Testimony in support of SJM 1

Submitted by Miki and David Barnes to the Oregon Senate Committee on Transportation and Economic Development on April 15, 2015. We extend my gratitude to the sponsors of SJM 1 and to the Senate Committee on Transportation and Economic Development for hearing our testimony.

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We appreciate the acknowledgment in SJM 1 that:

- "The operation of general aviation aircraft is the greatest source of lead emissions in Oregon..."
- The recognition that "Children are especially susceptible to the toxic effects of lead, and that "exposure to lead can lead to irreversible brain damage and reduce a person's cognitive function..."
- "Exposure to low levels of lead early in life has been linked to effects on a person's intelligence quotient, learning, memory and behavior..."
- "There is no safe level of exposure to lead."

In light of these serious health impacts, we appreciate SJM 1's support for prioritizing "the development and certification of unleaded aviation fuel in advance of 2018."

Lead Exposure and Health Impacts in Adults

- Medical research has identified a causal relationship between lead and hypertension, coronary heart disease, decreased red blood cell survival, delayed puberty onset in both males and females, and impaired male reproductive function.
- A likely causal connection was found between lead and cancer, impaired female reproductive function, birth outcomes (low birth weight, spontaneous abortion), decreased resistance to bacterial infections, declines in cognitive function, and increases in depression and anxiety.

Source: *Integrated Science Assessment for Lead.* U.S. Environmental Protection Agency. (June 2013). EPA/600/R-10/075F. Pg. lxxxiii to lxxxvii,. Available online at http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=255721#Download.

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Oregon and Lead Emissions

There are 457 airports in Oregon – 97 public use and 360 private use airports.

Source: Oregon State Department of Aviation

Significantly, there are 509 facility sources of lead in Oregon. Of that number 417, more than 80 percent, are airports.

Source: 2011 Environmental Protection Agency National Emissions Inventory.

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EPA NEI – Oregon Lead Sources

According to the 2011 Environmental Protection Agency (EPA) National Emissions Inventory (NEI) the top 20 facility sources of lead in Oregon are as follows, 12 are airports (***airports in bold italics***):

- ***Hillsboro Airport (Largest Facility Source of Lead in Washington County) – 1160 lbs.***
- Cascade Steel (Yamhill County) – 1080 lbs.
- Riddle Plywood (Douglas County) – 620 lbs.
- ***Bend Municipal Airport (Largest Facility Source of Lead in Deschutes County) – 560 lbs.***
- Columbia Ridge Landfill and Recycling Center (Gilliam County) – 540 lbs.
- ***Aurora Airport (Largest Facility Source of Lead in Marion County) – 520 lbs.***
- ***Scappoose Industrial Airpark (Largest Facility Source of Lead in Columbia County) – 400 lbs.***
- ***Troutdale Airport (Largest Facility Source of Lead in Multnomah County) – 360 lbs.***
- ***McMinnville Municipal Airport (Second Largest Facility Source of Lead in Yamhill County) – 340 lbs.***
- ***Corvallis Municipal Airport (Largest Facility Source of Lead in Benton County) – 280 lbs.***
- ***Mahlon Sweet Field (Largest Facility Source of Lead in Lane County) – 260 lbs.***
- Owen-Brockway Glass Container Inc. (Multnomah County) – 240 lbs.
- PGE Boardman (Morrow County) – 220 lbs.
- ***Hobby Field Airport (Second Largest Facility Source of Lead in Lane County) – 220 lbs.***
- ***Portland International Airport (Third Largest Facility Source of Lead in Multnomah County) – 220 lbs.***
- ***Robert's Field Airport (Second Largest Facility Source of Lead in Deschutes County) – 200 lbs.***
- EVRAZ Inc. NA (Multnomah County) – 197.4 lbs.
- SP Fiber Technologies (Yamhill County) – 194.2 lbs.
- ESCO Corporation (Multnomah County) – 192.6 lbs plus 4lbs. emitted by their NW Brewer location)
- ***Independence State Airport (Largest Facility Source of Lead in Polk County) – 175 lbs.***

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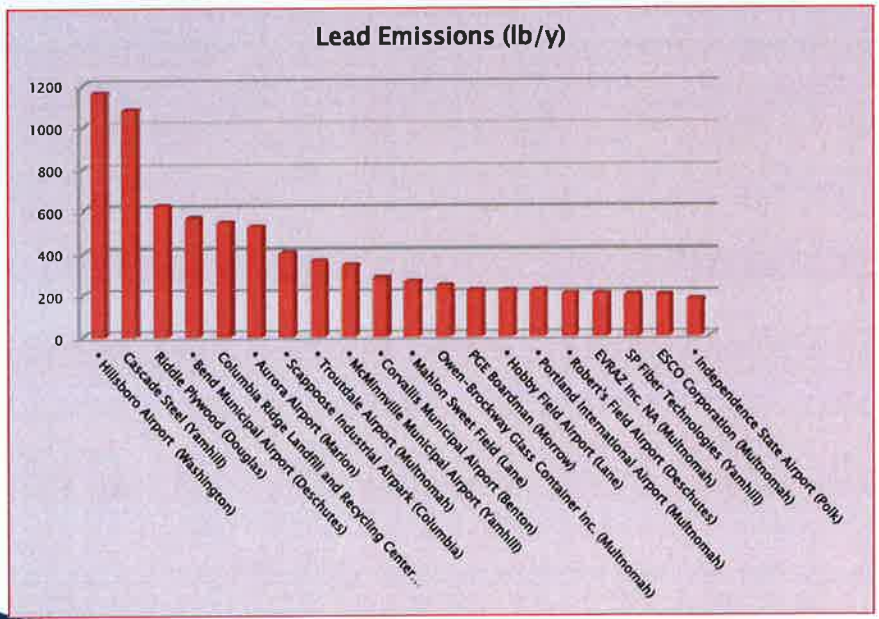

Chart of 2011 EPA NEI list of top 20 facility sources of lead in Oregon. Facilities marked with an * are airports. Lead emissions at airports are based on landing and take-off cycle emission estimates.

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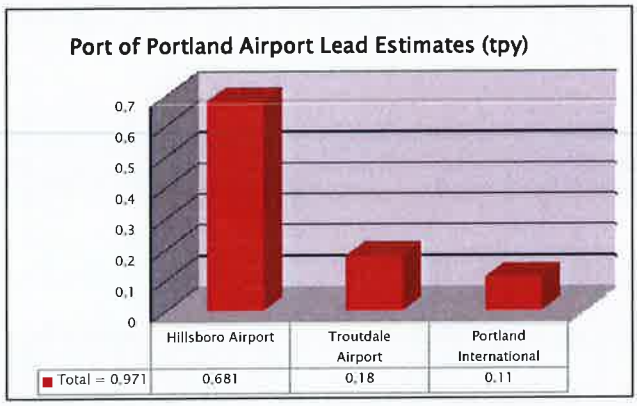
Port of Portland Lead Emissions Landing and Takeoff (LTO)



Sources: 2011 EPA NEI and EPA Memorandum from Hoyer, Marion, and Pedde, Meredith to the Lead NAAQS Docket EPA-HQ-OAR-2006-0735. 11/18/10.

Cruise Phase Emissions

- In addition to the landing and take-off cycle, lead is emitted during the cruise phase of flight and portions of the climb out and approach above 3,000 ft.
- Cruise phase emissions are not included in the landing and take-off cycle applied to individual airports.
- According to EPA estimates an additional 5.3 tons of lead were emitted over Oregon in 2008 during the cruise phase.
- Due to the intensive flight training, there is a high likelihood that much of the cruise phase lead is released over Washington County.
- Neither the Port nor DEQ factored in cruise phase lead emission accumulations when calculating background national ambient air quality standards for lead.

Sources: Lead Emissions from the Use of Leaded Aviation Gasoline in the United States - Technical Support Document. (EPA20-R-08-020). U.S. Environmental Protection Agency. Assessment and Standards Division Office of Transportation and Air Quality. (October 2008). Pg. 3-4. Available on-line athttp://www.epa.gov/ttn/chief/net/tsd_avgas_lead_inventory_2002.pdf.

Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2008 National Emissions Inventory. EPA-420-B-10-044. (December 2010). Pg. 17. Available on-line at http://www.epa.gov/otaq/regs/nonroad/aviation/420b10044.pdf.

HIO Aviation Activity and Lead

- Hillsboro Airport (HIO) emits more lead than any other facility source in Oregon.
  - Source: Environmental Protection Agency 2011 National Emissions Inventory.
- Nationwide, HIO is in the top one percent and ranks 21st out of nearly 20,000 U.S. airports in lead emissions.

Source: EPA Memorandum Selection of Airports for the Airport Monitoring Study from Hoyer M. and Pedde, M. to Lead NAAQS Docket EPA-HQ-OAR-2006-0735. (11/18/10).

- Piston-engine general aviation aircraft use lead based fuel whereas commercial jets do not. The majority of the training and recreational operations flying in and out of HIO currently utilize leaded fuel.

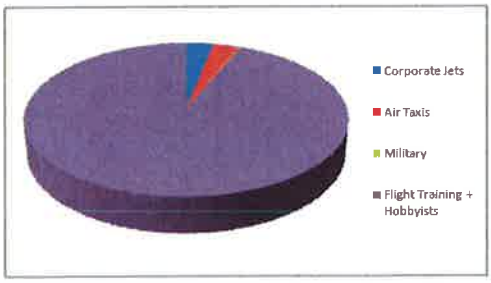
Source: *Lead Impacts from the Use of Leaded Aviation Gasoline in the United States*. Environmental Protection Agency: Technical Support Document (EPA420-R-08-020),. (October 2008).

Hillsboro Airport - Aviation Activity

- HIO, a general aviation reliever airport, is owned and operated by the Port of Portland. It logged more operations in 2013 than PDX did. Over the past 15 years, the annual operation count at PDX has dropped to a 30 year low, commensurate with 1984 levels thus there is no congestion at PDX to relieve.
- According to the FAA in 2007 there were 224,461 annual operations (take-offs and landings) at HIO, however, the Port of Portland in their environmental assessment on the proposed third runway, stated that there were over 240,000 that year.

  - Corporate Jets - 7,008
  - Air Taxi/Commuter - 6,860
  - Military - 300
  - Flight Training & Hobbyist - 210,293

Sources: *FAA APO Terminal Area Forecast Detail Report*, (Dec. 2013) and Hillsboro Airport Draft Environmental Assessment. Volume 1. (October 2009). Pg. 5.1-5.



Hillsboro Airport (HIO) – Lead Emissions

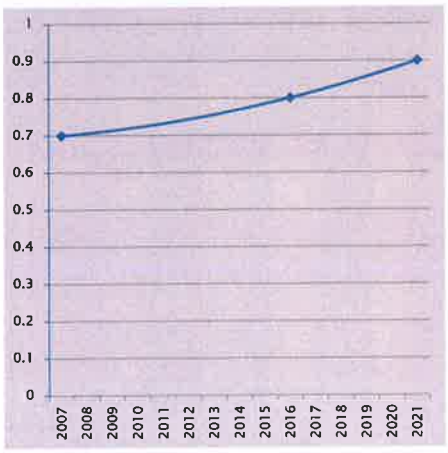
- The vast majority of the approximately 220,000 annual take-offs and landings at HIO are piston engine training and recreational flights, many of which circle repetitively over nearby residential communities, schools, day care centers, and parks at altitudes below 2,000 feet. Additional practice flights train over prime farmland, waterways, and surrounding communities. Port of Portland estimates indicate that in 2007, HIO alone is responsible for emitting 0.7 tpy, 1400 pounds.
- **HIO landing and take-off cycle lead emissions are expected to increase to 0.8 (tpy), 1600 lbs. by 2016 and 0.9 (tpy), 1800 lbs. by 2021.**

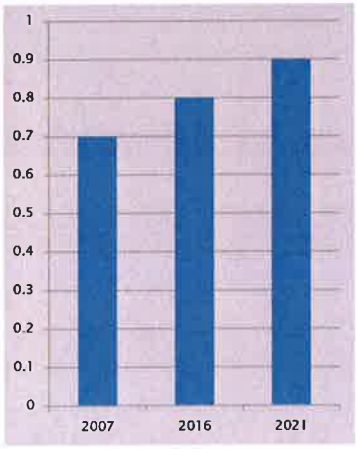
Source: Hillsboro Airport Parallel Runway 12L/30R Draft Supplemental Environmental Assessment. Prepared for Port of Portland. (3/15/13).

- HIO is surrounded on three sides by residential communities and on the fourth side by farmland. The blood lead levels of the children impacted by this airport have not been obtained or analyzed. Hillsboro's 35 public schools serve over 20,600 students.

Source: Hillsboro School District website at http//www.hsd.k12.or.us/AboutHSD/PublicDataPortal/FactsandFigures.aspx

HIO Projected Lead Emissions (tpy)





Sources: *Hillsboro Airport Parallel Runway 12L/30 R: Draft Environmental Assessment*. Vol. 2. Appendices. Pg. C.3-2. Prepared for the Port of Portland by CH2MHILL. (October 2009) and the *Hillsboro Airport Parallel Runway 12L/30 R* Final Supplemental Environmental Assessment,. Prepared for FAA by the Port of Portland. Vol. 1, Pg.28-29. (February 2009.).

Airports and Blood Lead Levels in Children

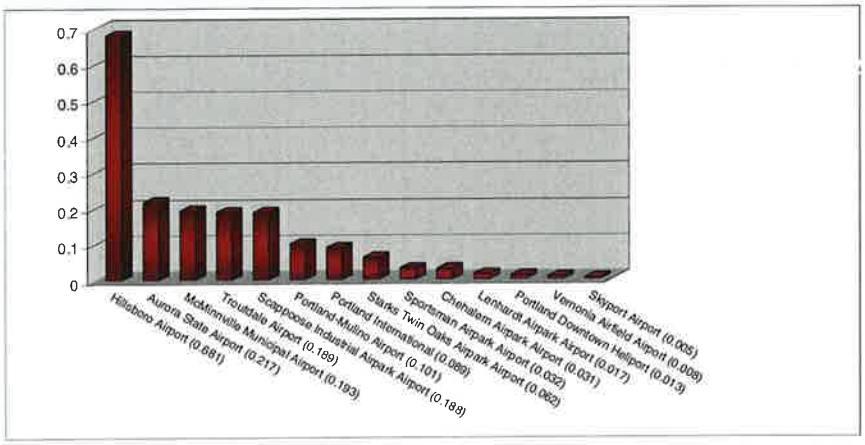
"Lead concentrations in air increase with proximity to airports where piston-engine aircraft operate."

Source: *Advance Notice of Proposed Rulemaking on Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline: Regulatory Announcement*. U.S. Environmental Protection Agency (EPA.). (April 2010). Available online at http://www.epa.gov/nonroad/aviation/420f10013.htm.

After completing a study of airports in 6 North Carolina Counties, Duke University researchers concluded that, "living within 1000 m [2/3 mile] of an airport where aviation gasoline is used may have a significant effect on blood lead levels in children. Our results further suggest that the impacts of aviation gasoline are highest among those children living closest to the airport."

Source: Miranda, M.L., Anthopolos, R., Hastings D. *A geospatial analysis of the effects of aviation gasoline on childhood blood lead levels*. Children's Environmental Health Initiative, Nicholas School of the Environment. Duke University. (July 2011).

2005 Lead Estimates: Airports Within 20 NM of Hillsboro



Data included in this graph was obtained from a DEQ public records request

Even if a replacement for avgas is identified by the FAA in 2018 there is currently no federal mandate to phase out leaded fuel

According a 12/15/14 Port of Portland commissioned Business Case Assessment to Provide Mogas at Portland-Hillsboro Airport, an unleaded aviation fuel option, at the Hillsboro Airport (HIO), even if approved by the Port of Portland, would only be likely to decrease lead emissions by 0.1 tons of lead per year which equates to 0.7 tpy in 2016 instead of 0.8 tpy. Thus the community would continue to be subjected to nearly three-quarters of a ton of lead emissions annually from HIO aviation activity.

A decision to use unleaded fuel, mogas, would be voluntary in nature and entirely up to pilot discretion.

Survey results from the above study indicate that the majority of pilots who use HIO purchase leaded aviation fuel at regional airports other than HIO such as Scappoose, Stark's Twin Oaks, Aurora, Grove Field, Mulino and Lebanon, in part because the fuel is cheaper at these facilities. The Port of Portland charges a 7 to 8 cents per gallon fuel flowage fee on all aviation fuel sold at HIO.

Source: Business Case Assessment to Provide Mogas at Portland-Hillsboro Airport. Prepared for the Port of Portland by KB Environmental Sciences, Inc. (12/15/14).

Please Include the Following Documents With This Testimony.

- Drum, Kevin. America's Real Criminal Element: Lead. Mother Jones. (January 3, 2013).
- Fischetti, Mark. Lead Exposure on the Rise Despite Decline in Poisoning Cases. Scientific American. (2/17/13.
- Legal Settlement Aims at Reducing Lead Poisoning Risks from California Airports. Center for Environmental Health. (12/10/14).
- Young, Allison. Lead Poisoning Toll Revised to 1 in 38 Young Kids. USA Today. (4/4/13).

Oregon Aviation Watch submissions.

- Slide Presentation prepared by Miki Barnes, LCSW, President of Oregon Aviation Watch for a June 6, 2014 Air Quality Workshop convened by Senator Michael Dembrow and Representative Mitch Greenlick.
- Barnes, Miki. A Review of the Port of Portland Commissioned Business Assessment on Selling Mogas at the Hillsboro Airport. Oregon Aviation Watch. (2/17/15).

Thank You

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Mother Jones

America's Real Criminal Element: Lead

New research finds Pb is the hidden villain behind violent crime, lower IQs, and even the ADHD epidemic. And fixing the problem is a lot cheaper than doing nothing.

By Kevin Drum | Thu Jan. 3, 2013 7:02 AM EST

When Rudy Giuliani ran for mayor of New York City in 1993, he campaigned on a platform of bringing down crime and making the city safe again. It was a comfortable position for a former federal prosecutor with a tough-guy image, but it was more than mere posturing. Since 1960, rape rates had nearly quadrupled, murder had quintupled, and robbery had grown fourteenfold. New Yorkers felt like they lived in a city under siege.

- America's Real Criminal Element: Lead [1]
- Is There Lead In Your House? [2]
- An Interview With Pioneering Toxicologist Howard Mielke [3]
- How Dangerous Is the Lead in Bullets? [4]
- Does Lead Paint Produce More Crime Too? [5]
- How Your Water Company May Be Poisoning Your Kids [6]

More *MoJo* coverage of the dangers of lead. [7]

Throughout the campaign, Giuliani embraced a theory of crime fighting called "broken windows," popularized a decade earlier by James Q. Wilson and George L. Kelling in an influential article in *The Atlantic.* [8] "If a window in a building is broken and is left unrepaired," they observed, "all the rest of the windows will soon be broken." So too, tolerance of small crimes would create a vicious cycle ending with entire neighborhoods turning into war zones. But if you cracked down on small crimes, bigger crimes would drop as well.

Giuliani won the election, and he made good on his crime-fighting promises by selecting Boston police chief Bill Bratton as the NYPD's new commissioner. Bratton had made his reputation as head of the New York City Transit Police, where he aggressively applied broken-windows policing to turnstile jumpers and vagrants in subway stations. With Giuliani's eager support, he began applying the same lessons to the entire city, going after

panhandlers, drunks, drug pushers, and the city's hated squeegee men. And more: He decentralized police operations and gave precinct commanders more control, keeping them accountable with a pioneering system called CompStat that tracked crime hot spots in real time.

The results were dramatic. In 1996, the *New York Times* reported [9] that crime had plunged for the third straight year, the sharpest drop since the end of Prohibition. Since 1993, rape rates had dropped 17 percent, assault 27 percent, robbery 42 percent, and murder an astonishing 49 percent. Giuliani was on his way to becoming America's Mayor and Bratton was on the cover of *Time*. It was a remarkable public policy victory.

But even more remarkable is what happened next. Shortly after Bratton's star turn, political scientist John DiIulio warned that the echo of the baby boom would soon produce a demographic bulge of millions of young males that he famously dubbed "juvenile super-predators [10]." Other criminologists nodded along. But even though the demographic bulge came right on schedule, crime continued to drop. And drop. And drop. By 2010, violent crime rates in New York City had plunged 75 percent from their peak in the early '90s.

All in all, it seemed to be a story with a happy ending, a triumph for Wilson and Kelling's theory and Giuliani and Bratton's practice. And yet, doubts remained. For one thing, violent crime actually peaked in New York City in 1990, four years before the Giuliani-Bratton era. By the time they took office, it had already dropped 12 percent.

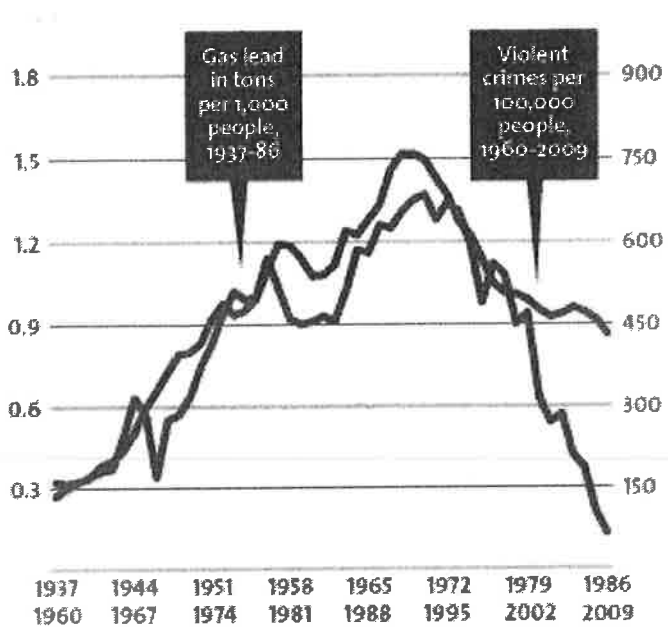
The PB Effect

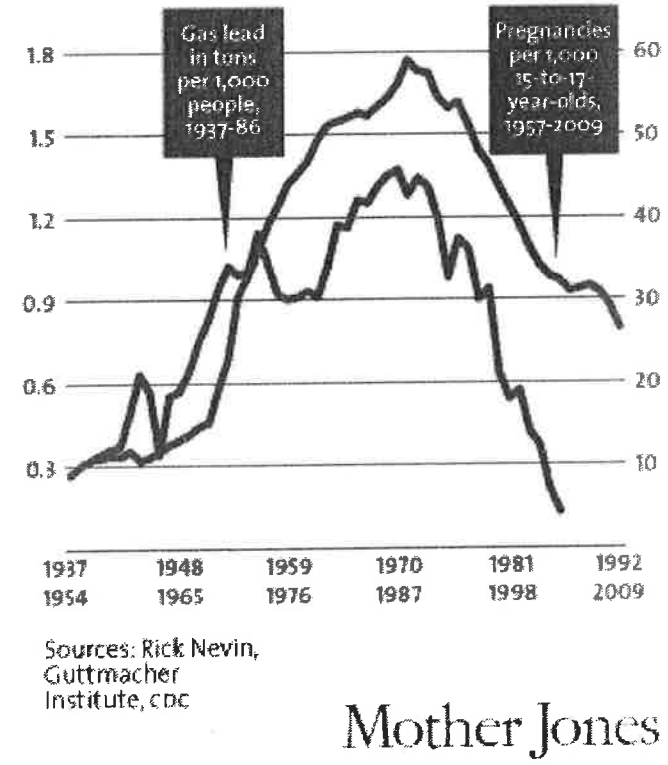
What happens when you expose a generation of kids to high lead levels? Crime and teen pregnancy data two decades later tell a startling story.

Second, and far more puzzling, it's not just New York that has seen a big drop in crime. In city after city, violent crime peaked in the early '90s and then began a steady and spectacular decline. Washington, DC, didn't have either Giuliani or Bratton, but its violent crime rate has dropped 58 percent since its peak. Dallas' has fallen 70 percent. Newark: 74 percent. Los Angeles: 78 percent.

There must be more going on here than just a change in policing tactics in one city. But what?

There are, it turns out, plenty of theories. When I started research for this story, I worked my way





through a pair of thick [11] criminology tomes [12]. One chapter regaled me with the "exciting possibility" that it's mostly a matter of economics: Crime goes down when the economy is booming and goes up when it's in a slump. Unfortunately, the theory doesn't seem to hold water—for example, crime rates have continued to drop recently despite our prolonged downturn.

Another chapter suggested that crime drops in big cities were mostly a reflection of the crack epidemic of the '80s finally burning itself out. A trio of authors identified three major "drug eras" in New York City, the first dominated by heroin, which produced limited violence, and the second by crack, which generated spectacular levels of it. In the early '90s, these researchers proposed, the children of CrackGen switched to marijuana, choosing a less violent and more law-abiding lifestyle. As they did, crime rates in New York and other cities went down.

Another chapter told a story of demographics: As the number of young men increases, so does crime. Unfortunately for this theory, the number of young men increased during the '90s, but crime dropped anyway.

There were chapters in my tomes on the effect of prison expansion. On guns and gun control. On family. On race. On parole and probation. On the raw number of police officers. It seemed as if everyone had a pet theory. In 1999, economist Steven Levitt, later famous as the coauthor of *Freakonomics*, teamed up with John Donohue to suggest that crime dropped because of *Roe v. Wade* [13]; legalized abortion, they argued, led to fewer unwanted babies, which meant fewer maladjusted and violent young men two decades later.

But there's a problem common to all of these theories: It's hard to tease out actual proof. Maybe the end of the crack epidemic contributed to a decline in inner-city crime, but then again, maybe it was really the effect of increased incarceration, more cops on the beat, broken-windows policing, and a rise in abortion rates 20 years earlier. After all, they all happened at the same time.

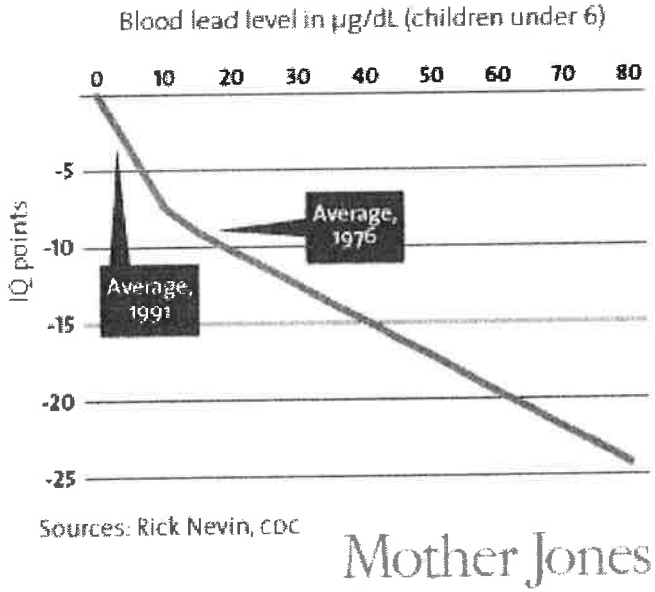
To address this problem, the field of econometrics gives researchers an enormous toolbox of sophisticated statistical techniques. But, notes statistician and conservative commentator Jim Manzi in his recent book *Uncontrolled* [14], econometrics consistently fails to explain most of the variation in crime rates. After reviewing 122 known field tests, Manzi found that only 20 percent demonstrated positive results for specific crime-fighting strategies, and none of those positive results were replicated in follow-up studies.

So we're back to square one. More prisons might help control crime, more cops might help, and better policing might help. But the evidence is thin for any of these as the main cause. What are we missing?

Experts often suggest that crime resembles an epidemic. But what kind? Karl Smith, a professor of public economics and government at the University of North Carolina-Chapel Hill, has a good rule of thumb for categorizing epidemics [15]: If it spreads along lines of communication, he says, the cause is information. Think Bieber Fever. If it travels along major transportation routes, the cause is microbial. Think influenza. If it spreads out like a fan, the cause is an insect. Think malaria. But if it's everywhere, all at once —as both the rise of crime in the '60s and '70s and the fall of crime in the '90s seemed to be—the cause is a molecule.

Did Lead Make You Dumber?

Even low levels have a significant effect.



A molecule? That sounds crazy. What molecule could be responsible for a steep and sudden decline in violent crime?

Well, here's one possibility: $Pb(CH_2CH_3)_4$.

In 1994, Rick Nevin was a consultant working for the US Department of Housing and Urban Development on the costs and benefits of removing lead paint from old houses. This has been a topic of intense study because of the growing body of research linking lead exposure in small children with a whole raft of complications later in life, including lower IQ, hyperactivity, behavioral problems, and learning disabilities.

But as Nevin was working on that assignment, his client suggested they might be missing something. A recent study had suggested a link between childhood lead exposure and juvenile delinquency later on. Maybe reducing lead exposure had an effect on violent crime too?

That tip took Nevin in a different direction. The biggest source of lead in the postwar era, it turns out, wasn't paint. It was leaded gasoline. And if you chart the rise and fall of atmospheric lead caused by the rise and fall of leaded gasoline consumption, you get a pretty simple upside-down U: Lead emissions from tailpipes rose steadily from the early '40s through the early '70s, nearly quadrupling over that period. Then, as unleaded gasoline began to replace leaded gasoline, emissions plummeted.

Intriguingly, violent crime rates followed the same upside-down U pattern. The only thing different was the time period: Crime rates rose dramatically in the '60s through the '80s, and then began dropping steadily starting in the early '90s. The two curves looked eerily identical, but were offset by about 20 years.

Gasoline lead may explain as much as 90 percent of the rise and fall of violent crime over the past half century.

So Nevin dove in further, digging up detailed data on lead emissions and crime rates to see if the similarity of the curves was as good as it seemed. It turned out to be even better: In a 2000 paper [16] (PDF) he concluded that if you add a lag time of 23 years, lead emissions from automobiles explain 90 percent of the variation in violent crime in America. Toddlers who ingested high levels of lead in the '40s and '50s really were more likely to become violent criminals in the '60s, '70s, and '80s.

And with that we have our molecule: tetraethyl lead, the gasoline additive invented by General Motors in the 1920s to prevent knocking and pinging in high-performance engines. As auto sales boomed after World War II, and drivers in powerful new cars increasingly asked service station attendants to "fill 'er up with ethyl," they were unwittingly creating a crime wave two decades later.

It was an exciting conjecture, and it prompted an immediate wave of... nothing. Nevin's paper was almost completely ignored, and in one sense it's easy to see why—Nevin is an economist, not a criminologist, and his paper was published in *Environmental Research*, not a journal with a big readership in the criminology community. What's more, a single correlation between two curves isn't all that impressive, econometrically speaking. Sales of vinyl LPs rose in the postwar period too, and then declined in the '80s and '90s. Lots of things follow a pattern like that. So no matter how good the fit, if you only have a single correlation it might just be a coincidence. You need to do something more to establish causality.

As it turns out, however, a few hundred miles north someone was doing just that. In the late '90s, Jessica Wolpaw Reyes was a graduate student at Harvard casting around for a dissertation topic that eventually became a study she published in 2007 as a public health policy professor at Amherst. "I learned about lead because I was pregnant and living in old housing in Harvard Square," she told me, and after attending a talk where future *Freakonomics* star Levitt outlined his abortion/crime theory, she started thinking about lead and crime. Although the association seemed plausible, she wanted to find out whether increased lead exposure *caused* increases in crime. But how?

In states where consumption of leaded gasoline declined slowly, crime declined slowly. Where it declined quickly, crime declined quickly.

The answer, it turned out, involved "several months of cold calling" to find lead emissions data at the state level. During the '70s and '80s, the introduction of the catalytic converter, combined with increasingly stringent Environmental Protection Agency rules, steadily reduced the amount of leaded gasoline used in America, but Reyes discovered that this reduction wasn't uniform. In fact, use of leaded gasoline varied widely among states, and this gave Reyes the opening she needed. If childhood lead exposure really did produce criminal behavior in adults, you'd expect that in states where consumption of leaded gasoline declined slowly, crime would decline slowly too. Conversely, in states where it declined quickly, crime would decline quickly. And that's exactly what she found [17].

Meanwhile, Nevin had kept busy as well, and in 2007 he published a new paper looking at crime trends around the world [18] (PDF). This way, he could make sure the close match he'd found between the lead curve and the crime curve wasn't just a coincidence. Sure, maybe the real culprit in the United States was something else happening at the exact same time, but what are the odds of that same something happening at several *different* times in several *different* countries?

Nevin collected lead data and crime data for Australia and found a close match. Ditto for Canada. And Great Britain and Finland and France and Italy and New Zealand and West Germany. Every time, the two curves fit each other astonishingly well. When I spoke to Nevin about this, I asked him if he had ever found a country that didn't fit the theory. "No," he replied. "Not one."

Just this year, Tulane University researcher Howard Mielke published a paper [19] with demographer Sammy Zahran on the correlation of lead and crime at the city level. They studied six US cities that had both good crime data and good lead data going back to the '50s, and they found a good fit in every single one. In fact, Mielke has even studied lead concentrations at the *neighborhood* level in New Orleans and shared his maps with the local police. "When they overlay them with crime maps," he told me, "they realize they match up."

Location, Location, Location

In New Orleans, lead levels can vary dramatically from one neighborhood to the next—and the poorest neighborhoods tend to be the worst hit.

Sources: Howard Mielke, US Census

Maps by Karen Minot

Put all this together and you have an astonishing body of evidence. We now have studies at the international level, the national level, the state level, the city level, and even the individual level. Groups of children have been followed from the womb to adulthood, and higher childhood blood lead levels are consistently associated with higher adult arrest rates for violent crimes [20]. All of these studies tell the same story: Gasoline lead is responsible for a good share of the rise and fall of violent crime over the past half century.

Like many good theories, the gasoline lead hypothesis helps explain some things we might not have realized even needed explaining. For example, murder rates have always been higher in big cities than in towns and small cities. We're so used to this that it seems unsurprising, but Nevin points out that it might actually have a surprising explanation—because big cities have lots of cars in a small area, they also had high densities of atmospheric lead during the postwar era. But as lead levels in gasoline decreased, the differences between big and small cities largely went away. And guess what? The difference in murder rates went away too. Today, homicide rates are similar in cities of all sizes [21]. It may be that violent crime isn't an inevitable consequence of being a big city after all.

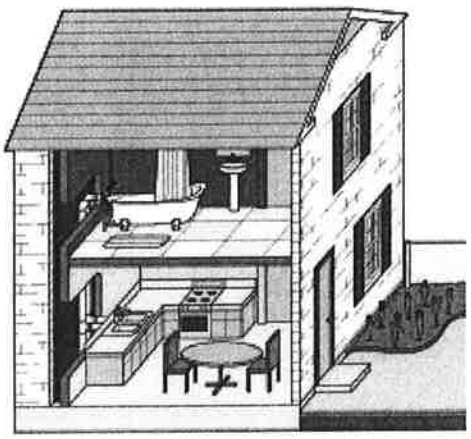
When differences of atmospheric lead density between big and small cities largely went away, so did the difference in murder rates.

The gasoline lead story has another virtue too: It's the only hypothesis that persuasively explains both the rise of

crime in the '60s and '70s and its fall beginning in the '90s. Two other theories—the baby boom demographic bulge and the drug explosion of the '60s—at least have the potential to explain both, but neither one fully fits the known data. Only gasoline lead, with its dramatic rise and fall following World War II, can explain the equally dramatic rise and fall in violent crime.

If econometric studies were all there were to the story of lead, you'd be justified in remaining skeptical no matter how good the statistics look. Even when researchers do their best—controlling for economic growth, welfare payments, race, income, education level, and everything else they can think of—it's always possible that something they haven't thought of is still lurking in the background. But there's another reason to take the lead hypothesis seriously, and it might be the most compelling one of all: Neurological research is demonstrating that lead's effects are even more appalling, more permanent, and appear at far lower levels than we ever thought. For starters, it turns out that childhood lead exposure at nearly *any* level can seriously and permanently reduce IQ. Blood lead levels are measured in micrograms per deciliter, and levels once believed safe—65 µg/dL, then 25, then 15, then 10—are now known to cause serious damage. The EPA now says [22] flatly that there is "no demonstrated safe concentration of lead in blood," and it turns out that even levels under 10 µg/dL can reduce IQ by as much as seven points. An estimated 2.5 percent of children nationwide have lead levels above 5 µg/dL.

But we now know that lead's effects go far beyond just IQ. Not only does lead promote apoptosis, or cell death, in the brain, but the element is also chemically similar to calcium. When it settles in cerebral tissue, it prevents calcium ions from doing their job, something that causes physical damage to the developing brain that persists into adulthood.



[2]

Is There Lead in Your House? [2]

Only in the last few years have we begun to understand exactly what effects this has. A team of researchers at the University of Cincinnati has been following a group of 300 children for more than 30 years and recently performed a series of MRI scans that highlighted the neurological differences between subjects who had high and low exposure to lead during early childhood.

High childhood exposure damages

One set of scans [23] found that lead exposure is linked to production of the brain's white matter—primarily a substance called myelin, which forms an insulating sheath around the connections between neurons. Lead

a part of the brain linked to aggression control and "executive functions." And the impact turns out to be greater among boys.

exposure degrades both the formation and structure of myelin, and when this happens, says Kim Dietrich, one of the leaders of the imaging studies, "neurons are not communicating effectively." Put simply, the network connections within the brain become both slower and less coordinated.

A second study [24] found that high exposure to lead during childhood was linked to a permanent loss of gray matter in the prefrontal cortex—a part of the brain associated with aggression control as well as what psychologists call "executive functions": emotional regulation, impulse control, attention, verbal reasoning, and mental flexibility. One way to understand this, says Kim Cecil, another member of the Cincinnati team, is that lead affects precisely the areas of the brain "that make us most human."

So lead is a double whammy: It impairs specific parts of the brain responsible for executive functions *and* it impairs the communication channels between these parts of the brain. For children like the ones in the Cincinnati study, who were mostly inner-city kids with plenty of strikes against them already, lead exposure was, in Cecil's words, an "additional kick in the gut." And one more thing: Although both sexes are affected by lead, the neurological impact turns out to be greater among boys than girls.

Other recent [25] studies link [26] even minuscule blood lead levels with attention deficit/hyperactivity disorder. Even at concentrations well below those usually considered safe—levels still common today—lead increases the odds of kids developing ADHD.

In other words, as Reyes summarized the evidence in her paper, even moderately high levels of lead exposure are associated with aggressivity, impulsivity, ADHD, and lower IQ. And right there, you've practically defined the profile of a violent young offender.

Needless to say, not every child exposed to lead is destined for a life of crime. Everyone over the age of 40 was probably exposed to too much lead during childhood, and most of us suffered nothing more than a few points of IQ loss. But there were plenty of kids already on the margin, and millions of those kids were pushed over the edge from being merely slow or disruptive to becoming part of a nationwide epidemic of violent crime. Once you understand that, it all becomes blindingly obvious. *Of course* massive lead exposure among children of the postwar era led to larger numbers of violent criminals in the '60s and beyond. And *of course* when that lead was removed in the '70s and '80s, the children of that generation lost those artificially heightened violent tendencies.

But if all of this solves one mystery, it shines a high-powered klieg light on another: Why has the lead/crime connection been almost completely ignored in the criminology community? In the two big books I mentioned earlier, one has no mention of lead at all and the other has a grand total of two passing references. Nevin calls it "exasperating" that crime researchers haven't seriously engaged with lead, and Reyes told me that although the public health community was interested in her paper, criminologists have largely been AWOL. When I asked Sammy Zahran about the reaction to his paper with Howard Mielke on correlations between lead and crime at the city level, he just sighed. "I don't think criminologists have even read it," he said. All of this jibes with my own reporting. Before he died last year, James Q. Wilson—father of the broken-windows theory, and the dean of the criminology community—had begun to accept that lead probably played a meaningful role in the crime drop of the '90s. But he was apparently an outlier. None of the criminology experts I contacted showed any interest in the lead hypothesis at all.

Police chiefs "want to think what they do on a daily basis matters," says a public health expert. "And it does." But maybe not as much as they think.

Why not? Mark Kleiman [27], a public policy professor at the University of California-Los Angeles who has studied promising methods of controlling crime, suggests that because criminologists are basically sociologists, they look for sociological explanations, not medical ones. My own sense is that interest groups probably play a crucial role: Political conservatives want to blame the social upheaval of the '60s for the rise in crime that followed. Police unions have reasons for crediting its decline to an increase in the number of cops. Prison guards like the idea that increased incarceration is the answer. Drug warriors want the story to be about drug policy. If the actual answer turns out to be lead poisoning, they all lose a big pillar of support for their pet issue. And while lead abatement could be big business for contractors and builders, for some reason their trade groups have never taken it seriously.

More generally, we all have a deep stake in affirming the power of deliberate human action. When Reyes once presented her results to a conference of police chiefs, it was, unsurprisingly, a tough sell. "They want to think that what they do on a daily basis matters," she says. "And it does." But it may not matter as much as they think.

So is this all just an interesting history lesson? After all, leaded gasoline has been banned since 1996, so even if it had a major impact on violent crime during the 20th century, there's nothing more to be done on that front. Right?

Wrong. As it turns out, tetraethyl lead is like a zombie that refuses to die. Our cars may be lead-free today, but they spent more than 50 years spewing lead from their tailpipes, and all that lead had to go somewhere. And it did: It settled permanently into the soil that we walk on, grow our food in, and let our kids play around.

That's especially true in the inner cores of big cities, which had the highest density of automobile traffic. Mielke has been studying lead in soil for years, focusing most of his attention on his hometown of New Orleans, and he's measured 10 separate census tracts there with lead levels over 1,000 parts per million.

To get a sense of what this means, you have to look at how soil levels of lead typically correlate with blood levels, which are what really matter. Mielke has studied this in New Orleans [28], and it turns out that the numbers go up very fast even at low levels. Children who live in neighborhoods with a soil level of 100 ppm have average blood lead concentrations of 3.8 µg/dL—a level that's only barely tolerable. At 500 ppm, blood levels go up to 5.9 µg/dL, and at 1,000 ppm they go up to 7.5 µg/dL. These levels are high enough to do serious damage.

> "I know people who have moved into gentrified neighborhoods and immediately renovate everything. They create huge hazards for their kids."

Mielke's partner, Sammy Zahran, walked me through a lengthy—and hair-raising—presentation about the effect that all that old gasoline lead continues to have in New Orleans. The very first slide describes the basic problem: Lead in soil doesn't *stay* in the soil. Every summer, like clockwork, as the weather dries up, all that lead gets kicked back into the atmosphere in a process called resuspension. The zombie lead is back to haunt us.

Mark Laidlaw, a doctoral student who has worked with Mielke, explains how this works [29]: People and pets track lead dust from soil into houses, where it's ingested by small children via hand-to-mouth contact. Ditto for lead dust generated by old paint inside houses. This dust cocktail is where most lead exposure today comes from.

Paint hasn't played a big role in our story so far, but that's only because it didn't play a big role in the rise of crime in the postwar era and its subsequent fall. Unlike gasoline lead, lead paint was a fairly uniform problem during this period, producing higher overall lead levels, especially in inner cities, but not changing radically over time. (It's a different story with the first part of the 20th century, when use of lead paint did rise and then fall somewhat dramatically. Sure enough, murder rates rose and fell in tandem.)

And just like gasoline lead, a lot of that lead in old housing is still around. Lead paint chips flaking off of walls are

one obvious source of lead exposure, but an even bigger one, says Rick Nevin, are old windows. Their friction surfaces generate lots of dust as they're opened and closed. (Other sources—lead pipes and solder, leaded fuel used in private aviation, and lead smelters—account for far less.)

We know that the cost of all this lead is staggering, not just in lower IQs, delayed development, and other health problems, but in increased rates of violent crime as well. So why has it been so hard to get it taken seriously?

There are several reasons. One of them was put bluntly by Herbert Needleman, one of the pioneers of research into the effect of lead on behavior. A few years ago, a reporter from the *Baltimore City Paper* asked him why so little progress had been made recently on combating the lead-poisoning problem. "Number one," he said without hesitation [30], "it's a black problem." But it turns out that this is an outdated idea. Although it's true that lead poisoning affects low-income neighborhoods disproportionately, it affects plenty of middle-class and rich neighborhoods as well. "It's not just a poor-inner-city-kid problem anymore," Nevin says. "I know people who have moved into gentrified neighborhoods and immediately renovate everything. And they create huge hazards for their kids."

Tamara Rubin, who lives in a middle-class neighborhood in Portland, Oregon, learned this the hard way when two of her children developed lead poisoning after some routine home improvement in 2005. A few years later, Rubin started the Lead Safe America Foundation [31], which advocates for lead abatement and lead testing. Her message: If you live in an old neighborhood or an old house, get tested. And if you renovate, do it safely.

Another reason that lead doesn't get the attention it deserves is that too many people think the problem was solved years ago. They don't realize how much lead is still hanging around, and they don't understand just how much it costs us.

It's difficult to put firm numbers to the costs and benefits of lead abatement. But for a rough idea, let's start with the two biggest costs. Nevin estimates that there are perhaps 16 million pre-1960 houses with lead-painted windows, and replacing them all would cost something like $10 billion per year over 20 years. Soil cleanup in the hardest-hit urban neighborhoods is tougher to get a handle on, with estimates ranging from $2 to $36 per square foot. A rough extrapolation from Mielke's estimate to clean up New Orleans suggests that a nationwide program might cost another $10 billion per year.

So in round numbers that's about $20 billion per year for two decades. But the benefits would be huge. Let's just take a look at the two biggest ones. By Mielke and Zahran's estimates, [32] if we adopted the soil standard of a

We can either get rid of the

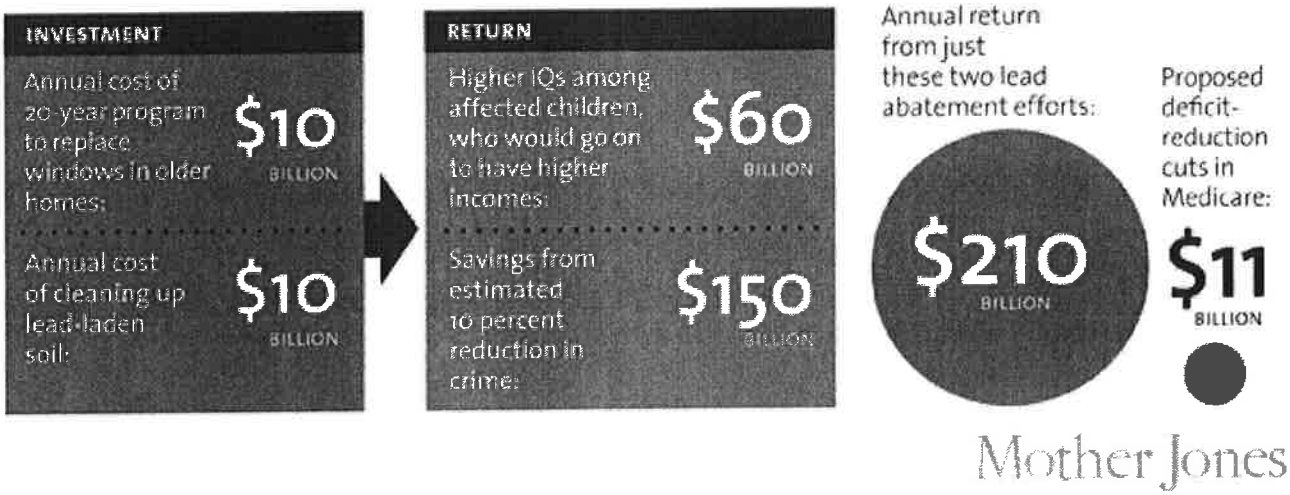
country like Norway (roughly 100 ppm or less), it would bring about $30 billion in annual returns from the cognitive benefits alone (higher IQs, and the resulting higher lifetime earnings). Cleaning up old windows might double this. And violent crime reduction would be an even bigger benefit. Estimates here are even more difficult, but Mark Kleiman suggests that a 10 percent drop in crime—a goal that seems reasonable if we get serious about cleaning up the last of our lead problem—could produce benefits as high as $150 billion per year.

remaining lead, or we can wait 20 years and then lock up all the kids who've turned into criminals.

Put this all together and the benefits of lead cleanup could be in the neighborhood of $200 billion per year. In other words, an annual investment of $20 billion for 20 years could produce returns of 10-to-1 *every single year* for decades to come. Those are returns that Wall Street hedge funds can only dream of.

Memo to Deficit Hawks: Get the Lead Out

Lead abatement isn't cheap, but the return on investment is mind-blowing.



There's a flip side to this too. At the same time that we should reassess the low level of attention we pay to the remaining hazards from lead, we should probably also reassess the *high* level of attention we're giving to other policies. Chief among these is the prison-building boom that started in the mid-'70s. As crime scholar William Spelman wrote a few years ago, states have "doubled their prison populations, then doubled them again, increasing their costs by more than $20 billion per year"—money that could have been usefully spent on a lot of other things. And while some scholars conclude that the prison boom had an effect on crime, recent research suggests that rising incarceration rates suffer from diminishing returns: Putting more criminals behind bars is useful

up to a point, but beyond that we're just locking up more people without having any real impact on crime. What's more, if it's true that lead exposure accounts for a big part of the crime decline that we formerly credited to prison expansion and other policies, those diminishing returns might be even more dramatic than we believe. We probably overshot on prison construction years ago; one doubling might have been enough. Not only should we stop adding prison capacity, but we might be better off returning to the incarceration rates we reached in the mid-'80s.

So this is the choice before us: We can either attack crime at its root by getting rid of the remaining lead in our environment, or we can continue our current policy of waiting 20 years and then locking up all the lead-poisoned kids who have turned into criminals. There's always an excuse not to spend more money on a policy as tedious-sounding as lead abatement—budgets are tight, and research on a problem as complex as crime will never be definitive—but the association between lead and crime has, in recent years, become pretty overwhelming. If you gave me the choice, right now, of spending $20 billion less on prisons and cops and spending $20 billion more on getting rid of lead, I'd take the deal in a heartbeat. Not only would solving our lead problem do more than any prison to reduce our crime problem, it would produce smarter, better-adjusted kids in the bargain. There's nothing partisan about this, nothing that should appeal more to one group than another. It's just common sense. Cleaning up the rest of the lead that remains in our environment could turn out to be the cheapest, most effective crime prevention tool we have. And we could start doing it tomorrow.

Support for this story was provided by a grant from the Puffin Foundation Investigative Journalism Project.

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[13] http://www.slate.com/articles/news_and_politics/dialogues/features/1999/does_abortion_prevent_crime/_2.html
[14] http://www.powells.com/biblio/64-9780465023240-0
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[22] https://www.motherjones.com/documents/531159-americas-children-and-the-environment-epa#document/p42/a84512
[23] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2789851/
[24] http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.0050112
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[26] http://www.ncbi.nlm.nih.gov/pubmed/17185283
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[29] http://urbanleadpoisoning.com
[30] http://www2.citypaper.com/news/story.asp?id=9738
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[32] http://www.sciencedirect.com/science/article/pii/S0048969710012672

DECEMBER 10, 2014

Legal Settlement Aims at Reducing Lead Poisoning Risks From California Airports

Avgas Companies at LAX, Oakland International Airport, John Wayne Airport and Others To Clean Up Lead-Tainted Fuel

Oakland, CA-The Center for Environmental Health today announced it has won a legal agreement with 30 companies that sell and/or distribute lead-containing aviation gas (avgas) at 23 California airports, calling on the companies to provide safer alternative fuels. The companies include the leading suppliers of aviation fuels made by Chevron, Shell Oil, and other major fuel companies. The settlement includes fuel companies operating at airports identified by the EPA as having some of the highest lead emissions among all airports nationally, including Van Nuys Airport in LA County (listed by EPA as the airport with the country's highest lead emissions), Los Angeles International (LAX), Oakland International, Orange County's John Wayne Airport, Montgomery Field in San Diego, and others throughout the state.

Lead is an additive in avgas used in piston-engine aircraft, usually small planes classified for general aviation or as air taxis, to boost fuel octane and purportedly to improve performance. In 2008, 550 tons of lead was used in the making of avgas. The EPA has noted that lead emissions from aviation fuel are "expected to distribute widely through the environment," and has previously found that emissions from small aircraft using leaded gas account for half of the nation's air emissions of lead.

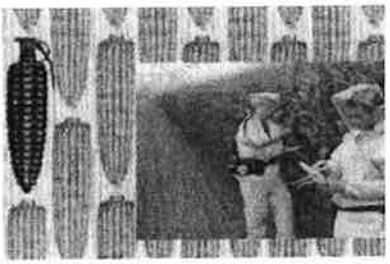
"With this settlement today, we expect the aviation industry to move more quickly to towards safer, lead-free fuels," said Caroline Cox, CEH Research Director. "No one living near an airport should be exposed to a stunningly toxic chemical like lead when safer fuels are available." The case, "CEH vs. Aerodynamic Aviation (RG11 600721)", was heard in Alameda County Superior Court.

Some alternative aviation fuels already exist. For example, a newer form of Avgas, known as 100VLL for "very low lead," has recently been approved by the Federal Aviation Administration, but most suppliers have not yet made it available in California. Also, ethanol-free premium automotive gas (Mogas) is an FAA-approved fuel that is compatible with more than 70 percent of current aircraft. In addition, the FAA is now testing four lead-free aviation fuels. including fuels made by Shell and Total.

Under the agreement with CEH, the fuel distributors will offer for sale the lowest-lead fuel that is commercially available in sufficient quantity. The

CEH Blog

From the Desk of...Tom Cotton?
CENTER FOR ENVIRONMENTAL HEALTH
APRIL 1, 2015



A Once-in-a-Century Pesticide (that Probably Causes Cancer)
CAROLINE COX MARCH 23, 2015

Black Lives Matter & Environmental Justice
CHARLES MARGULIS
JANUARY 26, 2015

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companies will also make Mogas available to airport-based fuel companies (fixed base operators, or FBOs) that request it, subject to certain terms (eg, coverage under liability insurance) and availability. The companies are also required to warn residents living within one kilometer of the airports where they operate of the lead risk, and to post warning signs at the airports. The companies, including Air Petro Corporation (a leading seller of Chevron fuels), Eastern Aviation Fuels (a leading national marketer of Shell branded fuels), Avfuel Corporation (the nation's leading independent supplier of aviation fuels) and others will pay a combined $550,000 in penalties and legal costs.

Leaded aviation gas has been recognized as a problem for more than a decade. The Aircraft Owners and Pilots Association (AOPA), which joined with the National Air Transportation Association (NATA) and other aviation and petroleum trade groups to form the General Aviation Avgas Coalition, told EPA in a 2010 comment that the groups are committed to "an unleaded future." In 2011, the FAA and EPA created the Unleaded Avgas Transition Aviation Rulemaking Committee, including industry representatives from the AOPA and NATA, to come up with lead-free solutions. But the groups' 2012 report called for an 11 year process to phase-in lead-free fuels.

"Eleven years is too long to wait for clean air free from lead poisoning risks," said Cox. "We will continue to monitor the industry and keep the pressure on for safer fuels as quickly as possible."

The Center for Environmental Health (CEH) is the leading national nonprofit committed to ending health threats from toxic chemicals in our air, water, food and in products we use every day. CEH protects children and families from harmful chemicals by working with communities, consumers, workers, and government to demand and support safer business practices. We also work with major industries and leaders in green business to promote healthier alternatives to toxic products and practices.

Settling Defendants:

Air88,Inc.d/b/aCrown Air Aviation
Air RutterInternational LLC
AirFlite, Inc.
Airport Property Partners LLCd/b/aAPPJetCenter
Amelia Reid Aviation LLC
American Airports Corporation
Ameriflyers of California
Atlantic Aviation Corporation
Aviation Consultants, Inc.d/b/a San Luis Jet Center
Business Jet Center Oakland,LP
California in Nice,Inc.d/b/a Nice Air
Castle & Cooke Aviation Services,Inc.
Channel Islands Aviation,Inc.
KaiserAir,Inc.
Lanc Air Corp.d/b/aSan Diego Jet Center
Landmark Aviation
Loyd's Aviation
Maguire Aviation Group,LLC
Napa Jet Center, Inc.
Pacific States Aviation Inc.
Rossi Aircraft,Inc.

Sacramento International Jet Center,Inc.
Signature Flight Support Corporation
South Bay Aviation,Inc.
Sun Air Jet,LLC
Van Nuys Skyways d/b/aMillionAirBurbank
Air Petro Corporation and World Fuel Services Corporation
Avfuel Corporation
Eastern Aviation Fuels, Inc.
Downstream Aviation, LP

Airports:

1. Bob Hope
2. Brackett Field
3. Brown Field Muni Airport
4. Buchanan Field
5. Camarillo Airport
6. El Monte Airport
7. Fresno Yosemite Internatl Airport
8. Hayward Executive
9. John Wayne Airport
10. Long Beach Airport (Daugherty Field)
11. Los Angeles Internatl Airport
12. Meadows Field
13. Montgomery Field
14. Napa County Airport
15. Oakland Internatl Airport
16. Palo Alto Airport
17. Reid-Hillview Airport
18. Sacramento Executive Airport
19. San Luis Obispo County Regional Airport
20. Santa Barbara Municipal Airport
21. Santa Monica Municipal Airport
22. Van Nuys Airport
23. Zamperini Field

Tags: ***airplanes, avgas, California, fuel, Lead, planes, poisoning, toxic***

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Lead poisoning toll revised to 1 in 38 young kids

Alison Young, USA TODAY *3:16 p.m. EDT April 4, 2013*

The increase is the result of the government last year lowering the threshold for lead poisoning.

(Photo: Chitose Suzuki, AP)

An estimated 535,000 young children in the United States have harmful levels of lead in their bodies, putting them at risk of lost intelligence, attention disorders and other life-long health problems, according to a new estimate released Thursday by federal health officials.

The new number shows lead poisoning affects 1 in 38 children ages 1 to 5, according to the report by the Centers for Disease Control and Prevention.

"To the extent that Americans think this is a problem of the past, clearly this is evidence there is still a problem," said Rebecca Morley, executive director of the National Center for Healthy Housing, a non-profit lead-poisoning-prevention advocacy group.

Morley noted that Congress has eliminated most of the CDC's funding for federal lead-poisoning-prevention programs nationwide, which is reducing or eliminating services to help identify exposure sources for poisoned children and take steps to prevent the poisoning of others.

Last May, for the first time since 1991, the CDC revised its standard for lead in a child's blood, cutting by half the amount that should trigger public health actions. The change was based on a growing body of scientific evidence showing even low-level exposures to lead can cause significant harm to children. The new report says an estimated 2.6% of young children are estimated to have a blood-lead level of at least 5, the new CDC standard.

"No safe blood lead level ... in children has been identified," the CDC report notes.

As lead has been removed from gasoline and paint, the CDC notes that substantial progress has been made reducing the number of U.S. children with elevated levels of lead in their bodies. In the 1976-80 period, the CDC estimates, 88% of children had blood-lead levels of at least 10, the CDC's previous action level for lead poisoning.

Children today continue to be exposed to lead from a variety of sources. Experts say lead-contaminated house dust and soil are among the most important sources, with children ingesting lead particles when they put dust-covered hands and toys in their mouths. Many older homes contain lead-based paint, which deteriorates into a fine dust. Soil can be contaminated from paint, but also with fallout from historical factory emissions and vehicles that once burned leaded gasoline.

USA TODAY's "Ghost Factories" investigation (http://ghostfactories.usatoday.com) found dangerous levels of lead contamination in neighborhoods across the country.

The CDC report notes that its latest review of lead poisoning data continues to find disparities based on race and income in the amount of lead in children's bodies. The report said, "These disparities can be traced to differences in housing quality, environmental conditions, nutrition, and other factors designed to control or eliminate lead exposure."

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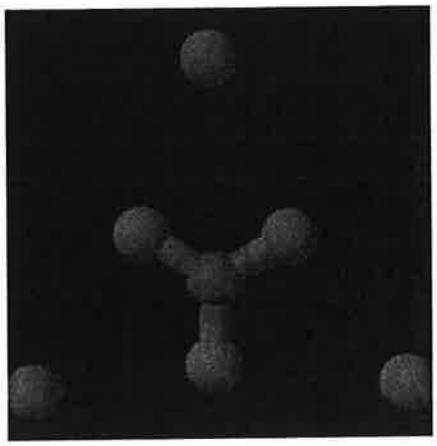
Energy & Sustainability » News

Lead Exposure on the Rise Despite Decline in Poisoning Cases

Leaded gasoline and lead paint are gone, but other sources are keeping the danger high

February 17, 2013 | By Mark Fischetti |



Courtesy of Ben Mills on Wikimedia Commons

BOSTON—Exposure to lead—so toxic—is a problem of the past, right? Wrong. Since the U.S. took lead out of gasoline in 1976 and banned lead paint in 1978, most health scientists, regulators and the public have considered the problem largely solved. But ongoing testing shows that even though the average concentration of lead in the American bloodstream has dropped by a factor of 10 since the late 1970s, the levels are still two orders of magnitude higher than natural human levels, which have been determined by studying skeletal remains of native Americans dating to before the industrial revolution.

Equally problematic, recent health studies have shown that exposure levels previously thought to be "safe" were too high. Scientists from various disciplines are advising the Environmental Protection Agency and health departments to lower the concentration deemed acceptable in the bloodstream, which today averages 1.3 micrograms per deciliter but can be much higher for many individuals. The change is warranted because the latest set of long-term tests done over decades has revealed that many of the health complications from lead arise even at low exposures. Higher levels are not necessary to instigate damage to the body or brain, Joel Schwartz of the Harvard School of Public Health told a somewhat surprised crowd on Feb. 16 here at the annual American Association for the Advancement of Science (AAAS) meeting. Excessive lead exposure correlates with a host of ills, including impaired cognition, attention deficit disorder and lower academic test scores for children, psychiatric disorders, and increased blood pressure, hypertension and arrhythmia.

Lead is also increasingly implicated in dementia in the elderly. As we age, our bones demineralize and release calcium (which is why calcium supplements are often recommended, especially for women). "But the bones also release lead," which accumulates in our skeletons over a lifetime, Schwartz said. "We don't know if the brain can adapt to the higher levels" of lead in the bloodstream, he said, calling for new research to find out.

The ramifications of lead exposure are financial as well, costing the U.S. about $209 billion a year, said Jessica Reyes, an economist at Amherst College. The bill includes everything from direct medical costs to a heightened need for special education classes and incarcerations for violent crime, which also correlates with higher lead exposure.

The ongoing trouble with lead exposure is not to be confused with lead *poisoning*, which has dropped significantly in developed countries, including the U.S. The latter condition is caused by acute exposure at high concentrations, which can occur from eating lead paint chips. But all the other problems "are more like chronic diseases that build over time," said A. Russell Flegal of the University of California, Santa Cruz. "We need to start thinking about the risks in that way."

Lead is still prevalent in our environment for many reasons. Because lead does not degrade, heavy emissions from the past accumulate in soil. Winds, especially during drought—like that afflicting the Midwest for the past year or so—kick it up as dust, and runoff from heavy rains and flooding can re-suspend the particles in the atmosphere. Trees take up soil particles, too, but when forests burn in wildfires, as has been occurring more frequently worldwide with global warming in recent years, that lead is released back into the air. Fires also release lead from old houses and buildings coated with lead paint that was applied prior to the U.S. ban. Lead smelting and refining is still an enormous industry worldwide, sending more of the metal into the environment. Aviation gas used in planes still contains lead.

Lead is still present in drinking water in many communities, where it can leach from lead pipes in homes, apartment buildings and municipal water system, or from brass fittings or solder used in plumbing. Another 25,000 to 30,000 tons of lead enters the U.S. environment each year from hunting and shooting-range ammunition, fishing-line weights, discarded batteries and electronic waste, said Mark Pokras at Tufts University.

Coal-burning power plants in developed nations also generate some lead in emissions and more so in ash, and the steep rise in coal power in China has boosted levels worldwide because regulations are more lax. Larger lead particles fall to the ground within about 200 meters of the source (including tailpipes, by the way), but the smaller particles, about 0.5 micron in size, can remain airborne for a week before they settle out. According to Flegal, lead particles from China have been found in rainfall in Santa Cruz, Calif.

Many steps can be taken nationwide to further reduce lead levels. Tougher emissions laws can be imposed. Lead paint, still sold in China, for example, can be banned in that country, or for import by other countries. Lead pipes and old lead paint can be removed. A high tax could be imposed on products containing lead, and lead in ammunition and fishing weights could be replaced with substitutes—although materials such as tungsten have not performed well in bullets. A different view about prevention is needed, too. For years, U.S. regulators have focused primarily on reducing lead poisoning, and they have succeeded. "So now we have to stop thinking about the problem as a small number of people who have an acute exposure, and start thinking about the problem as a large number of people who have a chronic exposure," Schwartz said.

Cost analyses might help push regulators into action, Reyes said. "Perhaps we will find that an X-amount of reduction in lead exposure equates with an X-amount of rise in test scores" [which has been shown in Massachusetts], she said. "Or perhaps we will find that a certain amount of reduction equates with a certain reduction in health-care costs."

Oregon Aviation Watch



On This Page

A Review of the Port of Portland Commissioned Business Assessment on Selling Mogas at the Hillsboro Airport

By Miki Barnes, LCSW
February 17, 2015

A "business case assessment" by private consultant KB Environmental on the possibility of making unleaded fuel available for sale at the Hillsboro Airport was released on 12/15/14. The report, which was prepared at the request of the Port of Portland (Port), was "designed and performed to evaluate the feasibility of providing unleaded, ethanol free, fuel (commonly known as 'mogas')" at the Port owned and operated Hillsboro Airport (HIO). Mogas would provide a third fuel option to the jet fuel and leaded avgas already available at HIO. The report concluded that, "The findings of the assessment show potentially favorable business outcomes for offering mogas at HIO..."[1]

As the title of the study suggests, its focus is on the economic business case for selling mogas, and does not acknowledge the urgency of the public outcry against exposure to toxic lead emissions which spurred the Port to commission this study.

Among the essential findings included in the report are the following:

- The FAA has established 2018 as the year by which it intends to make available "an unleaded replacement fuel for leaded aviation gasoline that is usable by most GA aircraft...a phase out period for the leaded fuels would likely extend to 2024 (i.e., approximately 10 years from now) at the earliest."[2]
- There are nearly 20,000 airports in the U.S. Only 120 of these facilities currently sell mogas. Of that number, two are in Oregon - Lebanon State and Grants Pass Airports.[3] EPA documentation revealed that in 2011 Grants Pass was the largest facility source of lead emissions in Josephine County. This airport began selling mogas in 2014.[4] HIO has a substantially higher annual operational count than any of the U.S. airports currently selling mogas.
- According to the January 2015 Federal Aviation Administration (FAA) Terminal Area Forecast (TAF), in 2013 HIO (which is predominantly a flight training airport) logged 210,000 annual take-offs and landings and had 277 aircraft based at the airport.[5] Grants Pass, by contrast, with 106 based aircraft, substantially less than half as many as HIO, logged 25,000 operations that same year.[6] The state owned Lebanon Airport, with 58 based aircraft, logged just under 10,000 operations in 2013.[7] It is also noteworthy that "Lebanon Airport mogas sales involve a substantial number of non-aeronautical users (i.e., boat and antique car owners)...This supplemental market would not likely apply to HIO due to security restrictions and the availability of non-ethanol containing fuel at a number of local service stations in the area."[8]

Lead Emissions at Airports in the Vicinity of HIO

The assessment included an analysis of the results of a survey distributed to 5,060 Oregon and Washington pilots by KB Environmental Services. According to the survey, only 26 percent of the 315 pilots who responded to the survey purchase leaded fuel at the Hillsboro Airport either through Hillsboro Aviation or Aero Air. The majority fueled up at other airports, which are also involved in the flight training industry. The top 6 airports for refueling are listed below, According to the Environmental Protection Agency (EPA) National Emissions

Inventory (NEI) all are listed as significant facility sources of lead emissions in their respective jurisdictions.

- **Scappoose Airpark (SPB) -** The EPA NEI ranked this Oregon airport as the number one facility source of lead emissions in Columbia County in 2011.
- **Twin Oaks (7S3) -** The EPA NEI ranked this Oregon airport as the second largest facility source of lead emissions in Washington County in 2011, surpassed only by HIO.
- **Aurora Airport (UAO) -** The EPA NEI ranked this Oregon airport as the number 1 facility source of lead emissions in Marion County in 2011.
- **Grove Field (1W1) -** The EPA NEI ranked this Washington state airport as the number 2 facility source of lead emissions in Clark County in 2011, surpassed only by Pearson Field.
- **Mulino (4S9) -** The EPA NEI ranked this Oregon airport as the number 1 facility source of lead emissions in Clackamas County in 2011.
- **Lebanon Airport (S30) -** The EPA NEI ranked this Oregon state airport as the number 2 facility source of lead emissions in Linn County in 2011, surpassed only by Albany Airport.

Background – HIO, Lead Emissions, and Public Health

Hillsboro Airport, the largest general aviation airport in Oregon, per the EPA is the number one facility source of lead in the state. The majority of the more than 200,000 annual operations at this airport are logged primarily on behalf of a private flight training school, Hillsboro Aero Academy, formerly Hillsboro Aviation. Most of the helicopters and fixed wing airplanes utilized for pilot training are piston engine aircraft, which currently rely on leaded fuel. Among nearly 20,000 U.S. airports, HIO ranks in the top one percent, 21st in the nation in lead emissions.[9]

As noted by Physicians for Social Responsibility's Toxics Program Manager, Kathy Attar, "The science is clear. There is no 'safe' level of blood lead, or exposure to lead. Research has found that even very low levels of lead exposure can have a detrimental impact on a child's IQ, likelihood of having a learning disability and educational attainment. That's why the law protects us from lead in paint and in our automobiles. Resolving lead in aviation fuel will benefit our communities through improved health and educational outcomes and decreased economic costs."[10]

Concluding Remarks

Though making mogas available is a step in the right direction, it is important to note that the use of this fuel is not currently mandated or required thus would be solely up to the discretion of the individual pilots. The assessment suggests that the sale of this fuel could lead to a reduction in HIO lead emissions of .05 to 0.1 tons per year (tpy). To put that in perspective, according to the FAA HIO Supplemental Assessment on the Proposed Third Runway, by 2016 emissions at this airport are expected to reach 0.8 tpy and, by 2021, 0.9 tpy. Thus the introduction of mogas might reduce lead emissions to between 0.7 to 0.75 tpy in 2016 and 0.8 to 0.85 tpy by 2021.[11] Thus even if mogas is made available, nearly three-quarters of a ton of lead or more annually will continue to be released into the environment by HIO aviation activity. Bearing in mind that as noted above, there is no safe level of lead in a child's blood, the option to provide mogas at HIO does not begin to address the magnitude of the problem. In addition, selling mogas at HIO does not address the emissions from nearby airports, which based on the business assessment survey results, are the primary sources of lead aviation fuel sales for users of the Hillsboro Airport.

Sources

[1] Business Case Assessment to Provide Mogas at Portland-Hillsboro Airport. Prepared for the Port of Portland by KB Environmental Sciences, Inc. (12/15/14). Pg. i. Available on-line at http://www.pdx.com/Content/PDF/HIO_HARE_Fuel_stdy.pdf.

[2] Ibid.

[3] Ibid.

[4] Hammill., Luke. As Hillsboro Airport Looks at Supplying Unleaded Fuel, Number of Airports Offering Product Doubles. Oregonian. 11/17/14.

[5] Hillsboro Airport. Federal Aviation Administration (FAA) Terminal Area Forecast (TAF). (January 2015).

[6] Ibid.

[7] Ibid.

[8] Ibid. Pg. 6.

[9] Hoyer, Marion and Pedde, Meredith. Selection of Airports for the Airport Monitoring Study. EPA Memorandum. (11/18/10) Pg. 2-4.

[10] Press Release: Coalition Statement on EPA's Response to Address Aviation Lead Pollution. (1/27/15). Available online at http://earthjustice.org/news/press/2015/coalition-statement-on-epa-s-response-to-address-aviation-lead-pollution.

[11] Hillsboro Airport Parallel Runway 12L/30R Final Supplemental Environmental Assessment. Prepared for the FAA by the Port of Portland. Vol. 1. Pg. 29-30. (February 2014).

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This slide presentation was prepared by Miki Barnes, LCSW, President of Oregon Aviation Watch for a Friday June 6, 2014 Air Quality Workshop convened by Senator Michael Dembrow and Representative Mitch Greenlick.

Oregon Aviation Watch

The mission of Oregon Aviation Watch is to enhance and protect the quality of life for Oregon residents by eliminating the adverse impacts of aviation activity.

Our vision is to achieve a transparent, accountable, and sustainable aviation system that neither disregards nor diminishes the environment, livability, health, or well-being of current and future generations of Oregon residents.

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Oregon Airports - Major Pollution Sources

- A review of the Environmental Protection Agency (EPA) National Emissions Inventory reveals that airports are major facility sources of a number of toxic emissions. There are 457 airports in Oregon - 97 public use and 360 private use.

- Many of the pollutants emitted by these airports are linked with negative health outcomes including cancer, respiratory ailments, dementia, IQ deficits, increased violence, cardiovascular disease, birth defects, ADHD, autism and a host of other serious and potentially life threatening conditions.

Commercial Airports and Pollution

- A May 2014 Massachusetts Department of Public Health study on the impacts of the Logan Airport (around 360,000 annual operations in 2013) in Boston found that children in high exposure areas closer to the airport were three to four times more likely to suffer from undiagnosed asthma as those in the low exposure areas. Adults living in the high exposure area for 3 or more years had a statistically higher chance of being diagnosed with Chronic Obstructive Pulmonary Disease (COPD).

- A May 2014 study published in the Environmental Science and Technology Journal found an at least 2-fold increase in particle numbers (PN) 10 miles downwind of Los Angeles Airport (around 583,000 operations in 2013) and a 4-5 fold increase 5-6 miles downwind. "These results suggest that airport emissions are a major source of PN in Los Angeles that are of the same general magnitude as the entire urban freeway network. They also indicate that the air quality impact areas of major airports may have been seriously underestimated."

Source: Emissions from an International Airport Increase Particle Number Concentrations 4-fold at 10 km Downwind. Abstract. (May 2014). Available online at http://pubs.acs.org/doi/full/10.1021/es5001566.

Pollutants Emitted by HIO

According to the 2011 EPA NEI, in Washington County:

- The Hillsboro Airport is the number one facility source of lead, acrolein, 1,3,butadiene, ethyl benzene, formaldehyde, acetaldehyde, organic carbon particulate matter 2.5, elemental carbon particulate matter 2.5 and carbon monoxide.
- HIO is the number two source of nitrous oxide, sulfur dioxide, and PM 2.5.
- HIO is the third largest source of volatile organic compounds.

HIO Aviation Activity and Lead

- Hillsboro Airport (HIO) emits more lead than any other facility source in Oregon.

- Nationwide, HIO is in the top one percent and ranks 21st out of nearly 20,000 U.S. airports in lead emissions.

  Source: EPA Memorandum from Hoyer M . and Pedde , to the Lead NAAQS Docket EPA-HQ-OAR-2006-0735. 11/18/10.

- Piston-engine general aviation aircraft use lead based fuel whereas commercial jets do not. The majority of the training and recreational operations flying in and out of HIO currently utilize leaded fuel.

  Source: *Lead Impacts from the Use of Leaded Aviation Gasoline in the United States.* Environmental Protection Agency: Technical Support Document (EPA420-R-08-020),. (October 2008).

Piston Engine Aircraft
Major Source of Lead Emissions

- Due to serious health risks associated with lead, it was phased out of automotive fuel between 1973 and 1996 and banned as a paint additive by 1978. Despite the dangers associated with this toxic substance, the general aviation industry persists in using leaded fuel.

- More than half of lead emissions into the air nationwide in 2008 were from piston engine aircraft.

Source: *Integrated Science Assessment for Lead.* U.S. Environmental Protection Agency. (June 2013). EPA/600/R-10/075F. Pg. lxxviii. Available online at http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=255721#Download

- "There are approximately 167,000 aircraft in the United States and a total of 230,000 worldwide that rely on 100 low lead avgas for safe operation."

Source Fact Sheet - Leaded Aviation Fuel and the Environment. Federal Aviation Administration. (6/19/13). Available at www.faa.gov.

Why does the U.S. have nearly 3 times as many lead emitting piston engine aircraft - 167,000 vs. 63,000 for the rest of the world combined? Clearly, other countries throughout the world have managed without this glut of publicly financed general aviation aircraft and airports.

- "Lead concentrations in air increase with proximity to airports where piston-engine aircraft operate."

Source: *Advance Notice of Proposed Rulemaking on Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline: Regulatory Announcement*. U.S. Environmental Protection Agency (EPA.). (April 2010) . Available online at http://www.epa.gov/nonroad/aviation/420f10013.htm.

- At this point there is no date set by which the FAA and EPA can or will ban 100LL [leaded aviation fuel].

Source: *Leaded Fuel Use in General Aviation Aircraft*. Port of Portland. Available online at http://www.portofportland.com/pdfpop/HAIR_LeadedFuel.pdf.

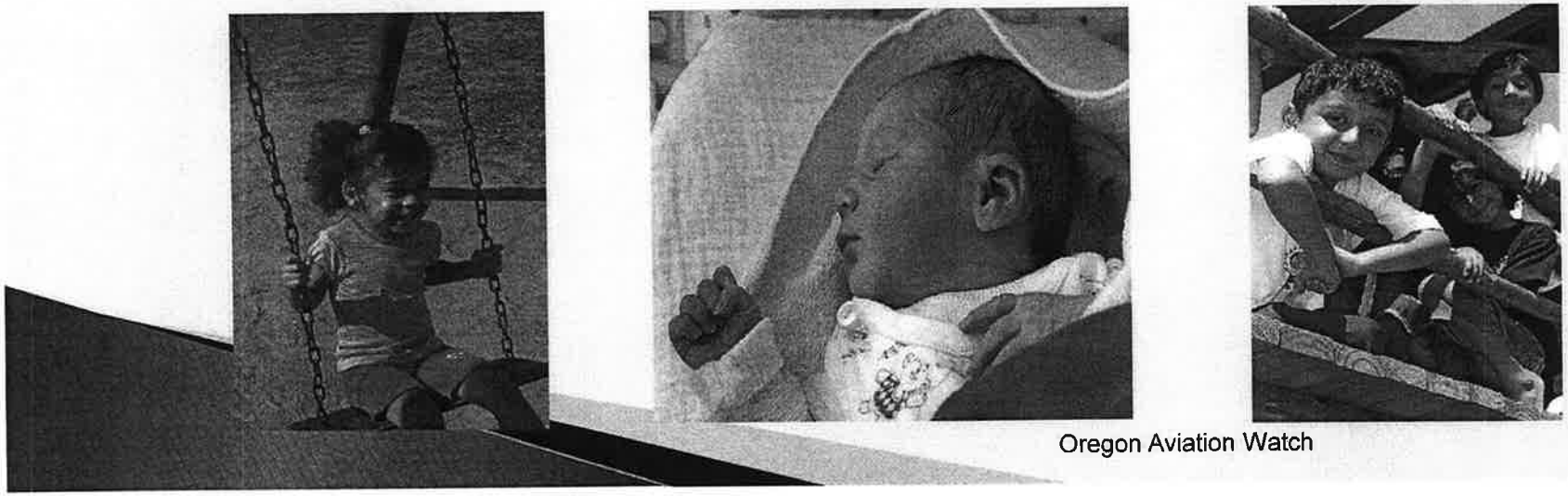
Why is Lead of Concern?

- Children are particularly vulnerable to the effects of lead. "...once an elevated blood lead concentration has been detected, it is too late to prevent lead's deleterious effects on the developing brain. This fact, plus the very low blood lead levels established to negatively impact development indicate that the only way to prevent childhood lead poisoning is to prevent lead from ever getting into children's bodies."

Source: Lidsky, T I. and Schneider, JS. *Lead Neurotoxicity in Children: Basic Mechanisms and Clinical Correlates*. Guarantors of Brain (2003), 126, 5-19.

- Estimates indicate "that the U.S. incurs $43.4 billion annually in the costs of all pediatric environmental disease, with childhood lead poisoning alone accounting for the vast majority of it. This is a very high cost to our society, which include medical costs, disability, education and parental lost work time."

Source: Agency for Toxic Substances and Disease Registry, *Case Studies in Environmental Medicine (CSEM) Lead Toxicity*. *(August 2010). Available online at* http://www.atsdr.cdc.gov/csem/lead/docs/lead.pdf.



Lead Exposure and Health Impacts in Adults

- Medical research has identified a causal relationship between lead and hypertension, coronary heart disease, decreased red blood cell survival, delayed puberty onset in both males and females, and impaired male reproductive function.

- A likely causal connection was found between lead and cancer, impaired female reproductive function, birth outcomes (low birth weight, spontaneous abortion), decreased resistance to bacterial infections, declines in cognitive function, and increases in depression and anxiety.

Source: *Integrated Science Assessment for Lead.* U.S. Environmental Protection Agency. (June 2013). EPA/600/R-10/075F. Pg. lxxxiii to lxxxvii.. Available online at http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=255721#Download.

Study on Airports and Blood Lead Levels in Children

After completing a study of airports in 6 North Carolina Counties, Duke University researchers concluded that, "living within 1000 m [2/3 mile] of an airport where aviation gasoline is used may have a significant effect on blood lead levels in children. Our results further suggest that the impacts of aviation gasoline are highest among those children living closest to the airport."

Source: Miranda, M.L., Anthopolos, R., Hastings D. *A geospatial analysis of the effects of aviation gasoline on childhood blood lead levels*. Children's Environmental Health Initiative, Nicholas School of the Environment. Duke University. (July 2011).

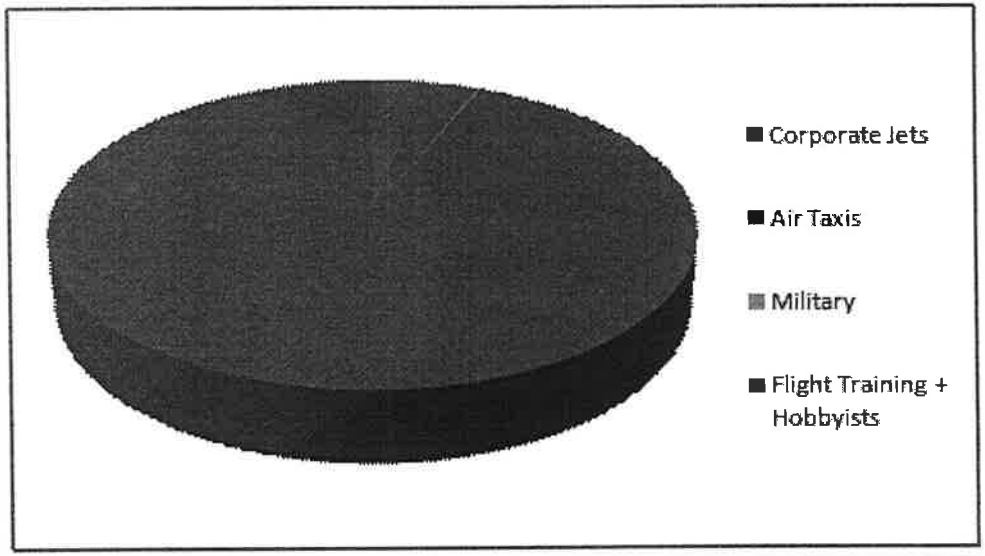
Hillsboro Airport – Aviation Activity

- HIO, a general aviation reliever airport, is owned and operated by the Port of Portland. It logged more operations in 2013 than PDX did. Over the past 15 years, the annual operation count at PDX has dropped to a 30 year low, commensurate with 1984 levels thus there is no congestion at PDX to relieve.

- According to the FAA in 2007 there were 224,461 annual operations (take-offs and landings) at HIO, however, the Port of Portland in their environmental assessment on the proposed third runway, stated that there were over 240,000 that year.

  - Corporate Jets – 7,008
  - Air Taxi/Commuter – 6,860
  - Military – 300
  - Flight Training & Hobbyist – 210,293

Sources: *FAA APO Terminal Area Forecast Detail Report,* (Dec. 2013) and Hillsboro Airport Draft Environmental Assessment. Volume 1. (October 2009). Pg. 5.1-5.



Hillsboro Airport (HIO) - Lead Emissions

- The vast majority of the approximately 220,000 annual take-offs and landings at HIO are piston engine training and recreational flights, many of which circle repetitively over nearby residential communities, schools, day care centers, and parks at altitudes below 2,000 feet. Additional practice flights train over prime farmland, waterways, and surrounding communities. Port of Portland estimates indicate that HIO alone is responsible for emitting 0.7 tpy, 1400 pounds.
- **HIO landing and take-off cycle lead emissions are expected to increase to 0.8 (tpy), 1600 lbs. by 2016 and 0.9 (tpy), 1800 lbs. by 2021.**

Source: Hillsboro Airport Parallel Runway 12L/30R Draft Supplemental Environmental Assessment. Prepared for Port of Portland. (3/15/13).

- HIO is surrounded on three sides by residential communities and on the fourth side by farmland. The blood lead levels of the children impacted by this airport have not been obtained or analyzed. Hillsboro's 35 public schools serve over 20,600 students.

Source: Hillsboro School District website at http//www.hsd.k12.or.us/AboutHSD/PublicDataPortal/FactsandFigures.aspx

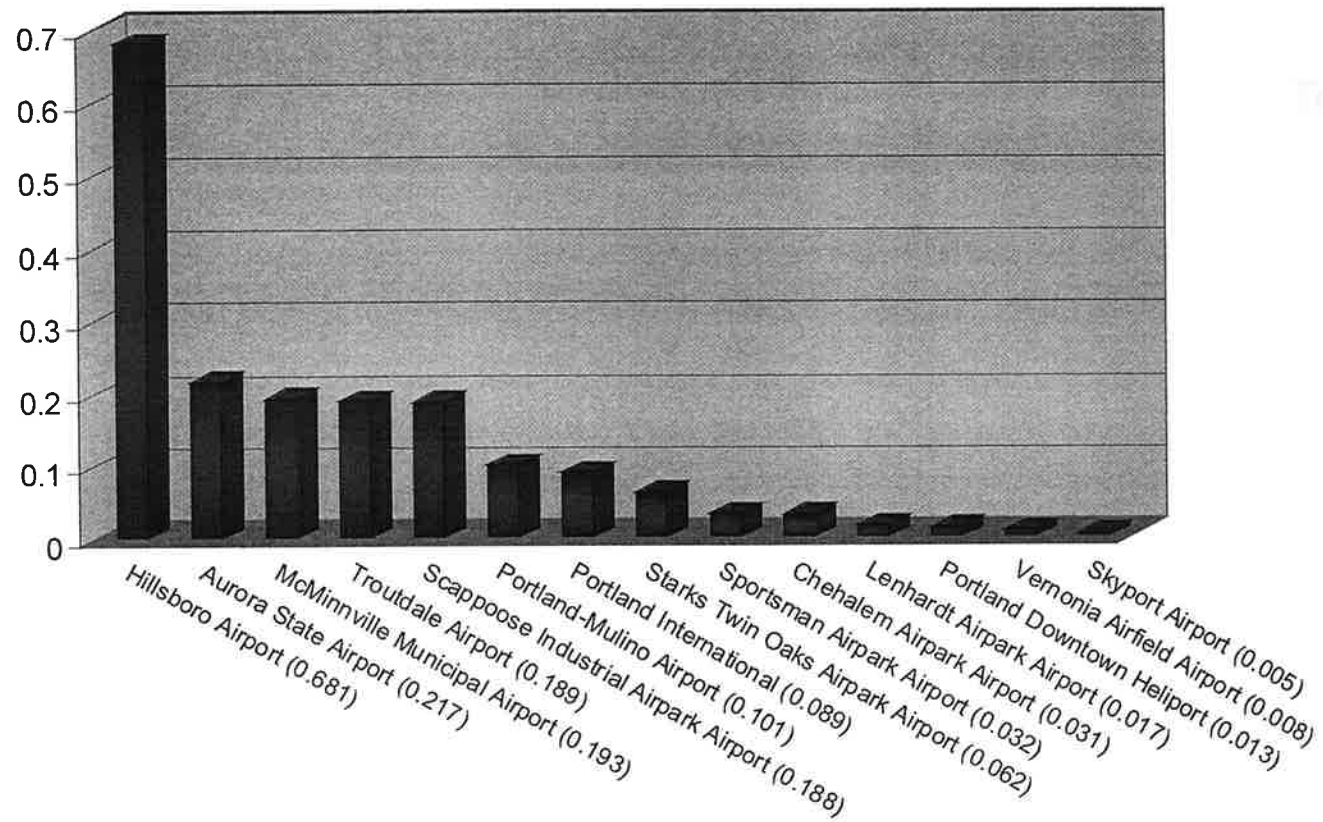
Calculating Aviation Lead Emissions - LTO

Lead emission estimates for individual airports are based on the landing and take-off (LTO) phase of flight:

- taxi/idle-out
- take-off
- climb out
- approach
- taxi/idle-in.

Consideration is also given to whether the aircraft has one or two engines, the concentration of lead in the fuel, and the retention of lead in the engine and oil.

2005 Lead Estimates: Airports Within 20 NM of Hillsboro



Data included in this graph was obtained from a DEQ public records request

EPA NEI - Oregon Lead Sources

According to the 2011 Environmental Protection Agency (EPA) National Emissions Inventory (NEI) the top 20 facility sources of lead in Oregon are as follows (***airports in bold italics***):

- ***Hillsboro Airport (Washington County) - 1160 lbs.***
- Cascade Steel (Yamhill County) - 1080 lbs.
- Riddle Plywood (Douglas County) - 620 lbs.
- ***Bend Municipal Airport (Deschutes County) - 560 lbs.***
- Columbia Ridge Landfill and Recycling Center (Gilliam County) - 540 lbs.
- ***Aurora Airport (Marion County) - 520 lbs.***
- ***Scappoose Industrial Airpark (Columbia County) - 400 lbs.***
- ***Troutdale Airport (Multnomah County) - 360 lbs.***
- ***McMinnville Municipal Airport (Yamhill County) - 340 lbs.***
- ***Corvallis Municipal Airport (Benton County) - 280 lbs.***
- ***Mahlon Sweet Field (Lane County) - 260 lbs.***
- Owen-Brockway Glass Container Inc. (Multnomah County) - 240 lbs.
- PGE Boardman (Morrow County) - 220 lbs.
- ***Hobby Field Airport (Lane County) - 220 lbs.***
- ***Portland International Airport (Multnomah County) - 220 lbs.***
- ***Robert's Field Airport (Deschutes County) - 200 lbs.***
- EVRAZ Inc. NA (Multnomah County) - 197.4 lbs.
- SP Fiber Technologies (Yamhill County) - 194.2 lbs.
- ESCO Corporation (Multnomah County) - 192.6 lbs plus 4lbs. emitted by their NW Brewer location)
- ***Independence State Airport (Polk County) - 175 lbs.***

National Ambient Air Quality Standards for Lead

Because lead is known to be harmful to public health and the environment, the Clean Air Act requires the EPA to set a level of lead in the air that is not to be exceeded. Currently that level is:

0.15 micrograms per cubic meter

Time in Taxi-In/Taxi-Out Cycle

EPA factors in 16 minutes for the taxi-in and taxi out phase of the landing and take-off cycle.

Source: Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2008 National Emissions Inventory. EPA-420-B-10-044. (December 2010). Pg. 17. Available on-line athttp://www.epa.gov/otaq/regs/nonroad/aviation/420b10044.pdf.

The Port's estimate of 0.7 tons of lead at HIO in 2007 was based on "10.0 total minutes of taxi/idle time and 240,690 total aircraft."

Source: Hillsboro Airport Parallel Runway12L/30R Draft Environmental Assessment. Volume 2 Appendices. Prepared for the Port of Portland by CH2MHILL.(October 2009) Pg. C2 Exhibit 2.

Cruise Phase Emissions

- In addition to the landing and take-off cycle, lead is emitted during the cruise phase of flight and portions of the climb out and approach above 3,000 ft.
- Cruise phase emissions are not included in the landing and take-off cycle applied to individual airports.
- According to EPA estimates an additional 5.3 tons of lead were emitted over Oregon in 2008 during the cruise phase.
- Due to the intensive flight training, there is a high likelihood that much of the cruise phase lead is released over Washington County.
- Neither the Port nor DEQ factored in cruise phase lead emission accumulations when calculating background national ambient air quality standards for lead.

Sources: Lead Emissions from the Use of Leaded Aviation Gasoline in the United States - Technical Support Document. (EPA20-R-08-020). U.S. Environmental Protection Agency. Assessment and Standards Division Office of Transportation and Air Quality. (October 2008). Pg. 3-4. Available on-line athttp://www.epa.gov/ttn/chief/net/tsd_avgas_lead_inventory_2002.pdf.

Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2008 National Emissions Inventory. EPA-420-B-10-044. (December 2010). Pg. 17. Available on-line at http://www.epa.gov/otaq/regs/nonroad/aviation/420b10044.pdf.

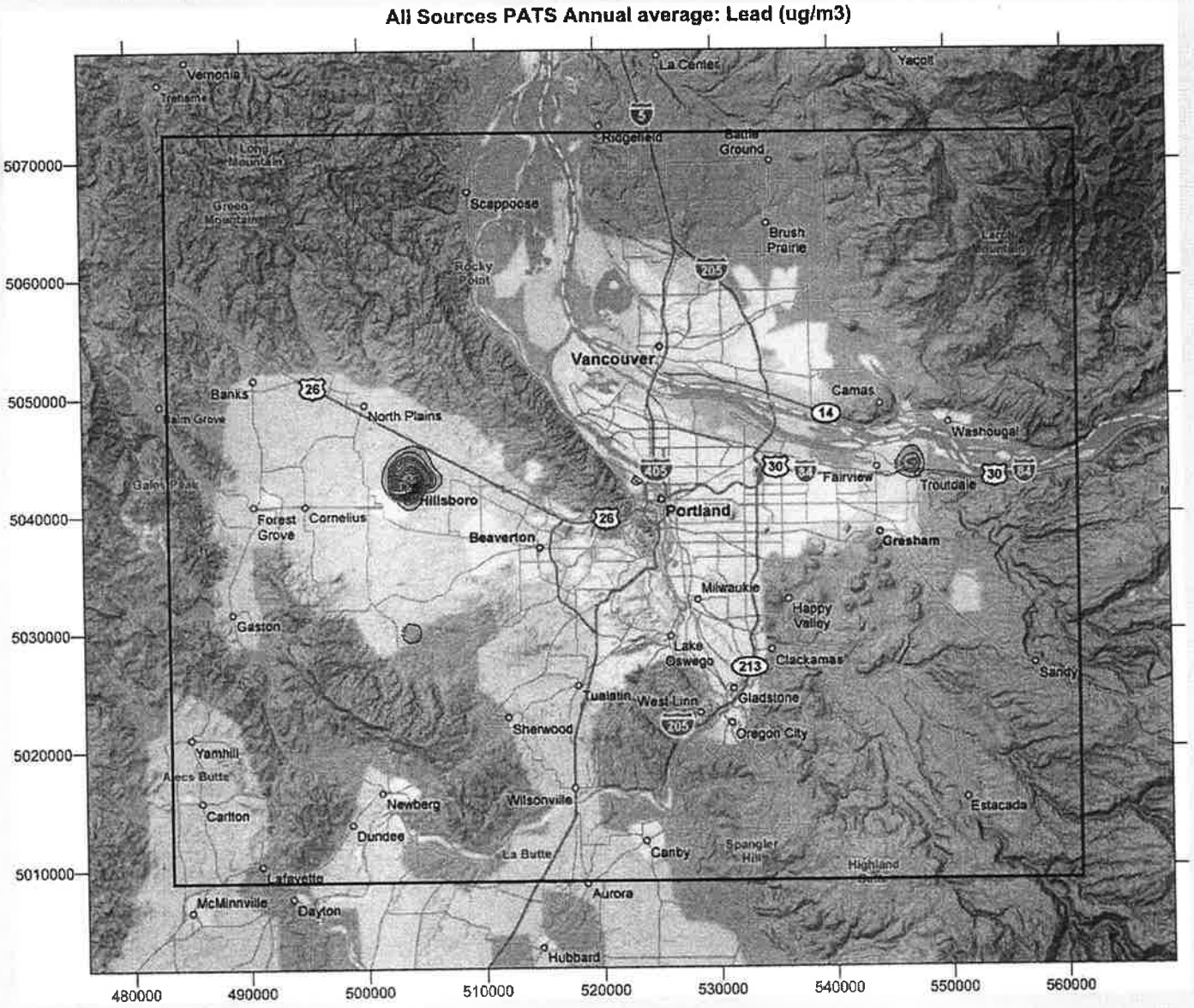
EPA/Port Cruise Phase Discrepancy

EPA - "For inventory purposes, lead emitted outside the LTO [landing and take-off] cycle occurs during aircraft cruise mode and portions of the climb-out and approach modes above the mixing height (typically 3,000 ft.). This part of an aircraft operation emits lead at various altitudes as well as close to and away from airports."

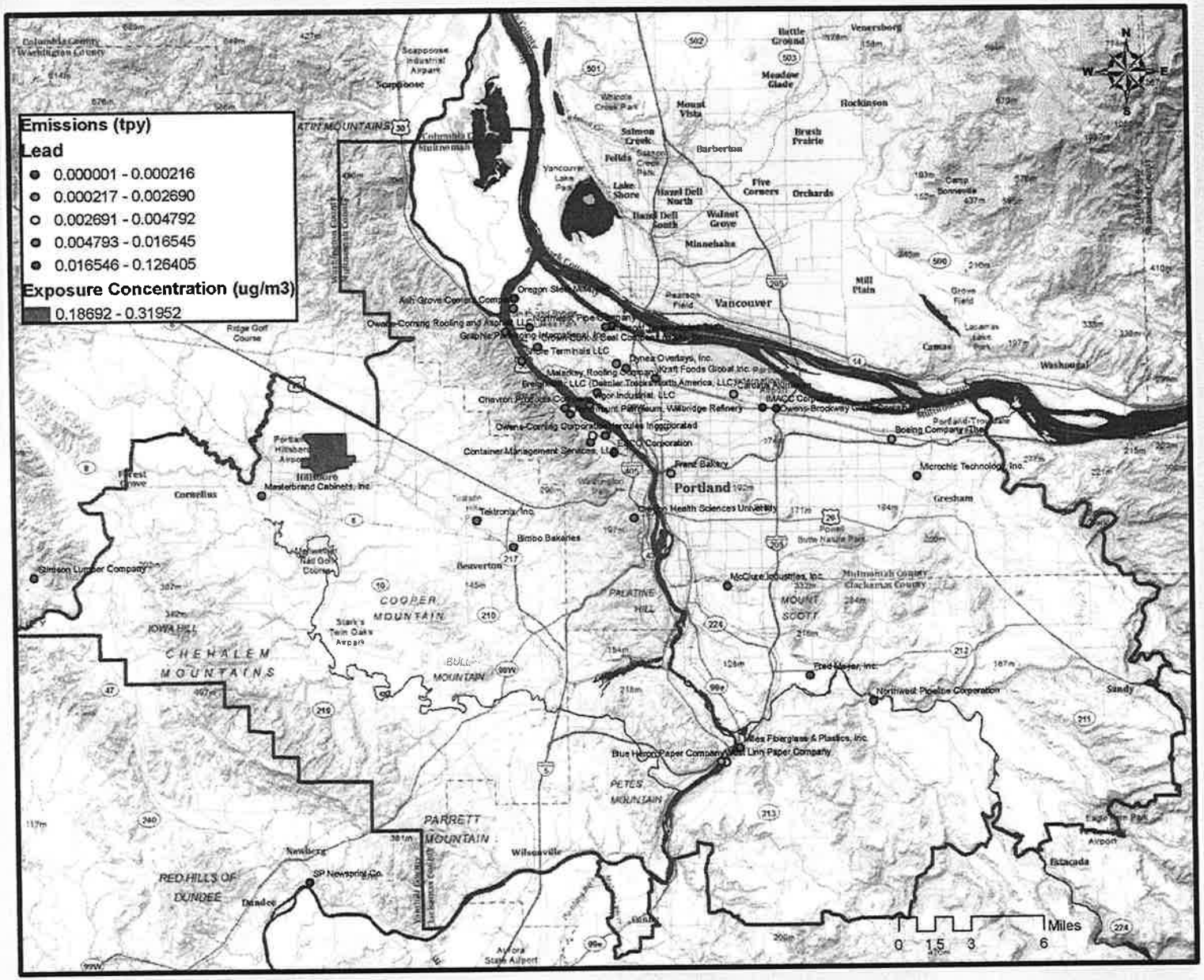
Source: Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2008 National Emissions Inventory. EPA-420-B-10-044. (December 2010). Pg. 17. Available on-line athttp://www.epa.gov/otaq/regs/nonroad/aviation/420b10044.pdf.

Port CDM Lead Study modeled dispersion at lower altitudes than 3,000 ft. such as 100, 300 and 500 meters and did not consider emissions in aircraft above 619 meters, (approximately 2,012 feet of altitude).

If all landing and take-off emissions below 3,000 were included in the Port estimate, lead emissions at HIO would likely be higher than the current 0.7 tpy estimate.

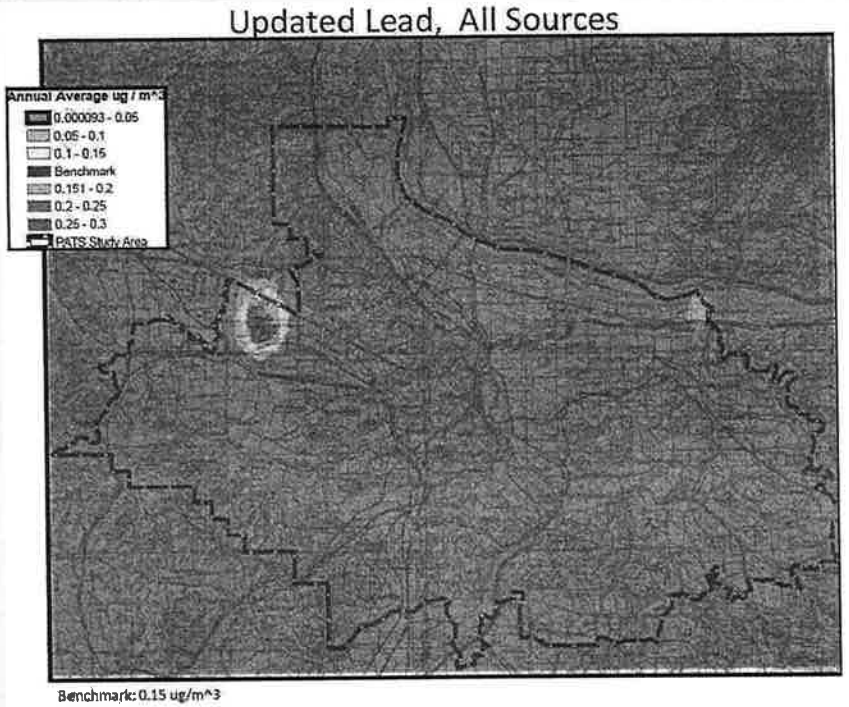


Source: DEQ Public Records Request.



Source: DEQ Public Records Request.

Lead Cloud over Hillsboro (Approximate)



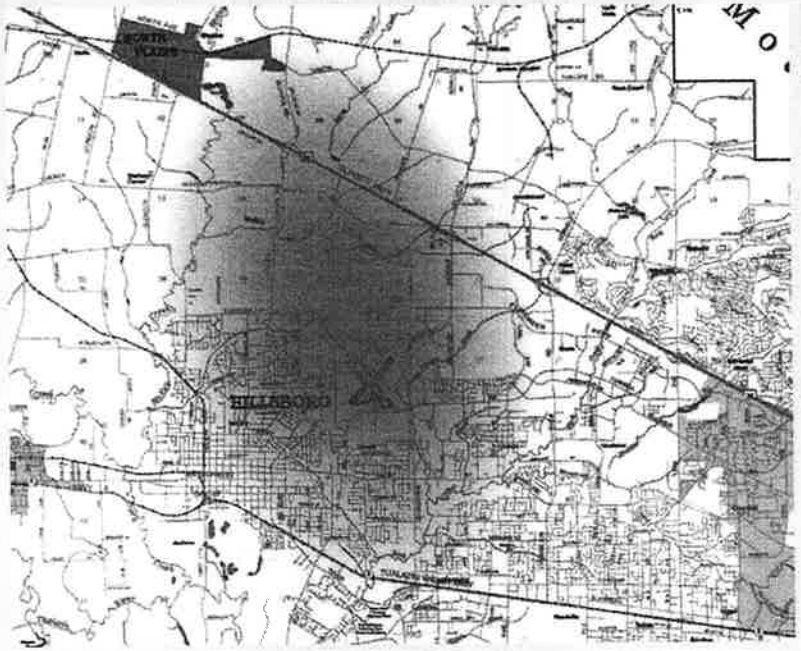


Figure 1-1
Results of ODEQ Modeling (provided by ODEQ)

The Oregon Department of Environmental (ODEQ) quality map, above, was developed for the Portland Air Toxins Solutions Project. The areas in the pink to red shades denoted above benchmark lead levels in the vicinity of the Hillsboro Airport. DEQ's decision to withdraw this map was based on a 2010 non-peer-reviewed Port of Portland commissioned CDM study. No authors affixed their individual names to the CDM report nor was their any indication of EPA involvement or community participation. Though DEQ accepted the Port study it admitted that, "DEQ has not conducted an analysis to compare the study to its Portland Air Toxics Solutions model."

This map was created, for illustrative purposes only, by Oregon Aviation Watch to show the Hillsboro Airport landing and take-off cycle lead impacts based on the adjacent map.

Source: *Portland Air Toxins Solutions Project Modeled Lead Data and the Hillsboro Airport*. Oregon Department of Environmental Quality. Last updated 1/20/12 .

DEQ PATS Study Lacked Complete Data on Lead Sources

DEQ included lead emissions from only 13 airports when doing their Portland Air Toxics Study (PATS). By comparison, the 2011 EPA National Emissions Inventory provides a much more extensive list of facility sources of lead. To summarize, in the 6 county area discussed below there are 139 lead sources, 109 of which are airports.

Washington County – 22 lead sources. All but one are airports yet the PATS study only factored in 3 airports in this jurisdiction – Hillsboro, Stark's Twin Oaks and Skyport all of which are flight training facilities.

Multnomah County – 33 facility sources of lead, 15 are airports. Only 3 airports in this jurisdiction were factored into the model – Troutdale, PDX, and the Portland Downtown Heliport.

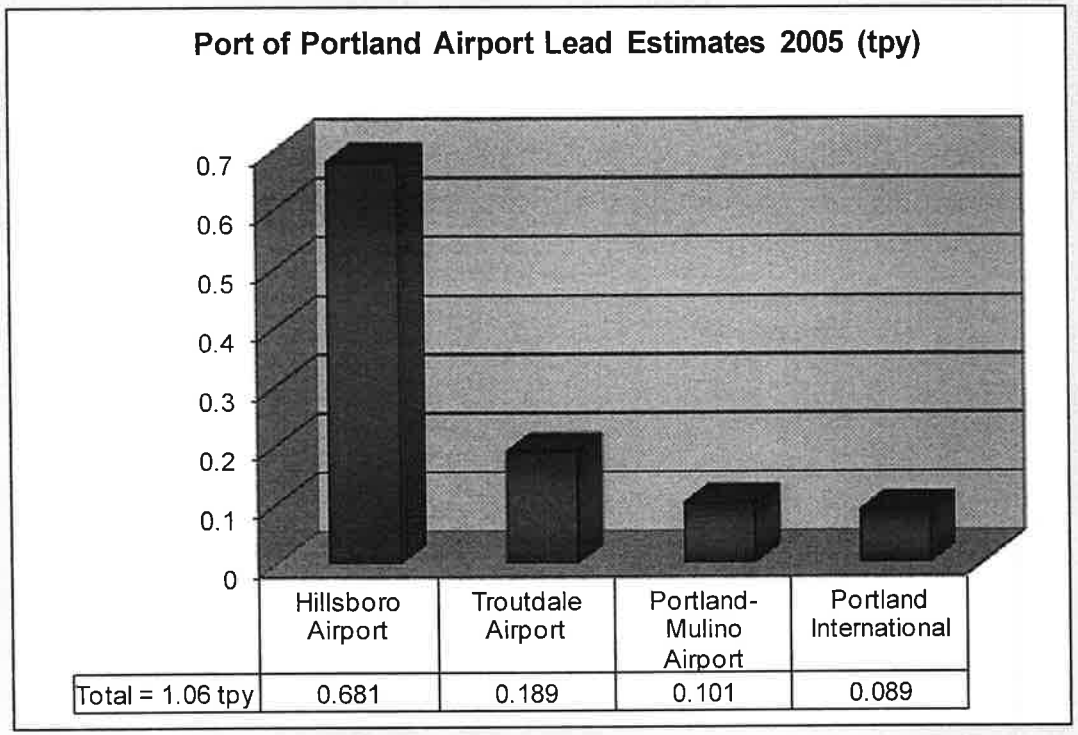
Clackamas County – 31 facility sources of lead. All but 2 are airports. Portland Mulino Airport holds the top spot on the list. In addition to Mulino, 3 other airports in this jurisdiction were included in the PATS study – Valley View Airport in Estacada, Sandy River Airport in Sandy and Country Squire Airpark in Sandy.

Columbia County – 9 facility sources of lead, 5 are airports. Scappoose Airpark was the only Columbia County airport considered in the PATS study. It is the number 1 facility source of lead in this jurisdiction, Vernonia Airport is number 2.

Clark County – 24 lead sources, all but 3 are airports with Pearson Field holding the top spot on the list. Only Pearson and Grove Field Airport emissions were considered for the PATS lead study.

Yamhill County – 20 facility sources of lead, all but 2 are airports. McMinnville Municipal is number 2 on the list.

Port of Portland 2005 Lead Emissions Landing and Takeoff (LTO)



Data included in this graph was obtained from a DEQ public records request.

Port of Portland Lead Study

- To refute DEQ's findings the Port commissioned a private consultant, CDM, to do a separate study. The findings were released in September of 2010.

- **Conflict of Interest** - The Port is the largest emitter of lead in the entire state and profits from every gallon of leaded fuel sold at the Hillsboro Airport. In addition it receives money from lease agreements with aircraft businesses and owners that utilize leaded fuel. As a result of these arrangements, the Port benefits monetarily by downplaying lead emissions and as such has an inherent bias.

Lack of Lead Monitoring at HIO

- Despite major discrepancies between the DEQ 2005 Portland Air Toxins Study and the Port of Portland CDM lead study, no third party objective analysis was ever carried out at HIO and no efforts to actually monitor lead emissions at the airport were instituted.

- Based on the Port study the FAA concluded that constructing a third runway at the Hillsboro Airport would not pose "...significant risks to children's health and welfare."

Source: Hillsboro Airport Parallel Runway 12L/30R. Final Supplemental Environmental Assessment. (February 2014). Vol. 1. pg. 28.

Port of Portland Vs DEQ Model

- The Port claimed that the CALPUFF model used by DEQ to estimate lead showed a higher level of lead emissions than the EDMS model recommended by FAA.
- The Port CDM study opted to use the EDMS modeling even though "EDMS does not calculate lead emissions." This method allowed the Port to enter its own data on assumed lead content in leaded fuel (avgas).
- According to an EPA lead study at the Santa Monica Airport, the two samples of avgas in that study "had lead concentrations 20% higher than the ASTM specification."
- Per the EPA, "EDMS has a limited number of piston engine aircraft in its aircraft database and is currently not set up to calculate metal emissions and thus is not a readily available tool for determining airport lead emissions related to aircraft operations."

Sources: Hillsboro Airport Parallel Runway 12L/30R. Final Supplemental Environmental Assessment. (February 2014). Vol. 1. pg. 28.

Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2008 National Emissions Inventory. EPA-420-B-10-044. (December 2010). Pg. 11. http://www.epa.gov/otaq/regs/nonroad/aviation/420b10044.pdf.

Den, Arnold. Final Results from EPA's Lead Modeling Study at the Santa Monica Airport. (February 22, 2010).http://www.smgov.net/uploadedFiles/Departments/Airport/CommissionMeetings/EPA%20Lead%20Modeling%20Study%20Presentation.pdf.

Highest Airport Lead Concentrations

- According to the EPA "Local scale impacts of piston engine aircraft emissions on air quality are expected to be greatest in areas immediately downwind of the airport from aircraft takeoff and run-up check locations...Runways are oriented so that aircraft have the maximum opportunity to be aligned with the prevailing wind."

Source: Hoyer, M and Pedde, M. Memorandum - Selection of Airports for Airport Monitoring Study. Environmental Protection Agency (11/18/10). Pg.4. Available online at http://www.epa.gov/otaq/regs/nonroad/aviation/memo-selc-airport-mon-stdy.pdf.

- At the Hillsboro Airport prevailing winds blow from the south from January through April and October through December. During the highest volume airport usage months, May through September, they blow from the northwest.

Source: Western Regional Climate Center website available online at http://www.wrcc.dri.edu/htmlfiles/westwinddir.html.

No Monitoring Equipment at HIO

- Based on prevailing winds the areas downwind of HIO to the southeast and north of the airport would be most likely impacted by high level lead concentrations, yet there is no actual monitoring or blood lead level testing in place to address this situation.
- Though DEQ has stated that the Hillsboro Hare Field monitor will sample for lead, its placement about a mile west of the airport is not aligned with the prevailing winds. As such it is not positioned to capture lead emissions from the Hillsboro Airport.

Preflight Run-Ups

EPA Airport Study

"The location of the predicted maximum lead concentration(s) at airports is downwind of the area(s) where pilots conduct the preflight run-up checks and take-off."

Source: Hoyer M . and Pedde, M. Selection of Airports for the Airport Monitoring Study: Memorandum. EPA, NAAQS Docket EPA-HQ-OAR-2006-0735. 11/18/10. Pg. 7.

Run-up (definition) - "the series of last-minute checks performed by pilots on an aircraft prior to take-off."

Source: Wikipedia

Port CDM Study

"...the emissions modeling did not specifically include aircraft engine run-ups. The FAA requires the use of EDMS to evaluate airport/ aircraft emissions, and this model is not enabled to calculate run-up emissions. Research is currently underway to develop ways to capture engine run-ups in emission models; however, an industry-accepted approach to such modeling has not yet been adopted."

Source: : Hillsboro Airport Parallel Runway 12L/30R. Final Supplemental Environmental Assessment. (February 2014). Vol. 2. pg. G.9-51.

Note: DEQ did not include run-ups in their 2005 study.

Recommendations

- Due to serious health risks and adverse impacts on public health and the environment, **the Port of Portland and FAA should immediately withdraw the HIO third runway proposal.** Adding a runway will nearly double the capacity at this airport which is already one of the biggest polluters in the county. Instead efforts should be made to reduce operations at this airport.
- **HIO should be required to complete a comprehensive Environmental Impact Statement before any further expansion.** An EIS has never been done at this airport.
- **A comprehensive study by an objective and unbiased third party should be commissioned** to identify the health impacts of HIO and other airports throughout the region.
- **A lead monitoring program specific to airports should be established** at HIO and other polluting airports.
- **A monitoring program for other aviation toxic emissions should also be established.**
- **Formation of an independent citizen advisory committee, free of Port and FAA control.** Members should include impacted residents, neighborhood representatives, and environmental organizations as well as public health and social justice advocates.

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