

Childhood lead poisoning risk from Middleton Municipal Airport

October 11, 2022

Introduction

Exposure to lead during childhood can result in several health effects including impacts on academic and intellectual development and achievement, attention related issues, behavioral problems, and hearing loss¹. Progress has been made in the prevention of childhood exposure in our community and communities across the United States. For example, banning the use of leaded gasoline in cars and trucks, lead-based paints, and lead solder in plumbing resulted in a dramatic decline in childhood lead poisoning in this country². Despite these successes, childhood lead poisoning remains a serious concern in Dane County. The leading cause of lead poisoning in Dane County remains exposure to lead paint chips and contaminated dust in homes built prior to 1978. This ongoing challenge reinforces the continued need for surveillance, identification, and mitigation of potential lead exposure hazards, combined with prevention and treatment services for children identified with or at risk for elevated blood lead levels (BLLs)^{1, 2}.

An often overlooked route of lead exposure is the continued use of lead additives in aviation fuels (avgas) to achieve the high octane levels required for piston-driven small aircraft. Despite the official phase out of leaded gasolines for automobiles by 1995, the use of lead additives in avgas are still commonly used and are deemed more effective than the recently introduced unleaded avgas fuel options. In fact, reported octane levels of unleaded avgas fuels such as 82 UL and 94 UL are too low to allow proper operation of many small aircraft engines, which currently prohibits the broader use of unleaded fuels². In recognition of this issue, the Federal Aviation Administration (FAA) announced the “Eagle Initiative” earlier this year to reduce lead emissions from this source. This initiative is a combined effort of government and industry resources to improve the technology and modification of small aircraft engines, increase octane levels of unleaded fuels, and develop infrastructure and commercial viability to allow the transition to unleaded fuels for piston-engine aircraft by 2030^{3, 4}.

Regardless of the progress noted above, emissions from aircraft using leaded avgas is currently the largest source of lead air contamination in the United States. As a result, concentrations of lead are significantly higher near airports that allow operation of smaller piston-engine aircraft than lead concentrations from current or historical sources (known as background concentrations), and provide a

potential source of exposure that can contribute to the rates of childhood lead poisoning cases in an impacted community^{2, 3, 5}.

Potential exposure risk from small aircraft airports

Previous research has indicated that the combustion of avgas by piston-engine small aircraft may pose a health threat to children that live or attend schools in close proximity to airports that support the operation of these types of aircraft by either the inhalation of lead or the ingestion of the contaminant after it settles into the surrounding soils^{2, 5, 6}. The US EPA further estimates that children living within 1 km (0.62 miles) of airports are at the greatest risk of being exposed to lead from avgas emissions⁶. This estimation has been supported by research efforts including studies of airports in Santa Clara, California and Buttonville, Ontario, Canada that demonstrated elevated lead concentrations that decrease exponentially with increasing distance from the airport and return to near background levels at approximately 1 km^{2, 5}. A subsequent study conducted by Miranda et al. (2011) supported the elevated risk within 1 km with the largest risk reported in children living within 500 meters (1640 feet) of airports in North Carolina. This is especially the case in areas in closest proximity to the portion of the airport where the piston-engine small aircraft remains stationary for a length of time idling while engine checks are performed in preparation for takeoff; an area referred to as the “maximum impact area”².

However, a number of variables that contribute to the potential health risk from avgas emissions to the surrounding community also govern the level of lead contamination from a specific airport. As noted by the US EPA (2020), these include the patterns and amount of aircraft activity, concentration of lead in the avgas, the duration of average time spent by aircraft in run-up operations prior to take-off, and meteorological data⁵. In other words, the potential health risks posed by proximity to an airport that support piston-engine aircraft operations are not created equally; an airport in question may contribute more or less than expected to childhood lead poisoning rates within the identified 1 km hazard area.

Childhood lead poisoning risk from the Middleton Municipal Airport

Middleton Municipal Airport, also known as Morey Field, located in Middleton, Wisconsin supports the operation of piston-engine small aircraft. The elevated risk of lead exposure posed by similar airports across the country has led to concerns in the surrounding community about the potential health risk from avgas lead emissions. Similar to other communities, the focus of concern is the possible exposure of children to elevated levels of lead in the environment and an increase in childhood lead poisoning cases.

As noted earlier, emissions from leaded avgas are the largest source of lead in the air in the United States; this is also true for Dane County where the Middleton Municipal Airport is located. In fact, this airport reportedly contributes approximately 32% of the county’s lead emissions⁷. Fortunately, in the

specific case of the Middleton Municipal Airport, there are limited residential structures and public activities located within 1 km of the airport, which significantly reduces the risk of an increased rate of childhood lead poisoning cases from exposure to avgas emissions.

Public Health Madison & Dane County provides prevention services when a child's blood lead level is less than 5 µg/dL and case management services when reported blood levels are equal to or greater than 5 µg/dL. A review of the blood lead testing results reported to the State of Wisconsin from children in Middleton from 2010 – 2020 indicated only 1 case of childhood lead poisoning (≥ 5 µg/dL of lead) within 1 km of the Middleton Municipal Airport. Moreover, this single case cannot necessarily be attributed to leaded avgas emission without evaluating other potential sources of lead exposure this child may have come into contact with, including lead paint chips, lead contaminated dust, and lead containing water pipes or solder. These other types of lead exposures were the primary cause in an additional 15 cases of childhood lead poisoning (≥ 5 µg/dL of lead) identified throughout the Town and City of Middleton (outside 1 km risk area from Morey Field) during the same 2010 – 2020 timeframe.

Conclusion

Although the primary drivers of childhood lead poisoning in Dane County remain exposure to paint chips and contaminated dust in older homes, exposure to leaded avgas emissions presents a potential source of lead exposure to children in other communities surrounding airports that support piston-driven small aircraft operations across the country. Following a review of the relevant literature and analysis of lead testing results of children from Middleton during 2010 – 2020, the data does not support that the Middleton Municipal Airport is a significant risk for elevated blood lead levels in children at this time. However, this level of risk could change if the airport expands, or residential structures and neighborhoods are built closer to this airport; in this case additional analysis would be warranted. Public Health Madison & Dane County will continue to monitor this situation and continue to recommend that Dane County parents test their children for lead.

Additional information about childhood lead services provided by Public Health Madison & Dane County can be found at the following link: <https://www.publichealthmdc.com/environmental-health/environmental-hazards/lead-poisoning/public-health-lead-services>

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