

HCNG → EGAG - Rob Buick

27 July 2023 @ NACF

Aviation Noise and Emissions:  
Health & Environmental Impacts  
A Primer

A video presentation

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# Aircraft Noise and Emissions: Health and Environmental Impacts

## A Primer

Jamie Banks, PhD, MSc

Quiet American Skies, a program of Quiet Communities, Inc.

April 2023

# Topics to be discussed

1. Aviation growth
2. Community experience
3. Aviation noise and health
4. Aviation emissions and health
5. Aviation and ecosystems
6. Greenhouse gas emissions
7. Economics
8. Policy
9. Summary and conclusion



# Video

- Can be viewed on youtube

<https://www.youtube.com/watch?v=-ytTPyj6lFg>

# Summary

- Noise and emissions from aviation sources are damaging public health and the environment.
- Aviation growth means these problems are on course to worsen substantially.
- These are national problems with **enormous public costs**.
- Current policy fails to address these problems.
- At present, no one is accountable for the harms to the public or to the environment.
- Health and environmental agencies need to be involved in aviation policy.
- Decisive federal action is required.



## THIS IS A NATIONAL PROBLEM.

**Balance must be restored to protect people on the ground as well as in the air.**



## FEDERAL ACTION IS NEEDED NOW.

*Special acknowledgement to Drs. Mathias Basner, Arline Bronzaft, Neelakshi Hudda, Thomas Münzel, Michael Osborne, and Zafar Zafari and their colleagues for their groundbreaking research work and to members of our Quiet American Skies program.*



# Spare slides

For Discussion reference, post video presentation

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# Aircraft Noise and Emissions: Health and Environmental Impacts

## A Primer

Jamie Banks, PhD, MSc

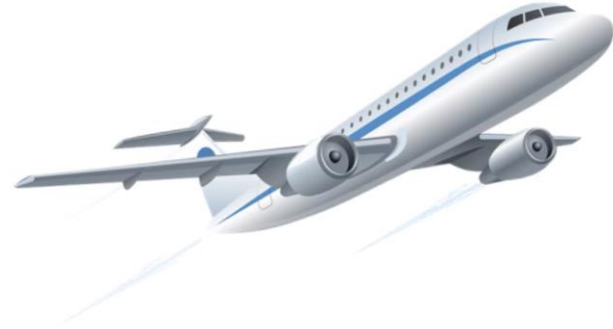
Quiet American Skies, a program of Quiet Communities, Inc.

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# Civilian aviation is growing.

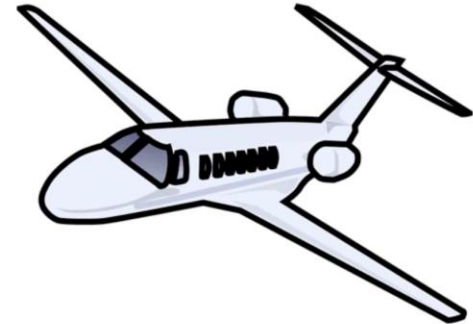
## Established sectors

- Commercial passenger
- Cargo
- General aviation



## Newly emergent sectors

- Urban air mobility
- Drones



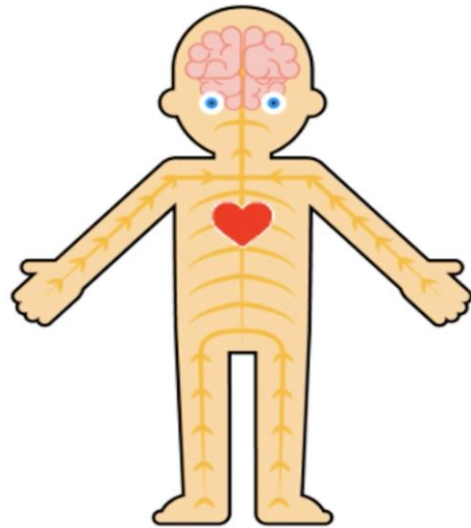
# Aviation Noise and Health



# Over 50 years ago...

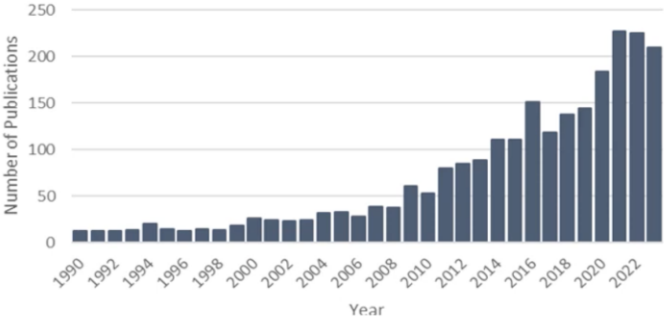
**US Surgeon General William H Stewart, 1968**

“...aside from hearing loss, it has been demonstrated that noise from aircraft and other sources causes **physiological changes, including cardiovascular, glandular, and respiratory effects reflective of a generalized stress reaction.**”

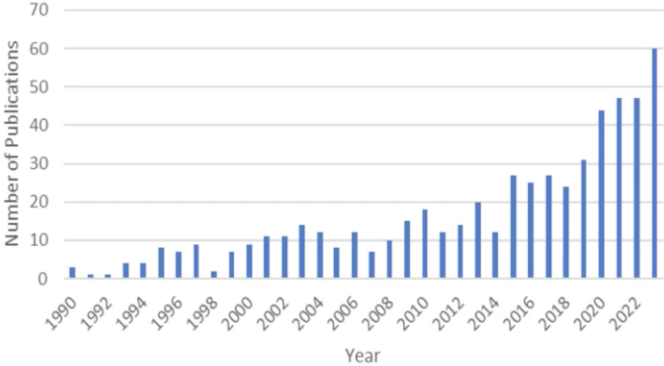


# Dramatic growth in scientific evidence over 30+ years

Noise and health  
N=2,196 (2022)



Aviation noise and health  
N=503 (2022)



Source: Pubmed and Science Direct searches, 1990-2023, 2/22/23



It's much more than an “annoyance.”



“Chronic noise, even at low levels, can cause annoyance, sleep disruption, and stress that contribute to cardiovascular disease, cerebrovascular disease, metabolic disturbances, exacerbation of psychological disorders, and premature mortality.”



“Noise interferes with cognition and learning, contributes to behavior problems, and reduces achievement and productivity.”

-- American Public Health Association, *Noise as a Public Health Hazard*, 2021

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It's not just loudness...

**Loudness**

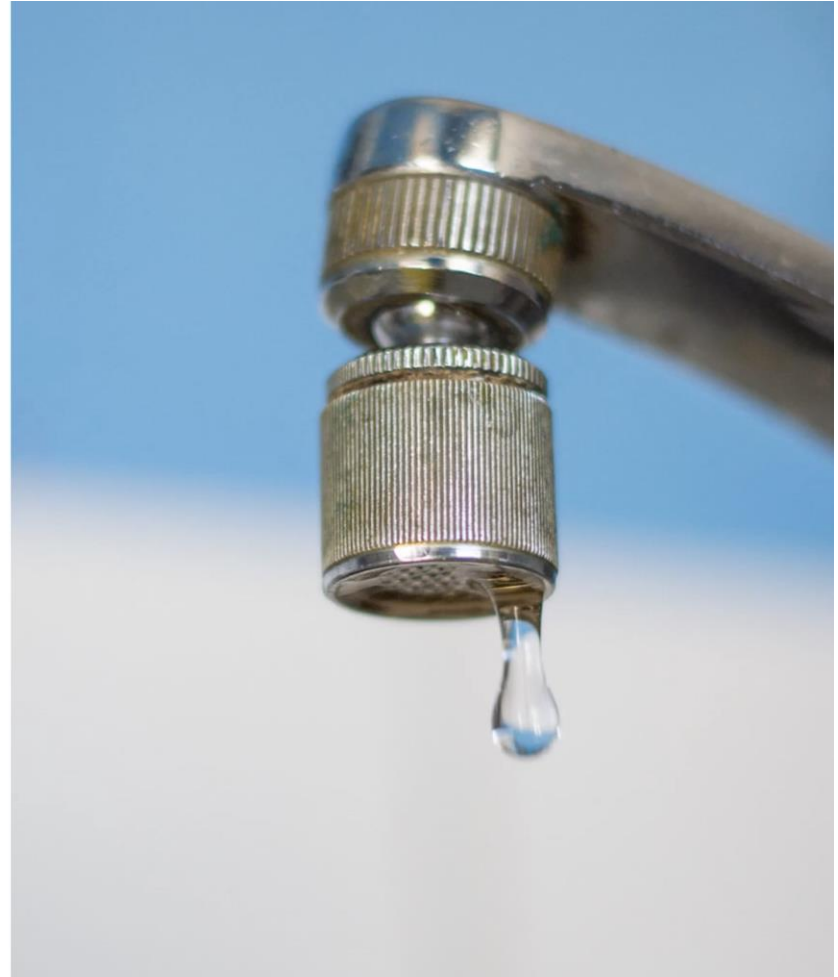
**Pattern**

**Repetition**

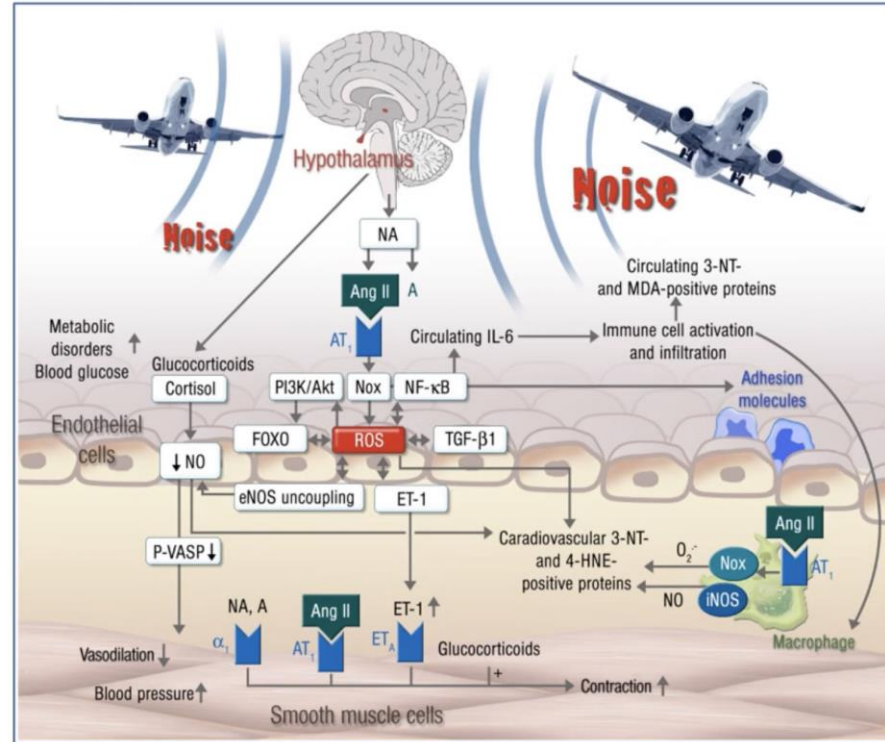
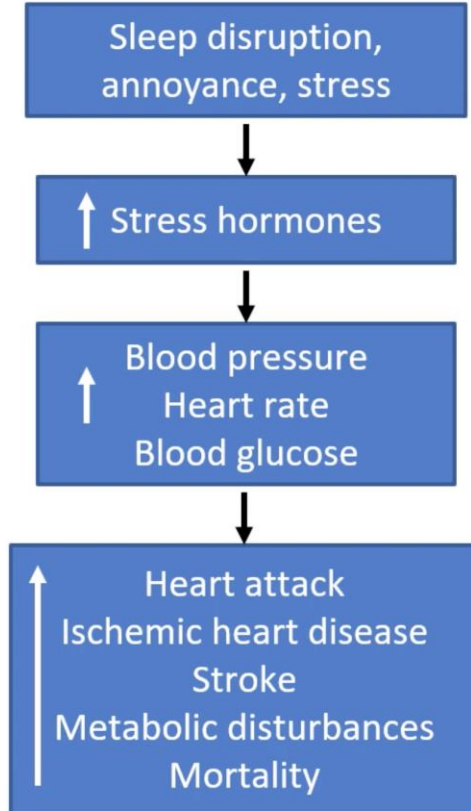
**Low frequency**

**Tonality**

**Duration**



# First line responses set off a physiological cascade



Source: Münzel T et al. Eur Heart J. 2017 Oct 1;38(37):2838-2849.





# Nighttime aircraft noise – a particular hazard



European Heart Journal (2020) 00, 1–9  
doi:10.1093/eurheartj/ehaa957

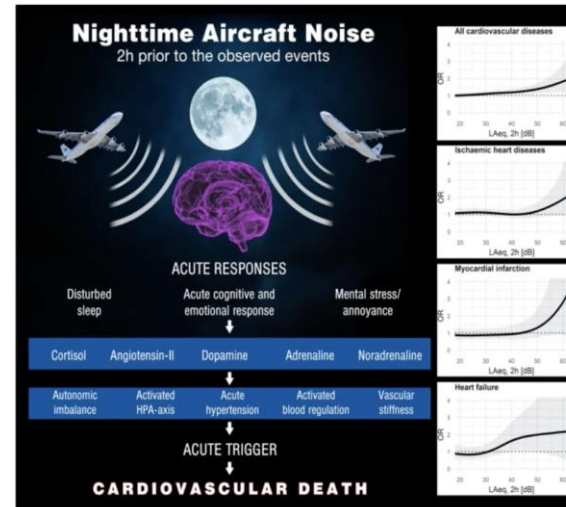
CLINICAL RESEARCH  
Epidemiology

## Does night-time aircraft noise trigger mortality? A case-crossover study on 24 886 cardiovascular deaths

Apolline Saucy<sup>1,2</sup>, Beat Schäffer<sup>3</sup>, Louise Tangermann<sup>1,2</sup>,  
Danielle Vienneau<sup>1,2</sup>, Jean-Marc Wunderli<sup>3</sup>, and Martin Röösli<sup>1,2,4</sup>

<sup>1</sup>Department of Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Socinstrasse 57, Basel 4002, Switzerland; <sup>2</sup>Faculty of Science, University of Basel, Peterplatz 1, Basel 4003, Switzerland; and <sup>3</sup>Empis, Swiss Federal Laboratories for Materials Science and Technology, Überlandstrasse 129, Dübendorf 8600, Switzerland  
Received 29 July 2020; revised 6 October 2020; editorial decision 4 November 2020; accepted 11 November 2020

High noise levels (> 50 dB) from nighttime aircraft was associated with a 44% increase in risk of dying from cardiovascular causes compared with the quietest conditions.



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## Repeated noise harms health.

*Repeated noise events prime the vasculature for developing endothelial damage, no tolerance development.*

-- Thomas Munzel, MD, Professor, Chief of Cardiology, University Medical Center, Mainz



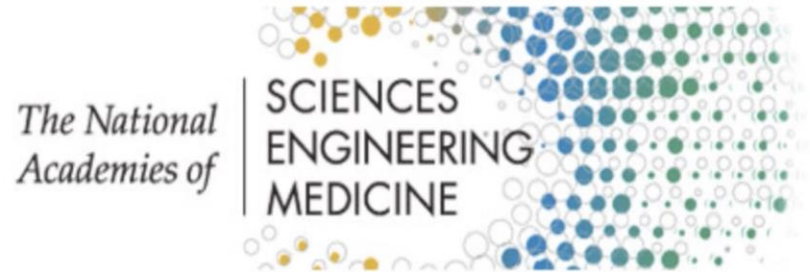
# Aircraft noise impairs children's learning.

Known for 40 years.

National Academies of Science, Engineering,  
and Medicine study:

- Students near airports exposed to noise  $\geq 55$  DNL have lower math and reading scores.
- Students at schools with sound insulation have better test scores.

\$ - hundreds of million invested by the FAA  
in insulating schools.



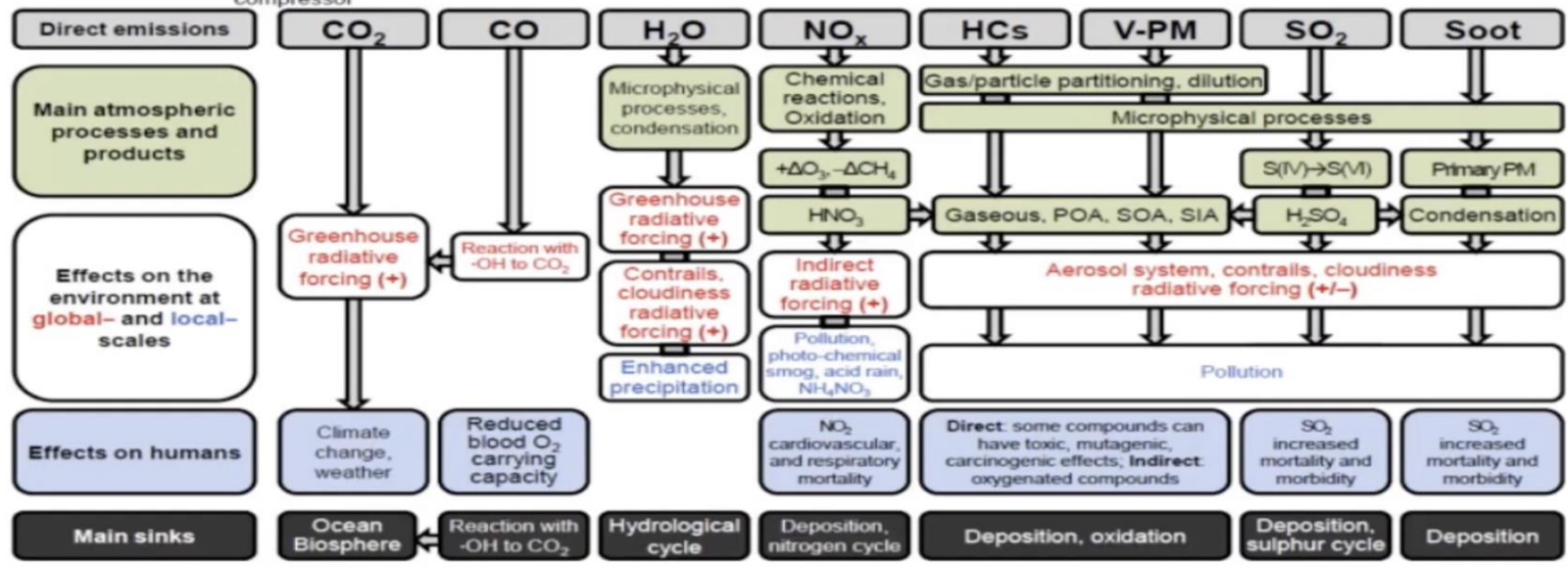
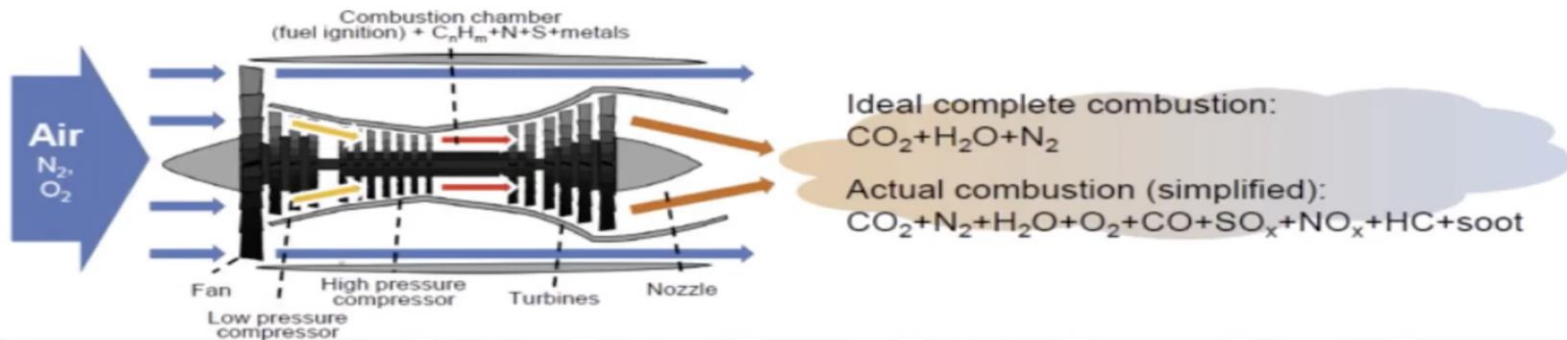
*Calling noise a nuisance is like calling smog an inconvenience. Noise must be considered a hazard to the health of people everywhere.*

-- US Surgeon General William H Stewart, 1978



# Aviation Emissions and Health





Source: Fig 2 from Masiol & Harrison, Atmos Environ 2014.



# Aviation exhaust emissions: ultrafine particles (UFP)

- Pollutes air outdoor and indoor air.
- Penetrates deep in the lungs, absorbed into the bloodstream.



- Not routinely monitored or regulated

Schraufnagel DEExp Mol Med. 2020 Mar;52(3):311-317. Hudda N, Simon MC, Zamore W, Durant JL. Environ Sci Technol. 2018 Feb 20;52(4):1765-1772. Hudda N, Gould T, Hartin K, Larson TV, Fruin SA. Environ Sci Technol. 2014 Jun 17;48(12):6628-35.



# Preterm Birth among Infants Exposed to *in Utero* Ultrafine Particles from Aircraft Emissions

Sam E. Wing,<sup>1</sup> Timothy V. Larson,<sup>2</sup> Neelakshi Hudda,<sup>3\*</sup> Sarunporn Boonyarattaphan,<sup>2</sup> Scott Fruin,<sup>4\*</sup> and Beate Ritz<sup>1\*</sup>

<sup>1</sup>Department of Epidemiology, University of California, Los Angeles, Los Angeles, California, USA

<sup>2</sup>Departments of Civil & Environmental Engineering and Occupational & Environmental Health Sciences, University of Washington, Seattle, Washington, USA

<sup>3</sup>Department of Civil & Environmental Engineering, Tufts University, Medford, Massachusetts, USA

<sup>4</sup>Division of Environmental Health, University of Southern California, Los Angeles, California, USA

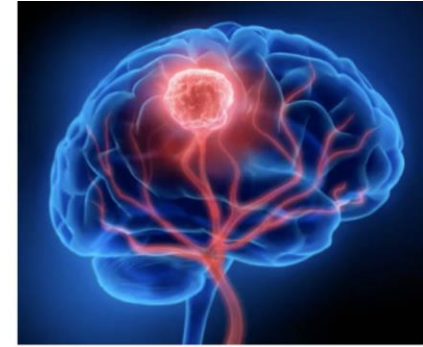
- Exposure to high levels of UFP increased risk of pre-term birth by 32%.
- N=174,186



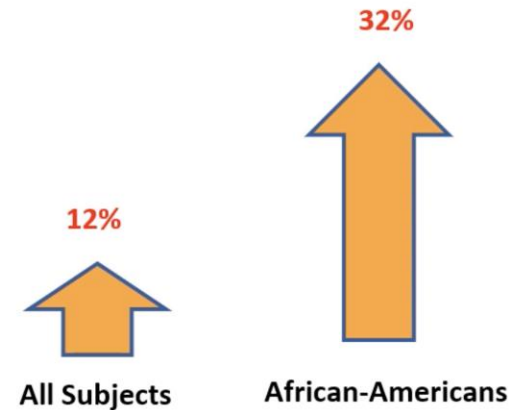


## Association between Airport-Related Ultrafine Particles and Risk of Malignant Brain Cancer: A Multiethnic Cohort Study

Anna H. Wu<sup>1</sup>, Scott Fruin<sup>1</sup>, Timothy V. Larson<sup>2</sup>, Chiu-Chen Tseng<sup>1</sup>, Jun Wu<sup>3</sup>, Juan Yang<sup>4</sup>, Jennifer Jain<sup>5</sup>, Salma Shariff-Marco<sup>4</sup>, Pushkar P. Inamdar<sup>4</sup>, Veronica W. Setiawan<sup>1</sup>, Jacqueline Porcel<sup>1</sup>, Daniel O. Stram<sup>1</sup>, Loic Le Marchand<sup>6</sup>, Beate Ritz<sup>7</sup>, and Iona Cheng<sup>4</sup>



- UFP exposure in residents living around LAX
- Increase in risk of malignant brain cancer per interquartile range of UFP concentration





## Health effects of short-term exposure to ultrafine particles around Amsterdam Schiphol airport

N. Janssen, G. Hoek, M. Oldenwening, F. Cassee, A. Lammers, M. Gerlofs-Nijland, R. He, D. van Dinther, R. Keuken, and S. van der Zee

- Children: increased daily respiratory symptoms and bronchodilator use.
- Adults: Decreased lung function, diminished heart function.



# Aviation and ecosystems



# Noise and wildlife

## Disrupts abilities

- Communication
- Finding reproductive partners
- Evading predators
- Finding prey

## Diminishes health and vitality

## Contributes to **loss of biodiversity**



# Noise impacts on forests, agriculture, marine ecosystems

- Disrupts pollination and seed distribution by wildlife.
- Inhibits ecosystem diversity.
- Damages cells, proteins, DNA, affecting plant growth.



Source: Cal Poly News, April 14, 2021



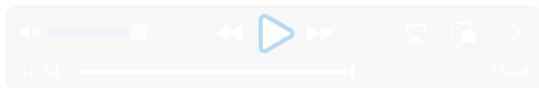
# Greenhouse gas emissions



## Aviation – one of the fastest growing sources of carbon dioxide (CO<sub>2</sub>) emissions

- U.S. aviation -- the largest contributor
  - 24% of all global aircraft emissions
- Absent new policies, global aircraft emissions are projected to triple by 2050.





# Economics







CLIMATE  
IMPACTS



HEALTH



EDUCATION  
REMEDATION



External costs of aviation noise  
and emissions are staggering.



The public bears the burden.



BIODIVERSITY  
LOSSES

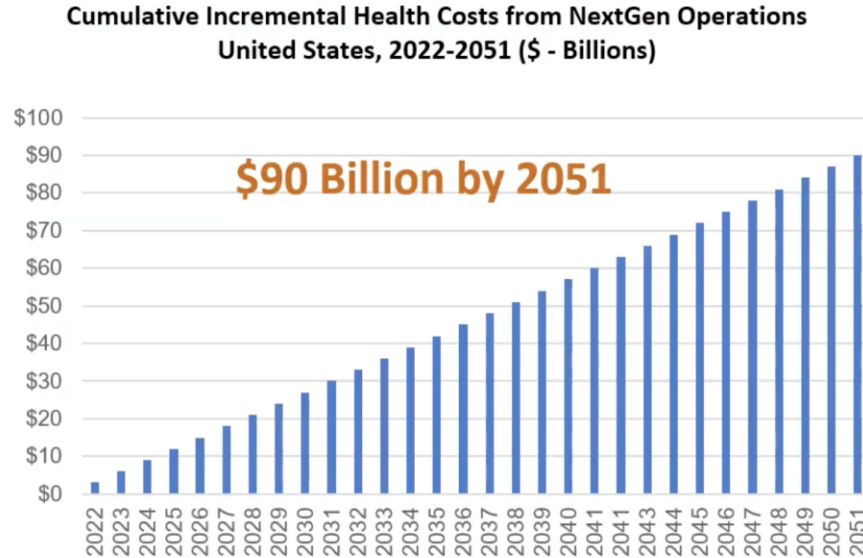


LOST PROPERTY  
VALUE



# The health impacts of Nextgen alone cost \$ billions.

- Baltimore-Washington International Airport = \$40 million per year (conservative)
- Nationally, at \$20 million per airport per year for 150 international airports in the US = \$3 billion/yr
- Over 30 years: \$90 billion



\*Zafari Z, Park J-E. Projecting the health and economic burden of aircraft noise. University of Maryland, 2022.



# Aviation Policy



## Communities have no control over impacts.

- The Airport Noise and Capacity Act (ANCA) of 1990 stripped localities of control over commercial jet aircraft noise – including operations and nighttime curfews.
  - In exchange, U.S. airlines upgraded to quieter engines, but gains have been offset by volume increases, flight pattern changes, etc.
- The FAA prevents airport sponsors from regulating noise by threatening to pull Airport Improvement Program (AIP) grants.



# No one is protecting the American people.

Congress, airports, and airlines point to others for responsibility.

Impacted communities are powerless to effect change.

Millions on the ground are unprotected.



Shutterstock.com 1697020858



# Aviation policy is not protecting health and environment.



- Aviation noise policy has not kept up with scientific knowledge on adverse effects or with dramatic industry growth.



- The foundation of policy is acoustic engineering, not human and environmental health.



- The US does not have effective federal noise control program.



# FAA metrics – the historic lynchpins of aviation noise policy – are fatally flawed.

- Thresholds for “significant impact” and “residential compatibility”
  - At odds with national and international thresholds: 2x to > 4x quieter
  - At odds with science showing those thresholds harm health, sleep, and learning
- Results of FAA’s own Neighborhood Environmental Survey\* confirm the inadequacy of those thresholds.

\* Federal Aviation Administration. Analysis of the Neighborhood Environmental Survey, Final Report, DOT/FAA/TC-21/4, February 2021.





The EPA and HHS must be involved, as they once were.





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# Quietcommunities.org

Contact us at: [info@quietcommunities.org](mailto:info@quietcommunities.org)

**Quiet Communities** is an independent, national nonprofit 501(c)(3) organization, dedicated to helping communities reduce health and environmental harm from noise and pollution.

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