MEMORANDUM

To: Rufus A. James
Airport Director
Fort Lauderdale Executive Airport

From: Robert C. Mentzer, Principal Consultant
Philip Soucacos, Senior Program Manager
Aofei Li, Staff Consultant
Trent Tougas, Staff Consultant

Date: September 27, 2023

Subject: Fort Lauderdale Executive Airport Lead Emissions Analysis

Reference: 03-10370.004

For the aircraft lead emissions analysis at Fort Lauderdale Executive Airport (FXE), the latest version of the Aviation Environmental Design Tool (AEDT 3e) was used to calculate the airport specific avgas fuel consumption. Calculating fuel consumption using AEDT allows for airport specific fuel consumption calculations for FXE based on the aircraft operations and the associated airport operational characteristics (e.g., taxi times, runway length, fleet mix, and operation type). A previous AEDT study (2bSP2), used for the 2017 Environmental Assessment (EA) that HMMH previously conducted, was selected as the starting point and converted to the latest version (AEDT 3e). Calendar year (CY) 2022, a 12-month period of radar data from FXE Aircraft Noise and Operations Monitoring System (ANOMS), was used to determine the aircraft types and operations using aviation gasoline (avgas) and were imported into AEDT.

In the ANOMS radar data there were 122,928 flight records for CY 2022. However, the Federal Aviation Administration (FAA) Operations Network (OPSNET)[1] reported 180,551 total operations for 2022, which provides a more accurate operations count. Due to the large difference between the ANOMS radar and FAA OPSNET data, the overall operation counts were scaled within each FAA category (e.g., air carrier, air taxi, etc.) to the operations reported by OPSNET. After breaking the information down by category, it was shown that 59.49 percent of operations were Piston aircraft utilizing leaded avgas and 40.51 percent were turboprop aircraft and jets. There were 187 different fixed-wing and rotary aircraft types and 107,416 Air Taxi and General Aviation (GA) operations (including touch-and-go operations) identified using avgas at FXE. AEDT 3e was then run using these operations and calculated that 1,405,250 pounds or 234,208.3 gallons of Avgas was consumed from aircraft operating below the mixing height (3,000 feet).

The AEDT computed fuel burn was then utilized and applied to the Environmental Protection Agency (EPA)[2] equation located in Appendix A1 of the FAA *Aviation Emissions and Air Quality Handbook* titled "Lead Emission Calculation," which can be utilized to calculate lead emissions based on the total fuel burn from GA aircraft.[3]

The following equation was utilized for this specific scenario:

$$\text{Pb(Tons)} = \frac{234{,}208.6 \text{ (gallons of avgas)} \times 2.12 \times 0.95}{907.180}$$

Pb = 0.519958094 Short Tons or Pb = 1,039.916 lb.

[1] *FAA, "OPSNET",* https://aspm.faa.gov/opsnet/sys/main.asp, Accessed on September 27th, 2023.
[2] *Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2011 National Emissions Inventory*, Environmental Protection Agency, https://nepis.epa.gov/Exe/ZyPDF.cgi/P100LFGL.PDF?Dockey=P100LFGL.PDF, Accessed on September 27th, 2023.
[3] *Aviation Emissions and Air Quality Handbook Version 3 Update 1*, Federal Aviation Administration, https://www.faa.gov/sites/faa.gov/files/regulations_policies/policy_guidance/envir_policy/airquality_handbook/Air_Quality_Handbook_Appendices.pdf, Accessed on September 27th, 2023.

The AEDT analysis estimated that the total lead emissions at FXE in CY 2022 are 0.5199 short tons (1,039.916 lb.). This yearly value was then scaled down to obtain an average monthly, daily, and hourly rate of lead emissions produced at FXE as a result of GA operations, which is shown in **Table 1** below.

Table 1. Average Lead Emissions at FXE Below Mixing Height by Year, Month, Day, Hour

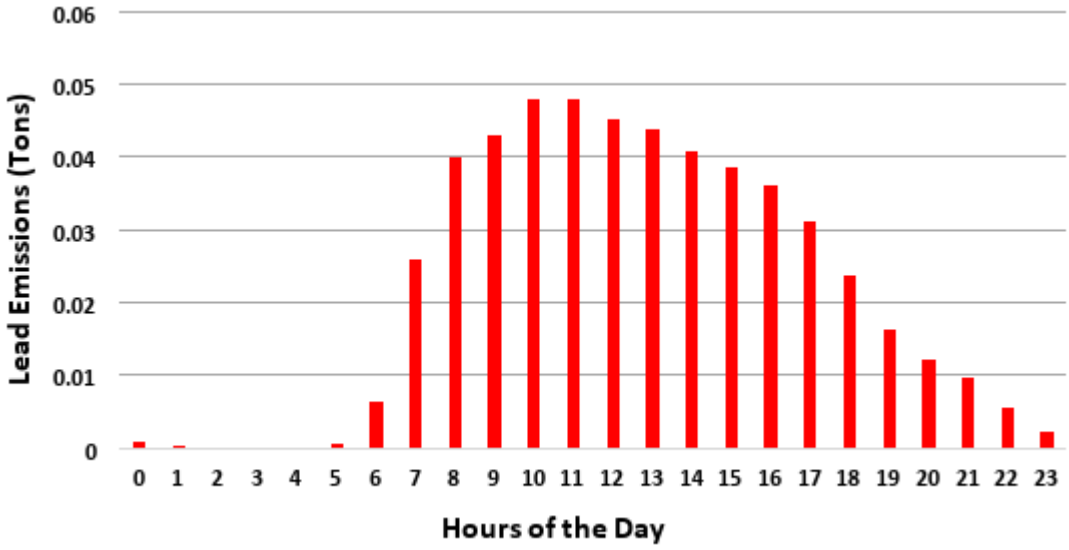
Source: HMMH

Flight Below Mixing Height		
Time Duration	**Emissions (Short Tons)**	**Emissions (lb.)**
Per Hour	**5.931E-05**	**0.118**
Per Day	**0.0014**	**2.847**
Per Month	**0.0433**	**86.659**
Per Year	**0.519**	**1039.916**

Figure 1 below provides a histogram that depicts the hourly distribution of annual lead emissions. This graph shows that most of the lead emissions at FXE are produced between 7 AM and 6 PM, with a maximum emissions rate occurring from 11 AM to 12 PM of approximately 0.04806 tons in CY 2022.

Figure 1. Hourly Distribution of Annual Lead Emissions

Source: HMMH



According to the most recent National Emissions Inventory (NEI)[4] in Florida airports contribute 72,669 lbs. (36.3345 tons) of lead from aircraft operations. Broward County contributed 2,457 lbs. (1.2285 tons) to that total, which equates to 3.38 percent of the total lead emissions for the state of Florida. There are 4 airports in Broward County contributing to the state aviation lead emissions:

- North Perry (HWO) – 1.31%
- Fort Lauderdale Executive airport (FXE) – 1.00%
- Pompano Beach Airpark (PMP) – 0.91%
- Fort Lauderdale -Hollywood International Airport (FLL) – 0.17%

[4] *2020 National Emissions Inventory (NEI) Data Supporting Data and Summaries,* https://www.epa.gov/air-emissions-inventories/2020-national-emissions-inventory-nei-data, Accessed on September 27th, 2023.

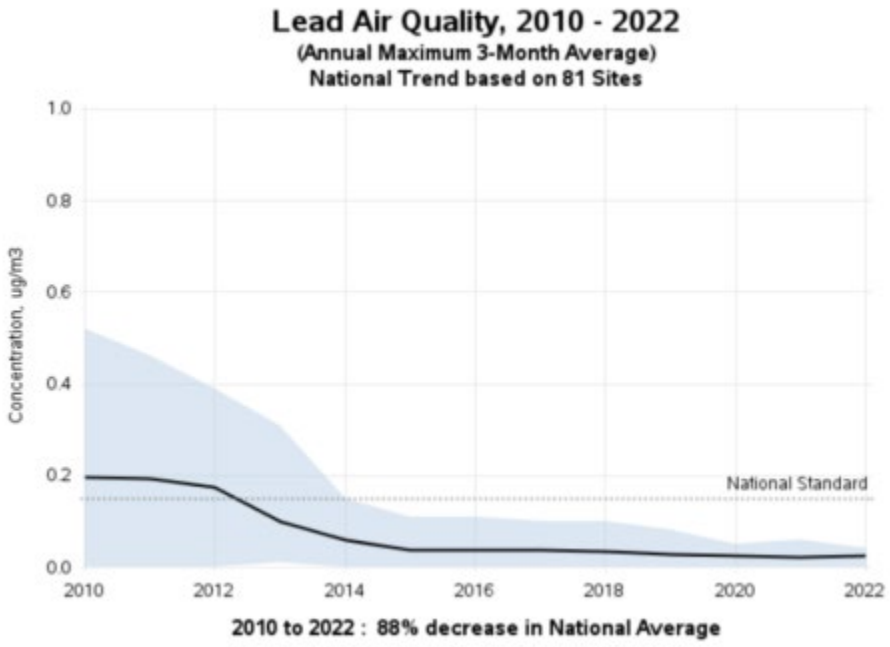
Broward County is currently in attainment for lead[5] National Ambient Air Quality Standards (NAAQS). An attainment zone is defined by the EPA as a "geographic area in which the air quality meets or is cleaner than the national standard." [6]

In addition to Broward County being in an attainment area for lead, the EPA's modeling and monitoring data has also indicated[7] that lead concentrations at and near airports are typically well below the NAAQS standard for lead. Meaning that even though Broward County does emit lead due to the number of operations of piston-engine aircraft, the emissions from the aircraft exhaust dissipate and disperse rapidly; thus, ambient concentrations outside the airport fence line are expected to remain below the NAAQS.

The EPA is concerned about aggregate exposures from all sources of lead, especially given the persistence of lead in the environment.[7] As shown in **Figure 2** below, average lead concentrations have decreased drastically after EPA's regulations[8] reduced the lead content in on-road motor vehicle gasoline. In 2008, the EPA revised and replaced the NAAQS[9] with a standard ten times more stringent than the previous standard. As a result, average National lead concentrations (3-month average) have decreased by 88 percent from 2010 to 2022 and are below the national standard.[8]

Figure 2. Lead Air quality National Trends

Source: EPA Lead Trends



The EPA released a fact sheet[7] summarizing the findings of their research on evaluating the impact of piston-engine aircraft operating on leaded fuel on air quality at and around U.S. airports. The fact sheet includes the following information:

- Areas where concentrations may be high (and exceed the lead NAAQS in more active airports) are typically within the fence line of the airports (areas in very close proximity to where conduct pre-flight engine checks).
- Lead levels dissipate quickly with distance from piston-engine aircraft exhaust.

[5] *EPA Greenbook,* https://www3.epa.gov/airquality/greenbook/anayo_ca.html, Accessed on September 27th, 2023.

[6] *NAAQS Designations Process*, https://www.epa.gov/criteria-air-pollutants/naaqs-designations-process, Accessed on September 27th, 2023.

[7] EPA, "Fact Sheet", https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100YG46.pdf, Accessed on September 27th, 2023.

[8] *EPA, "Lead Trends"*, https://www.epa.gov/air-trends/lead-trends, Accessed on September 27th, 2023.

[9] *EPA, "Lead NAAQS"*, https://www.epa.gov/lead-air-pollution/national-ambient-air-quality-standards-naaqs-lead-pb, Accessed on September 27th, 2023.

- Estimated lead concentrations decrease to below the standard within 50 meters of the area of highest concentration.
- EPA is concerned about all potential sources of lead exposure, including the low concentrations in air from piston-engine aircraft.

EPA has also released a fact sheet summarizing their research of lead impacts in soil.[10] The fact sheet includes the following information:

- Lead naturally occurs in soil at low levels.
- Lead does not breakdown over time, so lead deposited in the past can still be a problem today.
- Higher levels of lead are found in soil:
  - Near roadways as a result of air emissions from vehicles that used leaded gasoline.
  - Near the perimeter of buildings that used lead paint that deteriorated as chips and dusts, or from past renovation activities.
- Depending on where you live, it is common to find lead levels in your yard or garden at or above guidance values. This is generally not cause for alarm as there are ways to reduce exposure to lead in soil.
- Soil is highly variable and lead concentrations can be quite different even in samples collected from one or two feet of each other.

Several studies which analyzed soil samples at airports concluded that they did not contain high lead levels that exceed local, state, or federal standards. Recent example studies include:

- Reid-Hillview Airport (KRHV) in San Jose, California in 2022.[11]
- Peachtree-DeKalb Airport (PDK) in Chamblee, Georgia in 2020.[12]
- Multiple regional airports in Oklahoma in 2017.[13]

In addition, the Naples Airport Authority (NAA) in Florida recently completed laboratory testing on the airport and at several nearby downtown residences where no traces of lead or any other aviation fuel contaminates were found.[14]

FAA shares EPA's concerns about lead emissions from piston-engine aircraft and has several initiatives currently underway[15] to develop strategies to reduce and eliminate lead from fuel for piston-engine aircraft, in turn, reducing lead emissions over time for all U.S. Airports with GA operations, such as FXE. In addition, the FAA launched the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative to eliminate lead emissions from GA aircraft by the end of 2030.[16]

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[10] *EPA "Lead in Soil",* https://www.epa.gov/sites/default/files/2020-10/documents/lead-in-soil-aug2020.pdf, Accessed on September 27th, 2023.

[11] *San Jose Mercury News Report,* https://www.mercurynews.com/2022/06/11/study-finds-no-elevated-lead-levels-in-reid-hillview-airports-soil/ Accessed on September 27th, 2023.

[12] *PDK Aviation Park, Soil Sample Testing Report,* https://www.dekalbcountyga.gov/sites/default/files/users/user3595/Soil%20Sample%20Report%20-%20%20Full.pdf Accessed on September 27th, 2023.

[13] *A geospatial analysis of soil lead concentrations around regional Oklahoma airports, Chemosphere (2017),* https://www.sciencedirect.com/science/article/abs/pii/S0045653516313285, Accessed on September 27th, 2023.

[14] *Naples Airport Propels Industry Towards a Cleaner Future*, https://www.flynaples.com/naples-airport-propels-industry-towards-a-cleaner-future, Accessed on September 27th, 2023.

[15] *FAA, "Aviation Gasoline",* https://www.faa.gov/about/initiatives/avgas, Accessed on September 27th, 2023.

[16] *FAA, "FAA, Industry Chart Path to Eliminate Lead Emissions from General Aviation by the end of 2030",* https://www.faa.gov/newsroom/faa-industry-chart-path-eliminate-lead-emissions-general-aviation-end-2030, Accessed on September 27th, 2023.