CITY AIRPORT DEVELOPMENT PROGRAMME (CADP1) S73 APPLICATION

ENVIRONMENTAL STATEMENT

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Appendix 9.1 Issues Related to UFPs

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Appendix 9.1 Issues Related to Ultra Fine Particles

Chapter 9 of the ES provides a brief explanation as to why issues related to Ultra Fine Particles (UFPs) have been scoped out of the Air Quality Assessment. The Chapter concludes that it is not possible to predict UFP concentrations, and that there are no standards or guidelines against which any such predictions could be compared. Issues related to UFPs are considered in Chapter 12 on Public Health and Wellbeing, an approach that is consistent with studies that have been recently carried out at Stansted and Bristol Airports.

This appendix has been prepared to provide a more detailed review of issues related to UFPs.

What are UFPs?

UFPs are generally classified as particles that are smaller than 100 nanometres (nm) in size (effectively $PM_{0.1}$) and predominantly formed from combustion processes, either directly (primary UFP) or indirectly from gaseous precursors (secondary UFP). In terms of mass, UFP forms an extremely small fraction of suspended particulate matter (such as PM_{10} or $PM_{2.5}$); it is therefore common to express UFP in terms of Particle Number Concentration (PNC) i.e. particles per cubic centimetre of air.

The vast majority of non-volatile PM (nvPM) from aircraft engines exists as carbon particles, soot or organic carbon[1], but there is evidence that lubrication oil from aircraft engines may be important in the volatile fraction of UFPs[2]. The speciation of the engine exhaust components has not identified key tracers unique to aircraft activity, but UPFs from aircraft engines have a smaller modal diameter (less than 20nm) as compared to emissions from road traffic sources which have a modal diameter of c.30 nm.

Policy and legislative background

National Planning Policy Framework

Paragraph 181 of the National Planning Policy Framework (NPPF)[3] states: "*Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan*".

The NPPF relies upon compliance with the limit values and objectives, and only addresses pollutants for which such limit values and objectives have been derived. There is no reference to UFPs within the NPPF.

2.2 Aviation Policy Framework

The Aviation Policy Framework[4] set out the Government's high-level strategy and overall objectives for aviation. The Framework places a particular importance on areas where the EU Limit Values and air quality objectives are exceeded, but makes no reference to UFPs.

[1] Stacey et al (2019) Measurement of ultrafine particles at airports: A review. *Atmos Environ* 198
[2] Fushimi et al (2019) Identification of jet lubrication oil as a major component of aircraft exhaust nanoparticles. Available at https://doi.or/10.5194/acp-19-6389-2019
[3] National Planning Policy Framework (2021). Department of Housing, Communities and Local Government.
[4] Aviation Policy Framework (2013). Department for Transport.

Aviation 2050

Aviation 2050: The Future of UK Aviation[5] was published as a consultation document in 2018. The Government proposed the following measures to address the potential impacts of aviation's contribution to air quality:

- Improving the monitoring of air pollution, including ultrafine particles;
- Ensuring comprehensive information on aviation-related air quality issues is made available to better inform interested parties;
- Requiring all major airports to develop air quality plans to manage emissions through local air quality targets;
- Validation of air quality monitoring to ensure consistent and robust monitoring standards that enable the identification of long-term trends;
- Supporting the industry in the development of cleaner fuels.

Whilst reference is made to monitoring of UFPs, no reference is made to any relevant standards or guidelines for UFPs.

Flightpath to the Future

Flightpath to the Future[6] sets out a strategic framework for the recovery of the aviation industry from the Covid-19 pandemic and recognises that, whilst many of the issues considered through Aviation 2050 remain relevant, a clear plan of action for the sector is required. The document recognises that in addition to being committed to delivering a green sector for the future, the Government also needs to tackle more localised impacts of aviation, including air quality. No specific reference to UFPs is made.

London Plan

The London Plan[7] sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. The key policy relating to air quality is Policy SI1 Improving air quality, Part B1 of which sets out three key requirements for developments:

Development proposals should not:

- lead to further deterioration of existing poor air quality
- create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits
- create unacceptable risk of high levels of exposure to poor air quality.

In terms of existing air quality reference is made to the air quality objectives for nitrogen dioxide, PM_{10} and $PM_{2.5}$, and to the 2005 WHO Guideline for $PM_{2.5}$. No reference is made to UFPs.

Newham Local Plan

Policy SC5 of the Newham Local Plan[8] deals with air quality, and notes that proposals that deal with the following strategic principles, spacial strategy and design criteria will be supported. Relevant polices are:

- Development will support implementation of Newham's Air Quality Action Plan.

[5] Aviation 2050: The Future of UK Aviation (2018). Department for Transport.
[6] Flightpath to the future: a strategic framework for the aviation sector (2022). Department for Transport.
[7] GLA (2021) The London Plan
[8] London Borough of Newham (2018): Newham Local Plan

- Development along major roads or in other locations that experience air quality exceedances (of the objectives and EU limit values) should be configured to improve the dispersal of identified pollutants and reduce exposure.

No reference is made to UFPs.

Background to standards and guidelines for UFPs

Exposure to UFPs has received increased attention in recent years as there is increasing concern about the possible health effects. As a result of the size fraction, UFP can penetrate deep into the lungs and translocate to the blood system. There is also evidence that UFPs can translocate directly to the brain via the olfactory bulb[9].

However, given the shorter timeframe over which UFPs have been monitored and investigated, and the ongoing discussions relating to particle size distributions and emission sources, no guidelines or targets against which concentrations can be assessed have been established, and there is no synthesis of research upon which to establish a robust dose-response relationship. It is also important to note that information on particle number concentrations alone is not a sufficient metric to infer dose-response relationships as the particles have many different physical and chemical properties that are likely to have different impacts on health. A considerable amount of further research on the properties of different types of UFPs is required before such dose-response relationships can be derived.

A recent study carried out on behalf of Airports Council International[10] set out the following four main requirements for regulations and standards to be set:

- Parameters to be regulated: This is not necessarily limited to mass weight concentration. Particle numbers, particle surface area, physical-chemical properties of the surface (volatile or non-volatile) or the formation of reactive oxygen species could also be used;
- Standardisation of measurement: Harmonization of measurement guidelines and standardisation of measurement equipment (methods and technologies) is required;
- Standard-setting: Standards are generally set on the basis of dose-effect relationships, if possible on the basis of epidemiological and experimental studies. These requires both long-term measurements and health impact studies; and
- Applicability: Standards have to be applicable to emission sources from all activities.

WHO Guidelines

The revised World Health Organisation Guidelines[11] were published in 2021. Section 4.3 of the report considers the issue of UFPs. Since the 2005 Guidelines were published, the body of epidemiological evidence has grown, and two systematic reviews have documented the increasing number of studies that have been conducted. The studies have demonstrated "*short-term effects of exposure to UFP, including mortality, emergency department visits, hospital admissions respiratory symptoms, and effects of pulmonary/systemic inflammation, heart rate variability and blood pressure; and long-term effects on mortality (all-cause, cardiovascular, IHD and pulmonary) and several types of morbidity*". However, various UFP size ranges and exposure metrics have been used in these studies, preventing a thorough comparison. Therefore, there was consensus in the guideline development group (GDG) that the body of epidemiological evidence was not yet sufficient to recommend an air quality guideline (AQG) level.

The report did, however, recognise that there is a large body of evidence from exposure science, that is sufficient to formulate good practice advice. The most significant process generating UFP is combustion, and the main sources include vehicles, and other forms of transportation (including aviation and shipping), industrial and power plants, and residential heating.

Four good practice statements were formulated, related to [Statement 1] quantification of ambient UFP, [Statement 2] expanding UFP monitoring, [Statement 3] distinguishing between low and high particle number

[9] Hopkins et al (2018) Repeated Iron-Soot Exposure and Nose-to-Brain Transport of Inhaled Ultrafine Particles. Toxic Pathol (46)1 75-84
[10] Airports Council International (ACI) Europe (2018) Ultrafine Particles at Airports.
[11] WHO (2021) WHO global air quality guidelines.

concentrations (PNC) to guide decisions on the priorities of UFP source emission control, and [Statement 4] utilising emerging science and technology to advance population exposure assessment.

It is important to note that Statement 3 does not relate to a standard or guideline for UFP. The classification was purely intended to guide decisions on the priorities of UFP source emission control. PNC below 1000 particles/cm^3 (24-hour mean) can be classified as "low" and represents environments not affected by anthropogenic emissions. 24-hour mean concentrations exceeding the typical levels observed in urban background areas (10,000 particles/cm^3) or 1-hour mean concentrations exceeding levels found usually in all urban micro-environments (20,000 particles/cm^3) can be considered "high".

Approach to the air quality assessment

Monitoring for UFPs

Whilst it is accepted that additional monitoring for UFPs would be useful, there would be little benefit to a baseline monitoring study to inform this Environmental Statement. As discussed above, there is no standard or guideline to compare the results against, and the classifications proposed by WHO were not intended for such a purpose. PNC across Newham are expected to fall into the "high" category, but this only implies that measures to control UFP emissions should be focused on local sources (transport, industry, commercial and residential combustion).

Whilst many studies into UFP concentrations in the vicinity of airports have been undertaken, there is currently no standard method for the measurement of UFPs that is applied, and caution must be applied when comparing UFP concentrations based on different sampling methodologies, instrumentation, timescales and QA/QC procedures. A review carried out by Stacey (2019)[12] concluded that "*speciation of the exhaust components has not quantitatively succeeded in identifying the key tracers unique to aircraft activity, as the composition and proportions of aircraft exhaust components are too similar to typical human activity to adequately differentiate between them*".

Monitoring carried out in the vicinity of Heathrow Airport[13] has demonstrated that total UFP concentrations in the vicinity of the Airport are within the range of those measured at traffic and urban background sites. However, the distribution of particle sizes is completely different with a modal diameter of c.20nm at the Airport sites which contrasts with a modal diameter of 30nm at other sites in London. This position is likely to be reflected at locations close to London City Airport.

Emissions and Modelling

In terms of urban UFP concentrations, it is stated[14] that theories underpinning UFP emission and formation processes are generally well developed, but understanding of the origin of UFP (primary/secondary, specific sources), and chemical composition (solid/liquid, organic carbon/elemental carbon, metals, etc.) is generally very limited and UFP and precursor emission inventories hardly exist.

While ICAO has published a mandated method for determining non-volatile PM (nvPM) emissions from aircraft engines in controlled / characterised environments (the CAEP10 nvPM mass concentrations certification standard) [15] it is more difficult to perform "on-wing" studies as the quantities of exhaust gases from jet engines, the speed and temperature of emissions, and complex mixing processes all make gathering emission data at source extremely difficult. The new standard applies to all in-production and new engine types (rated thrust >26.7kN) on or after 1 January 2023 and represents a first step in the development of a mass and number nvPM standard for aircraft engines, and forms the basis for compiling emissions inventories for particle number emissions in the future. However, at present, the measured levels of nvPM emissions are considered confidential by the manufacturers.

There is a statistical relationship between the Smoke Number and nvPM which has been used to estimate Black Carbon (BC) mass and particle number emissions at the engine exit referred to as the Smoke Correlation

[12] Stacey et al (2019) Measurement of ultrafine particles at airports: A review. *Atmos Environ* 198

[13] Stacey et al (2020) Evaluation of ultrafine particle concentrations and size distributions at London Heathrow Airport. *Atmos Environ*, 222

[14] White Paper – Ambient Ultrafine Particles : evidence for policymakers. Prepared by the "Thinking outside the box team".

[15] Doc 9501, Environmental Technical Manual, Volume II, Procedures for the Emissions Certification of Aircraft Engines ISBN 978-92-9258-371-2

for Particle Emissions-CAEP 11 (SCOPE11)[16]. However, it is recognised that volatile (vPM) may represent the dominant component of total PM emissions from aircraft engines, and there is currently no technique that would allow it to be measured in a sufficiently robust manner for regulations on measurements or emissions limits.

The current ICAO Airport Air Quality Manual[17] describes a "first order approximation" (FOA v4.0) method for estimating emissions of particulate matter, including a procedure for estimating emissions on nvPM particle number. It does not provide a method to estimate vPM particle number, or any indication of the size distributions.

The ICAO Aircraft Emission Databank[18] incudes data on emissions of nvPM, as both mass and particle number as reported by engine manufacturers. Again, there are no data related to the volatile fractions, and there is no information on size distributions.

As it is not possible to construct a robust inventory for UFP emissions associated with airport operations, it is not possible to predict particle number concentrations (either as total PNC or size-fractionated).

Measures to control UFP emissions

The report published by the Airports Council International (ACI) in 2018[19] includes a section on mitigation options to minimise emissions of UFPs from airport operations. These relate to minimising aircraft taxiing times, implementing single engine taxiing, reducing APU use, minimising emissions from Ground Support Equipment, and promoting sustainable transport for both passengers and staff. All of these measures reduce a range of pollutants and are currently implemented at London City Airport[20],[21]. By way of example, the Airport recently decommissioned all diesel-powered Mobil Ground Power Units (MGPUs) and has replaced these with battery-powered alternatives, with electricity supplied from a renewable source.

Reference is also made in the ACI Report to changing the properties of aviation fuel, in particular related to the sulphur content. The sulphur content of aviation fuel is currently unregulated, but generally in the range of 700-900ppm (as compared to <10ppm for diesel fuels used for road transport). Following the introduction of the Ultra-Low Sulphur Diesel Directive in 2007, there was a marked change in the size distribution of particles at the Marylebone Road kerbside site, with a shift in the mode from around 20nm to 30nm[22]. Although there is no firm proof, this strongly suggests that the smaller particles recorded at airport sites may be related to the formation of sulphates in the jet engine exhausts.

The potential costs and benefits of introducing low sulphur aviation fuel have been investigated[23]. This concludes that the increase in cost of fuel would be just over 1% (at 2011 prices); however, there is a carbon penalty as the desulphurisation process involves the release of CO_2, and also consumes energy. A second, potentially adverse impact is the removal of sulphate particles in the upper atmosphere, which act as a global cooling agent.

An alternative approach than the desulphurisation of current aviation fuels is the introduction of Sustainable Aviation Fuels (SAFs). A recent study[24] has investigated the improvements to local air quality associated with the introduction of SAF blends. SAFs high cetane number, lack of aromatic hydrocarbons and near-zero sulphur content generally help reduce aviation emissions of key pollutants and toxic air contaminants. A key Airport Cooperative Research Programme (ACRP) study was conducted in 2018-2019 to assess the benefits of introducing SAF blends to commercial aircraft. Known as ACRP 02-80, the study was sponsored by the National Academy of Science, and was undertaken in two stages. The study investigated varying SAF blends[25] (5%, 25% and 50%) and reported benefits related to UFPs in terms of both particle mass [nvPM mass] and

[16] Agarwal A et al (2019) SCOPE11 Method for estimating Aircraft Black carbon Mass and Particle Number Emissions. *Environ Sci Technol* 53(3) 1364-1373.
[17] ICAO (2020) Airport Air Quality Manual, Doc 9889, Second Edition, 2020
[18] Available at https://www.easa.europa.eu/domains/environment/icao-aircraft-engine-emissions-databank
[19] Airports Council International (ACI) Europe (2018) Ultrafine Particles at Airports.
[20] Air Quality Management Strategy 2020-2023.
[21] Surface Access Strategy 2018-2025
[22] Jones et al (2012) *Atmos Environ* 50, 129-138
[23] Environmental cost-benefit analysis of ultra-low sulfur jet fuel. Available at partner.mit.edu/projects
[24] Gladstein, Neandross & Associates (2020) Sustainable Aviation Fuel: Greenhouse Gas Reductions from Bay Area Commercial Aircraft.
[25] Current regulations limit SAF blends to a maximum of 50% for safety grounds, but there is no technical reason why this could not be increased to 100% at some stage in the future.

particle number [nvPM #]. In a Fact Sheet that addresses the ACRP 02-80 study[26], the authors conclude that SAFs significantly reduce emissions of Particulate Matter, and reduce the emissions of UFPs. For a SAF 50% blend, which was considered the most common boundary condition, [nvPM mass] was reduced by 65% and [nvPM #] by 48%. Whilst not investigated in the study, the low sulphur content of SAFs is also expected to shift the mode from 20 nm to 30 nm (as was observed at roadside sites when sulphur was removed from diesel).

Sustainability Roadmap

In addition, the airport has recently published its Sustainability Roadmap[27] which sets out measures to decarbonise the airport, and many of these measures will help to further reduce emissions of UFPs, including:

- A revised Energy Strategy that is focused on renewable sources and which will remove the need for Combined Heat and Power (CHP) plant, as originally envisaged under the CADP1 proposals;
- Working with the airlines to explore the potential to expand the use of reduced thrust during taxiing, and the potential to introduce electric taxiing systems; and
- As vehicles reach the end of their working life, the airport is replacing them (where possible) with zero carbon powered versions, with the aim of having an entirely zero carbon powered fleet by 2030
- Greater provision of electric vehicle charging points at the airport;
- Working with partners to introduce a direct connection for passengers using the Elizabeth Line to access the airport;
- Targets to achieve 80% of journeys by sustainable and public transport modes by 2030; and
- Enhancements to walking and cycling provision in the vicinity of the airport.

The Roadmap also addresses the "future of flight". To support the delivery of net zero aviation and the commitment to facilitate reduction of aircraft emissions during this decade, a new Fuel Strategy will be prepared. This Strategy will build on the work already undertaken in recent years to adapt infrastructure to the upcoming phases of transition from traditional to new energy sources and facilitate supply to airline partners and increase their uptake. The Roadmap commits to working with partners to adapt infrastructure and operating environment to facilitate the development and roll-out of SAFs.

The Airport is also committed to supporting the development of zero-carbon aircraft technologies. From work completed so far, the introduction of hydrogen-powered aircraft has significant potential, with greater scalability in the medium term to the short and medium-haul flights and smaller aircraft that London City Airport specialises in.

The Airport is also preparing for sustainable urban air mobility (UAM) using electric air taxis (eVTOLs). Powered by electricity or hydrogen, they can carry passengers over short distances with the potential to transform intra-regional flight.

5.3 Jet Zero Strategy

With regard to the above, the Government recently published the Jet Zero Strategy[28] which recognises that SAFs are one of the key technologies available to government and industry to achieve Jet Zero. In respect of SAFs, the document identifies four Strategic Objectives as follows:

- We will have a SAF mandate in place by 2025, reducing greenhouse gas emissions of aviation fuel by the equivalent of at least 10% SAF use by 2030;
- Working with the private sector to build a thriving domestic SAF industry, with a commitment to have at least five commercial scale UK plants under construction by 2025;
- Working in partnership with industry and investors to build long term supply;
- Establish world-class testing and certifying facilities for SAF in the UK.

The Strategy also recognises the future, potential benefits of Zero emission flight (ZEF), and identifies six Strategic Objectives as follows:

- Grow UK share of the global aerospace manufacturing market as new forms of aircraft emerge;
- Facilitate collaboration between aviation, other transport modes and sectors of the economy on the adoption of hydrogen;

[26] Emissions Quantification Methodology Report: ACRP 02-80 Qualifying Emissions Reductions at Airports from the Use of Alternative Fuel.
[27] London City Airport (2022) Above and Beyond: Our Roadmap to a Sustainable Future.
[28] DfT (2021) Jet Zero Strategy – Delivering net zero aviation by 2050

- Ensure parallel development of aircraft with the energy and ground infrastructure required for their cooperation;
- Ensure the aviation sector workforce is prepared for the introduction of new aircraft;
- Stimulate the future innovation by promoting diversity and accessibility in the sector;
- Put in place the policy and regulatory system to enable zero emission aircraft to enter commercial service and deliver our aspiration of zero emission routes connecting different parts of the United Kingdom to be realised by 2030.

The Strategy is entirely consistent with the Sustainability Roadmap published by LCY in relation to SAFs and ZEF.

Health Impact Assessment

Recent Planning Inspectorate statement on aviation UFPs

Uttlesford District Council refused permission for the expansion of activities at Stansted Airport in January 2020, stating that "the application has failed to demonstrate that the additional flights would not result in a detrimental effect on air quality, specifically, but not exclusively PM2.5 and ultrafine particles contrary to Uttlesford Local Plan Policy ENV13 and paragraph 181 of the NPPF".

The issues related to UFPs were subsequently discussed in detail between experts representing the airport (Dr Michael Bull, Arup) and the Council (Dr Mark Broomfield, Ricardo). Both experts agreed that it was not possible to construct an emissions inventory for UFP, it was not possible to predict UFP concentrations, and that there were no standards or guidelines against which any predicted or measured UFP concentrations could be compared.

With regard to UFPs, the Inspectors Report noted that "*UFPs arise from combustion sources including burning of aviation fuel, which contains higher levels of sulphur than fuel used for road vehicles. It is also agreed that there is no reliable methodology for assessing the quantity of UFPs that would result from the development. While assumptions can be made about the mass of UFPs as a subset of* $PM_{2.5}$ *reducing over time, it is not possible to conclude on the number of UFPs in the absence of any recognised assessment methodology. That said the Health Impact Assessment considered epidemiological research which includes the existing health effects of* $PM_{2.5}$ *and thus UFPs as subset. This concluded there would be no measurable adverse health outcomes per annum*",

The Council, while raising concerns over UFPs, is nonetheless content that permission could be granted subject to conditions requiring monitoring of air quality".

Issues related to UFPs were also considered at the recent appeal to expand operations at Bristol Airport. Within the Appeal Decision, the Panel notes that "*neither the ES or the ESA assessed UFPs*", and recognised that "there are no air quality standards in regulations or policy for UFPs" and "indeed, the 2021 WHO guidelines note that the available information is insufficient to derive AQG levels for these". The Panel concluded that "*it is satisfied that the proposed condition as worded could also reasonably include future measures to monitor UFPs as methodologies become established and would thus provide comfort in respect of concerns over these particulates"*. Condition 8 does not specifically refer to UFPs but does commit to an annual update of the Air Quality Action Plan which provides for a review of targets against new scientific or technical developments.

Approach to the HIA for UFPs

Chapter 12 of this ES is related to public health and wellbeing. The assessment fulfils the EIA requirement to consider the likely significant effects on human health and follows good practice methods[29, 30, 31].. The assessment explains the public health implications of the project using a qualitative assessment methodology, which is informed by quantitative inputs where these are available, but also other sources of public health

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[29] Pyper, R., Cave, B., Purdy, J. and McAvoy, H. (2021). Health Impact Assessment Guidance: A Manual and Technical Guidance. Standalone Health Impact Assessment and health in environmental assessment. Institute of Public Health. Dublin and Belfast. https://publichealth.ie/hia-guidance/
[30] Cave, B., Claßen, T., Fischer-Bonde, B., Humboldt-Dachroeden, S., Martín-Olmedo, P., Mekel, O., Pyper, R., Silva, F., Viliani, F., Xiao, Y. (2020). Human health: Ensuring a high level of protection. A reference paper on addressing Human Health in Environmental Impact Assessment. As per EU Directive 2011/92/EU amended by 2014/52/EU. International Association for Impact Assessment and European Public Health Association.
[31] Institute of Environmental Management & Assessment (2022). Guide: Determining Significance for Human Health in Environmental Impact Assessment. [In Press]

evidence. For the reasons set out above it is not possible to predict UFP concentrations, and there cannot be quantitative UFP data inputs to support this assessment. This does not affect the validity of the assessment and puts it on a par with most other determinants of health. This methodology follows national and international good practice, allowing effects across the wider determinants of health to be assessed on a consistent and transparent basis.

UFPs are one of many public health issues for which there is currently not sufficient aetiological or effect size evidence to inform a clear policy position. It is part of the impact assessment process to appropriately reflect on and respond to uncertainties, applying the precautionary principle correctly and proportionately.

The qualitative assessment of UFPs is informed by a literature review of recent published peer-reviewed research on UFPs. The review has had regard to the strength of evidence, the quality of research (internal validity) and its application to the LCA context (external validity). The assessment considers the exposure pathway for UFPs and groups who may be particularly sensitive. The analysis characterises the magnitude of the change in UFPs due to the project using a qualitative framework. A conclusion is reached on the population health implications, including in relation to any significant inequalities. The assessment considers in-combination effects with other determinants of health, cumulative effects with other relevant projects and the need for mitigation and/or monitoring. The assessment is framed by the health policy context and UK air quality standards.

Conclusions

It is fully recognised that there are concerns related to UFP emissions from airports. From the evidence available, total UFP concentrations appear to be within the range of those measured at traffic and background sites, but the size distribution is different. There is no evidence to demonstrate whether this size difference is associated with greater or lesser health effects.

There are no national, regional or local polices that refer to the assessment of UFPs with regard to determining development proposals. There is currently no robust methodology to construct an emissions inventory for UFPs, and consequently it is not possible to predict UFP concentrations. In addition, there are currently no standards or guidelines in place against which measured or modelled UFP concentrations could be compared. Whilst the benefits of expanded monitoring networks are appreciated, there would be no advantage to undertaking a baseline survey at this time, as it could not assist in determining the likely significant effects of the proposed variation to conditions.

The issue was extensively discussed at the recent Stansted Airport inquiry where the Inspector was satisfied that the HIA had adequately considered the potential impacts of UFP emissions. This ES includes a chapter on public health and wellbeing that addresses the issue of UFPs.

UFP emissions are predominantly associated with combustion sources. Whilst not all measures to reduce PM+ and $PM_{2.5}$ emissions will necessarily reduce UFP emissions, those associated with primary combustion sources should be successful. The Airport has in place an Air Quality Management Strategy that has been agreed with the London Borough of Newham, and which addresses all of the measures recommended by ACI in its recent report on airports and UFPs.

A recent study funded by the National Academy of Science has demonstrated that SAF blends are very successful in reducing both PM and UFP emissions. The Sustainability Roadmap published by London City Airport sets out a commitment to introduce SAFs through working with partners and ensuring that infrastructure is provided. The Roadmap also commits to exploring zero-emission aircraft, to a range of other measures to reduce on-site combustion sources and the promotion of sustainable transport. The Roadmap is fully consistent with the Government’s Jet Zero Strategy.