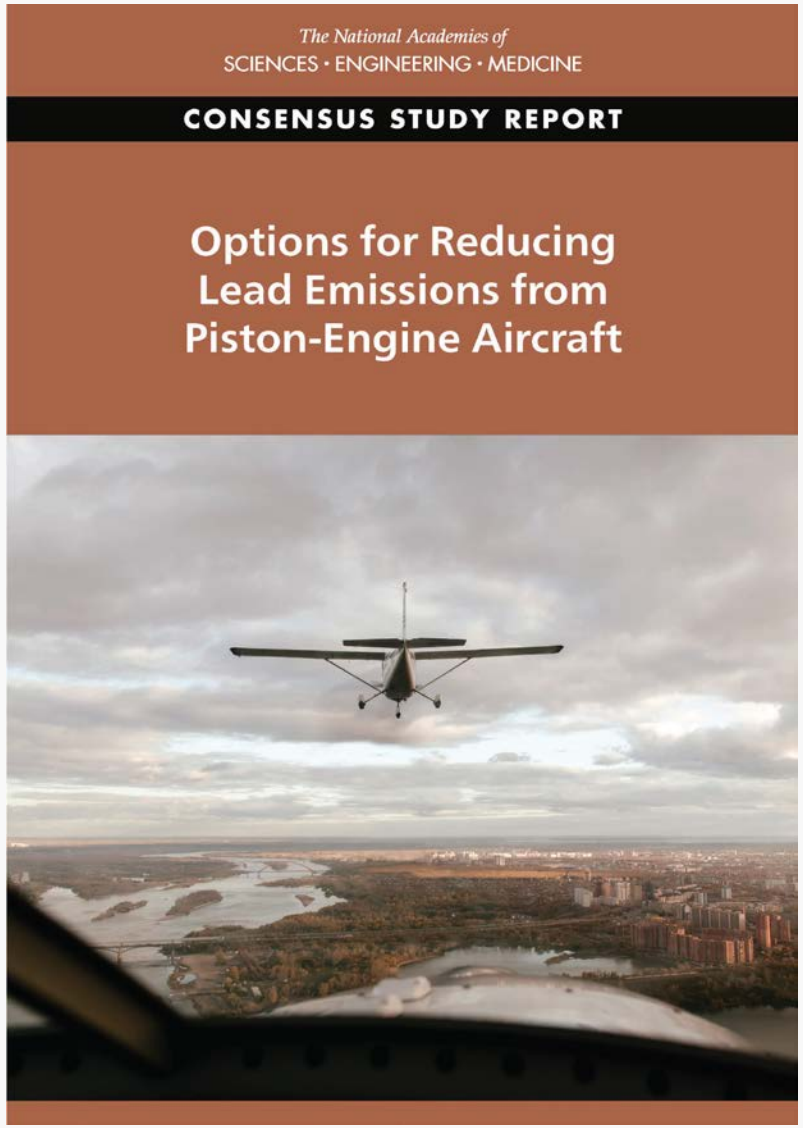
Study of Existing Literature to Determine Impact of Lead (Pb) on Area Around Reid Hill Airport

Michael McDonald

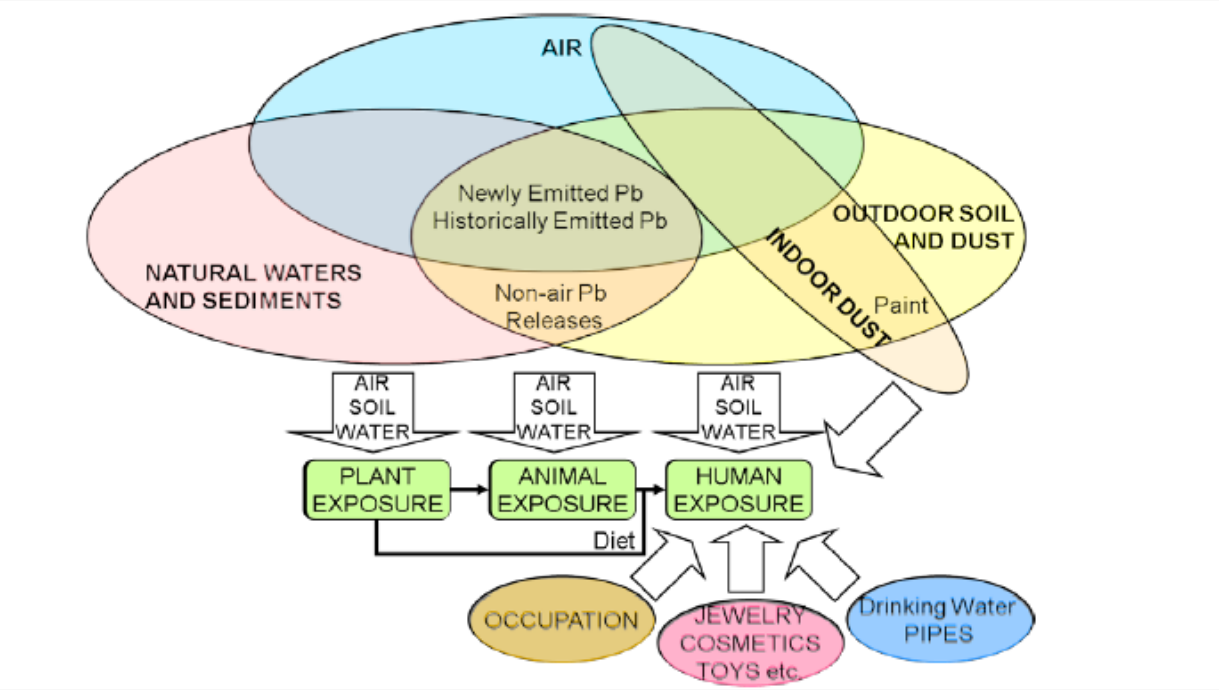
Findings

- **Re-suspended legacy lead from automotive gas is a major contributor to health issues**
- **Legacy lead from paint is also a major contributor to health issues**
- **Legacy automotive lead exceeds lead in aviation fuel by as much as 11,750 times**
- **Aviation lead is primarily an issue for the Reid Hillview aviation community**
- **Pilots are advocating transition to an unleaded aviation fuel that is available today**
- **Aviation in Santa Clara County represents an opportunity for the county**

Lead (Pb) Comes From Multiple Sources



- **Paint**
- **Historically emitted Pb (automotive gas)**
- **Other sources (general aviation)**



National Academies of Sciences, Engineering, and Medicine. 2021. *Options for Reducing Lead Emissions from Piston-Engine Aircraft*. Washington, DC: The National Academies Press. https://doi.org/10.17226/26050.

LEAD FROM AUTOMOTIVE SOURCES

Re-Suspended Lead Contaminates Soil in the Community

- **Lead contaminated urban soil is implicated as the major source for atmospheric Pb aerosol loadings.**
- **The contention that Pb contaminated soil is a major source of urban atmospheric Pb, as indicated by the results of this study, is supported by the published literature.**
  - In the US, motor vehicles used gasoline containing tetraethyl Pb additives from the 1920s to 1995.
  - By 1986, when leaded gasoline underwent a rapid phase-down but not yet completely withdrawn, 5-6 million metric tons of Pb had been used as a gasoline additive across the US, of which, about 75% was released into the atmosphere (Chaney and Mielke, 1986; Mielke and Reagan, 1998).
  - Thus, an estimated 4-5 million [metric] tons of Pb has been deposited into the US environment by way of gasoline-fueled motor vehicles (Mielke, 1994; Mielke et al., 2011).


Contents lists available at SciVerse ScienceDirect

Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv

Re-suspension of lead contaminated urban soil as a dominant source of atmospheric lead in Birmingham, Chicago, Detroit and Pittsburgh, USA

Mark A.S. Laidlaw [a,1], Sammy Zahran [b,c], Howard W. Mielke [d,e,*], Mark P. Taylor [a], Gabriel M. Filippelli [f]

Side note:
Aviation gas is not mentioned by author as source of lead for Birmingham, Chicago, Detroit, and Pittsburgh

1 metric ton = 1.1 US ton

Re-Suspended Lead Contaminates Soil in the Community

- **While airborne Pb used to be extremely high in cities, largely from the direct combustion of leaded gasoline and deposition of Pb oxides, much of the current airborne Pb is from these legacy sources.**

- **The air → dust → child exposure pathway described here may be observed in other urban areas where the legacy Pb deposition in soils remains a critical environmental burden to human health.**

Side note:
Aviation gas is not mentioned by author as source of lead for Detroit

Re-Suspended Lead Contaminates Soil in the Community

- **It is essential to acknowledge that Pb in the exterior environment of New Orleans was the result of the U.S. nationwide use of millions of tons of Pb in paint, gasoline and other sources (Mielke et al., 2008). The Pb contamination of exterior soils has been documented in many inner-cities (Laidlaw MAS and Filippelli, 2008)**

ELSEVIER

NeuroToxicology

Volume 30, Issue 6, November 2009, Pages 888-897

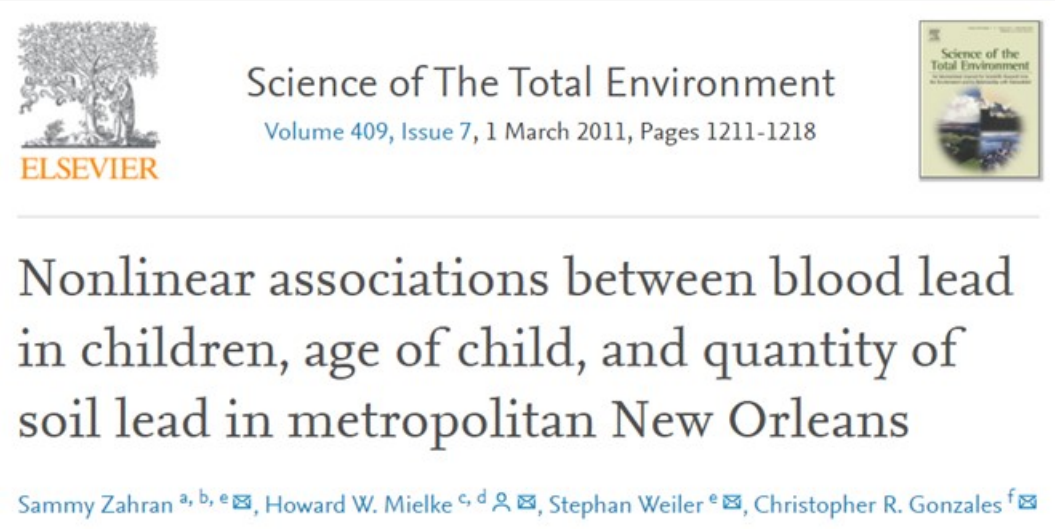
Children's blood lead and standardized test performance response as indicators of neurotoxicity in metropolitan New Orleans elementary schools

S. Zahran [a], H.W. Mielke [b, c], S. Weiler [d], K.J. Berry [a], C. Gonzales [e]

Side note:
Aviation gas is not mentioned by author as source of lead for New Orleans

Re-Suspended Lead Contaminates Soil in the Community

- **Urban soils in New Orleans integrate all dust sources of Pb, including lead-based paint (either deteriorated or haphazardly removed by power sanding, sand blasting, etc.), lead additives by gasoline emissions, and incinerator or industrial Pb emissions that have accumulated in the environment (Mielke, 1999, 2005; Mielke et al., 2010). Soils then, are both a sink and a source of Pb dust in New Orleans, rendering the city of New Orleans as a highly Pb contaminated urban agglomeration.**



Side note:
Aviation gas is not mentioned by author as source of lead for New Orleans

Re-Suspended Lead Contaminates Soil in the Community

- **The stock of historic Pb use is reflected in urban soils.**
- **Urban soils are repositories of prior period Pb use, collecting dust sources of Pb from haphazardly removed lead-based paint (Farfel et al., 2003; Farfel et al., 2005; Rabito et al., 2007), and the sum of fuel and point-source industrial Pb emissions from the past (Mielke and Reagan 1998; Mielke 1999; Mielke et al., 2005; Mielke et al., 2007; Mielke et al., 2011).**

Road Lead Correlates to Child Lead Risk

- **Our study indicates that soils adjacent to residential and busy streets account for the bulk of between-neighborhood variation in child blood Pb levels. Whether the accumulation of Pb near roadways reflects the legacy Pb contamination from gasoline (Laidlaw et al., 2012; Zahran et al., 2013) or the routine demolition of buildings resulting in the release of lead-based paint (Farfel et al., 2003; Rabito et al., 2007), the high-energy environment present on roadways induces atmospheric re-suspension of Pb particles and increases inhalation and accidental ingestion risk facing children (Sabin et al., 2006; Sternbeck et al., 2002; Zahran et al., 2013).**


Contents lists available at ScienceDirect

Environment International

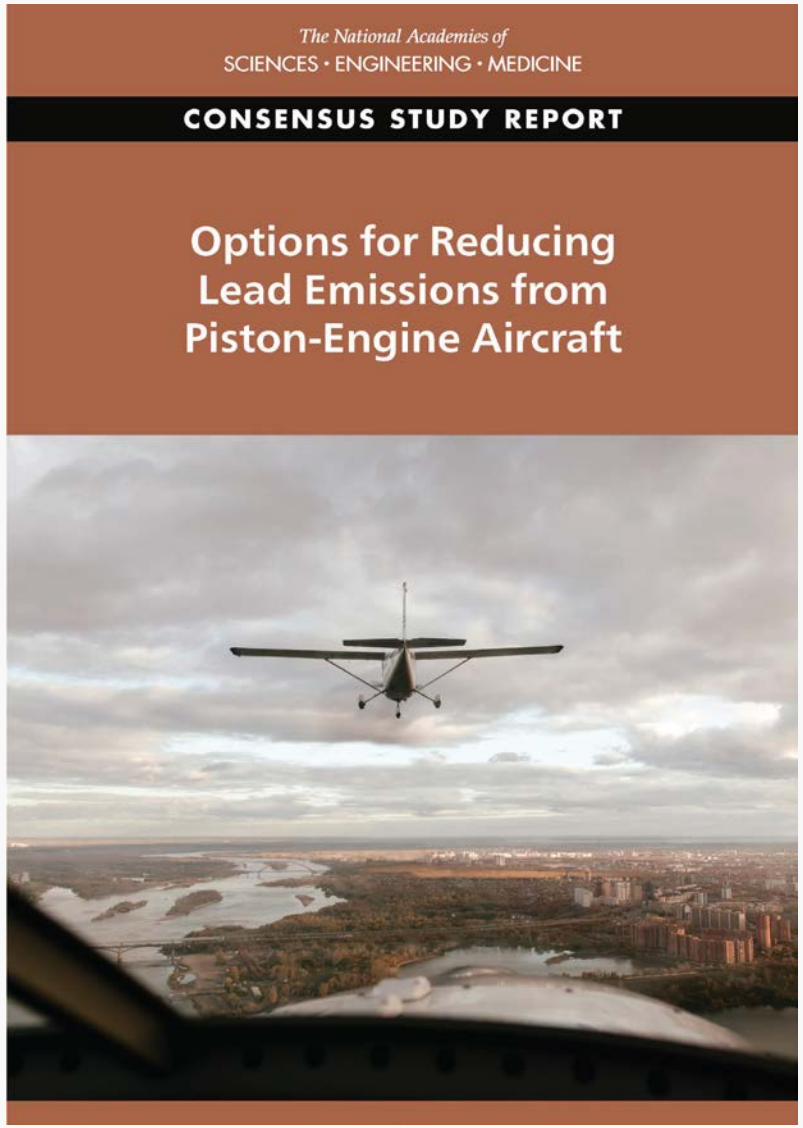
journal homepage: www.elsevier.com/locate/envint

Determining the relative importance of soil sample locations to predict risk of child lead exposure

Sammy Zahran [a,b], Howard W. Mielke [c,*], Shawn P. McElmurry [d], Gabriel M. Filippelli [e], Mark A.S. Laidlaw [f], Mark P. Taylor [f]

Side note:
Aviation gas is not mentioned by author as source of lead

EPA: Aircraft Emit 468 Tons of Lead Annually

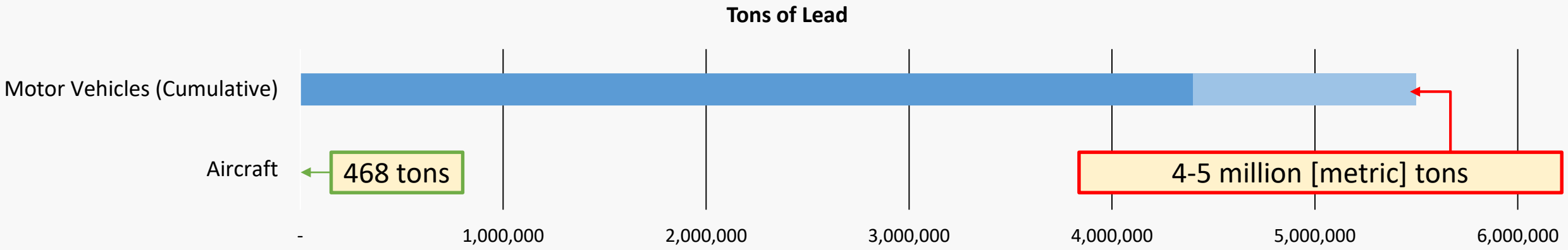


- EPA reports that in 2017 piston engine GA aircraft comprised the largest single source of lead air emissions in the United States. Those aircraft accounted for 468 tons of emissions, which was roughly 70 percent of total lead emissions to air in the United States. [2017 National Emissions Inventory]

- **Note that this estimate of lead emissions may be high**, as EPA assumes that all 100LL avgas contains the maximum amount of TEL permitted by ASTM, or 0.56 grams per liter. CRC (2010) reported that the average lead content of 100LL is 0.47 grams per liter, which would reduce the EPA estimated annual total to 393 tons. However, the higher EPA estimate is used as a baseline here.

Legacy Automotive vs Current Aircraft Lead Volumes

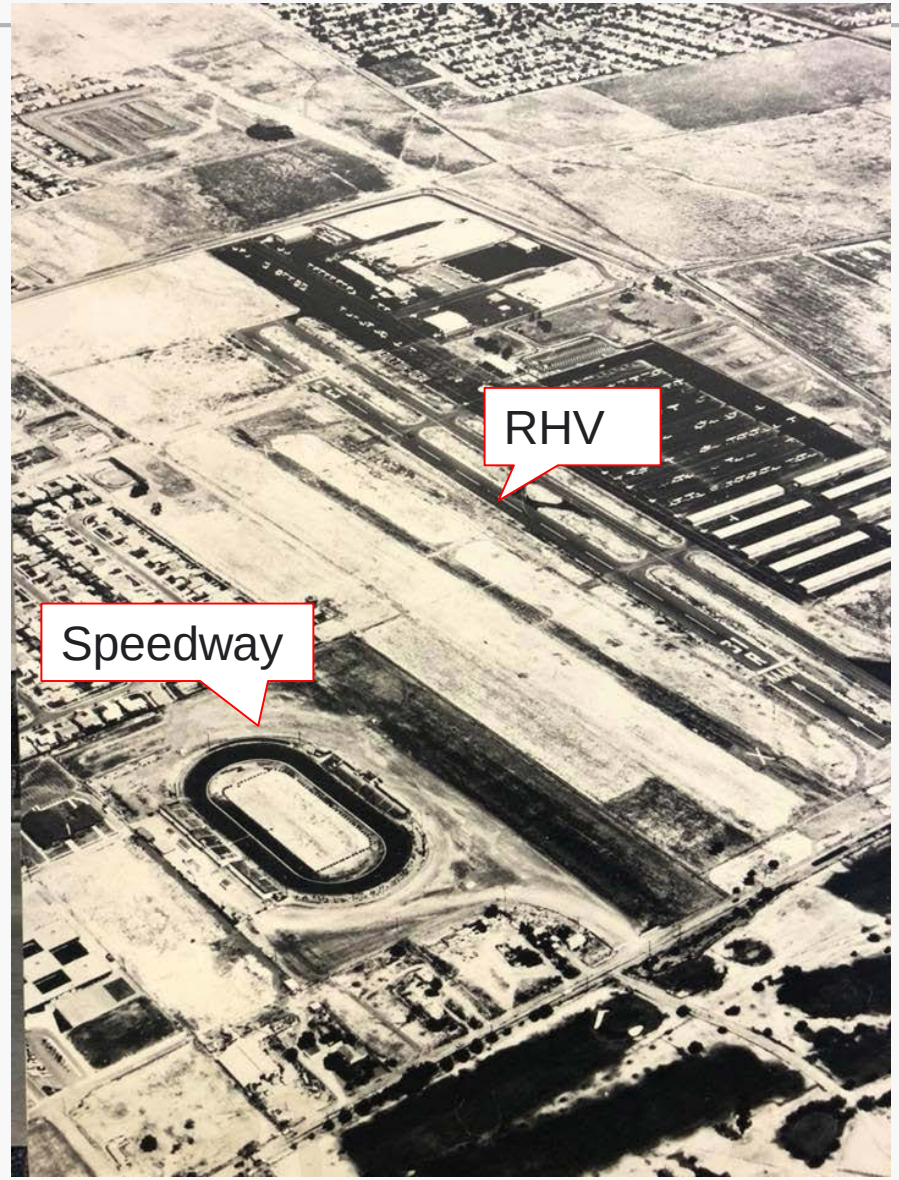
- Thus, an estimated 4-5 million [metric] tons of Pb has been deposited into the US environment by way of gasoline-fueled motor vehicles (Mielke, 1994; Mielke et al., 2011).
- EPA reports that in 2017 piston engine GA aircraft comprised the largest single source of lead air emissions in the United States. Those aircraft accounted for 468 tons of emissions, which was roughly 70 percent of total lead emissions to air in the United States. (2017 National Emissions Inventory)

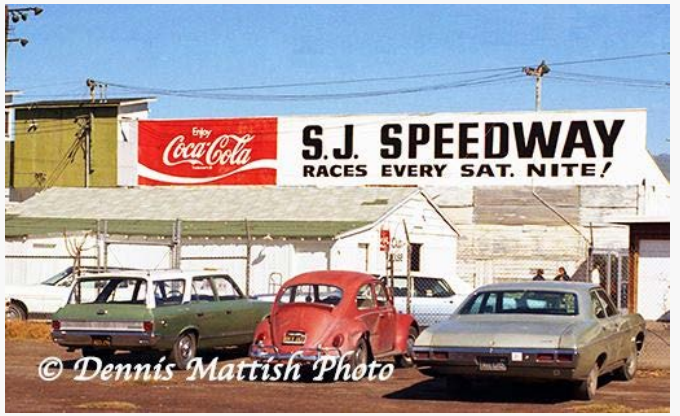


9401 to 11,752 times more historic lead than current annual aircraft lead emissions

1 metric ton = 1.1 US ton

Legacy Lead from San Jose Speedway





NASCAR West in San Jose began in 1954 and remained a NASCAR sanctioned track until it closed on September 3, 1977.

Weekly races

http://www.legendsofsanjosespeedway.com/

Legacy Lead from San Jose Speedway

- **23 Years of weekly auto racing**
- **All with leaded fuel**

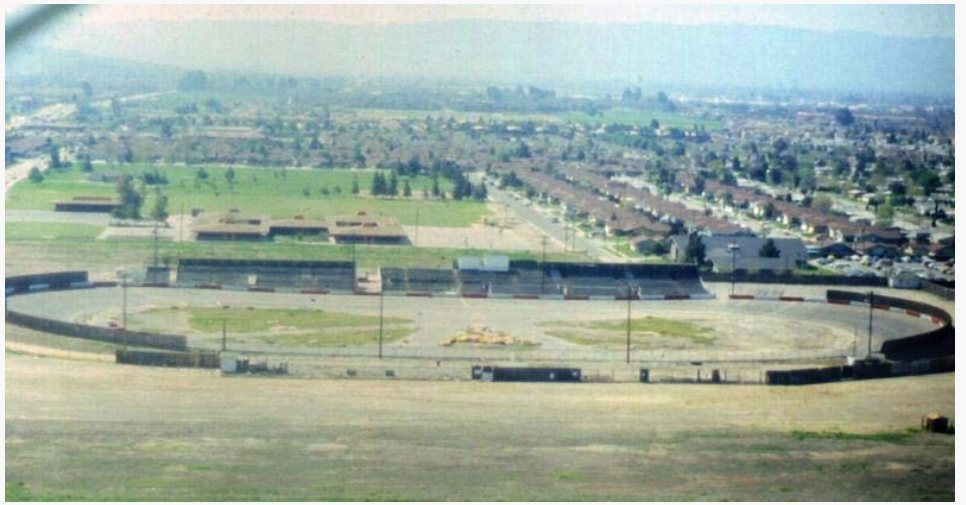
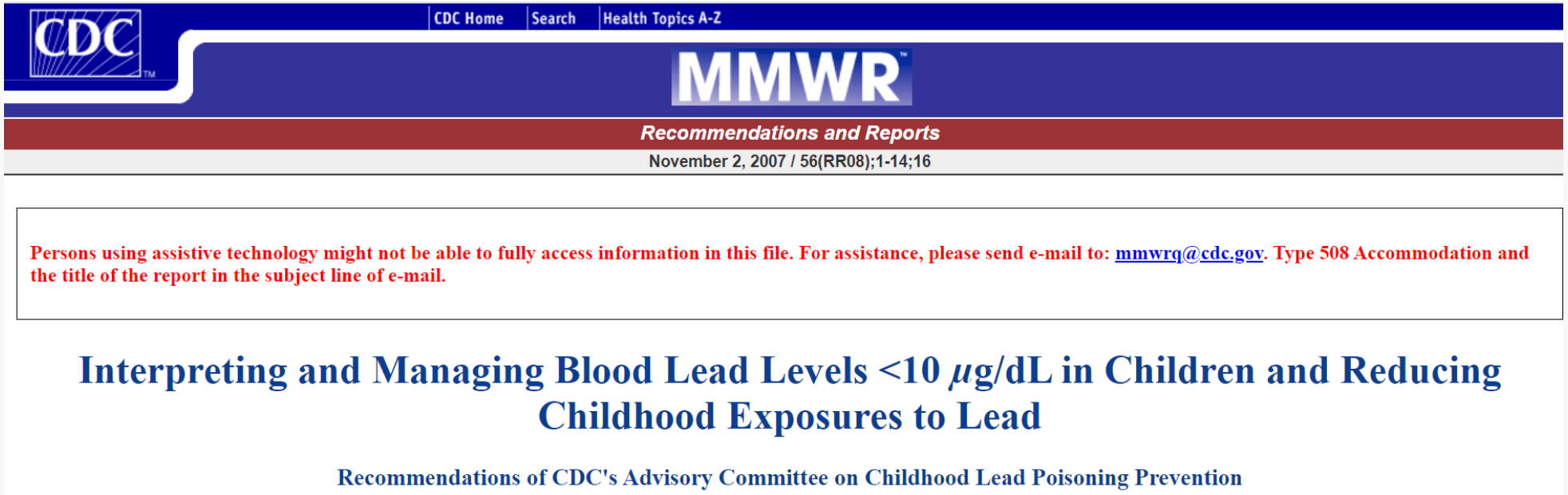


Photo of Speedway from 1978 taken from RHV. Community in background (above) outlined in black in photo (left)

Image credit: http://www.legendsofsanjosespeedway.com/

LEAD FROM PAINT

CDC Report on Lead in Children



CDC Home | Search | Health Topics A-Z

MMWR

Recommendations and Reports

November 2, 2007 / 56(RR08);1-14;16

Persons using assistive technology might not be able to fully access information in this file. For assistance, please send e-mail to: mmwrq@cdc.gov. Type 508 Accommodation and the title of the report in the subject line of e-mail.

Interpreting and Managing Blood Lead Levels <10 μg/dL in Children and Reducing Childhood Exposures to Lead

Recommendations of CDC's Advisory Committee on Childhood Lead Poisoning Prevention

- No characteristic developmental pattern is attributable solely to the effects of lead
- The major sources of lead exposure among U.S. children are **lead-contaminated dust, deteriorated lead-based paint, and lead-contaminated soil**
- The extent of **lead paint hazards** (i.e., the presence of lead in an accessible condition, such as deteriorated lead-based paint or lead-contaminated dust or soil) on interior and exterior surfaces and in soil is associated with increased BLLs in children

Side note: Aviation gas is not mentioned

SCC, Others Win $1.15B Showing Lead Paint is Health Hazard

Although lead paint was outlawed for residential use in 1978, health officials say it continues to take a toll on children's health. In 2013, Santa Clara County and nine other California jurisdictions won a landmark $1.15 billion judgment against companies that used to manufacture lead paint. The defendants, which include Sherwin Williams, are now challenging the ruling in the Sixth District Court of Appeal.

Source: "Report: Dangerous Lead Levels Found in San Jose's East Side", San Jose Inside, Jan. 3, 2017

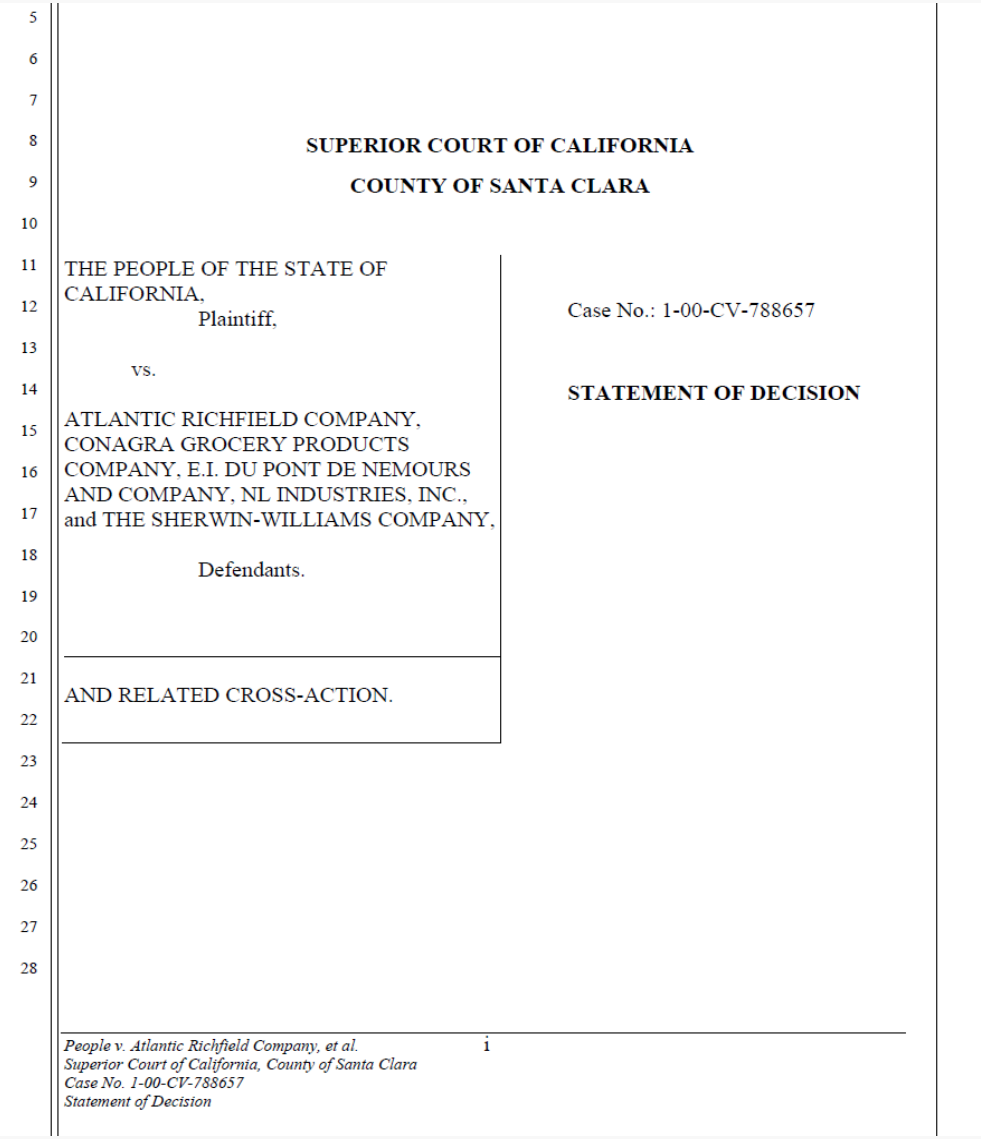
"*This landmark settlement will allow thousands of homes to be remediated, and as a result current and future generations of California children will no longer face the threat of lead poisoning*"

James Williams, Santa Clara County Counsel

Source: Reuters, "Paint makers reach $305 million settlement in California, ending marathon lead poisoning lawsuit", July 17, 2019.

https://www.reuters.com/article/us-usa-lead-settlement/paint-makers-reach-305-million-settlement-in-california-ending-marathon-lead-poisoning-lawsuit-idUSKCN1UC26J

Excerpts from Superior Court of California Ruling



SUPERIOR COURT OF CALIFORNIA

COUNTY OF SANTA CLARA

THE PEOPLE OF THE STATE OF CALIFORNIA,
Plaintiff,

vs.

ATLANTIC RICHFIELD COMPANY, CONAGRA GROCERY PRODUCTS COMPANY, E.I. DU PONT DE NEMOURS AND COMPANY, NL INDUSTRIES, INC., and THE SHERWIN-WILLIAMS COMPANY,

Defendants.

AND RELATED CROSS-ACTION.

Case No.: 1-00-CV-788657

STATEMENT OF DECISION

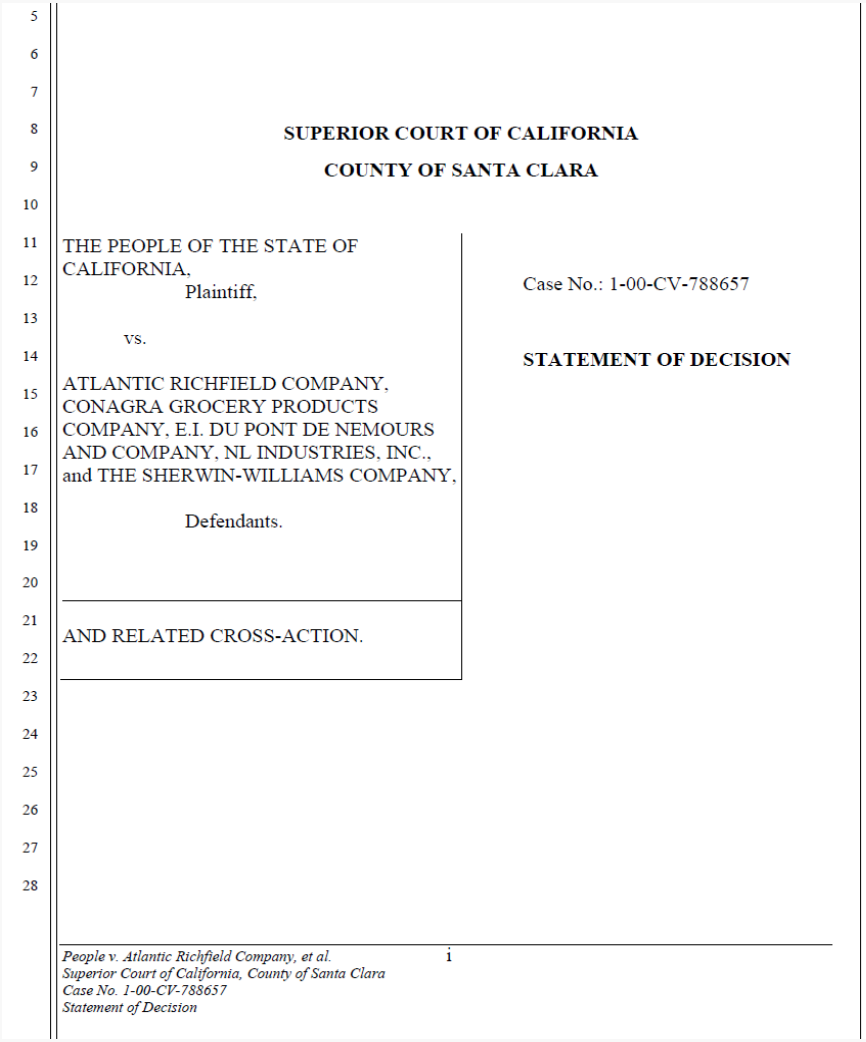
People v. Atlantic Richfield Company, et al.
Superior Court of California, County of Santa Clara
Case No. 1-00-CV-788657
Statement of Decision

i

- **Leading experts in the field of lead poisoning are virtually unanimous in concluding that lead paint is the primary cause of lead poisoning in young children.** (Tr. 140:13-141:19, 344:17-22, 2120:15-23.)

- **American Academy of Pediatrics recognizes that "[t]he source of most lead poisoning in children now is dust and chips from deteriorating lead paint on interior surfaces."** (Tr. 132:6-17; P66_1037.)

Excerpts from Superior Court of California Ruling



SUPERIOR COURT OF CALIFORNIA

COUNTY OF SANTA CLARA

THE PEOPLE OF THE STATE OF CALIFORNIA,
Plaintiff,

vs.

ATLANTIC RICHFIELD COMPANY, CONAGRA GROCERY PRODUCTS COMPANY, E.I. DU PONT DE NEMOURS AND COMPANY, NL INDUSTRIES, INC., and THE SHERWIN-WILLIAMS COMPANY,

Defendants.

AND RELATED CROSS-ACTION.

Case No.: 1-00-CV-788657

STATEMENT OF DECISION

People v. Atlantic Richfield Company, et al.
Superior Court of California, County of Santa Clara
Case No. 1-00-CV-788657
Statement of Decision

i

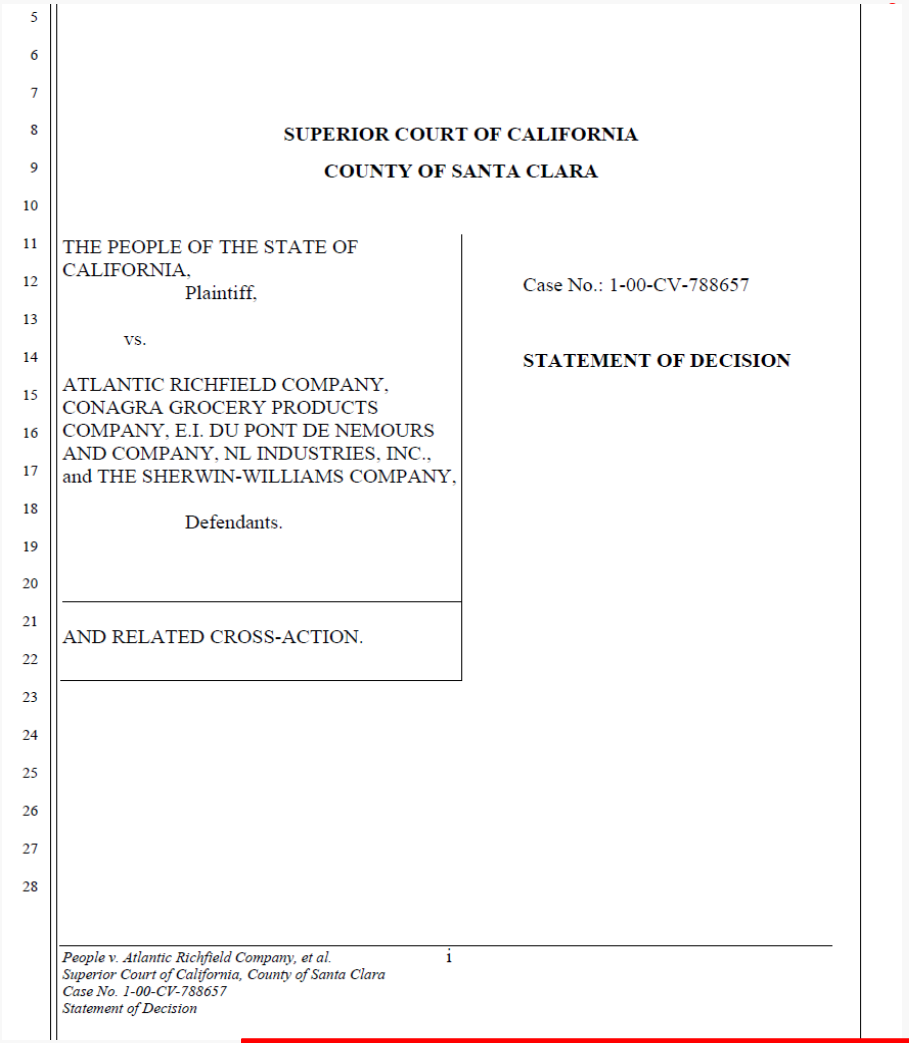
- **Lead paint accounts for at least 70 percent of childhood lead poisoning and is the dominant cause of lead poisoning in children living in older homes.** (Tr. 983:12-988:17, 1502:6-25.)

- **[C]onsistent with national and statewide data, lead paint is the primary source of lead poisoning for children in the Jurisdictions.** (Tr. 183:7-15, 905:15-906:9, 1097:19-1098:5, 1404:29-1405:4, 1413:6-28, 2043:10-25, 2057:19-2058:7, 2229:5-10, 2239:7- 2240:9, 2288:4-17, 2320:22-2321:18, 3263:9-3264:7.)

Public Entity	Pre-1950	1950 – 1979	Total Housing Units (2010 Estimate)
Alameda	173,981	255,444	**429,425**
Los Angeles	912,852	1,737,349	**2,650,201**
Monterey	18,772	71,014	**89,786**
San Mateo	56,556	159,769	**216,325**
Santa Clara	61,411	364,823	**426,234**
Solano	18,559	60,519	**79,078**

Table from page 20 of ruling

Excerpts from Superior Court of California Ruling



SUPERIOR COURT OF CALIFORNIA

COUNTY OF SANTA CLARA

THE PEOPLE OF THE STATE OF CALIFORNIA,
Plaintiff,

vs.

ATLANTIC RICHFIELD COMPANY, CONAGRA GROCERY PRODUCTS COMPANY, E.I. DU PONT DE NEMOURS AND COMPANY, NL INDUSTRIES, INC., and THE SHERWIN-WILLIAMS COMPANY,

Defendants.

AND RELATED CROSS-ACTION.

Case No.: 1-00-CV-788657

STATEMENT OF DECISION

People v. Atlantic Richfield Company, et al.
Superior Court of California, County of Santa Clara
Case No. 1-00-CV-788657
Statement of Decision

i

As long as lead paint remains on homes in the Jurisdictions, children living in those homes will be at significant risk of lead poisoning. (Tr. 248:22-249:20, 958:23-959:5, 1093:17-23, 1094:1-1095:15, 1305:1-6, 1405:5-12, 1414:1-1415:22, 1417:7-27, 1438:19-1439:17, 2295:13-27.)

Findings of Fact Summarized [p94]

- Higher blood lead levels are also due to non-paint sources, such as deposits from gasoline, candies, and water, but these other causes do not eclipse the more significant harm caused by lead paint

- Lead paint remains the primary source of lead exposure for young children

- Lead paint is prevalent in the jurisdictions and is of continuing adverse effect

Santa Clara County entitled to $103,500,000

Side note: Aviation gas is not mentioned as possible source by judge, plaintiff, or defendant

LEAD FROM AVIATION FUEL EXCLUSIVELY AN ISSUE FOR RHV AVIATION COMMUNITY

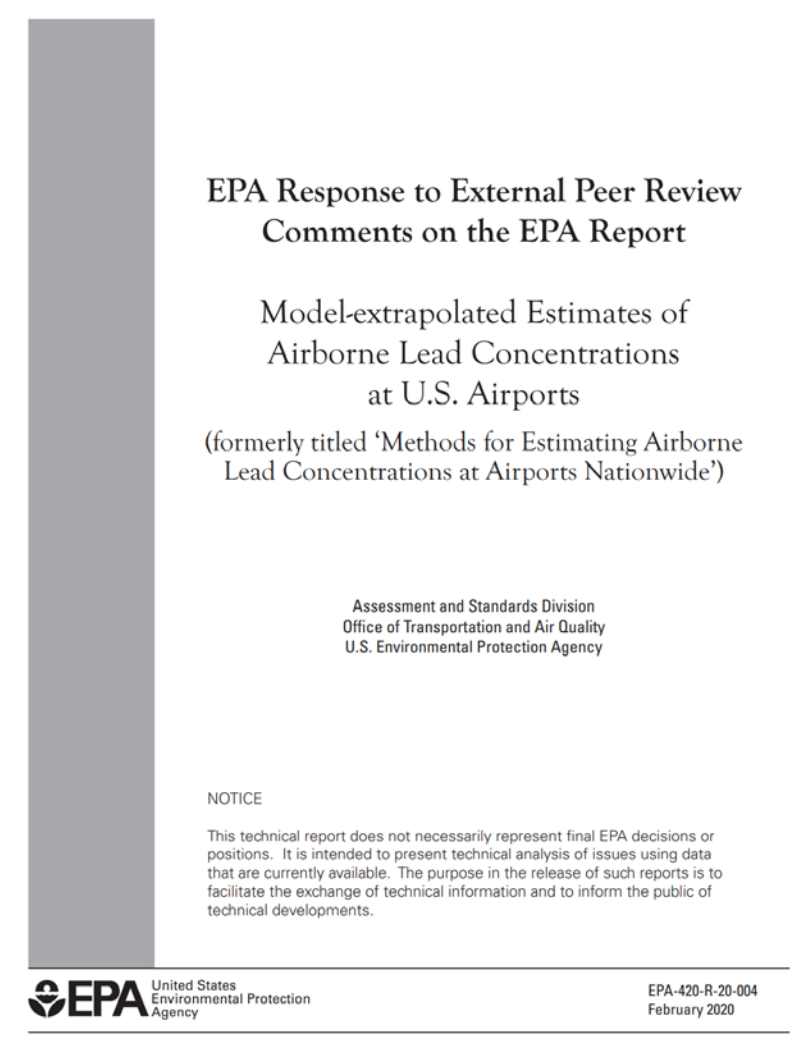
1 km Downwind from RHV Run Up and Primary Departure

- **Children residing within 1 kilometer of an airport are more likely to exceed thresholds of concern than children living further away**

- Zahran, S., Iverson, T., Mcelmurry, S. P., & Weiler, S. (2017). The Effect of Leaded Aviation Gasoline on Blood Lead in Children. *Journal of the Association of Environmental and Resource Economists*, 4(2), 575-610. doi:10.1086/691686

Note: Prevailing wind for San Jose is from 310 degrees. This is why SJC and RHV both have runways oriented in this direction. Wind will direct airborne lead.

EPA [2020] Did Lead Estimate Up To 500m



EPA Response to External Peer Review Comments on the EPA Report

Model-extrapolated Estimates of Airborne Lead Concentrations at U.S. Airports

(formerly titled 'Methods for Estimating Airborne Lead Concentrations at Airports Nationwide')

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

NOTICE

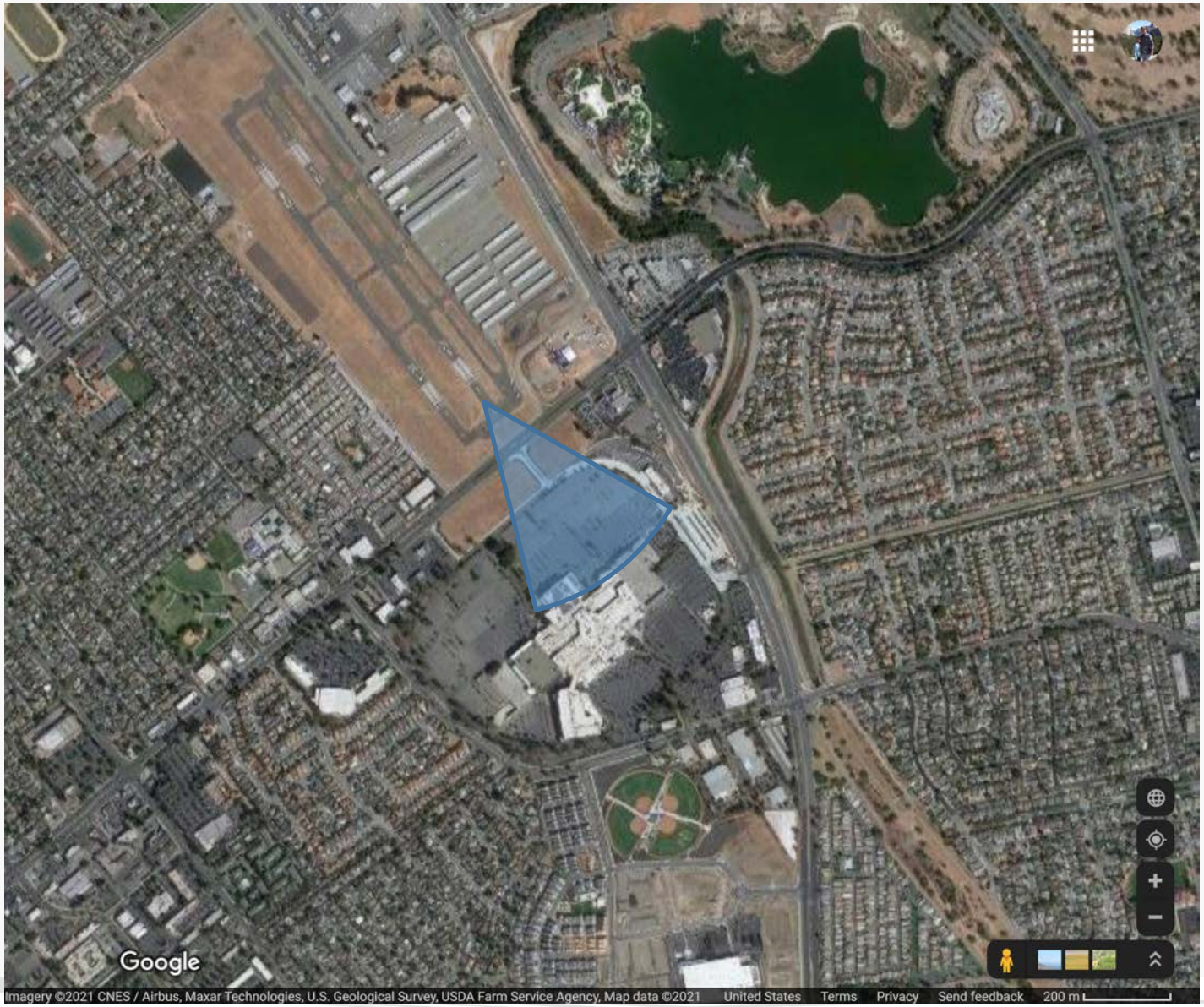
This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis of issues using data that are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments.

EPA United States Environmental Protection Agency

EPA-420-R-20-004
February 2020

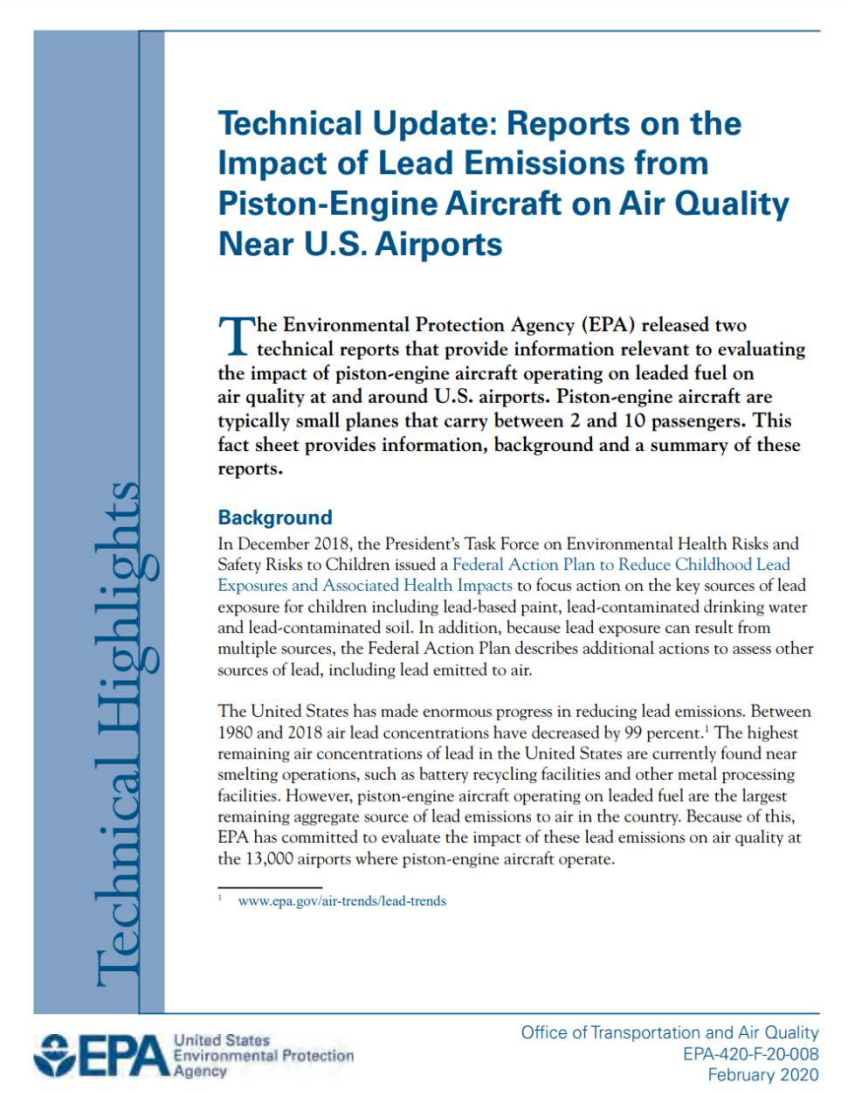
- The agency chose a distance of 500 meters because at that distance EPA estimated that airborne lead concentrations, averaged over 3 months (the averaging time used for the lead NAAQS) diminished to local background concentrations.
- EPA defined local background concentrations as the airborne lead concentrations that would be expected in the absence of a localized source, such as aircraft emissions.
- *EPA Response to External Peer Review Comments on the EPA Report: National Analysis of the Populations Residing Near or Attending School Near U.S. Airports*. Washington, DC: U.S. Environmental Protection Agency. EPA-420-R-20-002, February.

500m Downwind from RHV Run Up



- **500m was EPA area of concern for lead from aircraft**
- **Beyond this, local background lead concentrations prevail**

EPA [2020]



Technical Highlights

Technical Update: Reports on the Impact of Lead Emissions from Piston-Engine Aircraft on Air Quality Near U.S. Airports

The Environmental Protection Agency (EPA) released two technical reports that provide information relevant to evaluating the impact of piston-engine aircraft operating on leaded fuel on air quality at and around U.S. airports. Piston-engine aircraft are typically small planes that carry between 2 and 10 passengers. This fact sheet provides information, background and a summary of these reports.

Background

In December 2018, the President's Task Force on Environmental Health Risks and Safety Risks to Children issued a Federal Action Plan to Reduce Childhood Lead Exposures and Associated Health Impacts to focus action on the key sources of lead exposure for children including lead-based paint, lead-contaminated drinking water and lead-contaminated soil. In addition, because lead exposure can result from multiple sources, the Federal Action Plan describes additional actions to assess other sources of lead, including lead emitted to air.

The United States has made enormous progress in reducing lead emissions. Between 1980 and 2018 air lead concentrations have decreased by 99 percent.[1] The highest remaining air concentrations of lead in the United States are currently found near smelting operations, such as battery recycling facilities and other metal processing facilities. However, piston-engine aircraft operating on leaded fuel are the largest remaining aggregate source of lead emissions to air in the country. Because of this, EPA has committed to evaluate the impact of these lead emissions on air quality at the 13,000 airports where piston-engine aircraft operate.

[1] www.epa.gov/air-trends/lead-trends

EPA United States Environmental Protection Agency

Office of Transportation and Air Quality
EPA-420-F-20-008
February 2020

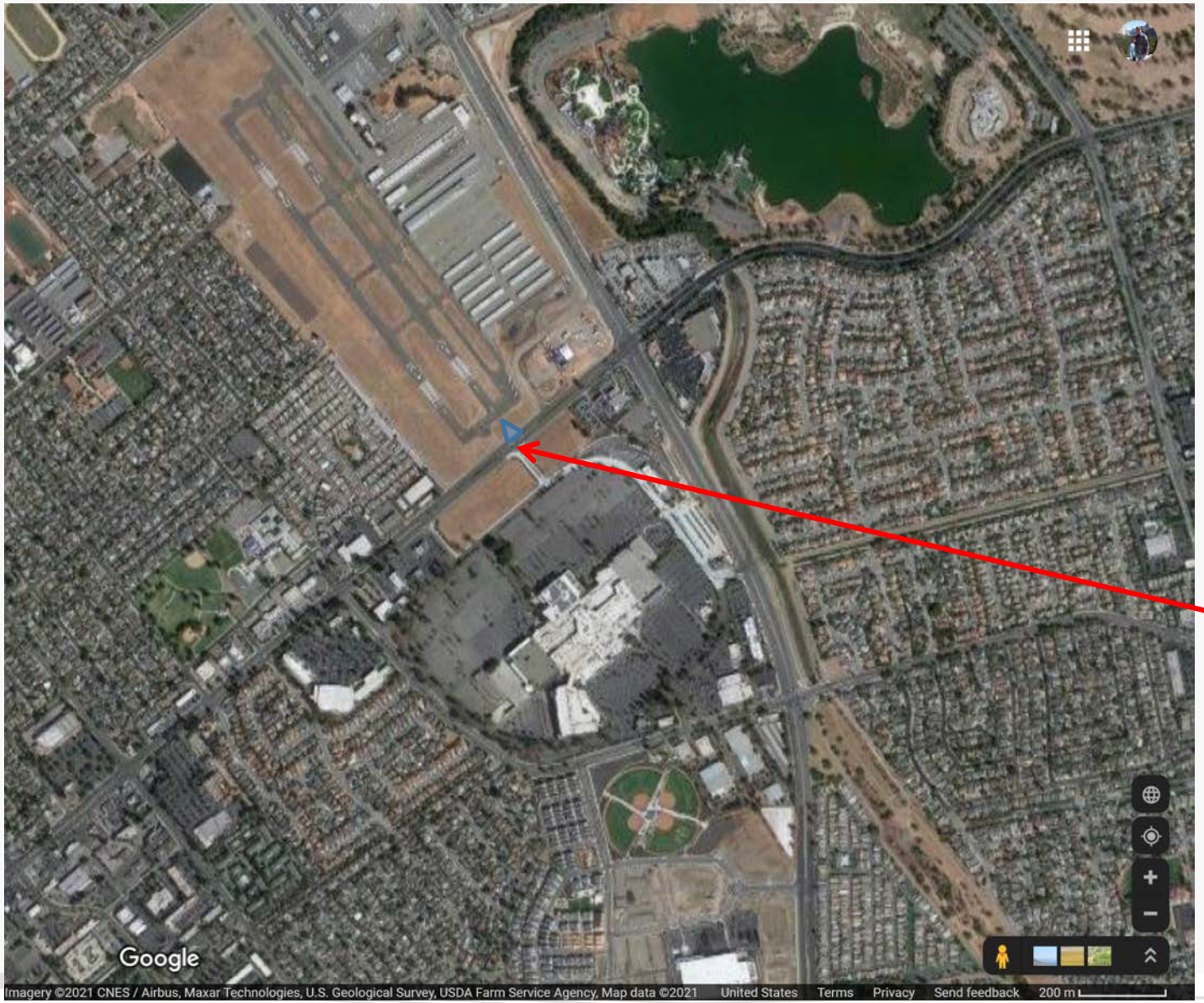
- The United States has made enormous progress in reducing lead emissions. **Between 1980 and 2018 air lead concentrations have decreased by 99 percent.[1]** [www.epa.gov/air-trends/lead-trends]

- **Lead levels dissipate quickly with distance from piston engine aircraft exhaust.**

- Thus, **within 50 meters of the high concentration area, lead levels were uniformly below the lead air standard**

[1]In 1975, the U.S. Environmental Protection Agency (EPA) began to phase out the use of TEL (lead) as a gasoline additive. The phaseout culminated with a ban in 1996 on the sale of gasoline with added lead for on-road vehicles.

50m Downwind from RHV Run Up



- **Within 50m was identified as potential lead risk by EPA**
- **Lead levels exponentially decrease with distance down to ambient levels**

EPA [2020] Results Based on Study at Reid Hillview

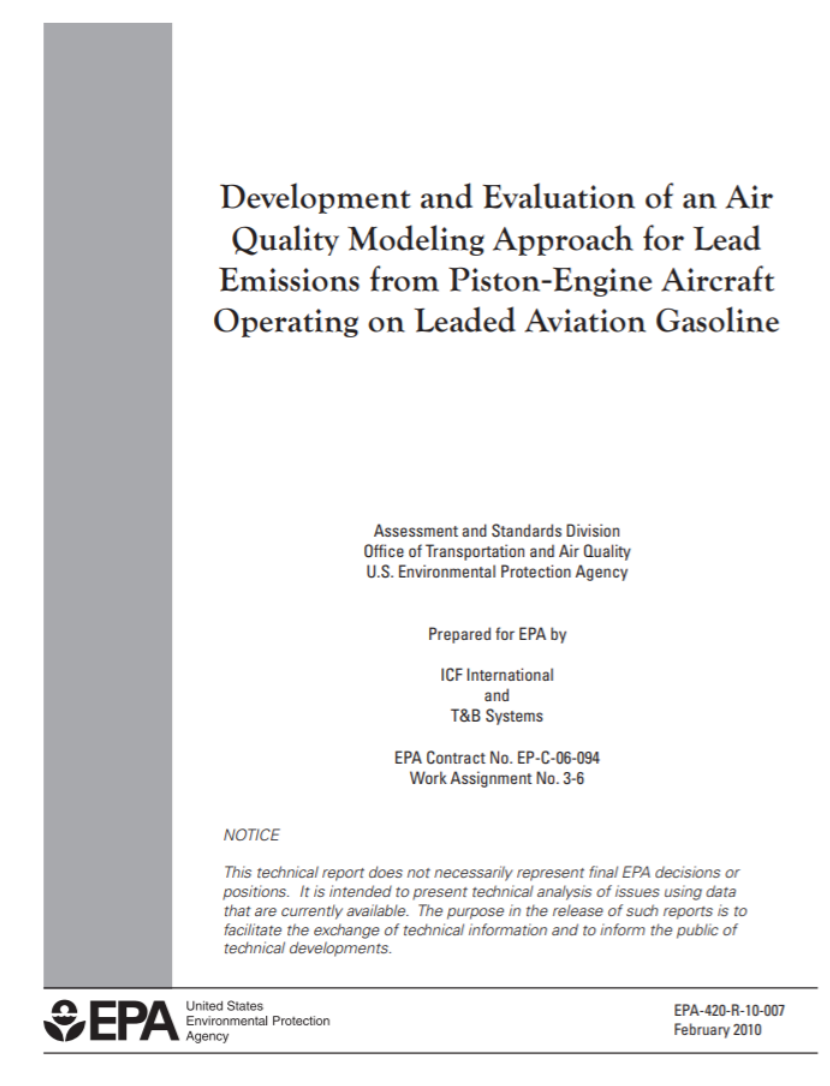
Max level	0.092 µg/m3 at monitor 1 (Run-up area) **BELOW NAAQS LIMIT**
Downwind levels	<0.0075 µg/m3 (Tully, mall) No trace (Park) **BELOW NAAQS LIMIT**

Single-engine airplane doing typical run-up.
90% of operations at RHV.

NAAQS lead standard: below 0.15 µg/m3

Source: EPA-420-F-20-008, February 2020

EPA [2010]



Development and Evaluation of an Air Quality Modeling Approach for Lead Emissions from Piston-Engine Aircraft Operating on Leaded Aviation Gasoline

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Prepared for EPA by

ICF International
and
T&B Systems

EPA Contract No. EP-C-06-094
Work Assignment No. 3-6

NOTICE

This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis of issues using data that are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments.

EPA United States Environmental Protection Agency

EPA-420-R-10-007
February 2010

- **The most important source contributors to the highest air Pb concentrations were emissions associated with the single-engine aircraft run-up, followed by the taxi and takeoff emissions from single-engine aircraft.**

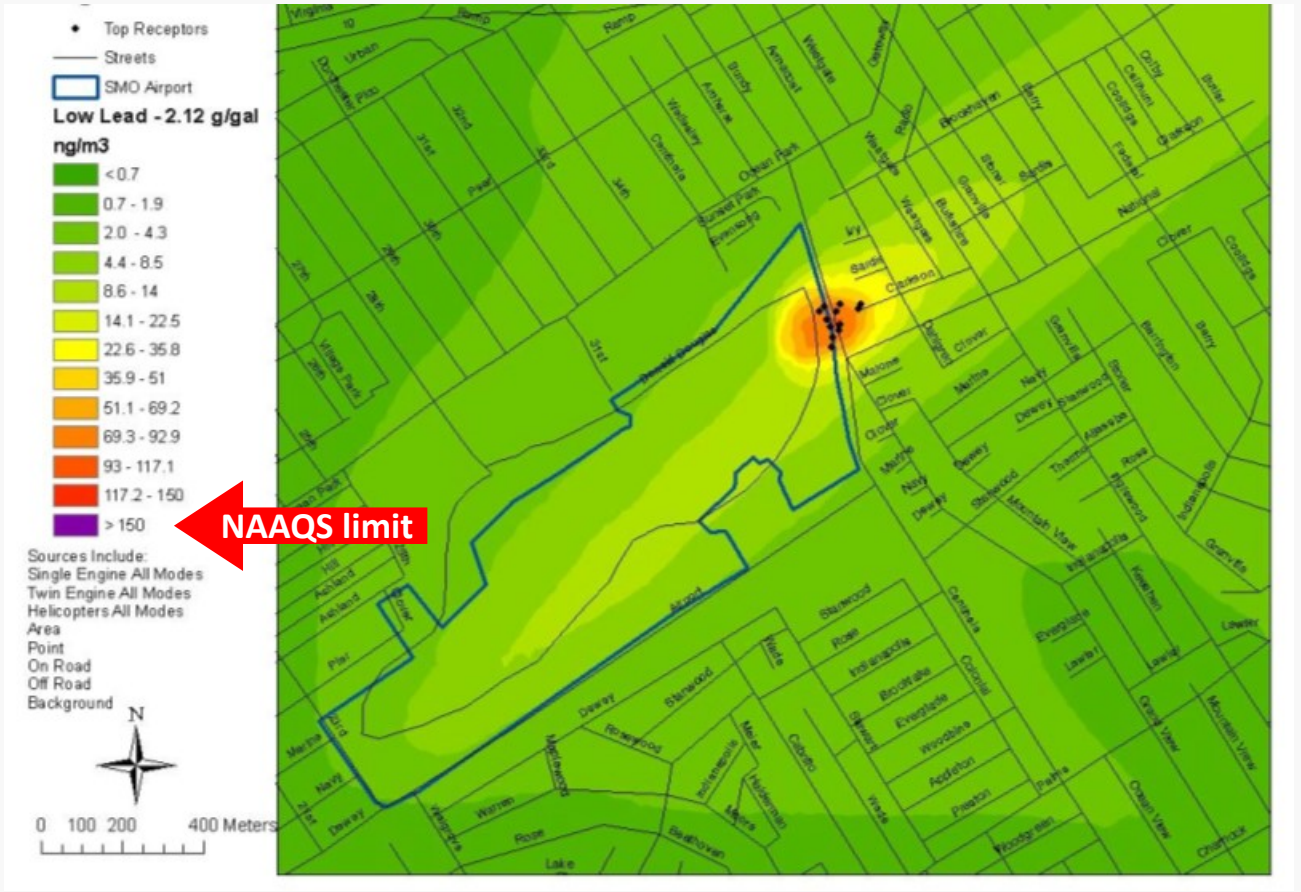
- **The model-to-monitor comparison for the winter campaign showed good agreement between the modeled and observed results (paired in time and space)**

EPA [2010]: High Exposure Only at Airport

- **Highest concentrations found where pilots do "run-up"**

- **Included soil and dust analysis from multiple residential homes from 0 to 20km away**
  - Interiors and exteriors of homes evaluated

No lead levels exceeding NAAQS found outside of airport



NAAQS lead standard: below 0.15 µg/m3 (<150ng/m3)

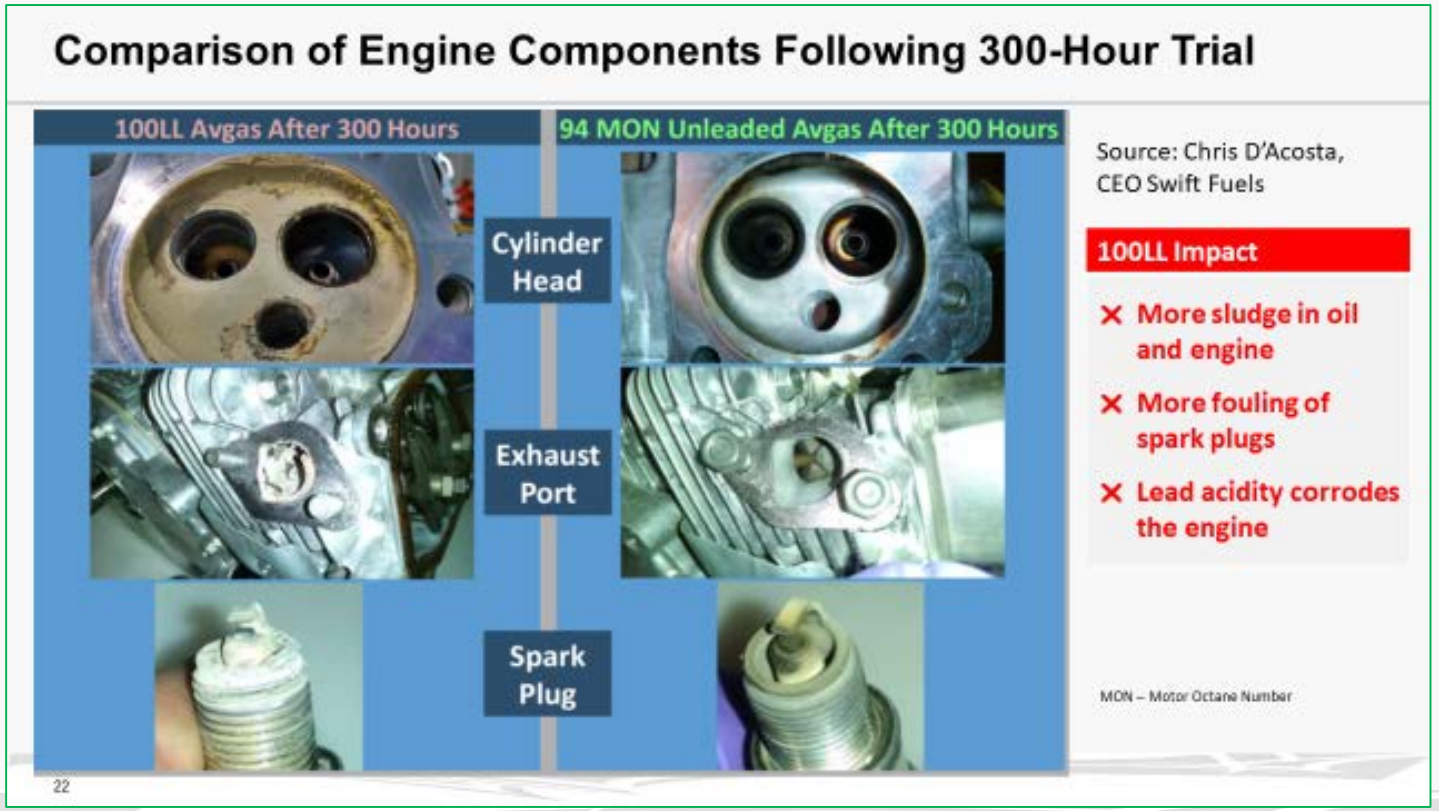
REID HILLVIEW PILOTS HAVE IDENTIFIED UNLEADED AVIATION FUEL OPTION

Reid Hillview Pilots WANT to Eliminate Lead

- **Pilots, passengers, fuel operators, aircraft mechanics are the ones most highly exposed to lead**

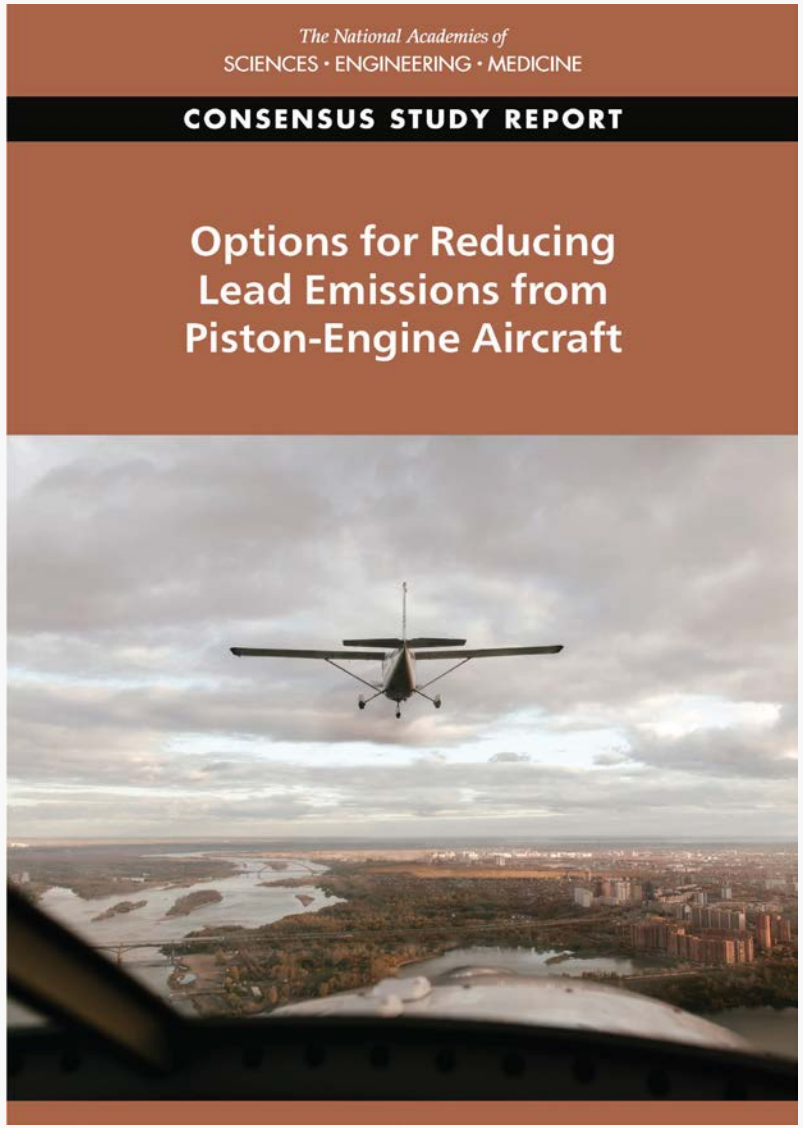
- **Pilots want to be good citizens and help the environment**
  - We want to be part of the solution as soon as possible

- **Lead is not good for our engines**
  - Fouled plugs, engine/oil residue
  - Increased maintenance costs



Reid Hillview Pilots Recommend UL94

AVAILABLE NOW!



- **FAA Approved unleaded aviation gas**
- **Identified by National Academy of Sciences as "good short-term solution"**
- **Nationally, UL94 can be used on 2/3 of piston fleet**
  - "A large portion of the current piston-engine fleet could use lower-octane unleaded avgas, including an existing grade known as 'UL94.' If all of these eligible aircraft were to use this fuel, aviation lead emissions could be reduced by about 30%"

- Fleet at Reid Hillview can substantially use UL94 without issue
- Usable by the RHV flight schools, which dominate traffic

Unleaded AvGas *for All Aircraft* Coming Shortly

- **Swift Fuels "100R"**
  - Made from 10% renewable bio-content (non hydro-carbon)
  - Same supplier as UL94
    - UL94 consumers will get first access to 100R
  - Currently in test by FAA

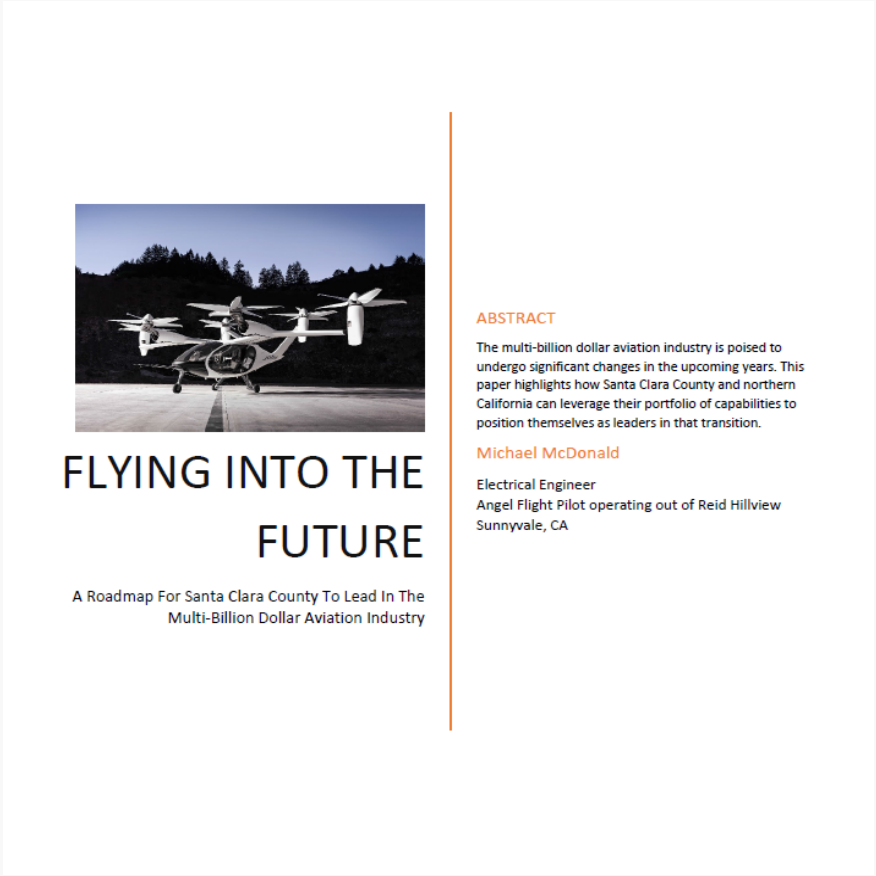
- **Other patented solutions in test and development**
  - BP / Total / Hjelmco
  - GAMI
  - Shell
  - Afton
  - Chevron

- **Immediately eliminates leaded AvGas**

Unleaded AvGas will be dominant fuel long before 2031
(when RHV could close)

AVIATION IS MAJOR OPPORTUNITY FOR COUNTY

Economic Impact Opportunity of Aviation for Santa Clara County



FLYING INTO THE FUTURE

A Roadmap For Santa Clara County To Lead In The Multi-Billion Dollar Aviation Industry

ABSTRACT

The multi-billion dollar aviation industry is poised to undergo significant changes in the upcoming years. This paper highlights how Santa Clara County and northern California can leverage their portfolio of capabilities to position themselves as leaders in that transition.

Michael McDonald

Electrical Engineer
Angel Flight Pilot operating out of Reid Hillview
Sunnyvale, CA

- **Next Generation of Aviation**
  - 18,000 new jobs in CA
  - $14B in economic impact in first decade in CA
- **Aviation employment needs (incremental)**
  - Remote pilots: 235,000 (before 2024)
  - Pilots: 208,000 (before 2039)
  - Technicians: 192,000 (before 2039)
  - Cabin crew: 169,000 (before 2039)
- **Santa Clara County needs to preserve aviation assets to participate**

Paper available at https://savereidhillview.org/PDF/Next%20Generation%20Aviation%20in%20Santa%20Clara%20County%20(1).pdf

Closing Reid Hillview Won't Help the Underserved

- **Increased congestion and traffic**
- **Increased pollution**
- **Increased height of buildings** — Currently limited because of airport
- **Increased rent** — New properties will increase rent in older properties
- **Increased home prices** — New properties will increase value of older properties
- **Decreased home availability** — People reluctant to move because of cap gains and nowhere to move to
- **Low-income homes replaced with high-income homes**
- **Increased cost of goods**
- **Increased crime**

	Homes/acre		RHV = 180 Acres	
Zoning	Min	Max	Min	Max
R1	1	8	180	1440
R2	8	16	1440	2880
Urban Village (258 on 3 ac) [Santana Row]	86		15480	

Summary

- **Re-suspended legacy lead from automotive gas is a major contributor to health issues**
- **Legacy lead from paint is also a major contributor to health issues**
- **Legacy automotive lead exceeds lead in aviation fuel by as much as 11,750 times**
- **Aviation lead is primarily an issue for the Reid Hillview aviation community**
- **Pilots are advocating transition to an unleaded aviation fuel that is available today**
- **Aviation in Santa Clara County represents an opportunity for the county**

For More Information, Visit

www.savereidhillview.org