

Aviation & Health**What this paper is about**

This paper briefly summarises the key human health issues associated with the environmental impacts of aviation and highlights issues for discussion.

Points for discussion

Delegates are asked to consider:

- Is local air quality monitoring undertaken at their airport (both on airport and off-airport) and if so who funds the monitoring and is it independently verified?
- Are Ultrafine Particles monitored at their airport?
- Are ACCs appraised of how health issues are addressed by their airport and what are the key issues?
- Are there any matters that UKACCs should raise in its response to the Aviation Green Paper?

Possible Action

Depending on discussion at the meeting.

Introduction

1. The impact of civil aviation on health is an area of growing public concern, with the key impacts of concern being emissions, air quality, aircraft noise and pollution from surface access to airports. This paper briefly summarises the key human health issues associated with the environmental impacts of aviation and highlights issues for discussion which could be further explored with their airports.

Aviation Noise

2. There is a growing evidence base suggesting that aircraft noise has serious negative effects on human health. The impact is particularly pronounced with night noise from aircraft. Aviation noise can affect human health and wellbeing in a variety of ways.

3. The recently issued World Health Organisation's (WHO) Environmental Noise Guidelines¹ for the European Region provide guidance on protecting human health from harmful exposure to environmental noise. They set health-based recommendations on average environmental noise exposure of five relevant sources of environmental noise - road traffic noise, railway noise, aircraft noise, wind turbine noise and leisure noise. The guidelines aim to support the legislation and policy-making process on a local, national and international level. The guidelines contain strong recommendations which WHO believes serve as the basis for policy-making processes.

4. Several health outcomes were reviewed by WHO which included cardiovascular and metabolic effects, annoyance, effects on sleep, cognitive impairment, hearing impairment and tinnitus, adverse birth outcomes, and quality of life, mental-health and well-being – and the effectiveness of interventions in reducing noise exposure and health impacts.

5. Here are some of the most common adverse health effects associated with aviation noise:

Those adverse health impacts rated as critical by the WHO are:

- **Mental health** – aircraft noise causes disruption to people's lives, referred to as annoyance, and there is evidence of an increase in stress and anxiety for people affected by aircraft noise. Annoyance can be defined as a feeling of resentment, displeasure, discomfort, dissatisfaction or offence which occurs when noise interferes with thoughts, feelings or activities. The annoyance of populations exposed to environmental noise varies not only with the sound itself (such as how loud it is, or its pitch), but also with social, psychological or economic factors.
- **Productivity and development of children** - studies have shown negative effects of noise, particularly in relation to aircraft noise, impacts on cognitive performance in school children, due to the interruptive nature of high levels of aircraft noise. Research has suggested effects on reading comprehension and memory. Cognitive performance affects attention, perception, mood, learning and memory.
- **Sleep disturbance** - noise-induced sleep disturbance refers to awakenings, changes to sleep structure such as changes to sleep stages, arousals in heart rate, and body movements. People can be aware of such disturbance, such as when they remember being awoken by noise, or the disturbance can go unnoticed at the time but may result in next-day fatigue.
- **Cardiovascular disease (CVD)** - noise events place the body under stress, even when the person displays no conscious reaction to the noise. The added stress leads to raised heart rate and blood pressure. Research has found an association between high levels of aircraft noise and an increased risk of developing CVD. It is thought that this occurs due to the way such stressors interact with the body, and the fact that the cardiovascular response to noise does not decrease, even though the individual may no longer consciously notice or react to the noise. Cardiovascular disease includes all


¹ <http://www.euro.who.int/en/health-topics/environment-and-health/noise/environmental-noise-guidelines-for-the-european-region>

the diseases of the heart and circulation including coronary heart disease, angina, heart attack, congenital heart disease and stroke.

Those adverse health impacts rated as important by WHO:

- Adverse birth outcomes
- Reduced quality of life
- Well-being and mental health (*eds: link to dementia*)
- Metabolic outcomes (*eds: obesity*)

6. The WHO's recommendations in relation to aircraft noise are:

|  Aircraft noise | Strength |
|---|----------|
| For average noise exposure, the GDG strongly recommends reducing noise levels produced by aircraft below 45 dB L_{dan} , as aircraft noise above this level is associated with adverse health effects. | Strong |
| For night noise exposure, the GDG strongly recommends reducing noise levels produced by aircraft during night time below 40 dB L_{night} , as night-time aircraft noise above this level is associated with adverse effects on sleep. | Strong |
| To reduce health effects, the GDG strongly recommends that policy-makers implement suitable measures to reduce noise exposure from aircraft in the population exposed to levels above the guideline values for average and night noise exposure. For specific interventions the GDG recommends implementing suitable changes in infrastructure. | Strong |

7. The WHO recommendations come with caveats as the guidelines recognise that these are aims to be achieved over time and they recognise that there will be a time lag from implementation of, possibly, a variety of interventions to an actual reduction in noise exposure. It is also important to note that current UK Government policy does not require airports to measure down to these noise levels. Defra is currently looking at the evidence underpinning the guidelines and has commissioned work to independently review/analyse policy across government departments, including devolved administrations, the costs and benefits that need to be taken into account, including implications for webtag. The review outcome is expected in 2021.

8. It should also be noted that Public Health England (PHE) is starting to build up research on aviation noise and health effects. UKACCs is in contact with PHE and is looking at the possibility of them attending next year's Annual Meeting to give an update on its work.

Air Quality

9. The relationship between air pollution and damage to human health is well established. Exposure to poor air quality can cause short-term eye, nose and throat irritation as well as headaches, dizziness and fatigue. It can also exacerbate the effects of asthma, particularly in children. Over time, this exposure can lead to respiratory disease, cardiovascular disease or even cancer. According to the UK Government, each year around 29,000 premature deaths are attributable to air pollution from large particles in the UK.

Airports can exacerbate air pollution problems both as a result of aircraft emissions and by increasing road traffic. In the Aviation Green Paper, the Government states that it is determined to improve air quality. The UK is compliant with ambient air quality legislation for most pollutants, but nitrogen oxides are an exception. Emissions of nitrogen oxides have fallen by almost 27% between 2010 and 2016. However, much work remains to be done.

10. The national Air Quality Objectives and EU limit and target values with which the UK must comply are summarised in the [National air quality objectives](#)² of the Air Quality Strategy.

11. The main pollutants of concern around airports are:

- **Nitrogen dioxide (NO₂)** - is formed by nitrogen oxide (NO_x) emissions from surface traffic, aircraft and airport operations. The main effect of breathing in raised levels of NO₂ is the increased likelihood of respiratory problems. NO₂ inflames the lining of the lungs, and it can reduce immunity to lung infections. This can cause problems such as wheezing, coughing, colds, flu and bronchitis.
- **NO_x** - in the lower atmosphere contributes to the production of ozone; ozone in the lower atmosphere is a pollutant, and contributes to global warming. NO_x from high-altitude supersonic aircraft are thought to damage the stratospheric ozone layer, the protective layer that filters out harmful radiation from the sun. Although airports are generally not responsible for local ozone pollution i.e. they produce little ozone, ozone plays an important role in the formation of NO₂ which is the main pollutant of concern in the vicinity of airports. Therefore examining the long term ozone trend around airports is important for understanding NO₂ concentrations in both the short and longer term.
- **Particulates** - The smaller the particles of pollution (PM), the deeper they can penetrate into the respiratory system and the more hazardous they are to breathe. Recent studies indicate that PM can cause lung irritation, which leads to increased permeability in lung tissue. The PMs of interest are:
 - **PM₁₀ and PM_{2.5}** - are of concern, since particulate emissions from jet exhausts are almost all in this fine fraction.
 - **Ultrafine Particles (UPF)** – UFPs are not currently subject to any regulation or standards and the WHO has not recommended an air quality guideline. UFP research is still in its early stages and the international debate on whether to regulate these pollutants continues. As research over the past 10 to 15 years has continually indicated, the finer combustion derived particle fractions, including particles under 0.1 µm in (aerodynamic) diameter, tend to have the biggest biological effects. In June 2012 airports were identified as a significant source of ultrafine particulate pollution, and that a large proportion of these particles are generated during aircraft take-off with the resulting ‘spike’ in ultrafine particles detected at least 600m from the airport based on studies at Los Angeles International Airport.

In a recent report by the Government’s air quality expert group (AQEG) it states “*Authoritative reviews of the health effects of UFP exposure have concluded that although some studies are suggestive of adverse health effects, there is currently insufficient evidence to justify setting a standard for UFP separate from those for PM_{2.5} and PM₁₀. This being the case, it is difficult at present to come to a firm view as to the significance of UFP as a pollutant in the UK atmosphere. However, until such matters are resolved through further research, it will be important to continue to monitor and evaluate the concentrations of UFP in the UK, both to understand better their sources and dynamics and to provide a database for use in health effects research*”. The group has recommended further monitoring, including the establishment of at least one permanent site monitoring in the vicinity of a major airport.

² https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf

12. The Aviation Green Paper recognises the need to take further action to ensure aviation's contribution to local air quality issues is properly understood and addressed and is proposing measures to improve monitoring of air pollution, including UFP, in order to improve understanding of aviation's impact on local air quality; to ensure comprehensive information on aviation-related air quality issues is made available to better inform interested parties (to be achieved through government guidance on the scope and content of airport air quality reports); to require all major airports to develop air quality plans to manage emissions within local air quality targets; to require validation of air quality monitoring to ensure consistent and robust monitoring standards that enable the identification of long-term trends; and to support industry in the development of cleaner fuels to reduce the air quality impacts of aviation fuels (to be achieved by international action to develop cleaner fuel standards and reviewing progress towards Renewable Transport Fuel Obligations by 2032).

Surface Access

13. Planning development to meet the projected increased demand in passenger air traffic is also a cause for concern. While emissions from road vehicles are expected to decrease, this will be offset by growth in surface access movements around airports. Increasing capacity in more rural areas will lead to the erosion of tranquillity, loss of habitats for wildlife and increased surface traffic. The environmental and health impacts of aviation should therefore include the impact of surface access to airports, and given that passengers, employees and goods often travel considerable distances to reach certain airports, this needs to be considered across the widest possible geographical context.

Areas for consideration by ACCs

14. As highlighted above, the environmental health impacts of aviation noise and air pollution are significant and are key issues to be addressed by airports and the industry. There is much research work being undertaken by Defra and DfT on developing better understanding of how the health impacts can be addressed but the outcomes of that work will not be known for some time. However, in the meantime it is important for ACCs to be kept informed of airport growth plans and ways in which their airport plan to manage and mitigate the negative impacts and to ensure that the measures put in place are widely communicated to local authorities, local communities and other interested parties.

15. Delegates are therefore asked to discuss ways in which ACCs can help ensure airports and the industry take into account the environmental health impacts of their operations and in growth plans.

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