Effects of Aircraft Noise

There has been extensive research and studies into the effects of exposure to environmental noise. Central to this research is the World Health Organization (WHO), who have published three important Guidelines which have, and continue to, inform policy makers on noise and health effects:

- WHO "*Guidelines for Community Noise*", 1999[i]: Partially superseded by the WHO Environmental Noise Guidelines for the European Region, 2018, however, the guideline values for internal noise and maximum noise levels from regular noise events remain relevant.
- WHO "*Night Noise Guidelines for Europe*", 2009[ii]: The Night Noise Guidelines for Europe recommend a lowest observed adverse effect level (LOAEL) for night-time noise and an interim target.
- WHO "*Environmental Noise Guidelines for the European Region*", 2018[iii]: Provides recommendations for protecting human health from exposure to environmental noise originating from various sources including road traffic, railway, and aircraft noise. The 2018 Guidelines partially superseded the WHO Guidelines for Community Noise 1999 but do not supersede the Night Noise Guidelines for Europe, 2009. The recommendations include guideline values for aircraft noise, road traffic noise and railway noise using L_{den} and L_{night} metrics in terms of the onset of health effects.

A number of studies have considered transportation noise sources including road, rail and aircraft with responses being found to differ depending upon the source. This work has resulted in organisations such as the European Environment Agency (EEA)[iv] and the WHO developing guidelines and advice based on reviews and meta-analysis of the available research.

In 2011, the WHO Europe and the Joint Research Centre published the report "*Burden of Disease from Environmental Noise"* [v]. The aim of this report was to provide technical support to policymakers in the form of quantitative risk assessment of environmental noise, using the evidence available in Europe.

For each noise-induced outcome, the report estimated the number of life years affected by noise, defined as Disability Adjusted Life Years (DALYs). DALYs are the sum of the potential years of life lost due to premature death and being in states of poor health or disability. The outcomes considered included were ischemic heart disease, cognitive impairment of children, sleep disturbance, tinnitus, and annoyance. It was estimated that 654,000 years were lost annually due to annoyance in the EU Member States, and other western European countries (from combined noise sources, but predominantly road traffic noise). This was only exceeded by those lost due to sleep disturbance annually, which were calculated as 903,000 years.

In October 2018, the WHO published new "Environmental Noise Guidelines for the European Region"[vi]. The guidelines summarise the research into the impact on health of environmental noise. The critical health outcomes investigated are presented below including the noise metrics most closely correlated to them:

- Cardiovascular disease – L_{den}, $L_{Aeq,16h}$, $L_{Aeq,24h}$
- Effects on sleep – $L_{Aeq,8h}$, L_{Amax} and SEL
- Annoyance – L_{den}, L_{dn} and $L_{Aeq,24h}$
- Cognitive development in children - L_{den}, L_{Aeq}, L_{Amax} and SEL
- Wellbeing - $L_{Aeq,16h}$ and $L_{Aeq,8h}$

The guidance strongly recommends reducing noise levels produced by aircraft to below 45 dB L_{den}, as aircraft noise above this level is associated with adverse health effects. For night noise exposure, guidance recommends reducing noise levels produced by aircraft during night-time to below 40 dB L_{night}, as nighttime aircraft noise above this level is associated with adverse effects on sleep. However, the guidelines are aspirational and focus purely on health. The guidelines do not consider the wider social and economic aspects aviation sustainability and are therefore considered aspirational.

At European level, the exposure response functions (ERFs) from the guidelines have been adopted as a means of calculating the harmful effects from aviation noise as a revision to Annex III of the END[vii]. However, this revised Annex of the END suggests local dose response relationships may also be used for this purpose. In the UK, the Department for Transport's current position with respect to aviation noise and the WHO guidelines is presented in Aviation 2050[viii]. This states that whilst the Government agrees with the ambition to reduce and to minimise adverse health impacts, it wants policy to be underpinned by the most robust evidence on these effects, including the total cost of action and recent UK specific evidence, which the WHO report did not assess.

In the UK, important historical studies include the UK Aircraft Noise Index Study (ANIS) published in 1984 and Attitudes to Noise from Aviation Sources in England (ANASE) published in 2007. In 2014, the Department for Transport commissioned the Survey of Noise Attitudes (SoNA) study, which built on previous noise attitudes surveys by Defra with the addition of an aircraft noise section. Importantly SoNA has been significant in informing the Government noise policy by way of their published Consultation Response on UK Airspace Policy in 2017[ix].

In the UK the CAA regularly reconsider the evidence base and report their findings, including the following key documents:

- CAP 2370 - Aircraft Noise and Sleep Disturbance: An update (2014-2022) - 2022
- CAP 2161 - Survey of Noise Attitudes 2014: Aircraft Noise and Sleep Disturbance - 2021
- CAP 1164 - Aircraft noise, sleep disturbance and health effects - 2014
  o ERCD report 1208 - Aircraft Noise, Sleep Disturbance and Health Effects: A Review – 2013 • Annoyance
- CAP1588 - Aircraft Annoyance: Recent Findings-2018
- CAP 1506 - Survey of Noise Attitudes 2014: Aircraft Noise and Annoyance - 2014, Cardiovascular disease and daytime health effects
- CAP 1278 - Aircraft noise and health effects: Recent findings - 2016

- ERCDreport0907-Environmental Noise and Health: A Review-2010 • Cognitive development in children
- ERCDReport0908–AircraftNoiseandChildren'sLearning-2010

Since 2019, the CAA have provided regular updates on recent work and findings in the field of aircraft noise and health effects to provide a succinct overview of emerging work in the field of aviation noise and health.

Importantly, the Department for Transport has commissioned the Aviation Night Noise Effects (ANNE) study[x], to examine the relationship between aviation noise on sleep disturbance and annoyance, and how this varies by different times of the night.

Additionally, the Civil Aviation Authority (CAA) has been tasked with developing the new Aviation Noise Attitudes Survey (ANAS). ANAS, findings expected this year, will build on lessons learnt from SoNA[xi] and focus on experiences of exposure to day-time aviation noise.

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[i] Guidelines for Community Noise, World Health Organization, 1999

[ii] Night Noise Guidelines for Europe, World Health Organization, 2009

[iii] Environmental Noise Guidelines for the European Region, World Health Organization, 2018

[iv] https://www.eea.europa.eu/publications/environmental-noise-in-europe

[v] Burden of disease from environmental noise Quantification of healthy life years lost in Europe – 2011

[vi] Environmental Noise Guidelines for the European Region, World Health Organization, 2018

[vii] Commission Directive (EU) 2020/367 of 4 March 2020 amending Annex III to Directive 2002/49/EC of the European Parliament and of the Council as regards the establishment of assessment methods for harmful effects of environmental noise

[viii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/769695/aviation-2050-web.pdf

[ix] Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace - October – 2017

[x] Aviation Night Noise Effects (ANNE) study findings expect this year

[xi] CAP 1506 - Survey of Noise Attitudes 2014: Aircraft Noise and Annoyance