



Accelerating the Transition to Lead Free Skies

December 15, 2022 Conference

Summary Report

March 2023



Table of Contents

INTRODUCTION 2

CONFERENCE BRIEFING BY SECTION 3

Health Perspective 3

Community Perspective 3

Acceleration Possibilities and Consideration 6

Product Development and Approval 6

Supply Chain: Manufacturing Scale Up 7

Infrastructure Build-Out 8

Airports and Business Models 8

Safety for Pilots and Aviation Workers 8

Safety on the Ground 9

Policy 10

ISSUES AND RECOMMENDATIONS 11

Highest Priorities 11

Other Priorities – General 13

Other Priorities – Communities 13

Other Priorities – Industry 14

CONCLUSION 16

APPENDICES..... 17

Appendix A: Conference Program 17

Appendix B: Speaker Roster 18

Appendix C: Background on Leaded Avgas 22

RESOURCES 26

INTRODUCTION

This report provides a summary and recommendations from a three-hour conference, *Accelerating the Transition to Lead-Free Skies*, held via Zoom on December 15, 2022. The conference was organized by the nonprofit Quiet Communities in collaboration with the Boston University class *Research for Environmental Agencies and Organizations*. See the Agenda and Speaker Roster in **Appendices A and B**.

The conference brought together diverse stakeholders to provide a balance of perspectives and to collaborate on recommendations for accelerating a national transition to unleaded aviation fuel (avgas) ahead of the 2030 deadline set by EAGLE (Eliminate Aviation Gasoline Lead Emissions), the FAA-industry partnership formed to address this issue. Leaders from science, affected communities, industry, government, and nonprofit organizations spoke on the problem of lead exposure; community response; economic, technical, and policy aspects; alternative fuel development, and the experience of airports that use unleaded avgas. Two hundred-fifty people registered for the conference and approximately half attended. A recording of the conference is available on the [Quiet Communities](#) and [Boston University](#) websites.

Today, leaded avgas used in piston engine aircraft is the leading source of lead pollution in the domestic atmosphere, accounting for 70% of all lead pollution released into the air in the United States (see Background in **Appendix C**). Widespread agreement exists within the scientific and medical communities that no level of lead is safe. Lead is a potent neurotoxicant, affecting the developing brains of children, and causing reproductive, cardiovascular, and neurodegenerative harm in adults. Lead does not biodegrade; rather, it accumulates in the environment – in water and soil – harming all living things. So how can we eliminate leaded avgas as soon as possible?

The conference was timed to take advantage of the opportunity that exists right now, defined by the convergence of multiple factors:

- [Recommendations](#) from the National Academies of Science, Engineering, and Medicine (NASEM) committee on ways to reduce lead emissions from piston engine aircraft
- The formation of [EAGLE](#)
- EPA's [Proposed Endangerment Finding](#) (October 17, 2022)
- Independent studies linking leaded avgas specifically to increased blood lead levels in children
- Alignment of interests amongst the Biden administration, members of both parties of Congress, the scientific community, industry, and NGOs to phase out leaded avgas
- Growing availability of fleetwide unleaded avgas alternatives
- Airports leading the way that could serve as models for the transition
- Ongoing discussions on the 2023 FAA Reauthorization Act

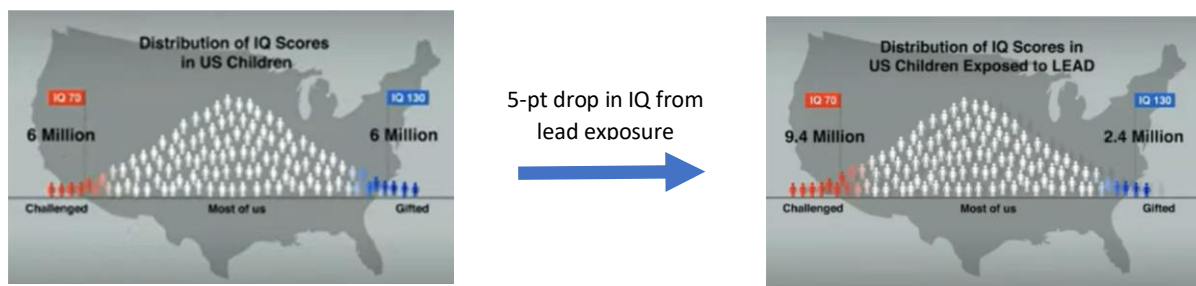
There is clearly a lot to be done to implement a national transition before 2030. Following a briefing on various conference sections, this report identifies the situational challenges and barriers to rapid implementation and recommends what can be done to overcome them. We are grateful to the participants in this conference; the insights and observations contained herein are from our conversations before, after, and during the event. Neither the event nor this report would have been possible without the contributions of time, thinking, and good will from all participants.

CONFERENCE BRIEFING BY SECTION

Health Perspective

The presentation by Bruce Lanphear, MD, MPH, a public health physician and pediatric epidemiologist specializing in environmental exposures, created the foundation for the conference, making clear that **no safe level of lead exists** and health effects extend from intellectual and behavioral impairments in children to reproductive, cardiovascular, and neurological harm in adults. The video, [Crime of the Century: Our Failure to Prevent the Lead Pandemic](#), provides more extensive detail on the hazards of lead exposure.

The effects of lead exposure have major national consequences. Here is just one example from Dr. Lanphear's conference presentation (Exhibit below). A 5-point drop in IQ from lead exposure alone increases the population of "challenged" children (IQ ≤ 70) by 57% – from 6 million to 9.4 million – and decreases the number of "gifted" children (IQ ≥ 130) from 6 million to 2.4 million. Exposure of children to other environmental toxicants increases the magnitude of this shift.



The 10-year study at Reid-Hillview Airport (RHA) led by Sammy Zahran, PhD, explicitly links leaded avgas to increased blood lead levels (BLL) in children. As airport traffic increased, so did BLLs in children living close to and/or downwind from the airport compared with children living further away. Decreased air traffic during the COVID pandemic was associated with decreased BLLs in children close to the airport. Lead exposure is also a risk factor for preterm birth that can be exacerbated by other factors like low vitamin D levels. Twenty percent of ADHD in children may be attributable to lead.

In adults, a recent meta-analysis (Chowdhury et al, 2018) and national study (Lanphear et al, 2018) indicate that lead may be the leading cause of coronary heart disease in the U.S. with most of blood vessel narrowing occurring at low levels (<50 ppb). These adverse health impacts have enormous economic implications for the country as well.

Takeaway: No level of lead is safe. Workers, families of workers, neighbors, pilots, wildlife, water resources, soil quality, all are threatened by continued use of leaded aviation gas. A national goal of quickly phasing out the airborne lead hazard needs to be set to protect children. The lead monitoring network must be expanded geographically and be made able to monitor ultrafine particles, the most common form of lead in aviation exhaust. Lead dust from all sources should be controlled using HEPA filters and damp mopping.

Community Perspective

A twenty-plus year history of neglect and inaction on leaded avgas has fueled anger and frustration in communities across the country. Many ask “so why has lead been allowed to persist in aviation fuels when it was banned 30 years ago from road vehicles?” Public officials have a responsibility to protect their constituents from harm. In the conference, we heard from a county in California that voted to ban the use of leaded avgas at its airport and from a community in Wisconsin that would like to see leaded avgas phased out at its local airport.

Cindy Chavez, a member of the Santa Clara County, CA, Board of Supervisors described the reasons why the Board voted in January 2022 to ban leaded fuel at Reid-Hillview Airport (RHA, San Jose).

- RHA is one of the top lead-emitting airports in the nation.
- The study by Zahran et al. showed that children near the airport were being harmed.
- The area around the airport is densely populated.
 - Approximately 52,000 residents live within 1.5 miles of the airport, including 13,000 children under 13 years.
 - Twenty-one schools and childcare centers are located within 1.5 miles of the airport.
- Nearly all residents living near the airport are low-income and people of color who already bear a disproportionate burden of environmental hazards and have elevated rates of death, Alzheimer’s disease, stroke, diabetes, and hypertension.

The county had stopped taking airport improvement grants in 2011, allowing it to decide independently to ban the sale of leaded avgas. Suits against the county resulted. The county is working with FAA to keep the ban in place.

Takeaway: The Reid-Hillview story shows that government officials really have no choice but to act to protect the health and safety of their constituents. There is no option of denying that the impacts are happening or that they are serious. The strength of evidence explicitly linking airborne lead to elevated blood lead levels coupled with the large number of residents – children and adults – at risk compels action.

Cynthia Richson, Chair of the Town Board of Middleton, WI (7K population), also provided a story where there was evidence but a different response. In this case, the City of Middleton (adjacent to the Town) is considering a major nonessential expansion of Morey Airport, a small recreational airport located 9 miles from the Town. Because of westerly winds, at least 70% of flights from Morey depart over the Town. A report from Trinity Consultants commissioned by the Town confirmed the presence of breathable airborne lead at ground level over a large area, and a study by the U.S. Geological Service found lead in two of six wells and in surface water.

The City of Middleton plans to build affordable housing next to and downwind from the airport where studies have shown airborne lead levels to be highest. These housing units are expected to be subject to repeated plane departures flying at low altitudes (e.g., 400-600 feet). After providing the study data and information to school and public health officials, public health officials felt [the evidence was insufficient](#) to conclude that the municipal airport contributed to elevated blood lead levels in the surrounding community. Pilots pushed back on the \$2/gallon higher price of unleaded vs. leaded fuel and are looking for subsidies. Although comments were made that residents near the airport “can move,” there are 400 general aviation airports in Wisconsin – you cannot just move away from the problem. Note: This comment was also reported by Cindy Chavez, who noted that many of her constituents cannot afford to move elsewhere: they do not have a choice.

Short of regulation, the Town of Middleton is excited about the alternatives now on the market: Swift's UL94 and GAMI's UL. Coincidentally, Swift's largest distribution hub is in Wisconsin. The Town hopes that Morey will be one of the first to get a railcar-full of UL to service their piston aircraft.

Takeaway: Education and outreach are needed to inform the public and school officials about the very serious hazards of leaded fuel and demonstrate that no level is safe. A lack of knowledge on the part of local officials and the public can stymie support for actions on leaded fuel, even when there is strong evidence that failing to do so leaves residents in harm's way. Education is needed to inform pilots of the economic benefits of unleaded fuel, e.g., cleaner, longer running engines, reduced maintenance that may help to offset the higher price of fuel.

Acceleration Possibilities and Considerations

This panel spoke about technical, economic, and structural aspects of the transition. Everyone on the panel – representing NASEM, FAA, fuel businesses, and aviation groups – agreed that phasing out lead was an urgent priority and all expressed commitment to an accelerated effort. It was clear that a nationwide transition is complex – involving different aspects – public support, product development and roll-out, scale-up of manufacturing and distribution, and new infrastructure. Addressing these efficiently requires a “multi-pathway approach” as well as collaboration amongst various players.

Some, if not all, felt a transition could be completed before the EAGLE 2030 deadline, assuming active engagement from the private sector, provision of adequate resources to regulators to enable swift and strong actions, and public and / or private investment in manufacturing and infrastructure build-out.



We asked participants to help us understand the ways in which this transition could be accelerated. Here is what we learned.

Product Development and Approval

Getting products into the market is obviously essential to a transition. Unleaded avgas not only eliminates harmful lead emissions but engines also run cleaner, requiring fewer oil and spark plug changes and less overall maintenance – there is a story of significant economic benefits to be told here.

The path to a transition relies on four interdependent pillars identified by the EAGLE program.



Product evaluation, testing, and approval are within the purview of the FAA, while R&D, manufacturing, and deployment are the responsibility of industry. Government can play a further role in fostering actions needed to more quickly get products into the market.

The regulatory process sets the pathway for the transition. Testing, approving and getting products into the market involves the FAA as well as the international standard-setting body, the American Society for Testing and Materials (ASTM), and OEMs (Original Equipment Manufacturers that make the planes), and the airports.

Government inertia is a potential source of slowdown for a transition. Adequate funding is needed to ensure that staff and contractors have the expertise and experience to expedite the regulatory process and issuing of Supplemental Type Certificates. Industry inaction can also be an obstacle to progress when profits do not compare favorably with other opportunities.

Unleaded products, once developed, go through one of two regulatory processes at FAA (PAFI, STC)¹ for approval based on safety, performance, and other critical fuel properties, such as fungibility (the ability to mix with other fuels - leaded and unleaded). Fungibility is critical, because if fuels are not fungible separate systems for storage and delivery are required. Once developed, the products must be certified by engine manufacturers and aircraft owners. The ideal product would:

- Be able to power all piston engine aircraft – high compression engines as well as lower compression engines.
- Be a fully fungible “drop-in” product that can be stored in existing truck fuel tanks and airport storage tanks.
- Be safe or safer than existing products for health and environment.

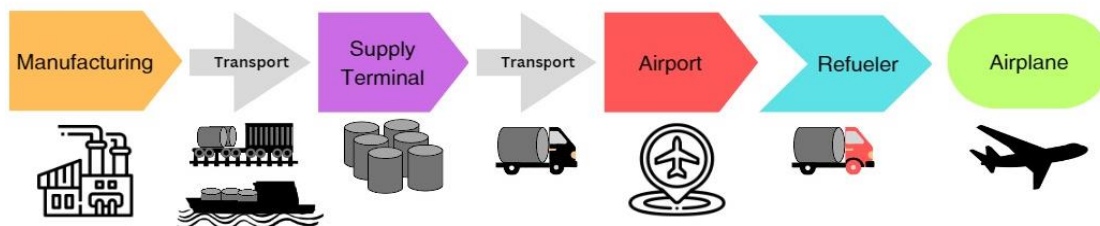
Fortunately, two products are already on the market and others are in development:

- UL94 from Swift Fuels, available since 2015, can service all but high compression engine aircraft.² 100R, a 100-octane unleaded fuel from Swift Fuels, is expected to become available by mid-2023 and be able to be used in all piston engine aircraft.
- G100UL from GAMI (General Aviation Modifications, Inc.) was approved in September 2022 for all piston engine aircraft.
- Two other companies (Phillips 66, Lionel Basel) were said to have unleaded products in the pipeline.

Now the challenge is getting the fuel manufactured and out into the marketplace. What can the FAA, Congress, EAGLE, trade groups, and others do to help manufacturers of fleetwide fuel get their products widely distributed and adopted?

Supply Chain: Manufacturing Scale Up

Scaling up the manufacture of unleaded avgas is essential. At present, manufacturing is limited to small batch production which serves to keep prices high and discourage infrastructure build-out. Build-out is needed at all levels of the system – refineries, transportation, storage. The challenge is how to scale up production and get rapid, broad-based distribution of unleaded fuels.



The small size of the unleaded avgas market is a serious barrier to investment. The annual volume of unleaded avgas is only 0.5% of the annual volume of jet fuel, according to Curt Castagna at the National Air Transportation Association (NATA). Large companies have the resources and may be inspired by social responsibility and “doing the right thing.” But if not, incentives can be put in place to encourage the

¹ PAFI: Piston Engine Aviation Fuel Initiative; STC: Supplemental Type Certification

² UL94 can be used in the 70% of the fleet that consumes 20% of total fuel volume. The remaining 30% of the fleet have high compression engines that account for 80% of leaded fuel consumed.

development of refinement capability for unleaded avgas. A possibility raised by George Braly of GAMI is that federal and /or state government could provide resources for manufacturing that could be phased out over time as volumes ramp up. Chris D'Acosta of Swift Fuels raised the possibility of private sector funding.

Infrastructure Build-Out

Infrastructure is needed at all levels to get manufactured avgas to airports and into planes. Transportation infrastructure is needed for fuel delivery from the refinery to the supply terminal and then from the supply terminal to the airport. Tanks must be available at the airport to store the fuel. Some airports – like Van Nuys, Santa Monica, and Watsonville -- already have the needed storage infrastructure. Others may not. Each above-ground fuel tank – required for new infrastructure – costs \$800K according to Watsonville Airport manager, Rayvon Williams. That is cost-prohibitive for most general aviation airports in the country.

Airports and Business Models

Airports vary widely in their proximity to people, in their business models, their fleet mix, their fuel infrastructure, and their resources and funding. What works for one airport may not work for others. The proportion of the fleet that can use unleaded fuel may differ.

The decision to transition to UL is complicated – it must balance the benefits with what financially makes sense and is possible. The costs of the transition may be very considerable if investments are required in new tanks, fuel dispensers, filters, and/or trucks. Liability must be considered. Once the fuel is in the storage tanks at the airport, the airport owners may be liable for any accidents.

The three airports represented at the conference – Van Nuys, Watsonville, and Santa Monica – were fortunate to have had the public support and resources needed to adopt unleaded fuel early on. For example:

- Santa Monica Airport was the first in Southern California to do so after getting the go-ahead from the City Council in October, 2021. The airport subsidizes the cost of UL fuel which costs \$0.50 - \$1.00 more per gallon based on funding from other sources. The airport also pays for the cost of the mechanic to ensure plans get the STC as well as the cost of the STC and will continue subsidizing the cost of fuel until it is no longer needed.
- At Van Nuys Airport, Los Angeles World Airport is helping to encourage use of unleaded fuel by waiving the fuel delivery fee through 2024.
- At Watsonville Airport, it was possible to use existing storage infrastructure for unleaded fuel, something most airports do not have. The airport was also able to waive flowage fees for pilots to encourage them to adopt unleaded fuel.

Safety for Pilots and Aviation Workers

While a transition is happening, pilots must understand when they are using unleaded fuel and be able to find fuel. If 100LL is not available, there can be a problem. Improperly fueling a high compression engine with unleaded fuel with lower-than-required octane ratings or having to travel further distances to find compatible fuel can put pilots and passengers at risk for serious accidents. Apart from getting unleaded fuel to the airports and into the tanks, pilots need to understand when they are using unleaded fuel and the octane rating of that fuel. Proper labeling, branding, quality control, matching filler ports are all needed to avoid fueling accidents.

- Watsonville Airport has taken multiple precautions to minimize the risk of misfuelling, installing signage around fueling stations, labeling of fuel dispensers, and pop-up notifications when using credit cards to repeatedly notify pilots that they are using unleaded, not leaded fuel.

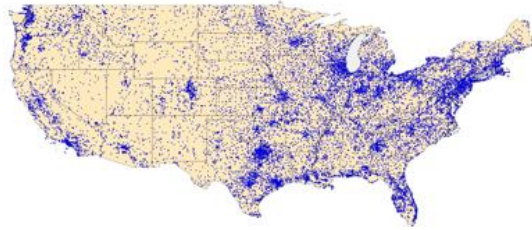
Safety on the Ground

Industry must maintain the availability of 100LL fuel during the transition. Because a phase-out of leaded fuel is going to take time, it is important that workers and the public minimize their exposure to lead.

- Workers are exposed to lead when refueling, performing maintenance tasks, and cleaning engines. Yet, pilots, maintenance personnel, and other aviation workers may not be aware of the hazards of leaded fuel. Informational materials and warning signs focused on flammability hazards, make scarce mention of lead. Pilots, maintenance personnel, and other aviation workers need to know more about their exposure to lead during refueling, maintenance activities, etc., to protect their health and that of their families from “take home lead” carried on the clothing and bodies of workers.
- The siting of housing, schools, parks, and playgrounds near general aviation airports is exposing the public to lead emissions. FAA has not updated its run-up area planning guidance – where to place run-up areas so they are away from areas of human activity, e.g., restaurants, neighborhoods, high traffic locations. Run-up areas are airport locations where pilots test out their engines.
- EAGLE is working on flight school guidance. Flight schools account for 45% of general aviation flight time today (R Olislagers, EAGLE) and are likely to be disproportionate sources of lead emissions, including lead.
- NATA has published a white paper for Fixed Base Operators (FBOs) on how to safely handle unleaded fuel and avoid misfuelling. An FBO is a company authorized by the airport to provide aviation services, such as fuel, parking, and hangar space.

Policy

A concise history of the 20-plus years it has taken to get to this moment was presented by Marcie Kever and Kelly Lester from Friends of the Earth and EarthJustice, nonprofit organizations involved in previous petitions to EPA and in advocacy work to get lead out of avgas. Both presenters spoke about the hazards of leaded aviation fuel at airports across the country (Map below).



Airports with lead emitting aircraft

They re-emphasized the points made about the health hazards of lead and added the following:

- It is estimated that over 400,000 deaths per year in the U.S. are due to adult lead exposure, and over 250,000 of those deaths are from cardiovascular disease.
- Neurodevelopmental harm to children from lead can persist into adulthood, and cognitive effects can be irreversible.
- Most of the 50 airports with the highest lead emissions from avgas are in communities of color, adding to the already disproportionate burden borne by Black children.
- Many airports are in low-income communities, where children also disproportionately face other sources of lead exposure.

With unleaded alternatives approved, there is no excuse for further delay.

Participants heard from Kevin Fox, Professional Staff member for Representative Ro Khanna on the House Subcommittee for the Environment that:

- The Subcommittee hearing in July 2022 demonstrated bipartisan frustration with the Administration and Executive Branch for moving too slowly on leaded avgas, when other countries have already taken the lead out. Congress has been frustrated that the FAA prioritizes industry voices over community voices.
- Legislation on leaded fuel is being explored for the next Congress with the FAA Reauthorization Act of 2023 coming up. Through this process, policy and a course for the FAA can be set by Congress.

Considerations include the following:

- Outlaw leaded aviation fuel under the CAA, while maintaining regulatory oversight by EPA and FAA.
- Make grant programs available to airports with no strings attached.
- Create a national model for transition based on what Santa Monica Airport has done where various discounts and subsidies are provided to STC aircraft.

ISSUES AND RECOMMENDATIONS

Quiet Communities compiled the following set of Issues and Recommendations from comments received during discussions with speakers and participants before, during, and after the conference. These also draw on the broader work of the organization to find feasible solutions that reduce harms from noise and related pollution. The approach is based on education and constructive collaboration that engages all stakeholders. The premise is that when people understand why something is important, are treated with respect, and asked to participate in a common endeavor, it is possible to garner agreement and move forward.

Highest Priorities

With a fleetwide unleaded product on the market today – fully fungible with 100LL and with an unleaded product expected on the market soon – immediate priorities are to scale-up manufacturing, build transportation and storage infrastructure, and implement measures to mitigate harm from lead exposure during the transition. ***Having unleaded fuel widely available would remove major barriers to adoption and acceleration.***

ISSUE: Federal support is needed to quickly get unleaded products into the marketplace – the private market is failing to do so. Fleetwide products are available now. Government action in terms of requirements and restrictions but also positive incentives such as funding and technical assistance are needed to scale production, set up a widespread distribution system, help airports build necessary infrastructure, and accelerate adoption by pilots and aircraft owners. There should be no assumption that the private market will produce a swift transition – it has not done so for decades.

RECOMMENDATIONS

- Legislatively create “small market incentives” for companies to manufacture and distribute fleetwide FAA-approved fuels.
- In the short term, consider establishing regional distribution models, e.g., in Southern California, as a starting point for a national distribution network.
- Where appropriate, use “early adopter airports” like Santa Monica, Van Nuys, and Watsonville as models.

ISSUE: Immediate steps should be taken to mitigate harm during the transition. Even an expedited transition will take time and during the transition, leaded avgas must remain in use for essential purposes. Here is a list of things that can be done to reduce harm immediately, some of which were recommended by the NASEM report:

RECOMMENDATIONS

- Federal agencies, state government, and trade organizations should initiate programs to educate the public, public officials, airport workers, pilots and others on harms from leaded avgas and exposure mitigation measures.
- Trade associations should request that the National Institute of Occupational Safety and Health (NIOSH) put general aviation work on its list and provide informational materials to help pilots and airport workers minimize exposure.
- Flight paths and run-up areas should be positioned or selected to minimize exposure of residential and public spaces to leaded avgas exhaust.
 - Run-up guidance would help foster this practice.

- **Municipal officials and urban planners should examine impacts from flight paths and not allow new residential areas, parks, schools, etc. to be built next to airports or under impacted areas.**
- **Residents should be informed about handling contaminated clothing; washing particles out of children's hair and clothing; preventing lead dust from getting indoors; and, using HEPA air cleaners, wet mopping, and HEPA vacuuming to minimize lead dust in the home.**
- **Parents and caregivers should feed their children diets rich in calcium and iron to reduce the chance of lead retention in the body.**
- **Nonessential flights (representing more than half of general aviation operations) should be minimized while leaded avgas is still in use.**
- **Moratoriums should be placed on nonessential airport expansions while leaded avgas is still in use.**

ISSUE: Some airports and run-up areas are located near densely populated areas, including residences, schools, healthcare facilities, playing fields, and parks. Many people were concerned specifically about the adverse impacts of airport operations on vulnerable children and the disproportionate burden of lead on low-income and/or minority communities. Particular concern was expressed over flight training, with frequent, repeated, and often low altitude flights over residential communities. For some residents already affected by noise and fear of accidents from flight school operations, the lead issue was a new and alarming one. And for communities fighting airport expansions, lead is yet another reason to protest. Lead is only one of the many concerns airport neighbors face, but it strikes deeply, affecting family responsibilities and causing significant distress.

RECOMMENDATIONS

- **Local governments should disallow the building of new residences, health facilities, and recreational areas near general aviation airports, e.g., within 1.5 miles and/or downwind, while leaded fuel is still in use.**
- **For residences, health facilities, and recreational areas already established, set a goal to institute harm mitigation measures immediately. Reduce flights using leaded gas and exposures from flights that occur. Dedicate resources to test all children living nearby for lead exposure. Educate residents about ways to reduce exposure outside and within their homes. Provide resources so that they can provide clean soil for their children to play in and ensure that drinking water is not contaminated.**

ISSUE: Many airports require funding and assistance to transition to unleaded fuel. Not all airports will be able to afford to transition to unleaded fuel. They may need help paying for costly storage and fueling infrastructure which could range into the hundreds of thousands of dollars or more. Subsidizing the cost of Supplemental Type Certifications (STCs; certifying that the unleaded fuel will work in a particular engine) and related mechanic fees would also be helpful in accelerating adoption by pilots and aircraft owners. As described, this was an approach Santa Monica Airport took to encourage pilots to use unleaded fuel. Airports also need help educating their aircraft owners and pilots about unleaded fuel, its safety, and where it is available.

RECOMMENDATIONS

- Congress should earmark funding for airports to install necessary storage and dispensing infrastructure, obtain STCs, waive fees, and take other actions to reduce the cost of fueling with unleaded avgas.
- Congress should provide additional subsidies to ensure the discounting of the (initial) higher price of unleaded fuel for airports that do not have the resources to do so themselves if the above actions are insufficient.

ISSUE: Safety in the air depends critically on proper fueling and knowing where unleaded avgas is available

RECOMMENDATIONS

- Trade associations and airports should develop guidance documents, educational/ informational materials, and other signage, labeling, etc., to be placed around fueling stations (see example of Watsonville Airport).
- Online maps should be made available so pilots see where they can access unleaded fuel.

Other Priorities - General

ISSUE: Widespread public support is needed for a national transition. The country cannot have a patchwork general aviation fuel system. People must understand the hazards of leaded avgas and the benefits of unleaded fuel. Support for a national transition is needed at the level of the public; local, regional, state, and national leaders; and the aviation industry. Education is needed to inform public and school officials about the very serious hazards of leaded fuel and demonstrate that no level is safe. A lack of knowledge on the part of local officials and the public can stymie support for any actions on leaded fuel, putting residents in harm's way. Education is needed to inform pilots of the economic benefits of unleaded fuel, e.g., cleaner, longer running engines, reduced maintenance that may offset the higher price of fuel.

RECOMMENDATIONS

- The federal government should launch a campaign to educate the public on the harms of leaded avgas, the availability of unleaded alternatives, and the health, environmental, and economic benefits of transitioning. Trade organizations need to launch a campaign to educate aircraft owners, pilots, airport managers, and other general aviation workers not only on the health benefits to workers, families, and the public, but also on the economic benefits, e.g., reduced maintenance, clean, longer lasting engines – and garner support.
- If these measures are implemented but do not result in adoption of unleaded fuel, then a mandate to transition should be implemented quickly.

Other Priorities - Communities

ISSUE: The lack of federal action has not been replaced with sufficient state or local protections. Speakers and participants noted that without federal policies and regulation, they must address this issue at the local level where *dismissal of concerns about lead* is common. Local officials and aviation personnel are sometimes described as being either ignorant about the harms of lead or in denial, making community members feel their concerns are negated and that they have no recourse. Representation of communities on the decision-making bodies controlling airport functioning appears to be insufficient to ensure that community interests are protected. Communities like Santa Clara County and the Town of Middleton, WI, found it necessary to fund their own studies to provide evidence of airborne lead exposure and substantiate ongoing harm. As we have seen, however, only one of those communities was able to garner support and take action.

RECOMMENDATIONS

- **Strong federal action is needed. Federal agencies – like the FAA and EPA – and state governments should create education and awareness-raising campaigns for public officials, professionals, and members of the public.**

ISSUE: Stationary monitors in the EPA air program are far and few between and do not monitor for ultrafine particles, a common form of airborne lead. Additional local monitoring can help determine how airport operations can be adjusted to reduce impacts on neighbors. Testing for lead in air and soil can help in protection and cleanup. Monitors should be capable of detecting lead in the very fine particulates emitted by piston engine aircraft.

RECOMMENDATIONS

- **Monitoring should be increased and able to detect lead-containing ultrafine particles. EPA’s air pollution monitoring network should be expanded and capable of measuring lead in the form of fine particulate emissions from leaded avgas combustion. The monitoring data should be used in airport expansion or siting permitting, environmental impact assessments, runway and flight path planning, and community health service provision.**

ISSUE: A history of neglect of community health and environmental concerns. It is now more widely recognized that the threat of airborne lead to residential communities located near general aviation airports has been neglected for decades and is an environmental justice issue. Many asked “why has the use of leaded avgas been allowed to persist and harm the health of children and families – many of whom already bear a disproportionate burden from environmental harms?” A history of prioritizing industry voices over community voices is a concern of Congress and communities alike.

RECOMMENDATIONS

- **Government officials need to be aware of the history, understand the frustration and anger of communities, and appreciate the urgent need to act now.**
- **Communities should understand that the EPA of previous administrations is not the EPA of today and that this EPA is moving, as evidenced by its Proposed Endangerment Finding. This should serve as a starting point for an expeditious transition.**

Other Priorities - Industry

ISSUE: General aviation workers are not adequately protected. Work at a general aviation airport is not currently listed by the National Institute for Occupational Safety and Health (NIOSH). Workers are exposed to lead when refueling, performing maintenance tasks, and cleaning engines. They may bring home lead particles on their clothing and expose family members. Yet warnings and information for workers are scarce despite the fact that NIOSH has been contacted repeatedly about this issue.

RECOMMENDATIONS

- **Aviation organizations should lobby NIOSH to provide the information to workers needed to reduce their exposure to leaded avgas and to protect their families from exposure to “take home” lead (lead on worker clothing). NIOSH can use the work it has done in other sectors regarding hazards from lead exposure to produce guidance and recommended exposure levels specific to aviation workers.**

ISSUE: Expedited approval of unleaded fuel products is needed. The process needs to be based on the three pillars of utility: 1) The fuel is safe for those in the air and on the ground; 2) The engine OEMs approve it; and, 3) It meets ASTM standards and is fungible (able to mix with other fuels). Any delays need to be addressed. If FAA needs to hire people with expertise and experience to accelerate review and certification, funding should be provided.

RECOMMENDATIONS

- **The FAA should create a visible oversight commission with membership from the affected and environmental communities as well as those familiar with industry, and excluding leaded gas producers. This would help expedite the regulatory process and ensure that federal, state and local agencies are given the necessary funding, staffing, expertise, and other resources. The commission would also engage with industry, including current producers of leaded gas and communities, to identify and overcome barriers to progress and issue an annual report to states, Congress, the President, and the American public.**

ISSUE: The higher price of unleaded avgas is a barrier to acceptance.

RECOMMENDATIONS

- **Make fuels qualify for the Sustainable Aviation Fuel break. This was mentioned by a few participants, who wondered why this incentive was not already available for unleaded aviation fuel. A closely related example was to subsidize airports that can waive the “fuel flowage fee.”**

ISSUE: Pilots need to understand why they should be using unleaded fuel, e.g., health benefits for the public, proven safety, and cost and time savings from cleaner running engines. They should be able to find unleaded fuel when they need it and know it is safe to use in their engine.

RECOMMENDATIONS

- **Government agencies and trade associations should provide informational materials that include the health, safety, and economic stories that need to be told.**

ISSUE: Liability fears may slow adoption. Some participants pointed to a fear of liability for using new fuels. If this cannot be accomplished by explicitly providing liability protection, another approach would be to establish – through guidance, policy, or regulation – a clear pathway to reducing liability.

RECOMMENDATIONS

- **Ensure that liability protection is available for users of certified fuels following necessary guidance.**

CONCLUSION

We hope this report is useful to all who read it. For those concerned about lead emissions, we hope that while it recognizes the urgent need to get rid of leaded avgas, it also helps you understand the complexities of a national transition. For members of the aviation community, we hope it helps you understand how critical it is to move as swiftly as possible to protect not only the health of the public but of aviation workers and their families, and that it provides impetus and assistance in that effort. For government agencies and legislative staff, we hope the recommendations are useful in helping you get this important job done.

Because it is possible that reading this report will generate further ideas or comments, we invite you to write to us at: rreibste@bu.edu, putting “avgas” in the subject line.

Rick Reibstein

Jamie Banks

Becky Petrou O’Rourke

About Quiet Communities

Quiet Communities, Inc. is an independent national nonprofit organization dedicated to reducing health and environmental harm from noise and related pollution. Its aviation program, Quiet American Skies, focuses on aviation noise and pollution and its effects on communities. Quiet Communities approach is one of constructive collaboration, bringing together diverse stakeholders to educate, find common ground, and develop feasible and enduring solutions. Its *Quest for Quiet Conference* series focuses on timely issues in science and policy related to its areas of interest. QC President, Jamie Banks, who led the effort to convene the conference on the part of the organization, is a health and environmental scientist.

About Boston University’s Class “Research for Environmental Agencies and Organizations”

CAS EE 538: Research for Environmental Organizations and Agencies, led by Professor Rick Reibstein, is a class in which students work on environmental projects they select from those proposed by various government and nonprofit entities and Professor Reibstein, or create themselves for the benefit of such organizations. Student Becky Petrou O’Rourke volunteered to help organize this conference on transitioning to lead-free skies. Rick Reibstein is an environmental lawyer with extensive experience in lead pollution. He is a former manager of the Massachusetts Toxics Use Reduction program and has also worked at the EPA. He was the recipient of the EPA’s Individual Environmental Merit Award in 2000, received the National Pollution Prevention Roundtable’s Pollution Prevention Champion Award in 2015, and is the inaugural Sustainability Champion for the Institute for Global Sustainability. Rick serves as Chair of QC’s Legal Advisory Council.

APPENDIX A: CONFERENCE PROGRAM

Section	Speakers
Welcome	<ul style="list-style-type: none"> Becky Petrou O'Rourke, Student, Boston University
Introductory Remarks	<ul style="list-style-type: none"> Jamie Banks, PhD, MSc, President, Quiet Communities, Inc. Rick Reibstein, JD, Professor, Boston University
Leaded Avgas: Who's Affected	<ul style="list-style-type: none"> Bruce Lanphear, MD, MPH, Professor of Health Sciences, Simon Fraser University, British Columbia Cindy Chavez, Superintendent, Santa Clara County Cynthia Richson, Town Chair, Middleton, WI
Possibilities for Acceleration <ul style="list-style-type: none"> Technical Economic How Fast Can We Get There? 	<ul style="list-style-type: none"> Amy Pritchett, ScD, Department Head, Aerospace Engineering, Penn State University Curt Castagna, CM, CEO National Air Transportation Association; CEO Aeroplex Robert Olislagers, Senior Coordinator, EAGLE Maria DiPasquantonio, Deputy Director, UAS Integration Pilot Program, Federal Aviation Administration <p>Panelists</p> <ul style="list-style-type: none"> Chris D'Acosta, CEO, Swift Fuels George Braly, CEO, GAMI
Airports Leading by Example	<ul style="list-style-type: none"> Robert Freeman, CM, IPMA-SCP, Airport Environmental Manager II, Los Angeles World Airports Rayvon Williams, CM, CAE, Airport Director, Watsonville Municipal Airport Stelios Makrides, Airport Director; Diana Hernandez, Airport Operations Administrator, Santa Monica Municipal Airport
Petitioner Comments	<ul style="list-style-type: none"> Kelly Lester, JD, EarthJustice Marcie Kever, JD, Friends of the Earth
Policy Discussion	<ul style="list-style-type: none"> Kevin Fox, Staff, US Representative Ro Khanna (Chair, House Committee on Oversight and Reform) Ideas for transition acceleration - open session
Closing Remarks and (2 min)	<ul style="list-style-type: none"> Rick Reibstein Jamie Banks

APPENDIX B: SPEAKER ROSTER



Jamie Banks, PhD, MSc is Founder and President of Quiet Communities Inc, a national nonprofit organization focused on reducing noise and related pollution. She is a scientist with a background in health outcomes and economics, environmental behavior, and policy. Before Quiet Communities, she served in senior positions at leading consultancies, including CRA International, ML Strategies, and Abt Associates, and founded Planet Rewards, an environmental software company. Jamie chairs the American Public Health Association's Noise & Health. She holds Masters degrees from MIT and Dartmouth Medical School and a PhD from University of Kent, UK.



George W. Braly is Head of Engineering at General Aviation Modifications, Inc. (GAMI). He is the inventor of the G100UL[®] High Octane Avgas, which is currently the only FAA-approved drop-in replacement for existing high octane leaded aviation gasoline. He is a commercial pilot qualified to fly single and multi-engine planes and has been a flight Instructor for more than 50 years. He graduated with a degree in Aerospace Engineering from Brown University. Prior to returning to his aviation engineering roots, and beginning his work with GAMI, he had a successful career as a litigator in very high visibility and nationally significant water law disputes, toxic tort cases, and other complex litigation.



Curt G. Castagna, C.M. is President/CEO of the National Air Transportation Association representing the interests of its 3800 general aviation business members, President/CEO of Aeroplex Group, CEO of Van Nuys & Long Beach Airport Association & Chair of the Los Angeles County Aviation Commission. Curt has over 40 years of diverse aviation experience, including operations and management, facility design, and sustainable airport development and a proven track record in airport advocacy, community and governmental affairs. He is recognized by his peers and colleagues for being able to establish collaborative partnerships when negotiating complex general aviation challenges, while maintaining a focus on compromise and consensus building. He is an active licensed pilot and aircraft owner & a Certified Member of the American Association of Airport Executives.



Cindy Chavez is a member of the Santa Clara County, CA Board of Supervisors, Santa Clara County, CA, representing more than 0.5 million people in the San Jose area. With a focus on equity, her public service spans public health, transportation, corrections, drug abuse, affordable housing, broadband access, crime, and gender-related issues. Before becoming Supervisor, she worked as a policy analyst for the Board of Supervisors and served two terms on the San Jose City Council, where she was also Vice Mayor. Supervisor Chavez led the effort to close Reid-Hillview Airport following a study showing elevated blood lead levels in children living near the airport.



Chris D'Acosta is CEO of Swift Fuels, a privately held R&D company. Mr D'Acosta has worked in leadership positions in the oil & gas industry for over 35 years, starting as a consultant to domestic and international clients including Shell and Amoco and then in various senior positions at Koch Industries. Since he became CEO, Swift Fuels has become a global leader in next generation fuels/process technologies, including high-octane unleaded piston-engine gasolines. Additionally, Mr. D'Acosta is an industry advisor for CISTAR and serves on the Industrial Advisory Board for Purdue University's Chemical Engineering Department. He earned a BS in Industrial Engineering from Texas Tech University.



Kevin Fox is a Professional Staff Member for Chairman Ro Khanna on the House Oversight and Reform Committee Subcommittee on the Environment. Kevin has worked for Chairman Khanna for six years covering energy and environment policy in Congress. Chairman Khanna represents California's 17th Congressional District including parts of Santa Clara and Alameda counties. The subcommittee recently held a hearing on leaded aviation fuel this past summer featuring academics, community advocates, and industry experts. The hearing examined the country's failure to ban leaded aviation fuel and its health harms.



Robert Freeman is Airport Environmental Manager at the Los Angeles International Airport with over 30 years of environmental industry experience. He leads LAWA's Environmental Leadership and Coordination Division advising on all air and water quality, hazardous materials/waste, soil contamination, sustainability, and other issues at LAX, Van Nuys Airport, and Palmdale Landholdings. He earned a BA from UC Irvine (Applied Ecology) and an MBA from Ashford University (Environmental Management). He serves as US Caucus Chair for Airport Council International's North America Environmental Affairs Committee and is Past Chair of California Airport Council's Environmental Working Group.



Marcie Kever directs the Oceans and Vessels program at Friends of the Earth and was their Legal Director for 10 years. Marcie has a strong background in campaign implementation, expertise on air issues, and experience in dealing with agency relations and legislative initiatives. Previously, Marcie was a program director for San Francisco Beautiful and an attorney and Equal Justice Works fellow for Our Children's Earth. She worked with a number of environmental justice organizations including as a staff attorney at the Golden Gate University Environmental Law and Justice Clinic. Marcie holds a J.D. from Golden Gate University School of Law and a B.A. in Environmental Studies from U.C. Santa Barbara.



Bruce Lanphear, MD, MPH, a Professor at Simon Fraser University, has conducted research on the impact of toxic chemicals on children's health for over 25 years. He led studies used by federal agencies to set standards for lead in air, water and house dust, and his studies were the impetus for federal agencies to conclude that no amount of lead is safe for children. Dr. Lanphear produces videos to show how our health is inextricably linked with the environment and to elevate efforts to prevent disease.



Kelly Lester is an Associate Attorney with the Toxic Exposure & Health Program at Earthjustice, where she works to eliminate exposures to hazardous chemicals through litigation and administrative advocacy. She received her J.D. from New York University and has a B.S. in Environmental Economics and Policy and a B.A. in Peace and Conflict Studies from the University of California, Berkeley.



Stelios Makrides is the Chief Operations Officer/Airport Director at Santa Monica Municipal Airport. In his role, he oversees the Operations, Facilities Maintenance Division, and the Fleet subdivision. Makrides has worked for the Airport for the past 16 years. His responsibilities have expanded greatly over the years to include navigating complex areas of work related to budgeting, maintenance, and community and federal government relations. Prior to joining the City of Santa Monica, he began his career in 2003 with the Santa Barbara Airport. Makrides earned a bachelor's degree in Aviation Administration from California State University, Los Angeles and is a member of the American Association of Airport Executives (AAAE).



Robert Olislagers is Senior Coordinator of the Eliminate Aviation Gasoline Lead Emissions (EAGLE), an industry/government coalition formed to safely eliminate the use of leaded aviation fuel. Robert retired as CEO of Centennial Airport after a successful 38-year career managing airports in NY, CA, and CO. He is recipient of some of the most prestigious awards in aviation, including the AAAE Distinguished Service Award, and the NBAA Order of the Silk Scarf and has received awards for his environmental stewardship, including the Colorado Governor's Environmental Gold Award for Sustainability and Airport Executive of the Year addressing air quality issues at airports in California. He has been recognized by for his work on airport noise and has been a frequent speaker at aviation noise conferences.



Maria DiPasquantonio is Deputy Director, UAS Integration Pilot Program (IPP) at the Federal Aviation Administration (FAA). She has served in a number of positions at FAA, most recently as FAA Senior Representative to the European Union and Senior International Program Officer.



Becky Petrou O'Rourke is a senior at Boston University studying Earth and Environmental Science with a minor in Chemistry. She first became involved with Quiet Communities, Inc. as a part of Professor Richard Reibstein's EE538 course on Research for Environmental Agencies & Organizations. Becky is passionate about environmental public health and collaborating with others to improve the health of people and the environment.



Amy Pritchett, ScD is Professor and Head of the Department of Aerospace Engineering at Penn State University. Dr. Pritchett received an SB, SM and ScD in Aeronautics and Astronautics from MIT in 1992, 1994 and 1997, respectively. She has published over 170 scholarly publications in conference proceedings and in scholarly journals in cognitive engineering, automation and aeronautics. She chaired the committee that wrote the National Academy of Sciences, Engineering, and Medicine report, *Options for Reducing Lead Emissions from Piston-Engine Aircraft*.



Rick Reibstein, JD is an environmental lawyer and teaches at Boston University. He is a former manager of the Massachusetts Toxics Use Reduction program and has also worked at the US EPA. He was the recipient of the EPA's Individual Environmental Merit Award in 2000 and received the National Pollution Prevention Roundtable's Pollution Prevention Champion Award in 2015. He chairs the Legal Advisory Council of Quiet Communities Inc. and is the author of *Reconstructing Environmental Governance: The Chance to Choose a Better Future* published in 2022.



Cynthia Richson is Chair of the Town Board in the Town of Middleton, Wisconsin. She was initially elected as Town Board Chair as a citizen write-in candidate in 2017 and is presently serving her third term in office. She is an attorney with an MBA from the University of Wisconsin-Madison and has more than 25 years of diverse professional experience, which includes experience serving as the head of corporate governance for two of the top ten state pension funds.



Rayvon Williams, CM, CAE is the Airport Director for Watsonville Municipal Airport (KWVI). He has served in this role since 2011. KWVI is a regional general aviation resource meeting the public safety, commercial, recreational, educational, charitable and emergency transportation needs of California's Central Coast. KWVI is one of the first airports in the nation to provide lead-free aviation fuel (UL94, a 94+ Motor-Octane aviation gasoline without Tetraethyllead that meets the ASTM D7547 Unleaded Avgas specifications) to its planes and operators.

APPENDIX C: BACKGROUND ON LEADED AVGAS

In 1973, the US EPA began to phase out the use of leaded gas in cars, trucks, and commercial planes under the Clean Air Act because of the threat lead poses to human health.³ By 1996 EPA announced that gas stations no longer had to post “unleaded only” signs; the phase out of leaded gasoline used in cars and trucks was completed. EPA Administrator Carol Browner said then:

The elimination of lead from gas is one of the great environmental achievements of all time. Thousands of tons of lead have been removed from the air, and blood levels of lead in our children are down 70 percent. This means that millions of children will be spared the painful consequences of lead poisoning, such as permanent nerve damage, anemia or mental retardation.

However, the use of leaded gas in small, single piston aircraft was allowed to continue. According to the US Environmental Protection Agency, “In 2017, approximately 470 tons of lead were emitted by engines in piston-powered aircraft, which constituted 70 percent of the annual emissions of lead to air in that year.” Today, leaded avgas is the leading source of lead pollution in the United States’ atmosphere according to the EPA.⁴

General aviation makes important contributions to the national economy. Operations include flight training, firefighting, banner towing, pipeline patrols, medevac operations, and recreation.⁵ According to the FAA, general aviation “sectors amounted to 2.2 percent of gross domestic product (GDP), \$911.3 billion in economic activity, and over 4 million jobs” as of 2018.⁶ (See Chart below).

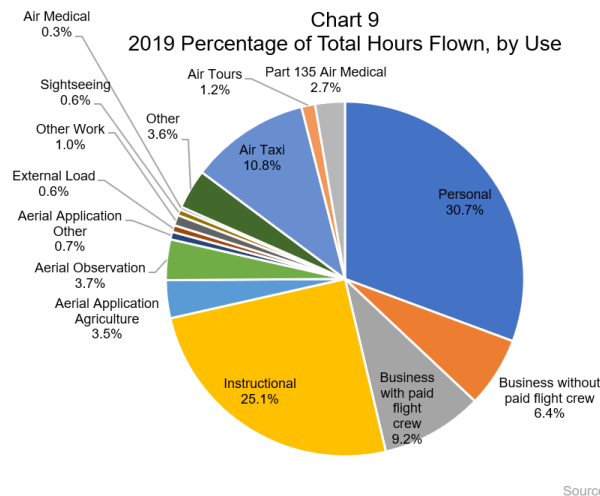


Figure 1. Chart 9 from FAA’s General Aviation and Part 135 Activity Surveys - CY 2019 (most recent non-COVID-pandemic data). *Indicates which uses in general aviation has most hours flown.* Figure source: (FAA) https://www.faa.gov/data_research/aviation_data_statistics/general_aviation/cy2019⁷

Lead, as an ingredient in avgas, is used to raise the “octane rating” of the fuel, which means it will work in high-compression combustion engines without the dangerous phenomenon of engine “knock” (premature ignition).

³ <https://www.epa.gov/history/epa-history-lead>

⁴ The details about aircraft using leaded fuel can be found in the [Technical Support Document \(TSD\) for the EPA’s Proposed Finding that Lead Emissions from Aircraft Engines that Operate on Leaded Fuel Cause or Contribute to Air Pollution that May Reasonably Be Anticipated to Endanger Public Health and Welfare](#),

⁵ The Aircraft Owners and Pilots Association (AOPA) notes the [International Civil Aviation Organization’s definition](#)

⁶ FAA’s [The Economic Impact of U.S. Civil Aviation March 2021 Report](#)

⁷ FAA’s [General Aviation and Part 135 Activity Surveys - CY 2019](#): Chapter III: Primary and Actual Use: Chart 9

Small-aircraft need high octane fuel to fly safely, but the use of lead is at significant detriment to the health of nearby communities and their environments.⁸

The Harms of Lead

Lead does not break down but is a persistent toxin that accumulates and cycles through the environment - air, water, soil – affecting successive generations of living organisms. Lead particles, which are highly toxic and respirable, settle on neighborhoods and environments that are in close to airports and other sources, rendering homes, soil and water less healthy.

Lead has been known since ancient times to be harmful to human health.⁹ Its very deleterious effects on the development of children, particularly on brain development, are well known. Population-wide IQ losses are described as “very meaningful” impacting not only the health, well-being, and future prospects for children and their families, but also for the national economy.¹⁰ In addition to being a persistent and acute, lethal poison at even very low levels, lead has serious chronic impacts, including cognitive limitation, pre-term births, and cardiovascular mortality.^{11,12,13,14,15}

- There is a general consensus among national and international experts and agencies that no level of lead is safe.

Studies have shown that workers and neighbors of general aviation airports where leaded gas is used are disproportionately exposed. Many of these communities are minority and/or low-income communities making this an environmental justice issue. A recent study at Reid-Hillview Airport (RHA), Santa Clara, CA is the third to find that “child BLLs [blood lead levels] increase in proximity to general aviation airports and increase dose-responsively with the volume of piston-engine aircraft traffic at general aviation airports.” In January 2022, RHA became the nation’s first general aviation airport to ban the sale of leaded fuel as was discussed at a July 2022 hearing of the House Oversight Subcommittee on the Environment.¹⁶ Testimony referred to a 2021 study

⁸ Leaded aviation fuel and the environment. Federal Aviation Administration. (2019, November 20). Retrieved December 11, 2022, from <https://www.faa.gov/newsroom/leaded-aviation-fuel-and-environment>

⁹ Riva, M. A., Lafranconi, A., D’orso, M. I., & Cesana, G. (2012). Lead poisoning: Historical aspects of a paradigmatic “occupational and environmental disease.” *Safety and Health at Work*, 3(1), 11–16. <https://doi.org/10.5491/shaw.2012.3.1.11>

¹⁰ McFarland MJ, Hauer ME, Reuben A. Half of US population exposed to adverse lead levels in early childhood. *Proc Natl Acad Sci U S A*. 2022 Mar 15;119(11):e2118631119. doi: 10.1073/pnas.2118631119.

¹¹ World Health Organization. (2022, August 31). *Lead poisoning*. World Health Organization. Retrieved December 11, 2022, from <https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health>

¹² ¹² Testimony of Bruce P. Lanphear, MD, MPH Simon Fraser University. Oversight Committee. (2022, July 28). Retrieved December 11, 2022, from <https://oversight.house.gov/sites/democrats.oversight.house.gov/files/Lanphear%20Testimony.pdf>

¹³ Canfield, R. L., Henderson, C. R., Cory-Slechta, D. A., Cox, C., Jusko, T. A., & Lanphear, B. P. (2003). Intellectual impairment in children with blood lead concentrations below 10 µg per deciliter. *New England Journal of Medicine*, 348(16), 1517–1526. <https://doi.org/10.1056/nejmoa022848>

¹⁴ Lanphear, B. P., Rauch, S., Auinger, P., Allen, R. W., & Hornung, R. W. (2018). Low-level lead exposure and mortality in US adults: A population-based Cohort Study. *The Lancet Public Health*, 3(4). [https://doi.org/10.1016/s2468-2667\(18\)30025-2](https://doi.org/10.1016/s2468-2667(18)30025-2)

¹⁵ Centers for Disease Control and Prevention (CDC). (2022, September 2). *Health effects of lead exposure*. Centers for Disease Control and Prevention (CDC). Retrieved December 11, 2022, from <https://www.cdc.gov/nceh/lead/prevention/health-effects.htm>

¹⁶ Testimony of Santa Clara County Supervisor Cindy Chavez, District Two. Oversight Committee. (2022, July 28). Retrieved December 11, 2022, from <https://oversight.house.gov/sites/democrats.oversight.house.gov/files/Chavez%20Testimony.pdf>

led by Dr. Sammy Zahran of Colorado State University which found increases in children's blood-lead levels (BLL) comparable to those found during the Flint, Michigan water crisis.¹⁷ An earlier studies by Miranda et al. (2011) also found significant associations between leaded avgas exposure (proximity to general aviation airport) and BLLs.¹⁸

Groups and organizations have petitioned the EPA to take action against the use of leaded avgas since 2006.¹⁹ Finally, in October 2022 the EPA proposed an endangerment finding – a formal designation of leaded aviation gas as a dangerous air pollutant, the first step in developing regulations concerning its use. At the same time, with new FAA-approvals, there are now high octane, unleaded fuels available, at least one approved for the entire piston engine aircraft fleet, with others in development.^{20,21}

¹⁷ Santa Clara County & California Department of Public Health (CDPH) Childhood Lead Poisoning Prevention Branch (CLPPB) & Mountain Data Group. (2021, August 3). *Leaded aviation gasoline exposure risk at Reid-Hillview Airport in Santa Clara County, California*. Retrieved December 11, 2022, from

<https://news.sccgov.org/sites/g/files/exjcpb956/files/documents/RHV-AirborneLead-Study-Report.pdf>

¹⁸ Miranda, M. L., Anthopolos, R., & Hastings, D. (2011). A geospatial analysis of the effects of aviation gasoline on childhood blood lead levels. *Environmental Health Perspectives*, 119(10), 1513–1516.

<https://doi.org/10.1289/ehp.1003231>

¹⁹ <https://www.epa.gov/regulations-emissions-vehicles-and-engines/petitions-and-epa-response-memorandums-related-lead>

²⁰ Tallman, J. W. (2022, September 22). *GAMI gets Fleetwide STC*. AOPA. Retrieved December 11, 2022, from <https://www.aopa.org/news-and-media/all-news/2022/november/pilot/unleaded-fuels-gami-gets-stc>

²¹ Lynch, K. (2022, September 2). *GAMI secures piston fleet approval for Unleaded Avgas*. Aviation International News. Retrieved

December 11, 2022, from <https://www.ainonline.com/aviation-news/general-aviation/2022-09-02/gami-secures-piston-fleetapproval-unleaded-avgas>

RESOURCES

Conference video: [Accelerating the Transition to Lead-Free Skies](#), December 15, 2022

Health and Community Perspective

- BL Lanphear video: [Crime of the Century: Our Failure to Prevent the Lead Pandemic](#)
- [Leaded Aviation Gasoline Exposure Risk at Reid-Hillview Airport in Santa Clara County, California](#)
 - [Press Briefing](#) on Reid-Hillview Airport Airborne Lead Study
- Zahran S, Keyes C, Lanphear B. [Leaded aviation gasoline exposure risk and child blood lead levels](#). PNAS Nexus. 2023 Jan 10;2(1). Erratum in: PNAS Nexus. 2023 Jan 27;2(1):pgad016.
- Lanphear BP, Rauch S, Auinger P, et al. [Low-level lead exposure and mortality in US adults: a population-based cohort study](#). Lancet Public Health. 2018 Apr;3(4):e177-e184.
- Miranda ML, Anthopolos R, Hastings D. [A geospatial analysis of the effects of aviation gasoline on childhood blood lead levels](#). Environ Health Perspect. 2011 Oct;119(10):1513-6. doi: 10.1289/ehp.1003231.

Acceleration Possibilities and Considerations

- National Academies of Science, Engineering report. [Options for Reducing Lead Emissions from Piston Engine Aircraft](#), 2021.
- Goyer I. [Transitioning to Unleaded Aviation Fuels](#). Plane and Pilot Magazine, Dec 13, 2022.
- [EAGLE Initiative](#)
- [EAGLE White Paper re EPA's Proposed Endangerment Finding for Lead Emissions from Piston Aircraft](#)
- [UL Avgas Fleet Authorization: FAA Policy \(Draft open for public comment\)](#)
- [Joint General Aviation Industry Statement Regarding EPA Proposed Endangerment Finding for Lead Emissions from Piston Aircraft](#)
- [Swift Fuels – Unleaded Fuel Products](#)
- [General Aviation Modifications, Inc.](#)
- [NATA White Paper: Unleaded Avgas Conversion Considerations for Aviation Fuel Providers](#)
- [NATA's Unleaded Avgas Fact Sheet](#)
- [NATA Regulatory Report: Unleaded Avgas](#)

Airports Leading by Example

- [Watsonville Airport](#)
- [Santa Monica Airport](#)
- [Los Angeles World Airport](#) - Van Nuys Airport

Policy

- [Friends of the Earth, EarthJustice 2021 petition to EPA](#)
- [Toxic Air: How Leaded Aviation Fuel Is Poisoning America's Children](#), House Oversight Subcommittee on the Environment, July 28, 2022