AIR POLLUTION SERVICES
KALACO GROUP LTD

Air Quality Site Suitability Guidance

Guidance from Air Pollution Services for the assessment of the suitability of site for sensitive development in the planning system

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Guidance: Air Quality and Health – Site Suitability Assessments

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Executive Summary

There is significant public concern over the health effects of air pollution, yet new sensitive development such as housing continues to be located on sites with poor air quality well above the World Health Organization's guidelines. In 2022 new English targets to reduce exposure to small airborne particles ($PM_{2.5}$) were set to reduce human exposure by 2040, with interim targets to be achieved by early 2028. Building a large number of new homes in areas of poor air quality is likely to make it difficult to deliver an effective exposure reduction. New development is necessary, but proper consideration of where new sensitive development is located is required to protect public health now and in the future.

This document sets out a new approach to assessing the suitability of a site for sensitive development with respect to air quality. It is widely accepted that health effects occur at levels well below the national air quality objectives and limit values that have been set to protect human health, yet in the planning system the suitability of a site is generally assessed using the objectives/limit values.

This document sets out a pragmatic approach to assessing site suitability for sensitive development that takes account of the difference in the background air quality and the air quality at the site to suggest where additional measures are required to reduce exposure of future users of the site. The aim is to avoid new sensitive development being located close to pollution sources such as major roads.

Contents

1. Introduction

1.1. This Air Pollution Services (APS) guidance sets out a new approach for undertaking an air quality site suitability assessment as part of planning applications.

1.2. The Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) published guidance on the assessment of the impact of development on air quality (EPUK/IAQM, 2017). It focuses on the impacts of development on the local area.

1.3. It does mention that there may be a requirement to carry out an air quality assessment of the impacts of the local area's emissions on the proposed development itself, to assess the exposure that residents or users might experience. It, however, provides little guidance on how this assessment of site suitability could be undertaken.

1.4. Some local authorities have published air quality guidance for developers. In general, these also focus on the impacts of development on the local area, with some setting out mitigation measures and damage costs.

1.5. An assessment of the impact of a development on local air quality[1] is typically considered in relation to compliance with regulatory thresholds (see Appendix A1) and focuses on locations of existing exposure. The assessment of site suitability needs to go beyond just achieving compliance with national air quality objectives (AQOs) and limit values (LVs). A site suitability assessment, which evaluates the risk of new exposure, needs to take into account the known health effects of exposure to air pollution.

Since the IAQM/EPUK guidance was last updated, the World Health Organization (WHO) has revised its air quality guidelines (AQGs) for key pollutants (World Health Organization, 2021). These guidelines are generally much more stringent than the previous WHO guidelines (World Health Organization, 2006). This is the most recent authoritative document on the potential for health effects of the key pollutants. Reduction in exposure to poor air quality is a key focus of Government.

1.6. The aim of an air quality site suitability assessment should therefore be to:

1) determine if, in relation to air quality, a site is suitable for the development that is proposed; and

2) protect the health of users of the development.

1.7. The approach suggested in this document takes a pragmatic approach with the aim of promoting additional measures to reduce exposure of future users of a development to air pollution. It will also identify sites which are of greater or unnecessary risk compared to a site located somewhere else in the general area. It recognises that local authorities, in most cases, support development (such as the need for new houses) and it facilitates an approach to consider whether a specific location is appropriate for sensitive development in relation to ambient air quality.

[1] i.e. not exposure of future users within the development.

1.8. During the development of this guidance a large number of local authority air quality officers have been approached for their comments. The responses received are supportive of the need for guidance on site suitability assessment and generally supportive of the approach.

2. Context

2.1. Since 2017, Environmental Impact Assessments (EIAs) have explicitly been required to include an assessment of the impacts of a project on population and human health (Her Majesty's Government, 2017). Guidance on EIA (European Commission, 2017) suggests that *"…human health should be considered in the context of the other factors … (such as health effects caused by the release of toxic substances to the environment, health risks arising from major hazards associated with the project, effects caused by changes in disease vectors caused by the Project, changes in living conditions, effects on vulnerable groups, exposure to traffic noise or **air pollutants**) …"* (emphasis added). This suggests site suitability should be considered in EIA. It should be noted that EIA is only required for a relatively small number of developments, albeit generally the largest ones. The framework for EIAs is currently in the process of being replaced by Environmental Outcome Reports (EORs). The requirements are currently unknown, however, it is anticipated that there will remain a desire to protect human health and evaluate development proposals in relation to the risk of exposure to air pollution.

2.2. Health impact assessments (HIA) are increasingly being used to assess the effects of major development on a wide range of determinants of health, including air pollution. The Institute of Environmental Management and Assessment (IEMA) have recently published guidance on determining significance for human health in EIA (Institute of Environmental Management & Assessment, 2022). Appendix A2 provides further information on the use of this guidance when considering the health impacts of air pollution.

2.3. The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021) requires development to support healthy communities, and therefore assessing whether a location is suitable for air pollution sensitive development is consistent with this framework. In the Chief Medical Officer's annual report on air pollution, the Chief Planning Officer has stated that, *"The national policy documents provide strong ideas for when and how local policy and decisions on planning applications should consider public health in planning"* (Chief Medical Officer, 2022), supporting our view that the planning system requires the effects of air pollution on public health to be considered.

2.4. The NPPF is, however, not explicit in how the planning system should consider the impacts of air pollution on health (Ministry of Housing, Communities and Local Government, 2021).

2.5. The government is committed to reviewing the NPPF, but it is unlikely that it will change the requirement to consider health in planning decisions.

2.6. Considering site suitability in a health context rather than compliance may help developers identify constraints at potential development sites and rethink design earlier. Greater and earlier involvement of air quality practitioners in the design process would help avoid expensive last minutes changes to the design. Appropriate site selection for pollution sensitive development could lead to more affordable housing with lower running costs and avoid the need for expensive mitigation measures to reduce exposure such as mechanical ventilation. It could also reduce the

exposure of the most vulnerable members of society by avoiding building social housing in areas of poor air quality.

3. Pressure to improve air quality

3.1. The Chief Medical Officer's 2022 annual report (Chief Medical Officer, 2022) concludes that further reductions in air pollution will lead to significant reductions in coronary heart disease, stroke and lung cancer, among others and states that as a society we need to concentrate on the places where people live, work and study; the same air pollution concentration in a densely populated area will lead to greater accumulated health effects than in a sparsely populated area as more people will be affected.

3.2. The Government's Chief Planner stated in the report on that, *"Urban planning should support reducing air pollution concentrations locally – such as reducing air pollution near schools and healthcare settings."*

3.3. In England, local authorities are responsible for improving the health of the people living in their area and for providing certain public health services (Her Majesty's Government, 2012)[2]. The Secretary of State has overall responsibility for improving health with national public health functions largely delegated to the Office for Health Improvement and Disparities. Recognising that the regulatory thresholds are not sufficiently protective of human health, a number of local authorities have started setting their own air quality targets, for example, Greater London (Mayor of London, 2018), Oxford City Council (Oxford City Council, 2021) and Walsall Council (Walsall Council, 2022). For these to be most effective they need to be included in the local plan.

3.4. The new $PM_{2.5}$ population emission reduction target (PERT) set under the 2021 Environment Act mandates that population exposure be significantly reduced by 2040. Although the English planning system does not currently explicitly require local authorities to consider this new target, it would seem prudent for sensitive development not to be located in areas of high $PM_{2.5}$ levels in the local context, particularly where there is also high population density.

3.5. In Wales, the Well-being of Future Generations Act (Welsh Government, 2015) has a 'Healthier Wales' as one of its seven goals. This Act requires public bodies, including local authorities, to collaborate to improve the Welsh environment, economy, society and culture. There are 50 well-being indicators including indicator 04 on levels of NO_2 in air, used to assess progress. The Welsh Government's draft Technical Advice Note (TAN) 11 (Welsh Governmment, 2022) on air quality, noise and soundscape includes the concept of 'pollution-sensitive development' for the first time. This is defined as "*dwellings, schools and other buildings or outdoor amenity spaces where members of the public are likely to spend long periods of time*". The draft TAN also allows Councils to set local AQOs for the first time.

3.6. In Scotland, the draft National Planning Framework 4 (Scottish Government, 2022) states that development proposals should consider opportunities to improve air quality and reduce exposure to poor air quality. An air quality assessment may be required where the nature of the proposal or the air quality in the location suggest significant effects are likely.

[2] Health is a devolved matter in Scotland, Wales and Northern Ireland.

3.7. Following the coroner's conclusion that exposure to air pollution contributed to both the cause and exacerbation of Ella Abdoo Kissi-Debrah's asthma and her death there has been public and political pressure for there to be a human right to clean air. This is reflected, for example, in the United Nations General Assembly resolution declaring that everyone has a right to a healthy environment, including clean air (United Nations, 2022), and the introduction of a private member's bill into the House of Lords on Clean Air (Human Rights) in 2022.

4. Economic Benefits

4.1. There are significant economic benefits of improving air quality. The University of Birmingham has recently estimated that the economic benefit in the West Midlands of achieving the 2021 WHO annual mean NO_2 and $PM_{2.5}$ AQGs in 20 years would be £2.6b, which includes almost £1.0b benefit in Birmingham. It considered the economic impacts of asthma, coronary heart disease, stroke, lung cancer, and mortality. It is likely to be a conservative estimate as other health effects have not been considered (J Barrington et al, 2022).

4.2. Notwithstanding the economic benefits to society of improving air quality there are also likely to be economic benefits to developers if the suitability of sites for sensitive development is considered early in the design stage. It will highlight where expensive measures (such as mechanical ventilation) are likely to be required to reduce the health risk at the initial design stages, rather than waiting for the air quality assessment which typically is one of the last assessments produced for planning applications. It may be that other, more sustainable, emission reduction measures could be introduced if considered early enough.

5. Outline of Approach

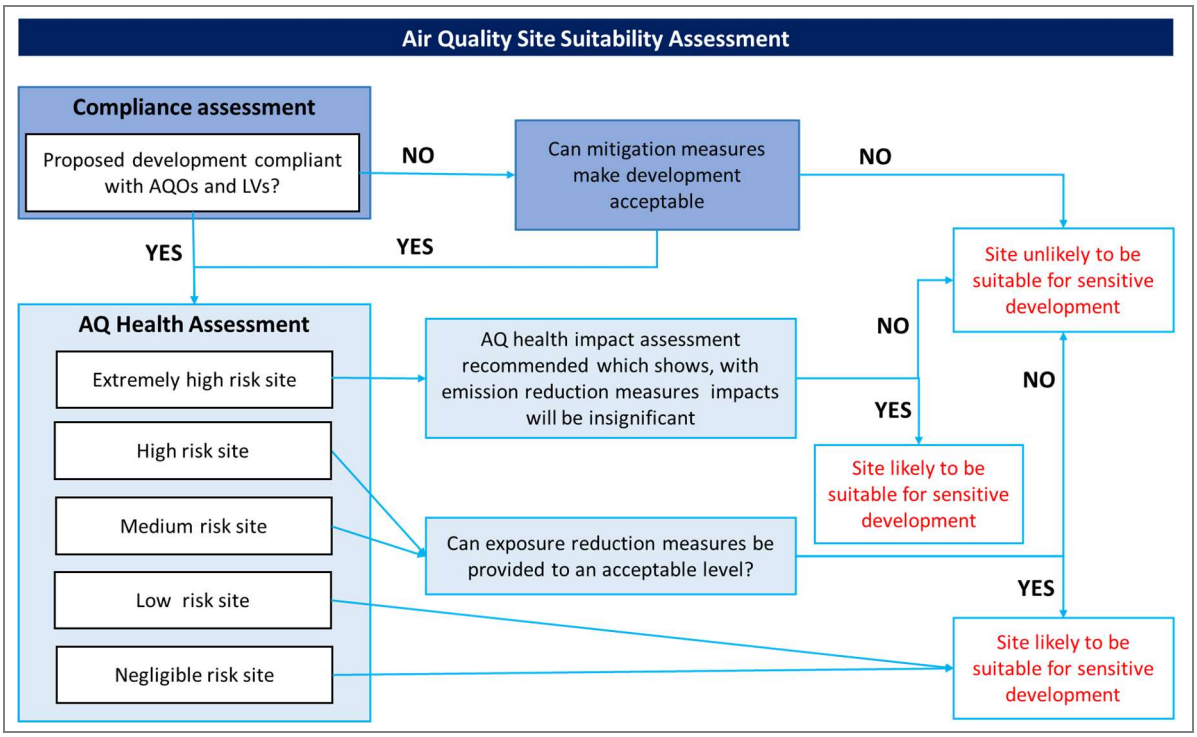
5.1. A site suitability assessment is an assessment of air quality at locations of human exposure; it is not an assessment of the effect on human health due to exposure to air pollution.

5.2. Figure 1 illustrates APS's approach to the assessment of the site suitability for a proposed use. It consists of three separate assessments as described in the following sections.

5.3. The air quality health indicator is based on long term exposure to air pollution, and therefore uses annual mean concentrations. This is not intended to suggest that short term exposure is not important, but is a pragmatic approach given that dispersion modelling of long term concentrations is more robust than short term concentrations and that there are no accepted conversion factors for the WHO AQGs and ITs to convert the short term objective values into equivalent annual mean concentrations such as contained within LAQM technical guidance for the AQOs (Defra, 2022).

5.4. A site suitability assessment should be undertaken for all air pollution sensitive development (see Box 1), irrespective of its size. It should also be undertaken for re-development of a site where there is existing and future sensitive development. That is, the redevelopment of a site should be used as an opportunity to reduce exposure for future users of the site.

Figure 1: Outline of Site Suitability Approach



6. Assessment of Compliance with Regulatory Thresholds

Introduction

6.1. Consideration in relation to compliance with regulatory threshold is the first step. Clearly where these are breached the site is not suitable.

6.2. Compliance with the AQOs and the LVs are assessed separately, to take account of the different locations where they apply (see Appendix A1) and different regulatory obligations (local vs national).

Air Quality Objectives

6.3. Compliance with the AQOs for a site suitability assessment, are assessed though estimating concentrations at the relevant locations on the proposed development for the averaging period of the AQO. Typically, this would be at the building façade for a residential development for compliance annual mean AQOs and any location for compliance with short-term AQOs.

6.4. For the short term AQOs, where road traffic is the key contributor, 'proxy annual mean' concentrations are often used as set out in Defra's Local Air Quality Management Technical Guidance (Defra, 2022). These are:

- 32 µg/m^3 for the 24-hour PM_{10} AQO[3]; and
- 60 µg/m^3 for the 1-hour NO_2 AQO.

[3] This value is calculated from the equation in LAQM.TG (22).

6.5. Where one or more relevant AQO is predicted to be exceeded in the future within the proposed development, the site would not be considered suitable for the proposed use unless suitable mitigation measures are available and agreed to be implemented.

6.6. The assessment must take account of the uncertainty and limitations of the assessment methodology, which typically relies on dispersion modelling. If the modelled concentrations are highly uncertain, a precautionary approach should be taken by assessing against a lower threshold, e.g. 36 µg/m^3 for annual mean NO_2 concentrations (i.e. 90% of the threshold). If reliable measurements on site are available these may be useful for understanding current air quality, but not necessarily future air quality.

6.7. There is always uncertainty when predicting air quality. In general, assessments are verified against existing measured concentrations and use reasonable worst-case assumptions for future predictions, and are therefore considered to be conservative. In some circumstances, however, the uncertainty will be greater than normal, for example due to inadequate model input data, such as traffic flows. A poor model representation of the local area can also lead to high uncertainties; it is therefore vital to carefully consider the model performance and take a precautionary approach for the assessment thresholds as necessary. Typical statistics indicating a poor model representation include:

- a high modelled 'road-NOx' bias adjustment factor (e.g. greater than 2);
- the graph of measured vs adjusted modelled NO_2 includes predictions outside +/-10%[4];
- a high root mean square error (RMSE) of adjusted modelled NO_2 (e.g. greater than 2 µg/m^3);
- few (e.g. three or less) appropriate monitoring sites used for the development of the adjustment factor.

6.8. Note these are only examples, there may be other reasons for higher than normal uncertainty.

Limit Values

6.9. The PCM model used by Defra to assess compliance with the LVs used receptors at 4 m from the kerb of major roads. This data is reported annually and can be used to identify sites where the LV may be exceeded. If the development site is located adjacent to a major road, but is currently a greenfield site, there may be no PCM predictions available.

6.10. In these cases, it is useful to predict the annual mean concentrations in the first year of occupation of the proposed development and at all levels of a proposed building where there will be long term exposure.

6.11. The LVs apply anywhere members of the public have access, although there are restrictions on the locations where compliance is assessed (see Appendix A1). To assess compliance with the LVs for a site suitability assessment the annual mean concentrations[5] should be predicted across the whole site, not just at the building facades.

[4] LAQM.TG (22) suggests that the modelled concentration should be within 25% of the monitored concentrations, preferably within 10%. This recommendation has been in the technical guidance since 2009 and does not account for the significant improvement in the performance of models such as the ADMS suite in predicting concentrations over recent years.

[5] Defra's reporting of compliance indicates there is no exceedance of the short-term LVs.

6.12. If the maximum predicted concentrations within the development site in the future year of first occupation are below the LVs it is considered unlikely to be a breach of the LVs.

6.13. As with assessing compliance with the AQOs a precautionary approach should be used where the uncertainty is higher than normally acceptable, or where reasonable worst-case assumptions have not been used.

6.14. If the site introduces locations which exceed LVs or delay the ability for a local authority to achieve compliance then the site is not suitable.

7. Air Quality Health Indicators for Future Users of a Site

Aim

7.1. The aim of the site suitability assessment is to protect the future users of a development from the health effects of air pollution as much as possible given that the WHO AQGs are currently, and are likely to continue for the foreseeable future, to be exceeded by a wide margin in many locations in the UK. This recognises that the regulatory thresholds are not protective of human health.

7.2. There is a gradient in background air pollution across the UK, generally with the highest levels in southeast England and the lowest in northwest Scotland. On top of the background, local emissions contribute to the quality of the air. The rapid spatial change in concentrations with distance from emission sources, such as road traffic, is well known.

7.3. The main principle behind APS's approach is that pollution sensitive development should be located where air quality is 'good' in the local context. The difference in pollution levels at the proposed development site (development air quality) and the local background air quality is used to determine whether additional measures are required to make the site suitable for the proposed land use.

7.4. For the purposes of the site suitability assessment the draft TAN 11 definition of sensitive development is used (Welsh Governmment, 2022):

"Dwellings, schools and other buildings or outdoor amenity spaces where members of the public are likely to spend long periods of time".

7.5. Box 1 provides a definition of 'sensitive development' for this guidance.

> **Box 1: Sensitive Development**
>
> For this guidance the term sensitive development applies where people spend long periods of time such as healthcare facilities, care homes and offices, i.e. more than about eight hours per day. Employers have a general duty to ensure people not in their employment are not exposed to risks to their health. Worker exposure limits, generally applied in the workplace, are insufficiently protective of the general public.
>
> It should be noted that deprivation causes people to have increased sensitivity to air pollution due to their higher rates of ill health. Social housing could be considered to be ultra-sensitive development.

7.6. The WHO AQGs and ITs are used to define air quality levels (AQLs) in the context of current air quality. These AQLs are used to classify the development and background air quality. This approach recognises that site suitability assessments should take account of the local context to reduce future exposure to air pollution. For example, this would help reduce exposure by avoiding locating schools next to major roads where the regulatory thresholds are achieved. It assumes that pollution

sensitive development is required in the local authority area, but within that area more polluted areas should be avoided.

Methodology

7.7. The risk to human health is assessed using the air quality in the first year of occupation of the proposed development using defined AQLs based on the WHO AQG and ITs.

7.8. As stated previously, the approach focuses on the annual mean concentrations. This is because it is difficult to accurately model short-term concentrations. For the AQOs there are well established relationships between the long- and short-term AQOs derived from monitoring data. Such relationships have not been derived for the WHO AQGs and ITs.

Step 1 – Define AQLs

7.9. Table 1 provides descriptions and Air Quality Levels (AQLs) based on the WHO AQGs and ITs. The descriptors are in the context of current air quality in the UK and over time, as air quality improves, will need to be updated to drive reductions in air pollution.

7.10. For site suitability assessments accompanying outline planning applications it is recommended that the development AQL be based on the worst-case concentration at the site boundary. This will provide a conservative assessment. Further to this, understanding the spatial variation in concentrations across a site could then help inform the design for a detail full planning application. Where the development site includes areas which are clearly not potential locations for relevant exposure (i.e. buildings could not be erected in specific parts of the site) it may be appropriate to not use the concentration at the site boundary but rather the area where buildings could be located.

7.11. For site suitability assessments accompanying reserved matters planning applications it would be more appropriate to base the development AQLs on the concentrations at the worst-case building facades as indicated on the development site plan.

7.12. Two AQLs are identified for the first year of occupation of the development:

- *Background AQL* derived from the background concentrations in the 1km x 1km grid where the development is located (Defra, 2023)[6] or suitable local background monitoring data (with relevant forward projection). Where a development covers several grids or is close to the boundary of one with much lower concentrations, it would be prudent to use the highest background concentrations as a worst-case scenario or interpolating to be relevant to the site.
- *Development AQL* derived from the predicted concentrations at the site, i.e. taking into account local sources of air pollution, such as the emissions from a nearby road. This would be at the site boundary (outline applications) or at the worst-case facade of the buildings on the site plan (detailed/full or reserved matters applications). This would include cumulative impacts, either through assumed traffic growth or the explicitly modelled traffic impact of other developments in the areas.

Table 1: Future Air Quality Levels*

Pollutant	Concentrations (µg/m³)*	AQL	Description
NO_2**	≤10 µg/m³	1	Achieves WHO AQG.

[6] Or equivalent background maps for the other nations.

Table 1: Future Air Quality Levels*

Pollutant	Concentrations (µg/m³)*	AQL	Description
	11-20 µg/m³	2	Achieves WHO IT3.
	21-30 µg/m³	3	Achieves WHO IT2.
	31-40 µg/m³	4	Achieves WHO IT1.
	>40 µg/m³	5	Exceeds regulatory thresholds.***
$PM_{2.5}$	≤5 µg/m³	1	Achieves WHO AQG.
	6-10 µg/m³	2	Achieves WHO IT4.
	11-15 µg/m³	3	Achieves WHO IT3
	16-20 µg/m³	4	Achieves WHO IT2
	>20 µg/m³	5	Exceeds regulatory thresholds.***
PM_{10}	≤15 µg/m³	1	Achieves WHO AQG.
	16-20 µg/m³	2	Achieves WHO IT4.
	21-30 µg/m³	3	Achieves WHO IT3.
	31-40 µg/m³	4	Achieves WHO IT2.
	>40 µg/m³	5	Exceeds regulatory thresholds.***

Note:
* Concentrations should be rounded to the nearest whole number.
** For NO_2 there is no WHO IT4.
*** Regulatory thresholds refer to the limit values and air quality objectives.

Step 2 – Define Risk

7.13. The difference between the development AQL and the background AQL along with the future AQL at the proposed development are used to assess the risk to the health of future occupiers of the site compared to exposure in the general wider area, as illustrated in Table 2.

Table 2: Health Risk for Future Occupiers of the Proposed Development

Future AQL at Proposed Development	Number of AQL changes in future year at site (i.e. Background AQL – Maximum AQL at Proposed Development)*				
	0	-1	-2	-3	-4
AQL 1	Negligible	Low	Medium	High	Extremely high
AQL 2	Low	Medium	High	Extremely high	Extremely high
AQL 3	Medium	High	Extremely high	**	**
AQL 4	High	Extremely high	**	**	**
AQL 5	Extremely high	**	**	**	**

Notes:
* The difference in Background Air Quality Level – Proposed Development Air Quality Level (see Table 1)
** The grey cells are non-feasible options

Step 3 - Evaluation

7.14. Any proposed development where the future background is AQL 5, i.e. one or more of the regulatory thresholds will be exceeded, should be assessed as described in Section 6. This is likely

to only apply to a few areas of London where background NO_2 concentrations continue to exceed the thresholds.

7.15. Where sensitive development is located where the air quality is poor in the local context additional exposure reduction measures should be adopted to reduce the exposure. In this way future users of the development will be exposed to better air quality than without the additional exposure reduction measures. This is consistent with the WHO advice to use the ITs to drive improvement.

7.16. The additional measures may include designing the layout of the development to give a buffer between local sources of pollution and sensitive development, re-orientating buildings to put living rooms and bedrooms away from pollution sources, and the use of mechanical ventilation (which needs to be well maintained).

7.17. Air quality is forecast to improve in the future and therefore time is an important factor when considering the recommended exposure reduction measures to reduce the risk. Thus, if future occupiers will suffer exposure for one year the risk is different to exposure over, say, 10 years. If high levels of air pollution are forecast for many years, it may be that the site is not suitable for the proposed use or additional exposure reduction measures are required to reduce the health risk. Information on the rate of change in annual mean concentrations in the locality (e.g. from the local authority's annual status report), together with professional judgement, should be used to assess how long it will be before the development AQL will drop to the same level as the background AQL. For example, where the development predicted concentration is near the top of the AQL band then it is likely that it would take longer for an improvement in air quality to reach the next band down. Where the prediction is just above the lower threshold of the band there is potential for the next AQL to be achieved in a relatively short period.

7.18. Greater consideration as to whether a site is suitable, or not, should be given to those sites with increased risk of health effects for future users. Proposals which result in an unacceptable risk to health could be considered for refusal.

7.19. Where the risk is assessed to be medium or above, all opportunities to improve air quality should be explored by the development and/or consultant, taking into account the risk of disbenefits of other environmental factors, such as the need to meet net zero emissions.

7.20. High and extremely high sites may not be suitable for the proposed land-use, unless suitable exposure reduction measures are introduced to ensure appropriate exposure. This is particularly the case where a large number of people will be exposed and/or the people exposed are likely to be from deprived communities who tend to have a greater risk of poor health.

7.21. A proportionate health impact assessment is recommended for extremely high risk sites, while it may also be beneficial for high risk sites in supporting a determination of significant effects on health. We recommend that this is reviewed by the local air quality and/or public health professionals.

7.22. The greatest level of risk from any pollutant should be used. However, exposure reduction measures are likely to be pollutant focused.

7.23. Any air pollution focused HIA should be reviewed by both air quality and public health officers of the local authority.

8. Example Assessment 1: City Centre (London)

8.1. Table 3 sets out an example of an assessment assuming it will be first occupied in 2025.

Table 3: 2025 Annual Mean Concentrations and AQLs

Pollutant	Background Concentrations* (µg/m³)	Background AQL	Development concentrations* (µg/m³)	Development AQL	Change in AQL
NO_2	31.3	4	35.4	4	0 levels
$PM_{2.5}$	11.7	3	11.8	3	0 level
PM_{10}	18.7	2	19.1	2	0 level
Notes: * In year of first occupation (either background or at Proposed Development)					

8.2. The proposed development site is currently unoccupied and therefore there is no existing exposure.

8.3. Table 3 shows that the proposed development will not change the AQL for any of the three pollutants. For NO_2 the background and development concentrations are predicted to be at AQL 4; for $PM_{2.5}$ at AQL 3 and for PM_{10} at AQL 2 based on Table 1.

8.4. Based on Table 2 the risk to the future occupiers of the proposed development, based on the considered sources of emissions, is:

- High for NO_2;
- Medium for $PM_{2.5}$; and
- Low for PM_{10}.

8.5. Therefore, although the regulatory thresholds are achieved, in this example, further exposure reduction measures would be required to reduce exposure for pollution sensitive development. This might include removing NO_2 and PM at the air inlet of a mechanical ventilation system, with ongoing maintenance requirements to ensure pollutants are effectively removed over a long period of time. Where this is not possible or the disbenefits (e.g. energy consumption) out-weigh the benefits, it maybe that this site is not suitable for the proposed land use.

8.6. Due to the high risk of potential health effects due to air quality, the development application may also benefit from a proportionate health impact assessment to determine the potential for adverse health effects.

9. Example Assessment 2: Suburban Area

Outline planning application

9.1. Table 4 sets out an example of an assessment assuming it will be first occupied in 2025.

Table 4: 2025 Annual Mean Concentrations and AQLs

Pollutant	Background Concentrations* (µg/m³)	Background AQL	Development concentrations* (mg/m³)	Development AQL	Change in AQL
NO_2	16.0	2	24.4	3	-1 level
$PM_{2.5}$	10.3	2	10.9	3	-1 level

Table 4: 2025 Annual Mean Concentrations and AQLs

Pollutant	Background Concentrations* (µg/m³)	Background AQL	Development concentrations* (mg/m³)	Development AQL	Change in AQL
PM_{10}	14.8	1	16.3	2	-1 level

Notes:
* In year of first occupation (either background or maximum at Proposed Development)

9.2. The proposed development site is currently unoccupied and therefore there is no existing exposure. The site suitability assessment is for an outline planning application and there is no detailed site plan available. Therefore, the assessment uses the maximum concentration at the site boundary near to a road.

9.3. Table 4 shows that the proposed development will introduce exposure at AQL 3 for NO_2 and $PM_{2.5}$, and AQL 2 for PM_{10} based on the maximum concentration at the development site (the site boundary). This is one AQL above the background AQL for all three pollutants. This shows that there are local sources of pollution affecting the site which will result in higher exposure of future users of the proposed development than if the development was away from local pollution sources.

9.4. Based on Table 2 the risk to the future occupiers of the proposed development, based on the considered sources of emissions, is:

- High for NO_2 and $PM_{2.5}$; and
- Medium for PM_{10}.

9.5. For $PM_{2.5}$ and PM_{10} the development concentrations are close to the lower boundary of AQL 2 and therefore it is likely that it will be in the same AQL as the background in a relatively short period of time (which would mean the site was low risk in terms of PM). If this was the only pollutant of concern, the conclusion may be, given that the worst-case location (the site boundary) has been used in the assessment, that no further site suitability assessment is required for the detailed planning application.

9.6. For NO_2 the development AQL is also one level behind the background AQL, however it is in a higher AQL than that for PM_{10}. It is also likely to take some time for the development AQL to fall to AQL 2. According to the matrix in Table 2 there is a high risk of health effects at this development site, and therefore suitable additional exposure reduction measures would be required to be submitted at the detailed planning application stage.

Full or Reserved Matters Planning Application

9.7. Table 5 sets out an example for the same proposed development, assuming the site suitability assessment is required to be undertaken for the detailed application. The detailed site plan has been developed considering the air quality predictions as part of the outline planning application and designed appropriately to minimise exposure to poor air quality. This time there is a site plan available showing the location of the buildings. Instead of using the concentration at the site boundary, the worst-case building façade has been used to assess the potential health risk of the proposed development.

Table 5: 2025 Annual Mean Concentrations and AQLs

Pollutant	Background Concentrations* (µg/m³)	Background AQL	Development concentrations* (mg/m³)	Development AQL	Change in AQL
NO_2	16.0	2	19.8	2	0 level
$PM_{2.5}$	10.3	2	10.4	2	0 level
PM_{10}	14.8	1	15.2	1	0 level
Notes: * In year of first occupation (either background or at Proposed Development)					

9.8. Table 5 shows that the predicted worst-case concentrations are much less as they have been predicted at the building façade away from emission sources like road traffic rather than at the site boundary. There is predicted to be no change in the AQL.

9.9. Based on Table 2 the risk to the future occupiers of the proposed development, based on the considered sources of emissions, is:

- Low for NO_2 and $PM_{2.5}$; and
- Negligible for PM_{10}.

9.10. Therefore, no additional exposure reduction measures would be required to reduce the risk.

10. Example Assessment 3: Small Town/Rural Area

10.1. Table 6 sets out an example of an assessment assuming it will be first occupied in 2025.

Table 6: 2025 Concentrations and AQLs

Pollutant	Background Concentrations* (µg/m³)	AQL	Development concentrations* (mg/m³)	AQL	Change in AQL
NO_2	7.8	1	10.8	2	-1 level
$PM_{2.5}$	9.6	2	9.6	2	0 levels
PM_{10}	13.9	1	14.3	1	0 levels
Notes: * In year of first occupation (either background or at Proposed Development)					

10.2. The proposed development site is currently unoccupied and therefore there is no existing exposure.

10.3. Table 6 shows that the proposed development will introduce exposure at AQL 2 for NO_2 based on the worst-case concentration at a building facade at the application site based on the detailed site plan.

10.4. Based on Table 2 the risk to the future occupiers of the proposed development, based on the considered sources of emissions, is:

- Medium for NO_2; and
- Low for $PM_{2.5}$ and PM_{10}.

10.5. For PM_{10} and $PM_{2.5}$ the development concentration is the same as the background level which suggests for PM the site is not located near to significant local PM emission sources and as air

quality improves into the future due to national policy, the conditions at the site will likely also improve.

10.6. For NO_2, the site is one level behind the background AQL due to local emission sources. This may result in a risk to the future users' health compared to users of a site located away from local sources of pollution. It should, however, be recognised that the background achieves the WHO AQG which is good and the concentration at the proposed development are only just above the WHO AQG. As air quality improves into the future due to national policy, the conditions at the site will also improve and it is likely that the site would achieve the WHO AQG within a short period (1-2 years based on the predicted concentration being near the lower threshold of the AQL band).

10.7. Therefore, in this example, only good practice design (i.e. ensure that sensitive development is located on parts of the development site where concentrations are lower than the maximum, ideally where AQL1 for NO_2 is achieved) should be incorporated but no additional exposure reduction measures would explicitly be required for the development.

11. Conclusions

11.1. This document sets out guidance for the use of the approach developed by APS for the assessment of the suitability of a site for its proposed use. It considers both the national policy requirement to consider compliance with regulatory thresholds and the protection of human health from exposure to air pollution. The latter is a pragmatic approach that seeks to drive improvement in air pollution to reduce exposure and hence reduce the adverse impacts of air pollution.

12. Further developments of this guidance

12.1. APS has suggested a new approach to site suitability assessment with respect to air quality. As noted above the aim is to help reduce population exposure to air pollution. Potential further extension of this approach could include a consideration of the additional health burden of exposure to air pollution of socially disadvantaged communities by, for example, applying a factor for development in the lowest quintile of relevant indices of deprivation at the lower layer super output area (LSOA).

12.2. Another option could be to include quantification of the health impacts using the accepted dose response relationships.

12.3. As noted above the descriptors for the AQLs are in the context of current air quality. Air quality is predicted to improve below the levels in 2019; the last year before the effects of the pandemic occurred, and air pollution levels declined due to reduced traffic. They have since increased at many locations. From 2023 onwards further improvements are anticipated. It will therefore be necessary to update the levels in Table 2 in a few years.

12.4. With any new assessment approaches there may be situations where the approach described does not work as well as expected. APS is keen to learn from the experience of others using this methodology so that if can be improved. Please email contact@airpollutionservices.co.uk.

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14. Appendices

A1. Air Pollution Thresholds

Regulatory Thresholds

Air Quality Standards

A1.1. The 2007 Air Quality Strategy (Defra and the Devolved Administrations, 2007), a statutory document required by the 1995 Environment Act, defines standards as

"…concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health or on ecosystems."

A1.2. Defra also states online that the standards are (Defra, n.d.):

"… concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment. They can also be used as a benchmark to indicate whether air pollution is getting better or worse."

A1.3. Defra's use of the term 'acceptable' is ambiguous. It could mean, in this context, the WHO AQGs as the most recent authoritative review of the health effects of the key pollutants. It could also be interpreted as meaning the AQOs, LVs and the targets required under the 2021 Environment Act.

A1.4. Often the term 'standard' is used as a generic term for the LVs and AQOs. This use is inconsistent with the 2007 Air Quality Strategy definition given above. This is because the AQOs, LVs and targets are set based on technical, economic and political considerations in addition to the scientific and medical evidence of the effects on health.

Air Quality Limit Values and Objectives

A1.5. The AQOs and LVs set for the protection of human health in England for the key pollutants are detailed in Table A1. There are a similar set of AQOs for the other nations. The AQOs and LVs are based on the medical evidence of the health effects available at the time they were set and, as noted above, take account of a number of other factors such as political acceptability, and the economic and technical feasibility of achieving them. For these reasons it should be recognised that they no longer meet the 2007 Air Quality Strategy definition of an air quality standard. The LVs are

recognised as being out of date by the European Commission, which in 2022 proposed LVs more closely aligned with the WHO AQGs (European Commission, 2022).

Table A1: Air Quality Objectives for England and Limit Values

Pollutant	Time Period	Criteria Type	Concentration, and the number of exceedances allowed per year (if any)	Date AQO / LV to be Achieved from and Maintained After
Nitrogen Dioxide (NO_2)	1-hour Mean	AQO / LV	200 µg/m^3 not to be exceeded more than 18 times a year	31st December 2005 / 1st January 2010
	Annual Mean	AQO / LV	40 µg/m^3	31st December 2005 / 1st January 2010
Fine Particles (PM_{10})	24-hour Mean	AQO / LV	50 µg/m^3 not to be exceeded more than 35 times a year	31st December 2004
	Annual Mean	AQO / LV	40 µg/m^3	31st December 2004
Fine Particles ($PM_{2.5}$)*	Annual Mean	AQO / LV	25 µg/m^3 / 20 µg/m^3	2020 / 2020

Table notes:

* The $PM_{2.5}$ AQO is not in Regulations and there is no legal requirement for local authorities to meet it.

A1.6. Compliance with the LVs is mandatory, and assessment of compliance is undertaken at the UK level by the Department of Environment, Food and Rural Affairs (Defra) using a combination of monitored and modelled data. The modelled data come from the Pollution Climate Model (PCM) which predicts annual mean concentrations where there is exposure at a distance of 4 m from the major road network, excluding junctions and short stretches or roads not considered to be representative of air quality in the wider area.

A1.7. Compliance with the AQOs is undertaken by local authorities. The AQOs are policy targets, and where they are exceeded the local authority must declare an Air Quality Management Area (AQMA) and provide an action plan setting out the exposure reduction measures to be introduced to meet them.

A1.8. Local authorities are also responsible for implementing measures which will achieve compliance with the limit values, and a number of cities including Birmingham, Bristol, Manchester and Leeds have introduced Charging Clean Air Zones (CAZs) to comply with this requirement.

A1.9. The NPPF (Ministry of Housing, Communities and Local Government, 2021) explicitly requires planning decisions to sustain and contribute towards compliance with the LVs and relevant national AQOs.

A1.10. Planning practice guidance for England (PPG) (Ministry of Housing, Communities and Local Government, 2019) states that air quality may be a material consideration in a planning decision if the proposed development would be particularly sensitive to poor air quality in its vicinity:

- where occupiers or users of the development could experience poor living conditions or health due to poor air quality; and
- where development would expose people to harmful concentrations of air pollutants, including dust. This could be by building new homes, schools, workplaces or other development in places with poor air quality.

A1.11. The PPG does not explicitly refer to the AQO or LVs in this context. It has been generally assumed by air quality practitioners, including implicitly by the EPUK/IAQM guidance (EPUK/IAQM, 2017),

that the criteria to be used is an exceedance of one or both regulatory thresholds. Some local authority air quality officers do, however, take into consideration other factor including the WHO guidelines and interim targets to identity appropriate mitigation to reduce human exposure to poor air quality.

A1.12. The London Plan, for example, states that development proposals:

- should not create an unacceptable risk of high levels of exposure to air pollution
- should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures.

A1.13. No definition is given of what 'unacceptable risk' means, although the London Environment Strategy does set out a $PM_{2.5}$ target of 10 µg/m^3 to be achieved by 2030 (Mayor of London, 2018).

Location where AQOs and Limit Values Apply

A1.14. Table A2 sets out the location with the objectives and limit values apply.

Table A2: Locations of relevant exposure

Receptor Locations	Relevant exposure
AQO	The annual mean AQO applies at locations where members of the public might be regularly exposed, such as building façades of residential properties, schools, hospitals, and care homes. The 24-hour mean AQO applies at the annual mean locations of exposure as well as at hotels and residential gardens. The 1-hour mean AQO applies at the annual mean locations of exposure and at hotels, residential gardens and any outdoor location where members of the public might reasonably be expected to spend one hour or longer, such as busy pavements, outdoor bus stations and locations with outdoor seating. Places of work like factories or offices are not considered places where members of the public might be regularly exposed and therefore the AQO's do not apply at these locations.
LV	Article 2(1), Annex III, Part A, paragraph 2 of Directive 2008/50/EC details locations where compliance with the limit values does not need to be assessed: "Compliance with the limit values directed at the protection of human health shall not be assessed at the following locations: a) Any locations situated within areas where members of the public do not have access and there is no fixed habitation; b) In accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and c) On the carriageway of roads; and on the central reservation of roads except where there is normally pedestrian access to the central reservation." The government models compliance with the Directive at locations 4 m from the kerbside, 2 m high, more than 25 m from major road junctions and adjacent to at least 100 m of road length where the Limit Values apply.
Table notes: n/a	

2021 Environment Act

A1.15. The Environment Act 2021 put a duty on the Secretary of State to lay before Parliament at least one long term target for $PM_{2.5}$. The new environmental targets include two for air quality (HIs Majesty's Government , 2022):

- An annual mean concentration target (AMCT) for $PM_{2.5}$ levels in England to be 10 µg/m^3 or below by 2040[7].
- A Population Exposure Reduction Target (PERT) for a reduction in $PM_{2.5}$ population exposure of 35% compared to 2018 to be achieved by 2040.

A1.16. The 2023 Environmental Improvement Plan (Defra, 2023) set interim targets to be achieved by the end of January 2028:

- The highest annual mean concentration in the most recent full calendar year must not exceed 12 µg/m^3 of $PM_{2.5}$.
- Compared to 2018, the reduction in population exposure to $PM_{2.5}$ in the most recent full calendar year must be 22% or greater.

A1.17. Local authorities' role in helping meet these targets is currently unclear (Defra, 2023) although there may be future obligations to reduce emissions though the planning system. Reforms to the planning system are proposed in the Levelling Up and Regeneration Bill and through review of national planning policy.

Non-regulatory Thresholds

A1.18. WHO has revised its AQGs for six pollutants, including PM_{10}, $PM_{2.5}$ and NO_2 (World Health Organization, 2021). The updated AQGs for these key pollutants are presented in Table A3. The WHO document aims to provide quantitative health-based recommendations to improve air quality.

A1.19. As noted above the AQGs are based solely on the latest epidemiological evidence. It is more than 15 years since WHO published its last AQGs (World Health Organization, 2006) and over that period there has been a huge increase in the evidence of health effects of air pollution. New epidemiological studies have shown adverse effects at much lower levels than had previously observed.

A1.20. In recognition of the difficultly of meeting the AQGs in many jurisdictions a series of ITs are proposed which WHO consider to be steps towards achieving the AQGs, rather than as end targets in themselves.

Table A3: WHO Guidelines and Interim Targets

Pollutant	Time Period	IT Levels				AQG Level
		1	2	3	4	
Nitrogen Dioxide (NO_2)	1-hour Mean	-	-	-	-	200 µg/m^3
	24-hour Mean	120	50	-	-	25 µg/m^3
	Annual Mean	40	30	20	-	10 µg/m^3
Fine Particles (PM_{10})	24-hour Mean	150	100	75	50	45 µg/m^3
	Annual Mean	70	50	30	20	15 µg/m^3
Fine Particles ($PM_{2.5}$)	24-hour Mean	75	50	37.5	25	15 µg/m^3
	Annual Mean	35	25	15	10	5 µg/m^3
Table notes: -						

[7] The European Commission put forward a proposal for this target to be met by 2030 in October 2022.

A1.21. The AQG are not legally binding standards; however, WHO believe they should be used to inform legislation and policy. Ultimately, the goal of the AQGs is to help reduce the health burden resulting from exposure to air pollution. Air pollution increases morbidity and mortality from cardiovascular and respiratory disease and from lung cancer and there is increasing evidence of effects on all other organ systems.

A2. Health Impact Assessments

A2.1. HIA are increasingly being used to assess the effects of major development on a wide range of determinants of health, including air pollution. The IEMA have recently published guidance on determining significance for human health in EIA (Institute of Environmental Management & Assessment, 2022).

A2.2. The approach used in HIA is different to that used in air quality assessments in that it is not based on air quality at individual receptors. Instead, it looks at the effects on health due to changes in air quality on the local population, considering both how many people are affected and by how much.

A2.3. Air quality is used in several examples of how the IEMA HIA guidance may be used. It notes, as an example, that a negligible air quality assessment conclusion based on concentrations being below regulatory thresholds does not exclude the possibility that there would be a minor adverse effect to population health. This acknowledges the non-threshold nature of some air pollutants even within regulatory limits.

A2.4. The guidance also states that, in addition to compliance with regulatory thresholds, it may also be relevant to discuss advisory guidelines, e.g. the WHO AQGs. It suggests that the HIA should include informed discussion about what is 'acceptable for the jurisdiction' to give, for example, the public confidence in the thresholds set by government for the purpose of health protection having taken into account other social, economic and environmental considerations.

A2.5. Box 2 sets out APS's views on acceptability of the use of the LVs and AQOs for HIA in the UK.

> **Box 2: What is Acceptable Air Quality for HIA?**
>
> - LVs and AQO do not provide sufficient protection of human health.
> - The UK Government acknowledged several years ago that air pollution causes health effects at concentrations below the LVs and AQOs (Public Health England, 2018).
> - England's Chief Medical Officers has stated that "*…we can and should go further to reduce air pollution – and it is technically possible to do so*" and that "*Further reductions in air pollution will lead to significant reductions in coronary heart disease, stroke and lung cancer, among others*." (Chief Medical Officer, 2022).
> - There is increasing public and political pressure to reduce exposure to air pollution (see section 3) such as the London Mayor's $PM_{2.5}$ target and several local authorities having lower targets than the LVs/AQOs.
> - The coroner investigating the death of Ella Abdoo Kissi-Debrah's referred to exceedances of the WHO air quality guidelines not the LVs or AQOs on her death certificate.
>
> For these reasons it is considered that using the WHO AQGs and ITs, taking into account the local context, would be more acceptable to the public in an HIA than the use of regulatory thresholds.

A2.6. It is not suggested that a full HIA should be undertaken for all air pollution sensitive development; but where an HIA is required that it should take account of the WHO AQGs and IT.