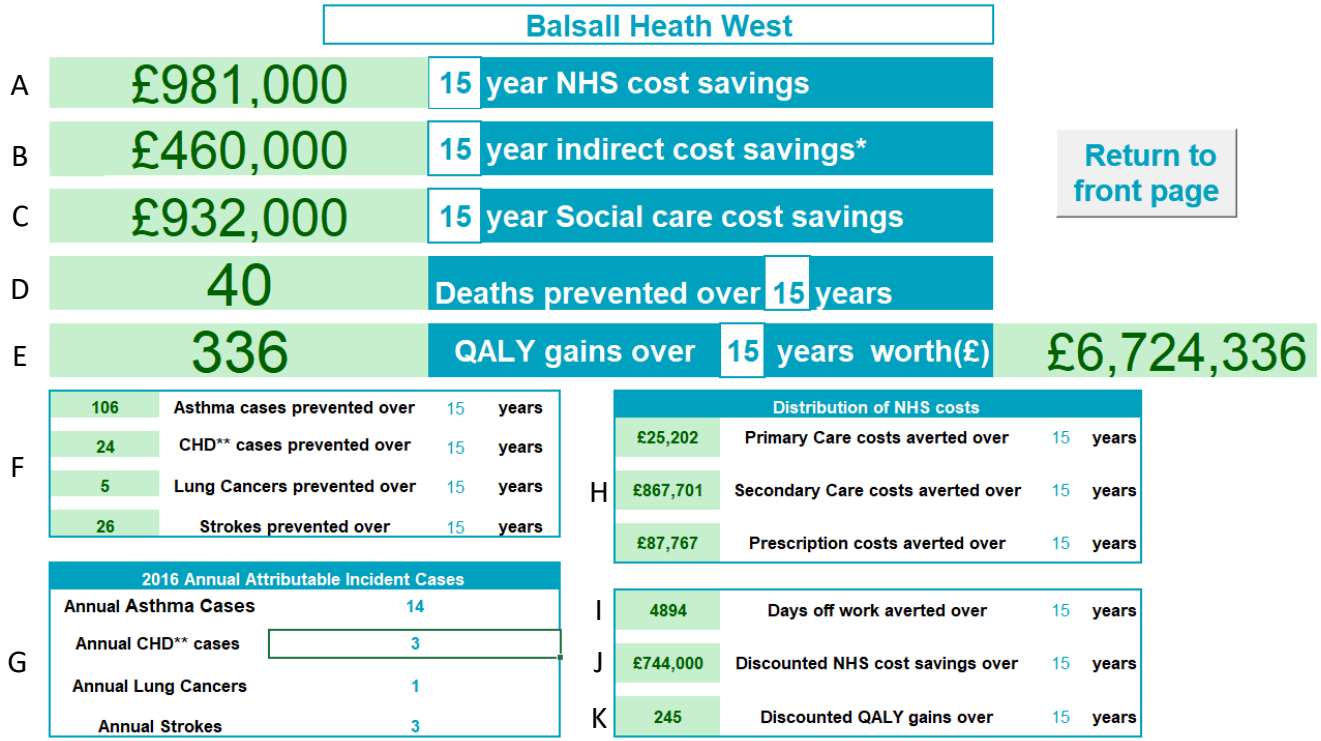
AQ-LAT features





1 **Desired administrative boundary** Click ▼ to activate drop down and select desired local authority
2 **Ward drop down** Click ▼ to activate drop down and select desired ward/all ward option
3 Time Horizon slider Move slider to set the duration for accruing of costs and/or benefits
4a/b Discounting slider Move slider to set rate at which costs and QALYs are discounted. Leave unchanged for HM Treasury recommended rates (See Glossary for further detail on discounting).
5 Annual average air pollutant concentrations (2021) Output shows WM-Air modelled annual average air pollutant concentrations at area level
6a/b PM2.5 / NO2 Target slider Select desired $PM_{2.5}$ /NO_2 for analysis. Selecting a pre-selected scenario will automatically change this value when scenario is confirmed
7 Target population slider Push the slider to select the proportion of desired ward who receive the change in air quality, e.g. selecting 50% will apply the air quality change to only 50% of the population
8 Scenario drop down Click ▼ to activate drop down to choose from preloaded scenario effects
9 Confirm scenario selection button Please press this button after choosing from the drop down to ensure that appropriate pre-selected scenario values load into both $PM_{2.5}$ and NO_2 target sliders
10 Run calculation button Will perform calculations and deliver an output dashboard

A NHS cost change Displays change in public NHS spending only related only to treating core diseases included in the model
B Indirect cost change Change in costs related to time off work for absence related to core diseases included within the model, does not include presenteeism or care costs
C Social care cost change Change in social care costs related to managing core diseases included in the model
D Change in deaths prevented Change in deaths from known all-cause mortality relationship with air pollution, includes mortality impacts from diseases not included in the model.
E Change in QALYs Change in quality-adjusted life years accruing from changes in mortality and cases of core disease included in the model.
F Change in disease cases Change in cumulative incidence in core diseases across time horizon of the model
G Annual attributable incident cases Number of annual incident disease cases related to baseline air pollution exposure
H Distribution of NHS cost changes Subdivides the NHS cost saving (shown in A) into silos
I Change in Days off work Change in workplace absence related only to core diseases included in the model
J/K Change in discounted NHS costs and QALYs This figure applies the discount rates specified in 4a & 4b to the NHS cost changes (shown in A) and QALY changes (shown in E).
*All effects are shown across time horizon chosen in Time Horizon slider (3)

How to use and interpret the AQ-LAT

The AQ-LAT allows users to estimate the future costs and benefits associated with changes in fine particulate matter ($PM_{2.5}$) and Nitrogen dioxide (NO_2) concentrations in the West Midlands Combined Authority area. The output dashboard of the Tool presents incremental changes in health outcomes and various sector costs (outputs A to K) for populations chosen by the user (features 1,2) between two scenarios:

1. A so-called business-as-usual (BAU) case which assumes that annual average air pollutant concentrations remains at modelled 2021 levels (shown in feature 5)*. The BAU case does not include projections about the impact of future changes in air pollution. Accordingly scenarios selected within the Tool ought to be considered changes versus current levels.

2. A comparator scenario using a user-specified scenario. The user can specify a target annual average air pollution concentration for $PM_{2.5}$ (feature 6a) and NO_2 (feature 6b) affecting a specific target portion of the population (feature 7). Alternatively the user may select a specific scenario (feature 8) in which concentration changes are automatically applied to annual average concentrations for $PM_{2.5}$ (feature 6a) and NO_2 (feature 6b). **After selecting a scenario, users must press the Confirm scenario selection button (feature 9).** All pre-loaded scenarios apply to 100% of the ward population only (feature 7). Users may also select a time horizon (feature 3) and a discount rate (feature 4a,4b). Please note that the time horizon will not extend beyond 30 years due to widespread uncertainty associated with extrapolation beyond that period. Once the comparator scenario is selected **the user should press the Run Calculation button (feature 10)**, which will then take the user to the output dashboard. Note, the change in disease cases associated with the air quality change is applied in the model immediately, whilst mortality changes are assumed to carry a lag (progressively introduced over 5 years).

Incremental results from the comparison of the two scenarios are displayed on the output dashboard (Outputs A to F, H to K). Outputs A to F and H and I reflect absolute incremental changes in costs, mortality, quality of life and disease associated with the change in air pollution specified in the comparator scenario, each measure is defined on page 1 ((Outputs A to F, H and K). NHS costs and QALYs (Outputs A and E) are discounted using user specified discount rates (feature 4a,4b) and displayed in Outputs J and K.
Finally, Output G is not an incremental figure, but reflects the current number of new disease cases in one year attributable to current levels of $PM_{2.5}$ and NO_2 air pollution (shown in feature 5).

*For modelled 2021 annual average air pollutant concentrations see Zhong J, Hood C, Johnson K et al. (2021) Using task farming to optimise a street-scale resolution air quality model of the West Midlands (UK) Atmosphere 2021, 12, 983. http://doi.org/10.3390/atmos12080983

How to interpret defined scenarios

WM-Air modelled[1] air pollutant concentrations averaged to ward level* for the following scenarios:

- **2021 Baseline (Business-As-Usual) Scenario**:** Air pollutant concentrations at baseline.

-**2030 Clean Air Strategy (NECD) Scenario**: Emissions reductions for all actions proposed in the 2019 UK Clean Air Strategy[2] including meeting National Emission Ceiling Directive (NECD)[2] commitments by 2030 are assumed. This includes ongoing modernisation of the vehicle fleet, agricultural actions but without the larger, more rapid shifts in the more recent Net Zero strategies.

-**2030 Electric Vehicle Scenario**: Emissions reductions for a greater transition to electric vehicle fleet (24% Car 25% Bus 9% HGV) compared to the Clean Air Strategy scenario are assumed. . Non-exhaust emissions are included as per the current model approach, with emissions pre unit activity taken from CERC's EMIT Atmospheric Emissions Inventory Toolkit (See 1 for further details). No impact from additional power generation is considered.

-**2030 Net Zero Scenario**: Emissions reductions for all actions proposed in the 2021 UK Net Zero Strategy[3] to 2030 are assumed. These have been estimated by the WM-Air team with reference to the CO_2 emissions reductions determined in the Climate Change Committee assessment of the Net Zero Strategy for air pollution (rather than carbon) emissions by sector.

*Modelled outputs at 10m2 resolution are averaged to ward level. This approach significantly smooths out the highest and lowest pollutant concentration values that the population will be exposed to.
** 2021 Baseline (BAU) Scenario does not account for COVID-19 impacts on activities/emissions.

1) Zhong, J., Hood, C., Johnson, K., Stocker, J., Handley, J., Wolstencroft, M., Mazzeo, A., Cai, X. and Bloss, W.J. (2021). Using Task Farming to Optimise a Street-Scale Resolution Air Quality Model of the West Midlands (UK). Atmosphere, 12, 983.
2) BEIS 2021. National Emissions Ceilings Directive (NECD) https://naei.beis.gov.uk/about/why-we-estimate?view=necd
3) Defra 2019. Clean Air Strategy https://www.gov.uk/government/publications/clean-air-strategy-2019
4) BEIS 2021. Net Zero Strategy: Build Back Greener https://www.gov.uk/government/publications/net-zero-strategy

GLOSSARY	
AQ-LAT	The name of the Tool - Air quality life assessment tool
Business-as-usual	The baseline scenario in the model which uses streetscale modelling for estimation of annual average pollutant concentrations (averaged to ward level) for 2021 and existing incidence rates for the core diseases. The BAU scenario is used as a comparator for changes in annual average air pollutant concentrations to calculate changes in disease incidence and outcome measures. Note, these projections are hidden and only incremental results between the two scenarios are displayed.
Comparator	The user-defined scenario which projects disease incidence and mortality into the future reflecting changes in annual average air pollutant concentrations.
Core diseases	Core diseases are diseases included in the model, these are conditions only with **robustly** established causal links with $PM_{2.5}$ and/or NO_2 exposure formally accepted by the UK Committee of the Medical Effects of Air Pollutants (COMEAP). These are Asthma (child and adult), Coronary Heart Disease (CHD), Lung Cancer and Stroke.
Discount rate	Formal economic analyses discount costs and benefits occurring in the future, as society does not value them as highly as immediate costs and benefits. The rates used by HM Treasury are set as default. However, the discount rate only affects outputs J and K, as all other outputs are presented undiscounted.
Incidence	The number of new cases of disease in the selected population over a one year period. **Cumulative incidence** refers to new cases of disease in the selected population over the duration of the analysis.
Incremental results	The Tool presents incremental results. That is, incremental cumulative disease incidence, costs, mortality and quality of life impacts, calculated by subtracting the impacts in the comparator scenario from the impacts in the business as usual scenario. Where the air pollution scenario reflects a reduction in air pollutants incremental results will be beneficial.
NO_2	Nitrogen dioxide (NO_2) is a localised pollutant, primarily originating from combustion processes. There is robust epidemiological evidence for an association between long term exposure and chronic adverse health effects.
$PM_{2.5}$	Particulate matter smaller than 2.5µm in aerodynamic diameter ($PM_{2.5}$) are solid and liquid inhalable particles which originate from a range of emissions sources. The strongest epidemiological evidence is associated with adverse health effects and long-term exposure to fine particles.
QALYs	Quality-adjusted life is a measure of the value of health outcomes reflecting both the length and quality of life.
Time horizon	The duration that the model will capture the effects of the specified air quality change