



99861

DATE: February 11, 2020

TO: Board of Supervisors

FROM: Sylvia Gallegos, Deputy County Executive

SUBJECT: Agreement with Mountain Data Group for Leaded Fuel Study

RECOMMENDED ACTION

Under advisement from December 4, 2018 (Item No. 19): Consider recommendations relating to a study of the relationship between leaded fuel emissions and blood lead levels of children in Santa Clara County.

Possible action:

- a. Approve Agreement with Mountain Data Group relating to providing study services in an amount not to exceed \$250,000 for period February 11, 2020 through June 30, 2020, that has been reviewed and approved by County Counsel as to form and legality. A single source exception to competitive procurement has been approved by the Office of Countywide Contracting Management pursuant to Board of Supervisors Policy 5.6.5.1(D)(2)(a).
- b. Approve Request for Appropriation Modification No. 148 - \$250,000 transferring funds from the General Fund Contingency Reserve to the Office of the County Executive budget. (4/5 Vote)

FISCAL IMPLICATIONS

The recommended action would transfer \$250,000 from the General Fund Contingency Reserve to the Office of the County Executive budget to cover contract costs for FY 2019-2020.

The adopted budget for the FY 2019-20 General Fund Contingency Reserve was \$164,105,457. The balance of this reserve as of January 28, 2020 was \$157,200,229 indicating that \$6,905,228 has been allocated for other purposes. There may be additional pending actions that will impact this balance once they are approved and processed. Board policy 4.3 states that the contingency reserve should be 5% of general revenues net of pass-through revenue. Since the use of contingency reserve impacts compliance with this policy, the midyear budget analysis may include a recommended action to replenish this reserve.

REASONS FOR RECOMMENDATION

At the December 4, 2018 meeting of the Board of Supervisors (Item No. 19), the Roads and Airports Department reported to the Board on a proposed Airports Business Plan Update. In response to concerns expressed at prior community meetings concerning the Airports Business Plan Update and the health impacts of leaded fuel used by general aviation airplanes, the Administration included information in the December 4 Board report regarding lead contamination and poisoning, the use of leaded fuels in piston-engine aircraft, and blood lead levels of children in Santa Clara County.

At the December 4, 2018 Board meeting, on the motion of Supervisor Chavez and as set forth in her memorandum to the Board, the Board directed the County Executive to report with a plan to study and address airborne lead or any associated concerns.

Executive Summary

Although there are developments in aviation that may reduce or eliminate lead emissions in piston-engine aircraft, they may not be realized at the local level for many years. Pursuant to the Board request for analysis to assess whether the use of leaded aviation fuel contributes to blood lead levels of children residing in the vicinity of County-owned airports, the Administration reviewed possible researchers who could perform the work, conducted meetings with California Public Health to access data, and now proposes to enter into an agreement with Dr. Sammy Zahran and his team (Mountain Data Group) to analyze available CA Department of Public Health blood data and other relevant data.

Dr. Zahran and his team are eminently qualified to conduct this analysis as set forth later in this report. The Department of Public Health and the CA Department of Public Health's Chief of the Program Evaluation and Research Section of the Childhood Lead Poisoning Prevention Branch have already reviewed the proposed research methods, and they would also peer

review the preliminary findings before the analysis would be presented to the Board of Supervisors.

Board approval of a Single-Source Agreement with Mountain Data Group is requested in order to execute a study of existing data to establish whether there is a significant relationship between leaded fuel emissions and blood lead levels in children residing within a ten kilometer radius of County-owned airports, both Reid-Hillview and San Martin airports. The results of the study would be presented to the Board and at a community meeting. The Administration also requests the Board's approval of a budget action to fund the agreement, transferring \$250,000 from the General Fund Contingency Reserve to the Office of the County Executive budget for this purpose.

Leaded Aviation Fuel and Lead Exposure Risk

The use of leaded aviation fuel (avgas) in piston engine aircraft presents a cause for understanding the distribution of lead particles in the areas surrounding general aviation airports. Although current levels of airborne lead around most general aviation airports across the country are below the National Ambient Air Quality Standard of $0.15\mu\text{g}/\text{m}^3$, the EPA has acknowledged that “[t]here is no safe level of [lead] exposure that has been identified, with confidence, as being clearly not associated possible risk of deleterious health effects”¹. Additionally, further review of scientific literature supports the contention that there is no safe blood lead exposure, and no blood lead level (BLL) over zero is free of all risk.²

Children with BLLs equal to or greater than $5\mu\text{g}/\text{dL}$ of blood are currently identified as having a BLL of concern by the Centers for Disease Control, though even low levels of lead in blood in children have been shown to result in cognitive decline and reduced IQ³ and, although the effects may be small, they are enduring and usually permanent.⁴ Persons exposed to lead in early life experience “an unfolding series of adverse behavioral outcomes: behavior problems as a child, pregnancy and aggression as a teen, and criminal behavior as a young adult.”⁵

¹ United States Environmental Protection Agency, Air Quality Criteria for Lead, Vol I (October, 2006)

² Vorvolakos, T., Arseniou, S., & Samakouri, M. (2016). There is no safe threshold for lead exposure: A literature review. *Psychiatriki*, 27(3), 204-214. doi:10.22365/jpsych.2016.273.204

³ Lanphear, B. P. (2000). Cognitive Deficits Associated with Blood Lead Concentrations. *Public Health Reports*, 115(6), 521-529. doi:10.1093/phr/115.6.521

⁴ Canfield, R. L., Jusko, T. A., & Kordas, K. (2005). Environmental lead exposure and children's cognitive function. *Rivista italiana di pediatria = The Italian journal of pediatrics*, 31(6), 293-300.

⁵ Reyes, J. (2015) Lead exposure and behavior: Effects on antisocial and risky behavior among children and adolescents. *Economic Inquiry* 53(3): 1580-1605.

Studies at general aviation airports⁶ have found the highest concentrations of airborne lead close to airport runways, decreasing with distance from the airport⁷, and shown a significant association between lead emissions from avgas and elevated BLLs in children.⁸ The continuing flow of lead into the environment remains a source of exposure risk, with a recent study of BLLs in children living near airports using avgas in Michigan indicating that “elevated BLLs in children proximate to airports is at least partly attributable to avgas deposition from piston-engine aircraft.”⁹ That study found that children residing within 1 kilometer of an airport are more likely to exceed thresholds of concern than children living further away.

Mountain Data Group’s Qualifications

The Administration is recommending approval of an Agreement with Mountain Data Group for the planning and execution of a study. Mountain Data Group is a data science consulting company co-founded by Dr. Sammy Zahran and Dr. Terry Iverson, professors at Colorado State University. Dr. Zahran is a Professor of Demography in the Department of Economics at Colorado State University and holds a joint appointment in the Department of Epidemiology, Colorado School of Public Health, and would serve as the Senior Academic for the County’s study.

Dr. Zahran is an expert in causal inference and applied statistical and econometric tools, and his academic research focuses on the economic, health and social costs of pollution and environmental risks. Dr. Zahran’s academic research has been funded by various agencies, including the National Science Foundation, the National Oceanic and Atmospheric Administration, the Robert Wood Johnson Foundation and Columbia University, and the National Institute of Standards and Technology.

Dr. Zahran’s published scientific work appears in diverse academic journals, including the “Proceedings of the National Academy of Sciences,” “Environmental Science and Technology,” “International Journal of Epidemiology,” “American Journal of Public Health,” and the “Journal of the Association of Environmental and Resource Economists.” Dr. Zahran has authored over twenty peer reviewed scientific articles on causes and health and human capital effects of early childhood lead exposure, including the following:

⁶ United States Environmental Protection Agency, Development and Evaluation of an Air Quality Modeling Approach for Lead Emissions from Piston-Engine Aircraft Operating on Leaded Aviation Gasoline, Technical Report, EPA-420-R-10-007 (February, 2010)

⁷ See also Piazza, B. (1999). Los Angeles Unified School District, Health and Safety Branch Santa Monica Municipal Airport: A Report on the Generation and Downwind Extent of Emissions Generated from Aircraft and Ground Support Operations

⁸ 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. doi:10.1289/ehp.1003231

⁹ 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

- Zahran, S., Iverson, T., McElmurry, S., Weiler, S. (2017). The Effect of leaded gasoline on blood lead in children. *Journal of Association of Environmental and Resource Economists*
- Zahran, S., McElmurry, S., Sadler, R. (2017). Four phases of the Flint water crisis: Evidence from blood lead levels in children. *Environmental Research*
- Zahran, S., Iverson, T., Weiler, S. (2014). Evidence that the accuracy of self-reported lead emissions data improved: A puzzle and discussion. *Journal of Risk and Uncertainty*
- Zahran, S., Magzamen, S., Breunig, IM, Mielke, HW. (2014). Maternal exposure to neighborhood soil Pb and eclampsia risk in New Orleans, Louisiana (USA): Evidence from a natural experiment in flooding. *Environmental Research*
- Zahran, S., Laidlaw, MAS, McElmurry, S., Filippelli, GM., Taylor, M. (2013). Linking source and effect: Resuspended soil lead, air lead, and children’s blood lead levels in Detroit, Michigan. *Environmental Science and Technology*

As an example of Dr. Zahran’s previous work, in the article published in the Journal of Association of Environmental and Resource Economists, “The Effect of Leaded Aviation Gasoline on Blood Lead in Children,” Dr. Zahran and fellow researchers examined data that linked blood lead data from over a million children to 448 nearby airports in Michigan. Across a series of tests, and adjusting for other known sources of lead exposure, the research found that child BLL increased in proximity to airports with piston-engine aircraft, and that BLL increased in relation to the percentage of days the prevailing wind drifted in the direction of a child’s residential location.

Research Study Design

Although developments in aviation could reduce or eliminate lead emissions from general aviation aircraft, many of those developments are not expected to be realized at the local level for a number of years. It is thus desirable to assess whether there is any cause for concern arising from lead emissions at the airports currently or whether BLLs in children living near County-owned airports can be attributed to another source, and, if so, whether there is an opportunity or necessity for mitigating actions or outreach and education.

The proposed study would review available data, with appropriate controls for additional sources of lead exposure and is estimated to be completed four months after execution of the agreement. Necessary source data for a study of this nature would include the following:

1. Blood lead data on children living in the area surrounding County-owned airports.

2. Flight records of piston engine aircraft activity.
3. Weather data including prevailing wind patterns, precipitation, barometric pressure, etc., over the period under study.

These data are either publicly available or will be obtained from the CA Department of Public Health (CDPH), the Federal Aviation Administration, and the National Oceanic and Atmospheric Administration. In coordination with the County's Public Health Department, the Administration engaged CDPH, and there is general agreement that the proposed analytical work would be performed to answer a policy question related to public health, and if the findings yield information that may have broader implications, it is anticipated that a three-party Data Use Agreement among CDPH, Mountain Data Group, and the County would be required for purposes of formal research that could be published in a scientific journal.

Mountain Data Group would study the available data to establish, first, whether a distance gradient exists (i.e., whether BLLs in children are highest near the airport, decreasing as distance grows), and second, if a distance gradient exists, whether it corresponds with flight activity and weather data to a measurable degree. With controls for other sources of lead in the study area, the study would indicate whether there is a strong association between lead emissions at County-owned airports and elevated BLLs in children living nearby, and whether a causal inference can be made. The proposed study is expected to be completed by June 30, 2020.

CHILD IMPACT

The recommended action would have no/neutral impact on children and youth. The results of this study may result in efforts to mitigate the potential for lead exposure for children living near sources of exposure.

SENIOR IMPACT

The recommended action would have no/neutral impact on seniors.

SUSTAINABILITY IMPLICATIONS

The recommended action would have no/neutral sustainability implications.

BACKGROUND

Lead was introduced in the 1920s as a fuel additive for use in engines to help boost fuel octane and prevent valve seat recession, but was immediately recognized as a significant public health concern. With newer automobile engine and fuel technology, leaded fuels were

transitioned out of general use over several decades due to the health risk associated with lead exposure. However, due to the lack of a commercially viable unleaded aviation fuel and incompatibility with today's piston-engine powered aircraft, leaded aviation fuel ("avgas") continues to be used in most small general aviation aircraft.

Effects of Lead Exposure

Lead contamination and poisoning presents serious public health risks. Lead is a confirmed neurotoxin, and even low levels of lead in blood can result in stunted physical and cognitive development in children, leading to lower IQ scores, poor academic performance, poor attention and impulse control, and numerous physical health complications.¹⁰ In adults, elevated blood lead levels are associated with kidney and brain damage, increased blood pressure, miscarriages, stillbirths, and infertility. Importantly, the effects of lead exposure cannot be corrected.

Development of Unleaded Avgas

Responding to concerns about lead emissions from small aircraft, the FAA has been engaged since 2010 with the aviation industry and fuel producers to develop policies, methods, and specifications to facilitate the introduction of alternative aviation fuels. In its June 20, 2019 update on the Piston Aviation Fuels Initiative (PAFI), the FAA announced it had established a rigorous test program to facilitate the evaluation and approval of unleaded fuels that would be as operationally safe as leaded fuels in the current fleet of piston engine aircraft. The PAFI has involved the testing of optimized fuels and the screening of new fuels that had not previously been a part of the program. Test results of some optimized fuels were not successful, and engine testing has revealed that additional refinement will be necessary.

That update also included an acknowledgement that it would be necessary to expand the scope of the PAFI to support fuel producers' research and development while engaging other candidate fuels for evaluation. However, the PAFI's slow progress and complicated process has resulted in all but one fuel producer, Shell, withdrawing from the program.

Further, as part of the FAA Reauthorization Act of 2018, which was signed into law in October of 2018, the Secretary of Transportation is required to enter into arrangements for the National Research Council to study aviation fuel.¹¹ The study must include an assessment of existing non-leaded fuel alternatives for piston-engine aircraft, ambient lead concentrations at and around general aviation airports, and mitigation measures to reduce

¹⁰ US Dept. of Health and Human Services, National Toxicology Program, NTP Monograph, "Health Effects of Low-level Lead Evaluation" (June 2012)

¹¹ FAA Reauthorization Act of 2018, HR 302—115th Congress (2017-2018) <https://www.congress.gov/bill/115th-congress/house-bill/302?s=5&r=302>

ambient lead concentrations. This study was due to be reported to Congress not later than October 5, 2019, but this deadline has been extended to July 2020.

At this time, there is no reliable estimate for when an unleaded avgas will be available, with some aviation professionals speculating that the industry will instead transition to electric aircraft or resort to engine modifications for the use of unleaded automotive gasoline.¹²

Electric and Hybrid Aircraft

In addition to the efforts to develop a viable unleaded aviation fuel, the aviation industry has embarked on the development of alternative fuel aircraft, including aircraft powered by electricity or hybrid technology. Some manufacturers have had success with small aircraft powered exclusively by electricity, with one model that can fly nine passengers set to begin production, this year,¹³ and one European commercial airline pledging to cover short-haul routes with a fleet of larger electric planes by 2030.

Similarly, some manufacturers are planning to have hybrid aircraft ready for testing by 2022, while a Los Angeles-based manufacturer, Ampaire, has unveiled a prototype hybrid aircraft in June 2019 that is the largest hybrid-electric aircraft in flight testing. Ampaire plans to introduce the aircraft, based on the six-seat Cessna 337 Skymaster, to commercial operations in 2021.

In the longer term, electric aircraft are estimated to make up six to ten percent of commercial airline flights by 2050. As an indication of support for the adoption of alternative fuel aircraft, passenger flights are expected to begin in Norway 2025, with all domestic flights in that country mandated to be electric by 2040.¹⁴

CONSEQUENCES OF NEGATIVE ACTION

A study of the impact of lead emissions at County-owned airports would not be conducted.

ATTACHMENTS:

- Service Agreement - Mountain Data Group (PDF)
- SIN-CEO-MountainDataGroup (PDF)
- F85-148 FY20 (PDF)

¹² Air Facts, The Unleaded Fuel Disaster – What It Means For Pilots, November 19, 2018 <https://airfactsjournal.com/2018/11/the-unleaded-fuel-disaster-what-it-means-for-pilots/>

¹³ CNN Business, Electric planes herald new era for aviation at the Paris Air Show, June 20, 2019, <https://www.cnn.com/2019/06/20/business/electric-planes-paris-air-show/index.html>

¹⁴ Deutsche Welle, Electric plane boom waiting in the wings, December 12, 2018, <https://p.dw.com/p/39v6S>