

Fingal Development Plan Stage 3 Submission

TO SUPPORT THE INCLUSION OF PA CH 8.1

Table of Contents

SUBMISSION DOCUMENTS
1.0 EXECUTIVE SUMMARY
2.0 DAA SUBMISSION
3.0 COUNCILLOR DARRAGH BUTLER'S SUBMISSION
4.0 HSE ENVIRONMENTAL HEALTH SECTION
4.1 SUBMISSIONS14
4.2 HSE Dept of Public health SUBMISSION TO PLANNING AUTHORITY 14
4.3 HSE EHS SUBMISSION #1TO PLANNING AUTHORITY 18
4.4 HSE EHS SUBMISSION #2TO PLANNING AUTHORITY 20
4.5 SUBMISSION TO ANCA20
5.0 FINGAL ENVIRONMENTAL HEALTH AIR & NOISE UNIT
5.1 SUBMISSIONS23
5.2 SUBMISSION TO PLANNING AUTHORITY 23
6.0 UNLAWFUL DEVELOPMENT
7.0 FINGAL COUNTY COUNCIL PLANNER'S REPORT
8.0 NOISE ZONES
8.1 NOISE ZONES
9.0 HEALTH AND HEALTH COSTS
9.1 SUMMARY
9.2 LATEST RESEARCH
9.3 POPULATION AND HUMAN HEALTH .39
9.4 HEALTH BURDEN - DALY CALCULATION 43
9.5 DAA'S HEALTH EXPERTISE44
9.6 HEALTH REVIEW
9.7 HEALTH STUDY ON AIRCRAFT NOISE EVENTS 52
CONCLUSION

SUBMISSION DOCUMENTS

Included in this submission are:

'Dublin_Airport_Noise_Medical_Report.pdf':

A health report summarising the latest research into adverse health effects from aircraft noise. The report was written by Professor Thomas Münzel MD, Head of the Department of Cardiology at the University Medical Center, Johannes Gutenberg University Mainz, Germany. Professor Münzel's research group focuses on environmental risk factors for cardiovascular disease with a focus on aircraft noise and air pollution. He has more than 1000 publications and a Hirsch index of 136. The report focuses on the latest research and particularly on the cardiovascular effects of night-time noise. The report also discusses the noise statistics from the revised EIAR.

'HealthEffectsOfAircraftNoiseOnTheCardiovascularSystem.pdf'

Slides from webinar by Professor Münzel on the research on the health effects of aircraft noise on the Cardiovascular System

HSE.pdf

Submission by the HSE Environmental Health section to the Planning Authority for Planning Application F20A/0668, dated January 28th, 2021.

HSE2.pdf

Submission by the HSE Environmental Health section to the Planning Authority for Planning Application F20A/0668, dated September 29th, 2021.

HSE-DeptOfPublicHealth.pdf

Submission by the HSE Department of Public Health to the Planning Authority for Planning Application F20A/0668, dated February 1st, 2021.

Environmental Health Submission Feb 2022.pdf

Submission by the HSE Environmental Health section to ANCA, dated February 24th, 2022.

Fingal-EnvironmentalHealth.pdf

Submission by the Fingal Environmental Health Air & Noise Unit, dated October 15th, 2021.

$\label{eq:constraint} A dverse Cardiovas cular Effects Of Traffic Noise With A Focus On Night Time Noise And The New WHON of the New Section 1.5 and the New Section 1.5 and$

Paper submitted to the Annual Review of Public Health by Münzel et al

I.0 EXECUTIVE SUMMARY

PA CH 8.1: SECTION 8.5.7 ENSURING ENVIRONMENTAL PROTECTION AND SUSTAINABILITY

I wish to support the proposed amendment to include the following text on page 309 of the Draft Fingal Development Plan 2023-2029:

"That the Development Plan recognises the inadequacy of the proposed noise insulation scheme to protect the health of those affected by aircraft noise and that in view of the increasing knowledge and scientific evidence of the serious health impact of aircraft noise on the physical health of Fingal residents that it is an objective to take measures including the expansion of noise insulation to ensure noise levels produced by aircraft during night time are reduced to below 40 DbL Night, as night-time aircraft noise above this level is associated with adverse effects including increased mortality, stress, high blood pressure and a deterioration in cardiovascular health".

In the following chapters in this submission, reference is made to:

- Daa's submission to the Development Plan
- Councillor Darragh Butler's submission to the Development Plan
- HSE Department of Public Health's submission to the Planning Authority on the daa's night-time planning application
- HSE EHS submissions to the Planning Authority on the daa's night-time planning application
- HSE EHS submissions to ANCA on the daa's night-time planning application
- Fingal's Environmental Health Air & Noise Unit submission
- Review of health research into aircraft noise
- Health costs of aircraft noise

In summary, the WHO guideline limits have been recommended by the HSE and Fingal's Environmental Health unit for mitigation purposes. Extensive research is available to show the adverse effects of night-time aircraft noise on public health. Fingal County Council have not factored in the health costs of aircraft noise, and insulation as a mitigation would be a small price in comparison to the annual 500million costs in annoyance and sleep disturbance alone.

Fingal County Council have included metrics in the Noise Zones and there's no reason why metrics for night-time insulation cannot be included in the Development Plan. The daa and ANCA have no health expertise and it's imperative that the Development Plan includes safeguards for public health.

Feedback is provided below on the submission by RPS on behalf of the daa and the submission by Councillor Darragh Butler. This proposed amendment does not impact on future development, as any noise impacts are included in the planning Noise Zones. The inclusion of the WHO strong recommendation is entirely appropriate in the Development Plan as the Local Authority has failed to control noise from Dublin Airport through the Noise Action Plans (NAPs) and the END. Citizens' health needs to be prioritised and noise insulation will help mitigate the effects of noise. I whole heartedly support the proposed amendment and commend Councillor Brian McDonagh for proposing the motion.

2.0 DAA SUBMISSION

FIN-C532-36

The RPS Group lodged a submission on behalf of the daa on Dec 16th with regard to PA CH 8.1, requesting that it should be rejected. There are a number of flaws in their argument which I would like to highlight.

Section 3.1 states:

"Airport Noise concerns are governed by the provisions of the Aircraft Noise (Dublin Airport) Regulation Act 2019 (and sections 34B and 34C of the Planning and Development Act, 2000, as amended. Under these provisions the Airport Noise Competent Authority (ANCA) is the statutory body with responsibility for assessing potential aviation noise impacts, whether a development is acceptable with reference to its aviation noise impacts and advising on any mitigation measures or conditions necessary in respect of aviation noise."

ANCA has responsibility for operating restrictions only and implementing them as a last resort in terms of the Balanced Approach. Its expertise is not in health, and it is not taking the advice of the World Health Organisation (WHO) on board. ANCA has not sought any advice on health from medical experts. The same was acknowledged by the daa who also have not sought medical expertise.

RPS make reference to the Noise Abatement Objective (NAO) for Dublin Airport. Its sole purpose is to set targets to reduce noise over a long period of time. It does not acknowledge the impacts that high levels of noise above the WHO limits are having on human health. Nor does it include a monetary assessment of the health costs associated with the number of people Highly Annoyed and Highly Sleep Disturbed. The NAO deals with relative numbers only.

RPS make reference to the adequacy of the noise insulation scheme in section 3.2. The WHO have made a strong recommendation that external noise levels greater than 40dB Lnight lead to adverse health effects. The daa have stated that the aim of their insulation programme is a reduction in noise of 5dB. It is very clear that a large cohort of Fingal residents are suffering adverse health effects of aircraft noise and ANCA have rubber stamped the daa's application to only provide insulation to those 'very significantly' adversely affected and have not provided insulation for those 'significantly' affected. This is a serious breach of the EIAR guidelines not to mitigate against 'significant' adverse effects and shows that ANCA and the Planning Authority are not serious about the protection of the health of Fingal residents.

In section 3.3 RPS state that this amendment is in conflict with NSO 6 of the NDP. This is factually incorrect. NSO 6 focuses on the delivery of the North Runway and the new control tower.

Strategic Investment Priorities

Airports

- daa is progressing the delivery of a new runway for Dublin Airport at an estimated cost of €320 million. The new North Runway is a key strategic infrastructure project for the State and will ensure that expected future demand can be met. The runway is due to enter service in 2022.
- The Irish Aviation Authority has continued its work on the new €50 million visual control tower at Dublin Airport. The technical fit-out of the tower, which is required to facilitate operations at the airport on the new North Runway, was completed on budget in 2020. Full operations are planned for the tower towards the end of 2021.

In fact the opposite is far more accurate. NSO 6 stresses the importance of the 'greening' of airports and achieving net zero carbon by 2050 and conforming to the Fit for 55 package. The adherence to 40dB Lnight would help achieve the aims of net zero carbon by 2050. Night-time flights have been shown to contribute more to non-CO2 effects of aviation than daytime flights.

Sectoral Strategies

While investment will continue to support international connectivity and competitiveness, it will also target the 'greening' of airports and ports.

In relation to airports, a new National Aviation Policy will be developed to provide a framework for the sustainable recovery and development of the Irish aviation sector over the course of the next decade. Similarly, in order to position our port network to address any future capacity constraints and address the global trend towards green and smart ports, a review of National Ports Policy will commence by the end of 2021.

In line with the European Green Deal, airports and ports are already identifying pathways towards achieving net zero carbon emissions by 2050. Measures include improved energy efficiency of airports and port infrastructure and related services, on-site generation of the renewable energy, and alternatives to carbon-based fuels as technology improves, including supports for sustainable aviation fuels (SAF), taking account of the Fit for 55 package, which was announced by the Commission in July 2021.

In section 3.4 RPS attempt to state that the proposed amendment *"makes an unsupported commentary in respect of the proposed insulation scheme*". Are RPS attempting to overrule the conclusions of the WHO? The WHO made strong recommendations to keep noise levels below 40dB Lnight. Can RPS outline what research they have conducted to counter the WHO's recommendation?



Recommendation	Strength
For average noise exposure, the GDG strongly recommends reducing noise levels produced by aircraft below $45 \text{ dB} L_{den}$, 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 <i>L</i> _{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.	s Strong

In section 3.5 RPS discuss the Development Plans – Guidelines for Planning Authorities. The following is an extract from these guidelines, and it clearly states that the objective 'should be referenced against an indicator for the purposes of monitoring'. It further states a 'measured objective that may be linked to data-based indicators or metrics'. The 40dB Lnight metric clearly satisfies this requirement.

The objective should be capable of implementation and should be referenced against an indicator for the purposes
of monitoring.

The objective should be framed and worded in a manner that means it is capable of being clearly understood and capable of implementation - a measurable objective that may be linked to data-based indicators or metrics, for example. Planning authorities should aim to select relevant and, where possible, 'action-oriented' objectives.

3.0 COUNCILLOR DARRAGH BUTLER's SUBMISSION

FIN-C532-38

Councillor Darragh Butler also made a submission on amendment PA CH 8.1. Councillor Butler states that:

"I do not believe it was adequately addressed during the debate, but I would have concerns that this motion has effectively sterilised any land from economic or housing development that would come under this designation."

Motion 204 was discussed at Development Plan meeting on October 3rd. Here is a link to meeting in which it was discussed:

https://fingalcoco.public-i.tv/core/portal/webcast_interactive/707531

Motion 204 starts approximated 2:25:00 into the recording. It continues until 3:06:40. Therefore this motion was debated in the chamber for over 40 minutes which is a considerable amount of time for one motion in the Development Plan. The motion was discussed by over 18 Councillors and was unanimously passed by all Councillors without being put to a vote.

This motion does not impact on economic or housing development. The Development Plan has Noise Zones for planning purposes that stipulate what development can occur in the different noise zones, and what mitigation measures need to be included for planning. The above motion does not impact on these noise zones and therefore has no impact on planning matters.

During the debate, Chief Executive Ann Marie Farrelly stated that ANCA is the Competent Authority for Noise and that the Planning Authority has limited function in relation to aircraft noise. ANCA was enacted as a result of the Irish Government legislating for EU598/2014 (<u>https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0598&from=EN</u>) by way of the Aircraft Noise Bill. The sole remit of EU598/2014 is "*on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC*". Therefore, ANCA is solely focused on operating restrictions. It does not have a remit on health but only in relation to operating restrictions. This is a very narrow remit, and the Planning Authority has a much wider remit in terms of human health and other planning related matters.

The current unlawful development taking place with the North Runway operations where the daa are failing to adhere to the 2007 planning permission conditions imposed by An Bord Pleanála in 2007 are being ignored by ANCA and they are stating that enforcement doesn't all under their role. The daa are breaching the noise insulation conditions attached to the 2007

planning and ANCA are also stating that the noise insulation schemes are not their responsibility. Therefore, there is a breakdown in understanding between the Chief Executive and ANCA as to its responsibilities. Fingal residents cannot rely on ANCA and therefore it must be the role of the planning authority to protect their health.

Ms Farrelly discusses the role of Land Use planning, but this does not protect the health of existing residents that are impacted by Dublin Airport operations. Land Use planning will only aid future developments. Ms Farrelly also states that ANCA has the competence to measure health impacts but neither ANCA or its consultants have any health or medical expertise. They are not informed about the latest medical research and have completely ignored evidence submitted on the health effects of aircraft noise. Resident groups have provided ANCA with a noise medical report from one of the world's foremost experts on the effects of aircraft noise on the Cardiovascular system, Professor Munzel from Germany. But no reference was made to this report by ANCA or the Planning Authority. A webinar by Professor Munzel was also provided and again no reference was made by ANCA or the Planning Authority. It is very evident that neither ANCA or the Planning Authority wanted to engage on health matters.

It is also of note that ANCA never considered the cost of health issues due to aircraft noise. It has been estimated that in 2019 the cost of health impacted borne by Irish society equates to 400-600 million euro when considering the impacts of annoyance and sleep disturbance. This has not been factored into consideration and it's imperative that the Fingal Development Plan takes these health costs into account.

I refer to an email response from ANCA enquiring about its role to issue enforcement notices against the daa for their unlawful development:

"In our correspondence of 5 December 2022, ANCA addressed your queries in respect of whether ANCA had issued enforcement notices (under Section 23 of the Aircraft Noise (Dublin Airport) Regulation Act 2019) regarding planning conditions associated with the operation of the north runway at Dublin Airport. As the planning authority is the enforcement authority regarding issues arising through planning conditions, we confirmed that no notices were issued under Section 23 of the Act of 2019 in this context. I draw your particular attention to Section 22 of the Act of 2019 which establishes the context for the enforcement notices that may/may not be issued under Section 23. ANCA will continue to independently apply the provisions of the legislation and again refer you to the planning authority as the relevant body for an investigation of the issues that you have raised. "

I also refer to further correspondence from ANCA in regard to noise insulation:

"The Planning and Strategic Infrastructure Department of Fingal County Council is the enforcement authority for matters arising through conditions contained within planning and development consents. In this context, ANCA has not issued any enforcement notices relating to compliance with planning conditions and this aspect of your correspondence should be directed to the planning authority.

The planning permission for the north runway provides for home and school insulation measures and the voluntary purchase of properties. The conditions within the planning permission detail the eligibility criteria for these schemes and also make provision for regular review to cater for changes in the noise climate around the airport that were not captured in the assessment forecasts. ANCA also made provision for an additional home insulation scheme through a regulatory decision in June 2022. The decision of the planning authority, incorporating this regulatory decision, has been appealed to An Bord Pleanála and this scheme is dependent on the outcome of the appeal process.

Although your correspondence references aspects of the debates of the houses of the Oireachtas as the bill progressed through the relevant stages, the Aircraft Noise (Dublin Airport) Regulation Act 2019 represents the final intent of the legislators. It is the function of ANCA to independently implement the role of competent authority arising from this Act and Regulation (EU) 598/2014 (the Aircraft Noise Regulation).

ANCA recently published a review of the effectiveness of the noise mitigation measures and operating restrictions on achieving the noise abatement objective (NAO) on our website. The assessment was carried out for the full calendar year of 2021, referencing the metrics of the NAO. These metrics are based on noise exposure as averaged over a full year as defined by environmental legislation. ANCA will carry out this review on an annual basis and the assessment of the full year that incorporates activity from the north runway will be prepared during 2023."

"Planning application F20A/0668, containing the regulatory decision by ANCA, has been appealed to An Bord Pleanála, and that authority will set the parameters for the preparation of noise exposure contours for the appeals process.

Aircraft noise exposure contours for ANCA will be based on models that reflect the aircraft activity for the relevant year. Environmental noise legislation prescribes the use of annual averaged metrics and these will be prepared for the calendar year of 2022 during 2023. ANCA does not have a timeline for the preparation of this data at this time."

"The identified role of ANCA in relation to insulation schemes is detailed within Section 20 of the Act of 2019 – i.e. ANCA must ensure that insulation schemes apply to all homes located within the relevant noise contours.

Environmental noise legislation requires noise impact assessments to be undertaken in a standard format across the European Union. These methods require assessment using average sound levels as determined over all the days of a year. Noise assessments for the year 2022 will be undertaken in accordance with this methodology. Work to compile the relevant contours for this period can commence after 31 December 2022. There is more information on these metrics on the ANCA website at <u>Aircraft Noise Information | Fingal County Council.</u>"

It is very evident from the above correspondence from ANCA that it will not investigate serious breaches of the noise contours and will only investigate on a yearly basis. This demonstrates that ANCA believes it has no remit to protect the public's health. It is therefore imperative that the proposed amendment is kept in the Development Plan as the local authority has a mandate to protect the health of its citizens.

4.0 HSE ENVIRONMENTAL HEALTH SECTION

4.1 SUBMISSIONS

- HSE Department of Public Health submission on 01/02/2021 on initial planning application
- The HSE Environmental Health (EHS) section made a submission, dated 28/01/2021 on the daa's planning application F20A/0668 regarding the removal of night-time flight restrictions at Dublin Airport.
- The HSE EHS also made a formal submission dated September 29th, 2021, on the daa's revised planning application.
- The HSE EHS then made a submission dated February 24th 2022 to the Aircraft Noise Competent Authority's (ANCA) public consultation. It is worth noting that the HSE are not a statutory body for consultation purposes in the ANCA process.

4.2 HSE DEPT OF PUBLIC HEALTH SUBMISSION TO PLANNING AUTHORITY

In the HSE Department of Public Health's submission, it highlights that:

- Noise can have negative impacts on human health and well-being.
- Environmental noise is among the top environmental risks to physical and mental health, and is associated with a substantial burden of disease in Europe.
- There is a plethora of evidence that sleep is a biological necessity, and that disturbed sleep is associated with a number of health problems.
- Noise disturbs sleeps by a number of pathways, and even at very low levels of noise, physiological reactions can be measured, such as increased heart rate, body movement and arousals.

It states that the proposed changes to the North Runway Planning Permission may have significant consequences for Public Health in the surrounding areas.

The submission then discusses the impact of lack of sleep on human health. It states that:

- Insufficient sleep and sleep disorders impact daily functioning, mood, cognition and cardiovascular health outcomes such as obesity, high blood pressure, diabetes, stroke and heart attack.
- Prevalence of poor sleep health is high, particularly amongst vulnerable populations such as racial/ethnic minorities and individuals of lower socioeconomic status. Many factors contribute to this high prevalence, including environmental factors.
- Noise has been shown to fragment sleep, reduce sleep continuity and reduce total sleep time.
- It is therefore important to identify and target determinants of sleep health, including environmental factors.
- Continuous exposure to aircraft noise increases the frequency of waking up during sleep and decreases slow-wave sleep (also known as deep sleep).
- The auditory system constantly scans the environment for potential threats, and humans perceive, evaluate and react to environmental sounds even when asleep.
 During sleep, night noise can be either intermittent (that is discrete noise events rather than constant background noise), or single noise event.
- When noise is accompanied by vibrations the combination of noise and vibration induces higher degrees of sleep disturbance than noise alone and other factors such as situational factors (depth of sleep phase, background noise level) and individual factors (noise sensitivity), contribute to whether or not noise will disturb sleep.
- Repeated noise-induced arousals lead to impaired sleep quality and recuperation, delayed sleep onset and early wakening, less deep and REM sleep, and more time spent awake and in superficial sleep stages.
- Noise may also prevent people from falling asleep again once woken. It is currently unclear how many additional noise- induced awakenings are acceptable and without consequence for sleep and health.
- When sleep is permanently disturbed and it becomes a sleep disorder, it is classified in the International Classification of Sleep Disorders as "environmental sleep disorder".
- Noise-induced sleep disturbance is an example of an environmental sleep disorder, which is a sleep disorder that causes complaints or either insomnia or daytime fatigue and somnolence. The exact prevalence of environmental sleep disorders is not known.

- It is generally accepted that insufficient sleep and sleep loss has a great influence on metabolic and endocrine functions, as well as on inflammatory markers, and it contributes to cardiovascular risk.
- C-reactive protein, an acute inflammatory marker, a predictor or strokes and heart attacks has been shown to linearly increase with total and/or partial sleep loss.
- Leptin, which is involved in glucose regulation and weight control, decreases with sleep loss thus increasing appetite and predisposing to weight gain, impaired glucose tolerance (risk of diabetes) and impaired host response.
- Sleep loss also effects neurobehavioural function, especially neurocognitive performance.
- Noise also activates the stress response, and long-term noise exposures may lead, in
 persons liable to be stressed by noise, to permanently increased cortisol concentration
 above the normal range. Increased risk of cardiovascular disease is connected with
 stress.
- There is considerable evidence for a relationship between sleep and the immune system, and the immune response may be impacted by environmental noise during sleep.
- Disturbed sleep leads to daytime sleepiness in 40% of affected subjects. As well as the
 potential health implications, daytime sleepiness interferes with work and social function
 and can have consequences including cognitive problems, motor vehicle accidents,
 poor job performance and reduced productivity.
- Time studies have indicated that the average amount of time people are in bed is 7.5 hours; therefore the average sleeping time would be somewhat shorter. There is considerable variation in sleeping time due to factors such as age and genetics.
- It is therefore recommended that for these reasons, a fixed interval of 8 hours is a minimal choice for night time protection, this protects about 50% of the population. It would take a 10 hour period to protect 80%.

The submission then cites the WHO Noise Guidelines and lists the potential adverse health outcomes associated with aircraft noise:

- Ischaemic Heart Disease (IHD):
- Hypertension:
- Stroke:
- Children's blood pressure:

- Annoyance:
- Cognitive Impairment:
- Hearing and tinnitus:
- Sleep disturbance:

It cites the WHO report's strong recommendations:

- Reduce noise levels produced by aircraft below 45dB Lden, and reduce night noise levels produced by aircraft to below 40dB Lden, as aircraft noise above this level is associated with adverse effects on sleep.
- To reduce adverse health effects, the group strongly recommends that suitable measures to reduce noise exposure from aircraft in the population exposed to levels above these guideline values are implemented.

With regard to replacing Condition 5 with a Noise Quota, the report states:

"This would effectively increase the number of flights taking off and landing between 23.00 and 07.00, and **reduce the protected period of time during which flight restrictions exist in current permission**. Sleep is an important biological process for overall health, and noise has been shown to disturb sleep. In addition to sleep disturbance, aircraft noise is associated with a number of adverse health outcomes.

Sleep time of 8 hours is thought to protect 50% of the population, therefore reduction of the restricted flight times to a 6 hour window between midnight and 6am may have an adverse effect on health outcomes. Proposed noise mitigation measures are welcomed, however **consideration should be given to whether these are sufficient to reduce night noise levels to recommended levels, especially in the summer months when air traffic is increased and windows are more likely to be open, modifying insulation effects.**

The current WHO recommendation is to reduce noise levels to below 45dB Lden from 55 dB Lden for the hours between 0700 and 2300 and to reduce to below 40db Lnight from 40dB - 45dB Lnight for night time hours between 2300 and 0700. This is a factor to consider in relation to the noise level contour, currently proposed by DAA, at night time noise levels of > 55dB Lnight, to qualify for noise abatement measures for homes in the vicinity of Dublin Airport. In the case of Vienna airport, homes in the vicinity with noise levels >54 dB during the day and >45dB at night are eligible for assistance towards soundproofing."

The HSE concludes that:

"The proposed changes may have the cumulative effect of increasing sleep disturbance in residents in the surrounding area, and increasing overall daily noise exposure despite proposed mitigation measures, with potential adverse health outcomes."

4.3 HSE EHS SUBMISSION #ITO PLANNING AUTHORITY

For daytime noise (Lden) the HSE references the WHO 2018 Guidelines stating:

"The WHO 2018 Noise Guidelines strongly recommends reducing noise levels produced by aircraft below 45 dB Lden, as it states that aircraft noise above this level is associated with adverse health effects."

On daytime noise, the submission concludes:

"While the EHS welcomes the significant reduction in the people exposed to airline noise between the 2018/2019 baseline and the 2022/2025 forecast baseline scenario it still acknowledges that a significant proportion of people, namely 63316 people assessed as highly annoyed and 128 people exposed to at least a high noise level based on the 2025 baseline scenario, will still be exposed to airline noise above the WHO recommendation of 45Lden."

For night-time noise (Lnight) the HSE again references the WHO 2018 Guidelines stating:

"The WHO 2018 Noise Guidelines strongly recommends reducing noise levels produced by aircraft during night time below 40 dB Lnight, as it states that aircraft noise above this level is associated with adverse effects on sleep."

On night-time noise (Lnight) the submission concludes:

"While the EHS welcomes the significant reduction in the people exposed to airline noise between the 2018/2019 baseline and the 2022/2025 forecast baseline scenario it still acknowledges that a significant proportion of people, namely 19464 people assessed as highly sleep disturbed and 281 people exposed to at least a high noise level based on the 2025 baseline scenario, will still be exposed to airline noise above the WHO recommendation of 40Lnight." The submission discusses the research by the WHO on the impact of aircraft noise on health:

"The World Health Organisation's Environmental Noise Guidelines 2018 summarise the research into the impact on health and exposure to aircraft noise. The critical health outcomes identified were:

For average noise exposure

For night noise exposure

1. Effects on sleep

- 1. Cardiovascular disease
- 2. Annoyance
- 3. Cognitive impairment
- 4. Hearing impairment and tinnitus
- 5. Adverse birth outcomes
- 6. Quality of life, well-being and mental health
- 7. Metabolic outcomes

As already outlined above the WHO strongly recommends reducing aircraft noise levels to below 45 dB Lden, and for night noise exposure to below 40 dB Lnight, as aircraft noise above these levels is associated with the above adverse health effects.

In order to reduce these health effects, the WHO strongly recommends that policymakers 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 WHO recommends implementing suitable changes in infrastructure."

The HSE EHS further state:

"The EHS acknowledges that the increase in people exposed to 50 dB Lden and 45 dB Lnight may result in adverse health effects as outlined in the World Health Organisation's Environmental Noise Guidelines 2018. Due to this the EHS feels that the mitigation measures proposed must be reflected in these increased numbers in order to reduce as much as possible the number of people exposed. The EHS also feels that the WHO levels of 45 dB Lden and 40 dB Lnight should be used when assessing eligibility for schemes such as the sound insulation improvement works."

The HSE EHS are very clear that 45 dB Lden and 40 dB Lnight should be used for assessing insulation improvement works. This is in line with the proposed amendment in the Development Plan and justifies its inclusion.

4.4 HSE EHS SUBMISSION #2TO PLANNING AUTHORITY

The submission concludes:

"The EHS makes the following observations in relation to this proposed development:

- The Conditions 3(d) and 5 were put in place to protect public health so if planning authority are going to increase the hours of operation they must ensure all who are significantly impacted have the opportunity of mitigation.
- All efforts should be made by the DAA to ensure as many people as possible are protected from the adverse health effects associated with aircraft noise as outlined above in this report. This must include reducing aircraft noise levels to below 45 dB Lden, and for night noise exposure to below 40 dB Lnight.
- The EHS is of the opinion that The World Health Organisation's Environmental Noise Guidelines of 45 dB Lden and 40 dB Lnight should have been used for ground noise assessments."

The HSE clearly state that Conditions 3(d) and 5 were put in place to protect public health and any changes to the planning conditions must ensure that mitigation is provided to all those who are significantly impacted. Noise levels must be reduced to below 45 dB Lden and 40 dB Lnight.

4.5 SUBMISSION TO ANCA

In their submission to the ANCA draft regulatory decision, the HSE EHS section state that in relation to Condition 1 of the Draft Regulatory Decision:

"The rationale given is not a rationale for revoking condition 5 of the current planning permission, but is a rationale for the Noise Quota Scheme proposed."

It further states that in relation to condition 2:

"The rationale given for amending the existing conditions is not given. The reasons given are for the new controls, which are less stringent than existing."

The HSE submission states that the existing Planning Conditions are in place to protect public health and that:

"The operating restrictions already exist and the Draft Regulatory Decision is to revoke and amend them, there should therefore be a clear rationale for this and clear evidence

that the mitigation measures proposed will ensure there is not a diminishing of health protection that is compliant with the existing operating restrictions."

It is very evident that revoking and amending the existing conditions will result in a diminishing of health protection. From table 7.21 of ANCA's Regulatory Decision Report the number of people Highly Sleep Disturbed increases from 22500 to 37080 by revoking and amending the existing planning conditions. The populations exposed to night-time noise >55dB Lnight will increase from 280 to 1059.

Table 7.21: Population HSD, HA and exposed above the NAO priorities in 2019 and in 2025 for the modelled runway use and restriction scenarios

Scenario	Population HSD	Population > 55 dB L _{night}	Population HA	Population > 65 dB L _{den}
2019 Situation	47,045	1,533	115,738	285
2025 P01 30.4 mmpa	22,500	280	64,241	119
2025 P02 32.0 mppa	37,080	1,059	79,405	196

The HSE state that if the planning authority and ANCA are going to increase the hours of operation of the runways, then they must ensure all who are significantly impacted have the opportunity of mitigation. This is not the case with the current application as only those 'highly significantly' and 'profoundly' affected are offered mitigation in the form of insulation.

The HSE also reiterates its previous submissions to the Planning Authority:

"The Conditions 3(d) and 5 were put in place to protect public health so if planning authority are going to increase the hours of operation they must ensure all who are significantly impacted have the opportunity of mitigation."

The HSE references the WHO 2018 Guidelines and notes that 45dB Lden and 40dB Lnight are "strong recommendations based on a complete review of the health research around aircraft noise."



Recommendations

For average noise exposure, the GDG **strongly** recommends reducing noise levels produced by aircraft below **45 dB** L_{den} , as aircraft noise above this level is associated with adverse health effects.

For night noise exposure, the GDG strongly recommends reducing noise levels produced by aircraft during night time below 40 dB L_{night} , as aircraft noise above this level is associated with adverse effects on sleep.

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.

They further reiterate their view that:

"It is therefore important that the noise mitigation measures are made available to all parties that are significantly impacted by the proposal to ensure protection of health."

The current proposal has failed to cater for all populations significantly affected by noise. It will result in a diminishing of health protection.

Astonishingly the HSE submissions are not mentioned in ANCA's Consultation Report. It is also worth noting that ANCA never formally requested the HSE to make a submission to their consultation process. It is a serious dereliction of their duties to not invite the State agency whose role is to protect Public Health.

5.0 FINGAL ENVIRONMENTAL HEALTH AIR & NOISE UNIT

5.1 SUBMISSIONS

• The Environmental Health Air & Noise Unit made a submission, dated 15/10/2021 on the daa's revised planning application.

5.2 SUBMISSION TO PLANNING AUTHORITY

The submission references the EIAR that has identified that a significant portion of people will be exposed to high levels of noise:

Noise level exposure - Proposed scenario v's Permitted scenario:

2022- 4% more people are likely to be highly annoyed by the 2022 proposed scenario than that of permitted scenario for 2022.

2022 -2% more people are likely to be highly sleep deprived by the 2022 proposed scenario than that of the 2022 permitted scenario.

2025-24% more people are likely to be highly annoyed by the 2025 proposed scenario than that of the 2025 permitted scenario.

2025- 65% more people are likely to be highly sleep deprived by the 2025 proposed scenario than that of the 2025 permitted scenario.

2035-19% more people are likely to be highly annoyed by the 2035 proposed scenario than that of the 2035 permitted scenario.

2035-65% more people are likely to be highly sleep deprived by the 2025 proposed scenario than that of the 2025 permitted scenario.

The submission references the WHO 2018 Guidelines:

"The 2018 WHO guidelines strongly recommend reducing night noise exposure levels produced by aircraft during night time to below 40dB Lnight. Aircraft noise above these levels are associated with adverse health effects. The DAA have modelled the night time insulation programme on exposure levels of 55dB which leaves a significant proportion of people exposed to night time levels above the 40dB exposure level recommended by WHO."

The submission further states that the removal of Condition 3(d) and the replacement of Condition 5:

"will have an adverse effect on a large percentage of the population."

The submission concludes:

"It is recommended that consideration is given to the proposed noise mitigation measures i.e. to provide an extension of the noise insulation schemes to include the 2018 WHO Environmental noise guidelines."

6.0 UNLAWFUL DEVELOPMENT

NORTH RUNWAY OPERATIONS – AUGUST 24TH, 2022

Operations began on the Northern Runway on August 24th, 2022. Since then all departing flights have been in contravention of the 2007 planning permission granted by An Bord Pleanála.

Below is an example of departure routes for Westerly operations showing divergent routes of 30 and 75 degrees. These routes were not part of the Environmental Impact Statement (EIS) assessed in 2007.



The following drawing by Bickerdike Allen Partners (BAP) is for "Airborne Aircraft Noise Contours 22022 HG typical busy day option 7B and initial departure routes." These are the routes on which the noise insulation programme was based and submitted to Fingal County Council for compliance with condition 7 of the An Bord Pleanála grant of planning for Reg Ref F04A/1755.



The Conditions of planning from 2007 also include a noise insulation scheme for dwellings, noise insulation scheme for schools and a voluntary dwelling purchase scheme. All these schemes that were agreed with Fingal County Council prior to the runway opening do not relate to current operations and so are ineffective in protecting public health.

It is imperative that the proposed amendment is added to the Development Plan to protect the public's health in line with the WHO recommendations.

7.0 FINGAL COUNTY COUNCIL PLANNER'S REPORT

PROPOSAL

On page 5 of the planning officers report, the planning officer describes the proposed relevant action and also includes on page 6 the wording of the planning application.

HSE SUBMISSION

The Planning Officer's report acknowledges the HSE submission (at pages 30-32) and acknowledges that a significant proportion of people, namely 63,316 people assessed as highly annoyed and 128 people exposed to at least a high noise level based on the 2025 baseline scenario, will still be exposed to airline noise above WHO recommendations of 45 Lden. It acknowledges that the EHS notes that the increase in people exposed to 50dB Lden and 45dB Lnight may result in ADVERSE HEALTH EFFECTS as outlined in the WHO Environmental Noise Guidelines 2018.

ENVIRONMENTAL HEALTH OFFICER

On P.28 reference is made to the Environmental Health Officer's report and also on p.82 and p.83. The Environmental Health Officer clearly states that:

"The 2018 WHO guidelines strongly recommend reducing night noise exposure levels produced by aircraft during night-time to below 40dB Lnight. Aircraft noise above these levels are associated with ADVERSE HEALTH EFFECTS. The DAA have modelled the night-time insulation programme on exposure levels of 55dB which leaves a significant proportion of people exposed to night-time levels above 40dB exposure level recommended by WHO".

They then recommend:

"It is recommended that consideration be given to the proposed noise mitigation measures i.e. to provide an extension of noise insulation schemes to include the 2018 WHO Environmental Noise Guidelines".

The Officer also notes the major escalation in people exposed to be highly sleep deprived over the years as proposed.

The Planner's report states that the EHO issues are addressed in section 7 of the planning and assessment of the relevant action.

The EHO issues as stated in 2.2.10 above are assessed at section 7.1.2 p. 163 and p.164 of the Planner's report. It states that:

"The review of the revised EIAR for the proposed development carried out by Brady Shipman Martin (who were engaged by Fingal County Council to provide an independent review of the planning documents) has identified potentially significant adverse and residual environmental impacts on the human health and wellbeing as a result of noise, on amenity and local communities as a result of noise."

Despite this fact no report from a medical health expert has been provided given the serious issues noted above, the planner makes no further comment on recommendations of these issues!!!

Noise insultation is not a mitigation measure of night-time noise on health effects and in no way protect the long-term health of those affected by aircraft noise.

How can the Planning Authority just leave it there without enough proper protection to those affected by the escalating environmental noise?

Again, at section 7.1.3 p.164 and p.165 of the Planner's report acknowledges the HSE submission on adverse health effects yet again.

Monitoring and noise insulation do not address the serious health issues and therefore these issues are not mitigated against. The Planning Officer just accepts this fact and moves on.

At section 9 "EIA prior to development consent being determined" of the Planner's report on p.188 the Planner states:

"These metrics help articulate the effect of aircraft noise on health and quality of life. The following would also be used to help identify where noise exposure results in the population experiencing harmful effects. These are the number of people exposed to aircraft noise above:

- 55dB Lnight (a level of night-time noise exposure observed by the WHO as representing a clear risk to health); and
- 65Db Lden (where a large proportion of those living around Dublin Airport can be considered highly annoyed)."

The Night Noise Guidelines (NNG) 2009 by WHO in the Executive Summary on page XVII state that for average night noise level over a year Lnight outside "40 to 55 dB - Adverse health effects are observed among the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected" & "Above 55 dB -

The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed, and sleep disturbed. There is evidence that the risk of cardiovascular disease increases."

It further states at page XVIII of the Executive Summary that "An interim target (IT) of 55 dB Lnight, outside is recommended in the situations where the achievement of NNG is not feasible in the short run for various reasons. It should be emphasized that IT is not a healthbased limit value by itself. Vulnerable groups cannot be protected at this level. Therefore, IT should be considered only as a feasibility-based intermediate target which can be temporarily considered by policymakers for EXCEPTIONAL local situations."

Taken the above together with the health warnings from Fingal's own Environmental Health Officer, the Health & Safety Executive and the report submitted by Professor Munzel, how on earth can Fingal County Council consider the Interim Target of 55dB Lnight as a temporary consideration for an exceptional local situation. There is nothing preventing the majority of the affected housing units being insulated to the WHO recommended 40dB Lnight other than money. This is not acceptable that people's health is being put at risk for daa profit.

It is not daa's health that is being affected and they could not care less about the local community's exposure to dangerous aircraft noise, and they take the cheap route. Unfortunately, ANCA also have no skin in the game and are bowing to daa's propaganda.

Furthermore, we also note at page VII of the Executive Summary of the 2009 WHO NNG document, it states that "A number of instantaneous effects are connected to threshold levels expressed in LAmax. The health relevance of these effects cannot be easily established. It can be safely assumed, however, that an increase in the number of such events over the baseline may constitute a subclinical adverse health effect by itself leading to significant clinical health outcomes."

As it states elsewhere in this appeal document, noise conditions within housing units which have been insulated by daa, revealed that noise levels have been recorded above that recommended by the WHO and also per the "ProPG: Planning & Noise – New Residential Development, May 2017" as indicated on p.15 of the Planner's report being its document used to evaluate noise zones by Fingal County Council.

This has a serious consequence for the ones closest to the runway as noise insulation does not provide adequate protection even if windows are closed, which in the summertime does not meet Building Regulation Requirements.

No studies on the health of the affected population have been carried out to identify the vulnerable groups as addressed by WHO. But this does not seem to deter daa, ANCA and

Fingal from imposing dangerous environmental noise on the vulnerable groups without adequate investigation.

The consequences of such a decision are premature death and severe health effects of the local members of the communities in St. Margaret's/The Ward and the only protection / mitigation is that daa shall monitor the noise levels to ensure that they do not exceed the noisest levels that were reached in 2019.

8.0 NOISE ZONES

8.1 NOISE ZONES

It is worth noting that the members of Fingal County Council approved new noise zones for planning purposes on December 9th 2019, via Variation No.1 of the Fingal Development Plan 2017-2023 (<u>https://www.fingal.ie/sites/default/files/2020-01/adopted-fdp-variation-1.pdf</u>). Variation No.1 took on board the growing scientific evidence that night-time noise is detrimental to health and included Lnight metrics in the definition of the zones.

		Table 7.2 Aircraft Noise Zones
Zone	Indication of Potential Noise Exposure during Airport Operations	Objective
	≥ 50 and < 54 dB L _{Aeq, 16hr}	To identify noise sensitive developments which could potentially be affected by aircraft noise and to identify any larger residential developments in the vicinity of the flight paths serving the Airport in order to promote appropriate land use and to identify encroachment.
D	and ≥ 40 and < 48 dB L _{night}	All noise sensitive development within this zone is likely to be acceptable from a noise perspective. An associated application would not normally be refused on noise grounds, however where the development is residential-led and comprises non- residential noise sensitive uses, or comprises 50 residential units or more, it may be necessary for the applicant to demonstrate that a good acoustic design has been followed.
		Applicants are advised to seek expert advice.
c	≥ 54 and < 63 dB L _{Aeq, 16hr}	To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure, where appropriate, noise insulation is incorporated within the development
	and	Noise sensitive development in this zone is less suitable from a noise perspective than in Zone D. A noise assessment must be undertaken in order to demonstrate good

	dB L _{night}	The noise assessment must demonstrate that relevant internal noise guidelines will be met. This may require noise insulation measures.		
		An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the development's design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels.		
		Applicants are strongly advised to seek expert advice.		
		To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure noise insulation is incorporated within the development.		
	≥ 54 and < 63 dB	Noise sensitive development in this zone is less suitable from a noise perspective than in Zone C. A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed.		
в	L _{Aeq,16hr} and ≥ 55 dB L _{night}	Appropriate well-designed noise insulation measures must be incorporated into the development in order to meet relevant internal noise guidelines.		
		An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the developments design. This assessment should make specific consideration of the acaustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels.		
		Applicants must seek expert advice.		
	≥ 63 dB L _{Aeq, 16hr}	To resist new provision for residential development and other noise sensitive uses.		
Α	and/or	All noise sensitive developments within this zone may potentially be exposed to high		
	≥ 55 dB L _{right}	levels of aircraft noise, which may be harmful to health or otherwise unacceptable. The provision of new noise sensitive developments will be resisted.		
Notes:				
•	'Good Acoustic Design ProPG: Planning & Noi	' means following the principles of assessment and design as described in se – New Residential Development, May 2017;		
•	 Internal and External Amenity and the design of noise insulation measures should follow the guidance provided in British Standard BS8233:2014 'Guidance on sound insulation and noise reduction for buildings' 			

Objective DA07 was included in Variation No.1. It states:

"Objective DA07: Strictly control inappropriate development and require noise insulation where appropriate in accordance with table 7.2 above within Noise Zone B and Noise Zone C and where necessary in Assessment Zone D, and actively resist new provision for residential development and other noise sensitive uses within Noise Zone A, as shown on the Development Plan maps, while recognising the housing needs of established families farming in the zone. To accept that time based operational restrictions on usage of a second runway are not unreasonable to minimize the adverse impact of noise on existing housing within the inner and outer noise zone." Objective DA07 facilitates the use of operating restrictions to mimise the adverse effects of noise

The new noise zones were adopted in December 2019 to take account of night-time noise from a planning perspective. Immediate mitigations plans should have been introduced to limit the health impacts to the populations exposed to such night-time noise levels but were not.

Variation number 1 of Fingal Development Plan 2017-2023 (https://www.fingal.ie/sites/default/files/2020-01/map-adopted_variation_no_1.pdf)



Zone B accounts for areas exposed to noise levels >55dB Lnight but ANCA are not intending to insulate all dwellings within Zone B. There is a very clear contradiction in what the planning authority perceives as areas requiring insulation compared to ANCA. It is worth highlighting that the noise zones were developed assuming worse case 100% usage in each direction to account for days when the airport is operating under certain conditions. ANCA are not taking these conditions into account and are averaging out the noise levels.

Zone C requires a noise assessment to ensure internal noise levels are met and insulation required if not.

Therefore, the planning authority insists on noise mitigation measures for future builds but not for the existing housing stock which must suffer the adverse health consequences of aircraft noise.

It's also very important to note that the Noise Zones with their specific noise criteria and limits for each zone are acceptable in the Development Plan, yet the Chief Executive is stating that the insertion of 40dB Lnight is not appropriate in the proposed amendment. Clearly if it's acceptable for the Noise Zones then it should be acceptable for this amendment.

9.0 HEALTH AND HEALTH COSTS

9.1 SUMMARY

- Imperative that independent noise monitoring is conducted on the dwellings most affected by aviation noise from Dublin Airport, including properties already insulated by the daa.
- Imperative that a health study be carried out on the population surrounding Dublin Airport to understand the health of the population relative to the norm.
- ANCA and the daa have totally ignored the objective of Target 2 of the EU Action Plan "Towards a zero pollution for air, water and soil" adopted in May 2021 as the targets for 2030 are set at far higher noise levels in 2019 and 2018 which exceed the baseline year of 2017 required under the EU Action Plan. The selection of 2019 as the baseline is contrary to ANCA's own SEA document used to screen the project.
- Neither ANCA nor the daa have evaluated the serious health effects and costs associated with such health effects of their proposed modification to the current restrictions in place at Dublin Airport. This has serious health implications for the inhabitants within the St Margarets The Ward area.
- ANCA and the daa are proposing noise insulation as a mitigation measure to night-time noise increases within the St Margarets The Ward communities. This is contrary to Fingal County Council advice within their own Development Plan and testing carried out within the St Margarets The Ward area on housing that has already been insulated by the daa recently indicates the guidance referred to by Fingal County Council and the WHO cannot be achieved and will cause serious health issues of those affected by the proposed increase in night-time noise.
- No mitigation measures are proposed by the daa or ANCA to solve the health implications being imposed by the removal of the existing restrictions.

9.2 LATEST RESEARCH

Latest research since the WHO 2018 Guidelines has been collated in the review paper 'Environmental risk factors and cardiovascular diseases: a comprehensive expert review' (https://academic.oup.com/cardiovascres/advance-article/doi/10.1093/cvr/cvab316/6381568). This review forms part of the medical health report from Professor Münzel which is part of this submission. The supplementary material associated with the review summarises the latest findings:

Table S1. Epidemiological/observational evidence for an association between traffic noise and cardiovascular disease, events, and mortality with focus on recent studies.

First author / year	Population / cohort	Noise sources	Major outcomes	Ref
Roca-Barceló, 2021	21,936 CVD deaths	Aircraft noise	CVD and CHD mortality risk tended to increase with increasing levels of aircraft noise (L _{dn}), while no linear trend was found for stroke mortality.	1
Kupcikova, 2021	502,651 subjects	Road traffic noise	Road traffic noise exposure (L_{den} >65 vs. ≤55 dB(A)) led to 0.77% (95% CI 0.60-0.95) higher SBP, 0.49% (95% CI 0.32- 0.65) higher DBP, 0.79% (95% CI 0.11-1.47) higher triglycerides, and 0.12% (95% CI –0.04-0.28) higher glycated hemoglobin.	2
Yankoty, 2021	1,065,414 subjects	Total environmental / transportation noise	The HRs for incident MI were 1.12 (95% CI 1.08-1.15), 1.11 (95% CI 1.07-1.14), and 1.10 (95% CI 1.06-1.14) per 10 dB(A) increase in L_{Aeq24} , L_{den} , and L_{night} , respectively.	3
Gilani, 2021	909 subjects	Road traffic noise	An OR of 2.25 (95% CI 1.38-3.67) for the prevalence of CAD per 5 dB(A) increase in road traffic noise (L _{den}) was found.	4
Saucy, 2021	24,886 CVD deaths	Aircraft noise	Acute increases in aircraft noise 2 hours preceding death were associated with total CVD mortality (OR 1.44, 95% CI 1.03-2.04) for the highest group of exposure (L _{Aeq} >50 vs. <20 dB).	5
Baudin, 2021	5,860 subjects	Aircraft noise	Aircraft noise levels per 10 dB(A) increase in L _{night} increased the odds of antihypertensive medication by 43% (OR 1.43, 95% CI 1.19-1.73).	6
Osborne, 2020	498 subjects	Combination of road traffic and aircraft noise	Higher noise exposure per 5 dB(A) increase in L_{Aeq24} predicted major CV events (HR 1.341, 95% CI 1.147-1.567).	7
Bai, 2020	37,441 cases of incident acute MI and 95,138	Road traffic noise	Road traffic noise (LAeq24) per IQR increase was associated with an elevated risk of incident acute MI (HR 1.07, 95% CI 1.06-1.08) and CHF (HR, 1.07 95% CI 1.06-1.09).	8

	cases of incident CHF			
Thacher, 2020	52,758 subjects	Road traffic noise	At the most exposed façade, road traffic noise per IQR increase was associated with a 13% (HR 1.13, 95% CI 1.06- 1.19) and 11% (HR 1.11, 95% CI 0.99-1.25) higher CVD and stroke mortality, respectively. At the least exposed façade, road traffic noise remained to be associated with CVD (HR 1.09, 95% CI 1.03-1.15), IHD (HR 1.10, 95% CI 1.01-1.21), and stroke (HR 1.06, 95% CI 0.95-1.19) mortality.	9
Thacher, 2020	52,053 subjects	Road traffic noise	There was no association between road traffic noise and filled prescriptions for antihypertensive drugs.	10
Andersson, 2020	6,304 men	Road traffic noise	The HRs were 1.08 (95% CI 0.90-1.28) for CV mortality, 1.14 (95% CI 0.96-1.36) for IHD incidence, and 1.07 (95% CI 0.85-1.36) for stroke incidence in response to road traffic noise (L_{Aeq24} >60 vs. <50 dB.	11
Shin, 2020	Subjects without a history of hypertension (701,174) or diabetes mellitus (914,607)	Road traffic noise	An increase in L_{Aea24} per 10 dB(A) was associated with an 8% increase in incident diabetes mellitus (HR 1.08, 95% CI 1.07-1.09) and a 2% increase in incident hypertension (HR 1.02, 95% CI 1.01-1.03). Similar estimates were obtained for L_{hight} .	12
Baudin, 2020	6,105 subjects	Aircraft noise	An increase per 10 dB(A) in L_{night} was associated with an increased risk of hypertension (RR 1.03, 95% Cl 1.01-1.06t). An association was also found between aircraft noise annoyance and hypertension risk (RR 1.06, 95%Cl 1.00-1.13 for highly annoyed vs. not highly annoyed).	13
Pyko, 2019	20,012 subjects	Road traffic, railway, aircraft noise	In subjects exposed to all three traffic noise sources at \geq 45 dB L _{den} , risks of IHD were elevated with a HR of 1.57 (95% CI 1.06-2.32), and a comparable observation for stroke (HR 1.42, 95% CI 0.87-2.32).	14
Héritier, 2019	4.4 million subjects	Road traffic, railway, aircraft	MI mortality was increased in response to road traffic (HR 1.034, 95% CI 1.014-1.055), railway (HR 1.020, 95% CI	15

		noise	1.007-1.033), and aircraft noise (HR 1.025, 95% CI 1.005-	
			1.046) per 10 dB increase in L _{den} .	
Héritier, 2018	4.41 million subjects	Combination of road traffic, railway, aircraft noise	For the core night, the highest HR was observed for IHD mortality (1.025, 95% CI 1.016-1.034), while this association was lower for the daytime (1.018, 95% CI 1.009-1.028). HF mortality and daytime noise was associated with the highest HR (1.047, 95% CI 1.027-1.068).	16
Pyko, 2018	4,854 subjects	Road traffic, railway, aircraft noise	Aircraft noise increased the incident risk of hypertension by 16% (HR 1.16, 95% CI 1.08-1.24) per 10 dB increase in L _{den} . Road traffic and railway noise were not associated with incidence of hypertension.	17
Yang, 2018	663 subjects	Road traffic noise	Road traffic noise per 5 dB(A) increase was associated with the prevalence of CVD (OR 2.23, 95% CI 1.26-3.93).	18
Cai, 2018	21,081 incident CVD cases	Road traffic noise	No associations were found between road traffic noise and incident CVD, IHD, or CBVD in the total population.	19
Hahad, 2018	14,639 subjects	Road traffic, railway, aircraft noise	Traffic-related noise annoyance is associated with increased prevalence of AF.	20
Héritier, 2017	4.41 million subjects	Road traffic, railway, aircraft noise	HRs for MI mortality were per 10 dB increase in L _{den} 1.038 (95% CI 1.019-1.058) for road traffic, 1.018 (95% CI 1.004- 1.031) for railway, and 1.026 (95% CI 1.004-1.048) for aircraft noise.	21
Zeeb, 2017	137,577 cases and 355,591 controls	Road traffic, railway, aircraft noise	There was no association between any of the traffic noise sources and incident hypertension. Likewise, no association between nighttime noise levels and hypertension was found. For the group of subjects with newly diagnosed hypertension followed by hypertensive heart disease, the ORs were elevated.	22
Fuks, 2017	41,072 subjects	Road traffic noise	A weak relationship between road traffic noise and incident self-reported hypertension was found, whereas no conclusive association with measured hypertension was established.	23

Pitchika, 2017	2,552 subjects	Road traffic noise	No association between road traffic noise (L _{Aeq24}) and prevalent hypertension was found.	24
Roswall, 2017	50,744 subjects	Road traffic noise	Road traffic noise was associated with a higher risk of MI, with a HR of 1.14 (95% CI 1.07-1.21) per IQR increase in L _{den} .	25
Evrard, 2017	1,244 subjects	Aircraft noise	Only in men, a 10 dB(A) increase in aircraft noise (L _{night}) was associated with risk of hypertension (OR of 1.34, 95% CI 1.00-1.97).	26
Dimakopoulou, 2017	780 subjects	Aircraft noise	A 10 dB increase in L_{night} resulted in an OR of 2.63 (95% CI 1.21-5.71) for hypertension and of 2.09 (95% CI 1.07-4.08) for doctor-diagnosed cardiac arrhythmia.	27
Sørensen, 2017	57,053 subjects	Road traffic noise	An IRR of 1.14 for HF (95% CI 1.08-1.21) per IQR increase in L_{den} road traffic noise was found.	28
Seidler, 2016	19,632 cases and 834,734 controls	Road traffic, railway, aircraft noise	A 10 dB increase in L_{Ae024} was associated with higher odds of MI in response to road traffic (2.8%, 95% 1.2-4.5) and railway noise (2.3%, 95% CI 0.5-4.2), but not aircraft noise. Aircraft noise levels of 60 dB and above were associated with increased MI risk (OR 1.42, 95% CI 0.62-3.25).	29
Recio, 2016	Cohort of subjects ≥65 years	Road traffic noise	Short-term road traffic noise increased the risk of death from IHD, MI, and CBVD.	30
Monrad, 2016	57,053 subjects	Road traffic, railway noise	A 10 dB increase in L_{den} road traffic noise was associated with a 6% increased risk of AF (IRR 1.06, 95% CI 1.00- 1.12), which was weaker after further adjustment for air pollutants. AF risk was not related to railway noise.	31
Sørensen, 2011	57,053 subjects	Road traffic noise	An IRR of 1.14 for stroke (95% CI 1.03-1.25) per 10 dB increase in L _{den} road traffic noise was found.	32
Beelen, 2009	120,852 subjects	Road traffic noise, traffic intensity	Traffic intensity was associated with CV mortality, with highest RR of 1.11 (95% CI 1.03-1.20 per increase in 10,000 motor vehicles/24 h). Road traffic noise (>65 dB(A)) was associated with increased risk of IHD (RR 1.15, 95% CI 0.86-1.53) and HF mortality (RR 1.99, 95% CI 1.05-3.79),	33

and traffic intensity.	1	which was attenuated after further adjustment air pollution	
		and traffic intensity.	

CVD: Cardiovascular disease, CHD: Coronary heart disease, L_{dn}: Day-night noise levels, SBP: Systolic blood pressure, DPB: Diastolic blood pressure, HR: Hazard ratio, MI: Myocardial Infarction, L_{Aeq(time period}): Noise levels over a certain period of time, L_{night}: Night noise levels, IHD: Ischemic heart disease, CHF: Congestive heart failure, IQR: Interquartile range, CBVD: Cerebrovascular disease, dB: Decibel, OR: Odds ratio, CI: Confidence interval, CAD: Coronary artery disease, L_{den}: Day-evening-night noise levels, AF: Atrial fibrillation, IRR: Incidence rate ratio, RR: Relative risk

It is important to point out that a majority of the above research did not form part of the WHO 2018 Guidelines as it wasn't available in time for the review. Neither ANCA nor the daa have considered this latest research. ANCA as the noise regulator has a duty to keep abreast of latest scientific research in order to perform its duties. HA and HSD figures are real people. ANCA needs to understand that these are real people and families and not just numbers. It will be responsible for inflicting night noise on residents and damaging their health. Who do residents sue for their ill health? ANCA and Fingal County Council will be responsible for removing the restrictions. They cannot hide behind the Aircraft Noise Bill as they have crafted the Noise Abatement Objective to allow tens of thousands of people to be Highly Sleep Disturbed. The onus rests with ANCA and Fingal County Council.

9.3 POPULATION AND HUMAN HEALTH

In the EIAR, chapter 7 is devoted to Population and Human Health.

The European Environmental Agency (EEA) published a report in 2020 titled 'Environmental Noise in Europe – 2020'. The report states that:

"Chronic exposure to environmental noise has significant impacts on physical and mental health and well-being. Exposure to environmental noise is a widespread problem in Europe, with at least one in five people exposed to levels considered harmful to health. Given the negative impacts on human health and the large number of people affected, environmental noise is therefore a significant concern for citizens and policy makers. Reducing environmental noise is a key objective under the Seventh Environment Action Programme (7th EAP) and the Environmental Noise Directive (END)."

Key findings of the report:

Environmental noise from road, rail, aircraft and industry sources affects millions of people, causing significant public health impacts

· Long-term exposure to environmental noise is estimated to cause

- 12000 premature deaths and
- contribute to 48000 new cases of ischaemic heart disease per year in the European territory.
- It is estimated that 22 million people suffer chronic high annoyance and
- 6.5 million people suffer chronic high sleep disturbance.
- As a result of aircraft noise, 12500 schoolchildren are estimated to suffer learning impairment in school.

• These significant health impacts are most likely to be underestimated, with new WHO evidence demonstrating effects at levels below the obligatory END reporting thresholds. In addition, the END does not comprehensively cover all urban areas, roads, railways and airports across Europe.

(i.e. Noise below current END reporting values also cause health effects)

• Exposure to environmental noise does not affect everyone equally. Socially deprived groups, as well as groups with increased susceptibility to noise, may suffer more pronounced health-related impacts of noise.

The report further states that the policy objectives on environmental noise have not been achieved. The number of people exposed to high levels of noise has not decreased. The key

objective of the 7th EAP of significantly reducing noise pollution in the EU and moving closer to the WHO recommended levels by 2020 has not been achieved. Fingal County Council and ANCA need to explain how they moved closer to the WHO recommended levels by 2020. Note this is recommended levels and not interim levels. The 7th EAP also categories 'High' noise levels as those levels > **55 dB Lden and > 50 dB Lnight**. Fingal County Council and ANCA need to support these definitions of high noise.

The report states that 4 million people are exposed to high levels of aircraft noise. It also states how noise pollution is a threat not only to humans but also to wildlife.

"Anthropogenic noise affects a wide variety of terrestrial and marine wildlife species causing a range of physiological and behavioural responses. These can reduce reproductive success and increase mortality and emigration, resulting in lower population densities."

The noise contours for Dublin Airport extend over the Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). No analysis has been carried out on the effects of aircraft noise on these areas.

The new divergent flight routes and potential night-time use of the North Runway has not been studied for their effects on existing wildlife and in particular bird species. These flight routes have changed since the original EIS in 2004-2007. It has become very apparent in Fingal that many bird species are now thriving under the quieter skies and the effects of changing flight routes and operation times need to be examined.

Environmental noise is the second biggest environmental killer after air pollution.

The WHO have strongly recommended that noise from aircraft should be reduced below 45dB Lden and 40dB Lnight as aircraft noise above these levels are associated with adverse health effects such as cardiovascular disease, hypertension and cognitive impairment in children. The WHO report states that "1 million healthy years of life are lost every year in the EU". A 2011 WHO report places "the burden of disease from environmental noise as the 2nd highest after air pollution". Interestingly the WHO 2018 report states that overall, the GDG "estimated that the benefits gained from minimizing adverse health effects due to aircraft noise exposure outweigh the possible (economic) harms".

Questions need to be asked of Fingal County Council as to why no health study has ever been conducted on the residents of Fingal living in the vicinity of Dublin Airport. The Council is fixated on the economic benefits of the airport to the detriment of the population of Fingal.

In addition to the WHO report I would like to point to a recent paper at Euronoise 2018 titled 'Transportation noise and incidence of hypertension'

(<u>http://www.euronoise2018.eu/docs/papers/92_Euronoise2018.pdf</u>). The results "*indicated a clear association for aircraft noise*" and "a particularly high risk estimate for those exposed to both aircraft and road traffic noise, indicating that exposure to multiple sources of traffic noise may be especially harmful".

The new noise zones recently incorporated into the Fingal Development Plan are a clear recognition by Fingal County Council that serious adverse health effects occur at exposure levels well below those that are mitigated for in this application. All future properties that lie inside Zones A, B and C require to be thoroughly insulated as outlined by the WHO 2018 Guidelines.

Note that this variation to the Development Plan states that in Zone A "all noise sensitive developments within this zone may potentially be exposed to high levels of aircraft noise, which may be harmful to health or otherwise unacceptable. The provision of new noise sensitive developments will be resisted". Under this variation it is acknowledged by Fingal County Council that noise insulation is not a solution within Zone A which covers most of St Margarets The Ward.

The Variation refers to "Pro PG Planning and Noise Professional Practice Guidance on planning and noise for new residential developments", dated May 2017 as the guidance for "Good Acoustic Design".

With reference to the ProPG document at Fig 2 it notes that in bedrooms between the hours of 23:00-07:00 that 45dB LAmax should not be exceeded. Footnote 4 states "*in most circumstances in noise sensitive rooms at night (eg bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB LAmax more than 10 times per night*".

The St Margarets The Ward Residents have carried out a noise survey of a number of houses recently insulated by the daa under their noise insulation programme. Please refer to noise report from the MLM Group.

As a minimum requirement for an Independent Regulator, independent monitoring should be carried out in the areas closest to the airport. The regulator should not accept only the results from the noise monitoring stations. It should have its own independent analysis carried out to understand how the populations closest to the airport are being affected. This should also be carried out on dwellings that have been insulated to understand the residual effects of noise post insulation.

The Independent Regulator should also conduct a health survey of the population surrounding the airport. A regulator cannot understand the effects of noise without conducting a health screening. The regulator has not engaged medical expertise on the health effects of noise and is thus not adhering to regulation EU598/2014:

(11) The importance of health aspects needs to be recognised in relation to noise problems, and it is therefore important that those aspects be taken into consideration in a consistent manner at all airports when a decision is taken on noise abatement objectives, taking into account the existence of common Union rules in this area. Therefore, health aspects should be assessed in accordance with Union legislation on the evaluation of noise effects.

In addition, competent authorities may take due account of the following factors:

(1) the health and safety of local residents living in the vicinity of the airport;

9.4 HEALTH BURDEN - DALY CALCULATION

The total number of Highly Sleep Disturbed (HSD) and Highly Annoyed (HA) people for various scenarios are presented by the daa in their reporting template and summarized here:

Scena	rio	Total HSD
2025	Proposed	37080
2025	Permitted	22500
2018		42260
2019		47045

In the EU's 2016 review and evaluation of the Environmental Noise Directive titled "Evaluation of Directive 2002/49/EC Relating to the Assessment and Management of Environmental Noise" (<u>https://op.europa.eu/en/publication-detail/-/publication/7febde6d-9a89-11e6-9bca-01aa75ed71a1</u>), it uses a value of **110987** euro for a DALY (Disability Adjusted Life Year).

Calculations were performed using 3 different DALY values: €78500 (Vito 2003), €70850 (60k stg, DEFRA 2014)) and €110987 (EU review 2016).

	Total Yearly Cost for	Total Yearly Cost for	Total Yearly Cost for
Scenario	HA and HSD (Vito 2003)	HA and HSD (DEFRA 2014)	HA and HSD (EU 2016)
2025 Proposed	€328,420,450	€296,415,145	€464,336,312
2025 Permitted	€224,495,870	€202,618,247	€317,402,842
2018	€413,927,360	€373,589,216	€585,230,012
2019	€431,585,935	€389,526,924	€610,196,537

These health costs due to just annoyance and sleep disturbance were not taken into account by ANCA or the Planning Department.

9.5 DAA'S HEALTH EXPERTISE

Following an AIE request to the daa for all documentation and materials compiled by the daa on the health effects of aircraft noise on residents living in the vicinity of an airport, including any medical opinions and reports, any opinions on WHO guidelines and any correspondence or reports provided to senior management, only 4 documents were provided. This decision was appealed to the OCEI Commissioner and below is the feedback from the Commissioner's office.

The daa submits that it hasn't sought medical opinions or reports or even compiled material on the health effects of aircraft noise. How is it possible to do a health impact assessment without this information?

19. DAA does not accept that it is hiding information. DAA submits that it has not commissioned medical opinions and reports on the impact of noise on nearby residents; nor has it compiled any materials on the health effects of aircraft noise, save for the five documents identified as falling within scope. DAA submits that, in common with most other airports in other jurisdictions, DAA does not have in-house competency to undertake research and make generalised assessments or judgments on a specialised environmental and health issue such as the health effects of aircraft noise on nearby residents. Rather, the type of information gathered and used by DAA is, by its nature, publicly available, as DAA relies on public health guidance and research to guide its understanding. DAA submits that its approach is determined primarily by international and national regulations which are predicated on reports by specialists and experts at a European and global level. As a result, DAA relies primarily on published material and associated regulations, which now fall under the Aircraft Noise (Dublin Airport) Regulation Act 2019, implementing Regulation (EU) No 598/2014. DAA submits that, while over time it has collected aircraft noise information, that information has been published either as part of its noise contour maps or as part of the noise complaints information provided to local communities on a regular basis. In any event, such information does not include information on the health effects of aircraft noise on nearby residents, so it does not fall within the scope of your request.

The same question can be asked of ANCA. What Health expertise has ANCA sought on the impacts of aircraft noise? As the Independent Noise Regulator has it sought the advice of the HSE or other Health Authorities in Ireland? Has it commissioned its own medical assessments? How can ANCA adjudicate on Noise when it doesn't have the expertise to understand the health impacts?

However as indicated in the previous sections of this report, the tools to calculate the cost associated with health damage to those affected by airport noise are readily available. Under current legislation it is the responsibility of the Competent Authorities to inform affected citizens of the consequences of the imposition of environmental noise on them and to evaluate the cost associated with the consequences of such noise production.

9.6 HEALTH REVIEW

A review of night-time transportation noise and the WHO 2018 Guidelines was carried out by Münzel et al in 2020 – "Adverse Cardiovascular Effects of Traffic Noise with a Focus on Nighttime Noise and the New WHO Noise Guidelines" (https://www.annualreviews.org/doi/abs/10.1146/annurev-publhealth-081519-062400).

This review states that:

"The 2018 WHO report focused on the effects of LDEN (24 h noise) in their evaluation of cardiometabolic disease, so in this review we summarize the current knowledge of the pathway from exposure to nighttime noise to cardiovascular and metabolic disease, identify research gaps, and present mitigation measures."

The review states that:

"The focus of the WHO report was to evaluate the effects of exposure to transportation noise over the whole day, estimated as Lden. The WHO evaluated the effects of nighttime noise previously in 2009. However, since 2009, a number of mechanistic studies have investigated the effects of nocturnal noise, indicating that it may be a particularly crucial time window, as exposure to noise during nighttime disturbs and stresses the body during sleep, thereby increasing a number of cardiovascular risk factors (44, 54, 80, 81)."

The review then summarises the current knowledge of the cardiovascular effects of nighttime noise.

"The WHO recently evaluated the effects of transportation noise on measured and selfreported sleep (3). A meta-analysis of psychoacoustic surveys on self-reported sleep disturbance (percent highly disturbed) showed statistically significant odds ratios of 1.9 for aircraft, 2.1 for road, and 3.1 for rail per 10 dB(A) increase in noise when questions referred to the effects of noise on sleep (3). However, in studies where the sleep questions did not refer to specific noise sources but to general sleep indicators, such as problems with falling asleep and awakenings, associations with traffic noise were less pronounced.

Furthermore, as part of the WHO review, a combined analysis was conducted of two existing studies examining acute effects of traffic noise events on sleep physiology measured by polysomnography (5, 22). This event-related analysis showed that a 10 dB(A) increase in indoor maximum noise from road, rail, or aircraft was significantly associated with awakenings or sleep stage changes (from deeper sleep stages to wake or stage 1) with odds ratios of 1.35 (3). Based on this analysis, the WHO strongly recommended to decrease nighttime noise (Lnight) for road traffic noise below 45 dB(A), for railway noise below 44 dB(A), and for aircraft noise below 40 dB(A) to prevent effects on sleep (103).

A 2018 study (73), published after the WHO review, with young (19–33 years) and older (52– 70 years) volunteers confirmed effects from nighttime transportation noise events on increased sleep electroencephalography (EEG) arousal indices, although sleep structure and continuity were not affected [Leq was 45 dB; maximum event levels were 50–62 dB(A)] (73). Amplitude of sleep spindles, which are known to have a sleep-protective function (100) and to be relevant for memory consolidation (2), was consistently decreased during noise compared with noisefree nights in both age groups.

Which time window during sleep is most critical is still unclear, although such knowledge is important for efficient noise control. A study of 12 women and 12 men who slept for 2 weeks in a sleep laboratory applied 3 different noise scenarios with noise curfews at different times during the night (11 PM-3 AM, 11 PM-5 AM, 3 AM-7 AM) and analyzed the polysomnograms (33). Investigators found that noise in the beginning of the night impaired the process of falling asleep. However, sleep disturbances experienced in the beginning of the night were compensated later if nighttime curfews were in place. In contrast, even short periods of noise toward the end of the sleeping period were observed to cause sleep disturbances. In line with this finding, several observational studies on transportation noise indicate that noise exposure has the strongest effect on self-reported sleep quality in the morning, when the sleep pressure is lowest. In a Norwegian study of 13,019 participants (24) and a Swiss study of 1,375 participants (29), modeled nighttime traffic noise exposure was associated primarily with selfreported early awakenings, whereas associations with other sleep-quality parameters such as awakening during the night or difficulty falling asleep were less pronounced. Also, psychoacoustic surveys observed that noise exposure occurring during the early part of the night and during the time just preceding usual awakening were reported to be most annoying (63). Strikingly, a panel study of 40 individuals found that noise exposure during work had sustained effects on nighttime sleep quality, suggesting that daytime noise may also be relevant for sleep (57)."

The review then looks at night-time noise and risk for cardiovascular disease (CVD):

"Although exposure to transportation noise is known to disturb sleep duration and quality, epidemiological studies comparing the effects of daytime and nighttime transportation noise are necessaryto improve our understanding of which exposure time window is most harmful.

Separating long-term effects of daytime and nighttime noise exposure in epidemiological studies are challenging. Exposure misclassification for daytime noise is higher than for nighttime noise because large-scale epidemiological studies are based on residential exposure, which may not reflect personal exposure during the day, when people are likely not to be at home. Also, daytime and nighttime exposure levels are often highly correlated. This finding is especially evident for road traffic noise where input data on traffic are based on traffic count samples, which are then extrapolated over the whole day, resulting in correlations between daytime and nighttime noise close to 1 (36, 42, 89). In reality, correlation between road traffic noise at different time intervals is expected to be lower (71).

A Spanish cross-sectional study overcame this correlation dilemma by calculating three different estimates for residential traffic noise for their population of \approx 2,000 persons: noise at the most exposed façade; noise at the bedroom façade; and "indoor bedroom noise" where information on insulation, type of window, and window-opening habits was included (28). They found a significant association with a higher systolic blood pressure only for indoor bedroom noise, suggesting that nighttime noise affects the blood pressure. However, they also found noise at the most exposed façade to be more strongly associated with hypertension than was indoor bedroom noise, suggesting that exposure during the day and evening can also be harmful.

For aircraft and railway noise, correlations between daytime and nighttime noise are lower than for road traffic noise. The Hypertension and Exposure to Noise Near Airports (HYENA) study of ≈5,000 persons living near one of six major European airports investigated effects of nighttime aircraft noise (20, 39, 40, 49). In this study, correlation between daytime and nighttime aircraft noise was 0.8 and a significant association between nighttime aircraft noise and prevalent hypertension was found, whereas no association was seen for daytime aircraft noise (Figure 1c) (49). A follow-up study of the Greek population of the HYENA study later supported this finding in a longitudinal design: The data showed a significant association between nighttime aircraft noise and incident hypertension, whereas associations with daytime aircraft noise were weaker and insignificant (20). Within the framework of the HYENA study, 140 participants were selected for a field study with continuous measurements of noise and blood pressure during sleep at home (40). The study found a 6-mm Hg increase in systolic and a 7-mm Hg increase in diastolic blood pressure if an aircraft event of >35 dB(A) had occurred within the last 15 minutes. Results of similar size were observed for road traffic noise. This association was independent of the sequence of noise measurements, indicating that there is no habituation happening during the night. Using the same study population, both measured nighttime bedroom exposure and modeled long-term exposure to road traffic noise were found to be associated with a decrease in systolic and diastolic dipping, whereas no association was found for aircraft noise (39). Subsequent longitudinal studies on aircraft noise and risk of CVD found similar associations for modeled daytime noise compared with nighttime noise, which indicates that, for aircraft noise, separating the effects of daytime and nighttime noise is problematic when using standard noise modeling (38, 108). This limitation highlights the importance of improved or new noise assessment methods that better capture the difference in noise over the course of the day.

A recent Swiss study developed a method for estimating an "intermittency ratio" (IR) during nighttime, which quantifies the contribution of individual noise events above the background noise level (105). The IR varies from 0%, corresponding to continuous noise (no events above background), to 100%, corresponding to all noise made by single noise events. It thereby captures a potentially very important aspect of noise, as single distinct noise events during sleep have been linked to awakenings and cardiac arousals (4, 5), and nighttime noise events have been found to affect arterial stiffness (Figure 1b) (27). Data from 4.4 million people indicated that moderate IR levels during nighttime were found to be more strongly associated with overall cardiovascular mortality than were low IR and high IR (41). The project also investigated associations with CVD for noise exposure at different time windows during the day, estimated as combined long-term noise exposure from road, rail, and air based on modeled hourly traffic data (42). Despite the inherent difficulties in separating the effects of different noise time windows (correlations ≥ 0.94), the combination of the three noise sources vielded more variation, thereby facilitating the analyses. For IHD, the highest mortality risks were found for noise exposure during the core nighttime period, whereas for heart failure, exposure during the daytime period was associated with the highest risk (42). Overall, this finding suggests that for acute CVD, nocturnal intermittent noise exposure is more relevant than daytime exposure, whereas for more chronic CVD, continuous daytime exposure is most relevant. In support, measured brachial-ankle pulse wave velocity in 2,775 participants (49-81 years old) was significantly associated with the number of noise events during the nighttime (at residence) but not with the number of noise events during the day (Figure 1b) (27)."

"In summary, the few epidemiological studies that have successfully managed to separate daytime and nighttime exposure to noise have found that nighttime noise is indeed an important risk factor for some CVDs and that intermittent noise with peaks clearly above the background level during the nighttime may be particularly harmful."

The review goes on to investigate translation studies and the effects of simulated night-time noise on vascular function.

It also looked into mechanistic insights from animal studies on the effects of around-the-clock noise on stress hormones, oxidative stress, and cerebrovascular complications:

"A study on mice exposed to noise for 1–4 days found that around-the-clock aircraft noise resulted in higher levels of circulating neurohormonal stress hormones, endothelial dysfunction, vascular inflammation, and oxidative stress"

This has consequences for the areas of St Margarets The Ward and Portmarnock where the population will be exposed to high levels of both daytime and night-time noise, without any respite.

The study also examined the effects of sleep versus phase noise on the cardiovascular system and the brain and noise and the circadian clock system.

The conclusion of the review states that exposure to noise towards the end of the sleeping period may be the most crucial regarding effects of noise on sleep, and that night-time noise compared with daytime noise is associated with more adverse cardiovascular effects. Compared with daytime noise, night-time noise leads to a stronger stress reaction. Also, evidence suggests that intermittent noise with peaks clearly above the background levels during the night-time may be particularly harmful. This is very evident in the rural areas of St Margarets The Ward, where the intermittent aircraft noise events far exceed the background noise levels.

WHO 2018 Guidelines clearly state that the CNG indoor guidelines [WHO 1999] remain valid:

"The current environmental noise guidelines for the European Region supersede the CNG from 1999. Nevertheless, the GDG recommends that all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid. Furthermore, the current guidelines complement the NNG from 2009."

The WHO Community Noise Guidelines (<u>https://apps.who.int/iris/handle/10665/66217</u>) make reference to LAmax and single noise events. In its executive summary it states:

"Currently, the recommended practice is to assume that the equal energy principle is approximately valid for most types of noise and that a simple LAeq,T measure will indicate the expected effects of the noise reasonably well. When the noise consists of a small number of discrete events, the A-weighted maximum level (LAmax) is a better indicator of the disturbance to sleep and other activities. In most cases, however, the A-weighted sound exposure level (SEL) provides a more consistent measure of single-noise events because it is based on integration over the complete noise event. In combining day and night LAeq,T values, nighttime weightings are often added. Night-time weightings are intended to reflect the expected increased sensitivity to annoyance at night, but they do not protect people from sleep disturbance. Where there are no clear reasons for using other measures, it is recommended that LAeq,T be used to evaluate more-or-less continuous environmental noises. Where the noise is principally composed of a small number of discrete events, the additional use of LAmax or SEL is recommended. There are definite limitations to these simple measures, but there are also many practical advantages, including economy and the benefits of a standardized approach."

In the guideline section it references the use of LAmax for dwellings:

"In Dwellings. The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30 dB LAeq for continuous noise and 45 dB LAmax for single sound events. Lower noise levels may be disturbing depending on the nature of the noise source. At night-time, outside sound levels about 1 metre from facades of living spaces should not exceed 45 dB LAeq, so that people may sleep with bedroom windows open. This value was obtained by assuming that the noise reduction from outside to inside with the window open is 15 dB. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35 dB LAeq. The maximum sound pressure level should be measured with the sound pressure meter set at "Fast".

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB LAeq on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB LAeq. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development."

Table 1: Guideline values for community noise in specific environments.

Specific	Critical health effect(s)	Liter	Time	Lamer
environment		[dB(A)]	base	fast
		10-0-1	[hours]	[dB]
Outdoor living area	Serious annovance, daytime and evening	55	16	-
Ç.	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility & moderate annovance,	35	16	
<u>,</u>	daytime & evening			
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open	45	8	60
	(outdoor values)			
School class rooms	Speech intelligibility,	35	during	-
& pre-schools,	disturbance of information extraction,		class	
indoors	message communication			
Pre-school	Sleep disturbance	30	sleeping-	45
bedrooms, indoor			time	
School, playground	Annoyance (external source)	55	during	-
outdoor			play	
Hospital, ward	Sleep disturbance, night-time	30	8	40
rooms, indoors	Sleep disturbance, daytime and evenings	30	16	-
Hospitals, treatment	Interference with rest and recovery	#1		
rooms, indoors				
Industrial,	Hearing impairment	70	24	110
commercial				
shopping and traffic				
areas, indoors and				
outdoors				
Ceremonies, festivals	Hearing impairment (patrons:<5 times/year)	100	4	110
and entertainment				
events				
Public addresses,	Hearing impairment	85	1	110
indoors and outdoors				
Music and other	Hearing impairment (free-field value)	85 #4	1	110
sounds through				
headphones/				
earphones				
Impulse sounds from	Hearing impairment (adults)	-	-	140
toys, fireworks and				#2
firearms	Hearing impairment (children)	-	-	120
				#2
Outdoors in parkland	Disruption of tranquillity	#3		
and conservations				
areas		1		

#1: As low as possible.

The CNG indoor noise level recommendations are still valid as stated by the WHO 2018 Guidelines, and the current guidelines complement the NNG from 2009. Therefore, single noise event indicators cannot be dismissed, as suggested by ANCA, as these are still valid. LAmax is referred to in 200/49/EC as a supplementary noise indicator and therefore ANCA have a duty to take it on board. Evidence has been provided that the LAmax levels exceed the CNG guidelines and Pro PG guidelines in dwellings that have already been insulated by the daa. This evidence cannot be refuted by ANCA, and it has deliberately refused to take this evidence on board. noise levels in their bedrooms that lead to adverse health effects and are at risk to acute cardiovascular events. Insulation is not a safe mitigating factor for these residents and only a complete ban on night-time flights can protect their health.

9.7 HEALTH STUDY ON AIRCRAFT NOISE EVENTS

On December 23rd, the European Heart Journal published an editorial (https://academic.oup.com/eurheartj/advance-article/doi/10.1093/eurheartj/ehaa984/6046141) titled 'Noise and cardiovascular risk: nighttime aircraft noise acutely triggers cardiovascular death'. The editorial refers to 'Does night-time aircraft noise trigger mortality? A case-crossover study on 24 886 cardiovascular deaths', by A. Saucy *et al.*, doi: <u>10.1093/eurheartj/ehaa957</u>.

The editorial discusses how most epidemiological studies have focused on cardiovascular side effects of long-term exposure to transportation noise.

"So far, most epidemiological studies have focused on cardiovascular side effects of long-term exposure to transportation noise (for reviews, see Basner *et al.*^Z and Munzel *et al.*⁸). Importantly, translational studies in humans and animals primarily focused on health side effects of nighttime noise with respect to the cardiovascular system.⁹ In humans only one night of aircraft noise triggered endothelial dysfunction, increased stress hormone levels, and deteriorated sleep quality.¹⁰ These effects were even more pronounced in patients with already established CVD.¹¹ The acute administration of the antioxidant vitamin C improved endothelial dysfunction, suggesting an involvement of reactive oxygen species in the pathophysiology of noise-induced vascular dysfunction.¹⁰ Recent animal studies indicated that aircraft noise applied during the sleeping phase of mice, but not during the awake phase, raises blood pressure, dysregulates genes related to the circadian clock and stress hormone levels, causes endothelial dysfunction, and increases cerebral and vascular oxidative stress.¹² These observations may indicate that the disturbance of sleep (e.g. sleep deprivation or fragmentation) may account at least in part for noise-induced cardiovascular damage."

Even one night's exposure to noise pollution affected the cardiovascular system:

"Epidemiological and translational studies of humans with and without coronary artery disease revealed that nighttime exposure to different transportation noise patterns for only one night adversely affected blood pressure, diastolic heart function, sympathovagal balance, and the plasma proteome."

This study sought to determine the effect of acute exposure to night-time aircraft noise on cardiovascular death. The authors analysed 24886 CVD deaths from the Swiss National Cohort around Zurich Airport between 2000 and 2015. The authors established that:

"for nighttime deaths, aircraft noise exposure levels 2 h preceding death were significantly associated with mortality for all causes of CVD"

The authors also calculated a population-attributable fraction of 3% in their study population and finally concluded that nighttime noise may trigger acute cardiovascular mortality.





Quite worryingly, the study found higher associations for people living in areas with low background noise and in buildings constructed before 1970. A large cohort of rural Fingal, Dublin West and Meath would fit into this category and so are more at risk.

The editorial asks the question about these findings: "What are the societal and political consequences?"

They state that this study describes for the first time the acute effect of noise on cardiovascular mortality, indicating that aircraft noise is a trigger for fatal acute coronary events.

The authors suggest that if these findings are confirmed by further studies at airports with higher night-time noise exposure, a complete ban on night-time flights must be the consequence and reinforcing the WHO noise limits.

Based on this study's findings, Fingal County Council and the Health Authorities should conduct a similar study around Dublin Airport. No such study has ever been carried out.

This editorial shows that LAmax single noise events during the night-time period can trigger fatal acute coronary events, and it is imperative that they should be minimized.