

Lead (Pb) Emissions from Aircraft: A Public Health Problem with Opportunities for Advocacy

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APHA Environmental Section



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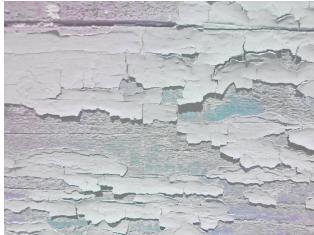
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Lead (Pb) is a well-known toxin,

For centuries, lead has been known to be dangerous to health.¹

Any exposure to lead is unsafe.²⁻³

No blood lead level (BLL) has been found to be safe for children.²⁻³



...largely regulated by EPA.

EPA began to regulate lead emissions under the Clean Air Act in 1973.⁴

By 1996 the phase-out of leaded gas used in vehicles like cars, trucks, and commercial planes was complete; however, there were **exceptions**:⁴⁻⁵

- **aircraft**
- **racing cars**
- **farm equipment**
- **marine engines**



appx **429 tons (69%)** of Pb emitted to ambient air associated with use of leaded aviation gasoline

Source: National Emissions Inventory (NEI), 2020



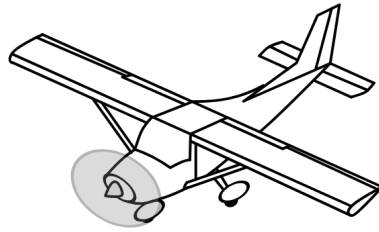
(1) Hernberg (2000) [Am J Ind Med](#)

(2) WHO. (2022, August 31). [Lead poisoning.](#)

(3) CDC. (2022, September 2). [Health effects of lead exposure.](#)

(4) EPA. (1996, January 29). [Press Release.](#)

(5) EIA.gov. (2022, December 29). [Gasoline and the environment.](#)



Piston-engine aircraft still use leaded aviation gasoline (avgas).

Common Uses:¹

- Personal/Recreational use (30.4%)
- Instructional use (23.7%)

Other Uses: business/personal travel, aerial surveys, agriculture, firefighting, law enforcement, medical emergencies, and express freight.²

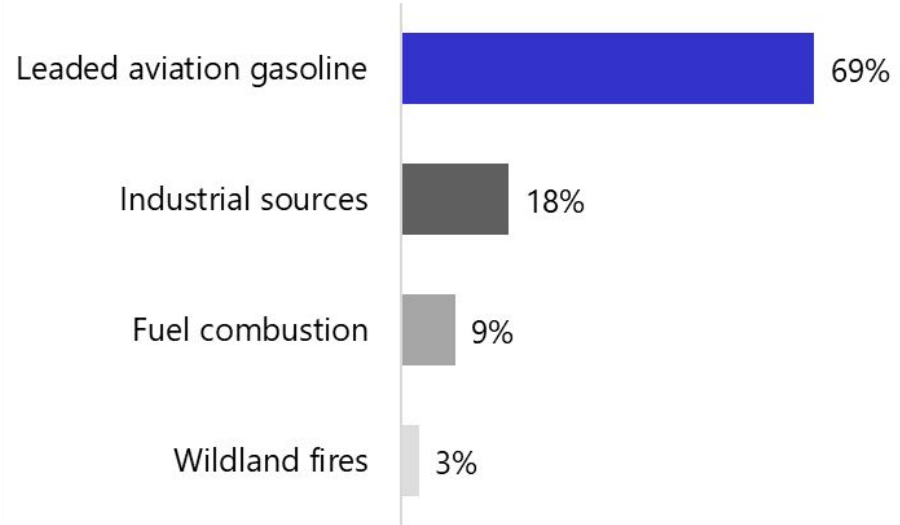


Fig 1. Sources of Lead (Pb) Emissions.

Data source: National Emissions Inventory (NEI), 2020. Chart: Excel.

(1) FAA. (2022) [General Aviation and Part 135 Activity Survey.](#)

(2) FAA, (2019, November 20) [Leaded aviation fuel and the environment.](#)

About **20,000 general aviation airports** in the US¹

It's a public health issue:

- **16 million people** live within 1 km²
- **5.2 million people** live within 0.5 km...
... **363,000** are children aged 5 or younger.¹

It's an environmental justice issue: ¹⁻³

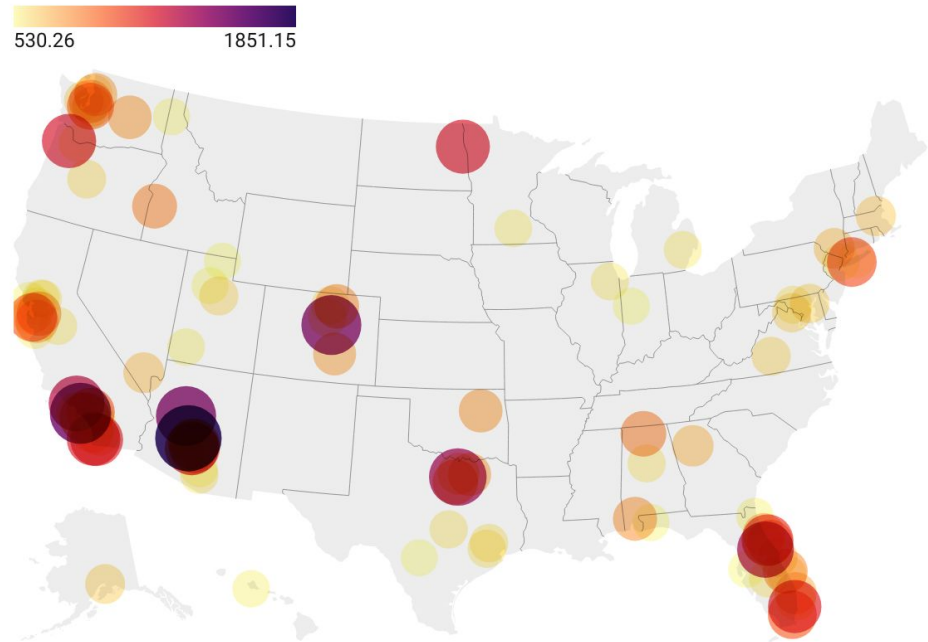
- Many of these communities near the airports have populations with a higher prevalence of
 - people of color
 - people with low-incomes

It's an occupational health & safety issue: ¹⁻³

- Maintenance workers working closer to the runway had higher BLLs.⁴
- More work hours in the runway or more work hours corresponded to higher BLLs.⁴

Top 100 Lead Polluting Airports in the US

Airports with the greatest yearly lead emissions according to NEI 2017 data are shown, with larger circles and darker colors indicating greater lead emissions.



Map: Quiet Communities • Source: EarthJustice
(https://earthjustice.org/sites/default/files/files/top100leadpollutingairports_2021-08-23.pdf) • Created with Datawrapper

(1) EPA. (2022, October 7). [Proposed Finding That Lead Emissions From Aircraft...May Reasonably Be Anticipated To Endanger Public Health and Welfare.](#)
(2) Oversight Committee. (2022, July 28). [Testimony of Santa Clara County Supervisor Cindy Chavez, District Two.](#)
(3) EarthJustice. (2021). [Top 100 Lead-Polluting Airports.](#) | (4) Park et al. (2013) [Aviat Space Environ Med](#)

Pb Health Effects - profound and permanent

Children

- Negative effects on brain and nervous system development¹⁻²
 - e.g., irreversible cognitive impairment

IQ points lost to BLLs has an **estimated nationwide cost of \$554 billion**, with 74% from BLLs of <5 µg/dL.

*from 1999 to 2010
Boyle et al. (2021) [Sci Total Environ](#)

Maternal Health

- Miscarriage¹
- Stillbirth¹
- Premature birth¹
- Low birth weight¹
- Source of Pb to fetus¹

Adults

- Increased risk of high blood pressure¹
- Cardiovascular problems¹
- Kidney damage¹
- Headaches, Fatigue, abdominal pain...¹⁻²

Lead accounts for avoidable deaths of US adults each year:

Cardiovascular disease mortality: 256,000 deaths

Lanphear et al. (2018) [Lancet Public Health](#)

Pb Effects: Avgas Study Examples

Miranda et al. (2011)

- Geospatial analysis in North Carolina found a **significant association** between **potential avgas exposure** (proximity to general aviation airport) and **BLLs** in children.
- With confounding factors controlled, **dose-response patterns** were seen for
 - ◆ **BLLs & airport distance**
 - From 0.5 km to 1.5 km, with largest impact on children living within 0.5 km.

[*Environ Health Perspect.*](#)

Zahran et al. (2023)

- Children living closer to Reid Hillview airport (Santa Clara County, CA) had increases in BLLs that were **50% of the increases estimated for children in the height of the Flint Water Crisis.**
- With confounding factors controlled, **dose-response patterns** were seen for
 - ◆ **BLLs & airport distance**
 - Children at 0.5 km & 1 km at greatest risk of elevated BLLs
 - ◆ **BLLs & aircraft traffic**

[*PNAS Nexus*](#)

Important Dates:

Organizations like Friends of the Earth & Earthjustice have been working on this issue with community groups since the early 2000s.¹

- EPA proposed an Endangerment finding in October 2022 & finalized it in October 2023.¹

FAA's **E**liminate **A**viation **G**asoline **L**ead **E**missions (EAGLE) Initiative was launched on February 23rd, 2022.²⁻³

- Partnership between FAA and aviation and petroleum industry ²
- Non-mandatory goal to transition to unleaded fuels by the end of 2030 ²⁻³

Current FAA-approved unleaded fuels:³

- Swift Fuels UL 94
- GAMI 100UL

How can we accelerate the transition to unleaded fuels?

(1) EPA. (2023, October 20). [Petitions and EPA Response Memorandums related to Lead Emissions from Aircraft that Operate on Leaded Fuel.](#)

(2) FAA. (2023, September 5). Aviation Gasoline. <https://www.faa.gov/about/initiatives/avgas>

(3) FAA. (2023, December 7). EAGLE Initiative. <https://www.faa.gov/unleaded>

Accelerating the Transition to Lead-Free Skies

A Solutions-Focused Conference (December 2022)



Key Takeaway Points

There is **no safe level of lead**.

Continued use of leaded avgas is a **public health problem** that harms workers, communities, & vulnerable populations (e.g., children, pregnant people).

Quick change is needed & the public health community can help:

- Dispel misinformation about lead exposure & health effects
- Increase awareness
- Advocate with affected communities

The Clean Air Act gives EPA power to address lead pollution from aircraft

The Administrator shall, from time to time, issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.

42 U.S.C. § 7571(a)(2)(A)

- This “endangerment finding” is the first step to regulation. Once EPA makes this endangerment finding, EPA and FAA must act.

For decades, environmental groups have urged EPA to start regulating leaded avgas

- 2003: Bluewater Network first requests EPA make an endangerment finding for leaded avgas; EPA rejects request in 2005
- 2006: Friends of the Earth (“FoE”) formally petitions EPA to make endangerment finding; EPA denies request in 2012
 - In 2010, EPA acknowledges no safe level of lead has been identified and about half of domestic lead emissions were from use of leaded avgas
 - In 2012, EPA denies 2006 petition but says it intends to initiate proceeding with aim of proposal in 2015
- 2014: FoE and others seek reconsideration of denial; EPA responds with plan to issue proposed endangerment finding in 2017

For decades, environmental groups have urged EPA to start regulating leaded avgas

- 2021: Earthjustice—on behalf of our clients FoE, Oregon Aviation Watch, Alaska Community Action on Toxics, and Center for Environmental Health—and the Town of Middleton, Wisconsin and the County of Santa Clara, California petition EPA again to make an endangerment finding
- 2022: EPA responds to the most recent petition in January, stating its intention to issue a proposed endangerment finding that year; in October, EPA publishes proposed endangerment finding
- 2023: EPA makes final endangerment finding

At long last, this EPA has finalized an endangerment finding

- In October 2023, EPA finalized its endangerment finding, concluding that:
 1. Lead air pollution may reasonably be anticipated to endanger the public health and welfare; and
 2. Engine emissions of lead from certain aircraft cause or contribute to the air pollution referred to in 1.

... which in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.

42 U.S.C. § 7571(a)(2)(A)

EPA's endangerment finding is the result of years of advocacy and research

- Continued pressure from environmental groups through litigation and petitions
- Research by scientists to show the effect of lead emissions from avgas
 - 2011: Marie Lynn Miranda et al., *A Geospatial Analysis of the Effects of Aviation Gasoline on Childhood Blood Lead Levels*, 119 *Env't Health Persps.* 1513
 - 2017: Sammy Zahran et al., *The Effect of Leaded Aviation Gasoline on Blood Lead in Children*, 4 *J. Ass'n Env't & Res. Economists* 575
 - 2022: Heather Klemick et al., *Cardiovascular Mortality and Leaded Aviation Fuel: Evidence from Piston-Engine Air Traffic in North Carolina*, *Int'l J. of Env't'l Res. & Pub. Health* 19(10):5941
 - 2023: Sammy Zahran et al., *Leaded Aviation Gasoline Exposure Risk and Child Blood Lead Levels*, 2 *PNAS Nexus* 1

EPA's endangerment finding is the result of years of advocacy and research

- EPA also gathered information about the scope of leaded avgas emissions, showing that hundreds of thousands of children are at risk
- Estimates from EPA's *National Analysis of the Populations Residing Near or Attending School Near U.S. Airports* (Feb. 2020):
 - More than 5 million people live within 500 meters of a runway and 50 meters of a helipad
 - More than 360,000 children 5 or younger live in very close proximity to a general aviation airport
 - More than 160,000 children attend schools near these airports

Now that EPA's endangerment finding is final, leaded avgas should be phased out

- Endangerment finding triggers obligation for EPA to issue proposed emission standards, and EPA must consult with the FAA on aircraft emission standards. *See* 42 U.S.C. § 7571(a)(2).
- FAA must also set standards for aviation fuels to control or eliminate emissions that EPA has determined endanger public health or welfare. *See* 49 U.S.C. § 44714.

Now that EPA's endangerment finding is final, leaded avgas should be phased out

- Alternative fuels that can be used in piston-engine aircraft are available and are also in development:
 - UL94 has been on the market and available for years and can be used in approximately two-thirds of all piston-engine aircraft
 - G100UL is approved for use in all aircraft in the fleet and expected to be available in California mid-2024
 - Other companies expect to be able to bring 100-octane unleaded fuel to market soon

Major Stakeholders

- Community members and impacted individuals
- Public and environmental health advocates and professionals
- Local, state, and federal public officials
- State and federal regulatory bodies – EPA, FAA
- Pilots**, airport operators and airport advisory boards
- Fuel producers, distributors, fixed based operators – GAMI, SWIFT
- Industry trade associations – AOPA, GAMA, NATA, EAA

Congress is paying attention

- **2022:** Oversight Subcommittee on Environment Ro Khanna (CA-17) holds hearing on leaded aviation gasoline, received bipartisan support
- **2023-current:** FAA Reauthorization bills include provisions championed by industry voices that would further entrench leaded avgas at airports
- **2023:** Alaska Senators Murkowski and Sullivan introduce Congressional Review Act (CRA) resolution to repeal EPA's endangerment finding on leaded avgas
- **2024:** Rep. Zoe Lofgren (CA-18) leads 44 other House colleagues in letter to EPA and FAA, calling on agencies to move forward with standard setting process for leaded avgas

Public officials and concerned citizens are getting involved at all levels of government

- Multiple state-wide efforts to ban sale of leaded avgas
 - California state-wide ban introduced by state Sen. Menjivar – *Feb 2024*
 - Washington state-wide ban introduced by state Rep. Doglio – *Feb 2023*
 - New Mexico state-wide ban introduced by state Sen. Soules – *Jan 2023*
- Local municipalities and airports aim to curb leaded avgas emissions
 - Santa Clara County bans sale of leaded avgas at county airports – *2022*
 - Naples Airport Authority in Florida creates unleaded avgas subsidy – *2023*
 - Long Beach County in California creates unleaded avgas subsidy – *2024*
 - Rocky Mountain Metropolitan Airport in Colorado approves plan to phase out use of leaded avgas by *2027*

Examples: How the Public Health Community Can Help

- Dispel misinformation about lead exposure & health effects
- Increase awareness **among the public** and **within the public health community**
- Host or co-host educational events/webinars
- Consider the development of policy statements
- Advocate with affected communities

Questions?