The Muncie Waelz Proposal and Health

Waelz Sustainable Products, a joint venture of Zinc Nacional and Heritage Environmental, proposed a new factory in Muncie that would produce zinc oxide and iron from electric arc furnace dust, which is a waste product from steel mills. They were proposing to build on the site of the former BorgWarner factory at 5401 W. Kilgore Ave in Muncie, Indiana. The factory would use the ‘Waelz process’ of heating the dust with a carbon source (either coal or coke) to a high temperature and then collecting the zinc oxide out of the exhaust. Waelz Sustainable Products proposed to process 360,000 tons of electric arc furnace dust per year, or about one thousand tons per day.

The Waelz process has been around since 1888, and it is well known to produce air pollutants. Because of the US law called the Clean Air Act, Waelz Sustainable Products was required to get an air permit from the state. They submitted an air permit application to the Indiana Department of Environmental Management (IDEM) in April 2019. The application has the company’s own estimates for what its air emissions would be, but very little documentation of how accurate the numbers were. The estimates for lead and carbon monoxide emissions varied between different sections of the permit. Table 1 shows the emissions estimates from the application and which page of the application they appeared on.

---

2 https://en.wikipedia.org/wiki/Waelz_process
### Table 1. Air emissions estimates from the air permit application submitted to the Indiana Department of Environmental Management by Waelz Sustainable Products. The page numbers are the pdf pages where the estimates are found in the application.

<table>
<thead>
<tr>
<th>Pollutant in tons per year</th>
<th>“Facility-Wide Potential Emissions” page 12</th>
<th>“Potential to Emit” page 58</th>
<th>“Potential HAP emissions from the Waelz Kilns” page 218</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon monoxide</td>
<td>169.2</td>
<td>181.43</td>
<td>181.43</td>
</tr>
<tr>
<td>nitrogen oxides</td>
<td>140.02</td>
<td>140.02</td>
<td></td>
</tr>
<tr>
<td>coarse particulate matter (PM10)</td>
<td>163.2</td>
<td>163.2</td>
<td></td>
</tr>
<tr>
<td>fine particulate matter (PM2.5)</td>
<td>160.78</td>
<td>160.78</td>
<td></td>
</tr>
<tr>
<td>sulfur dioxide</td>
<td>19.35</td>
<td>19.35</td>
<td></td>
</tr>
<tr>
<td>volatile organic compounds</td>
<td>17.35</td>
<td>17.35</td>
<td></td>
</tr>
<tr>
<td>cadmium</td>
<td></td>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td>lead</td>
<td>&lt;0.5</td>
<td>0.93</td>
<td>0.63</td>
</tr>
<tr>
<td>mercury</td>
<td></td>
<td></td>
<td>0.77</td>
</tr>
<tr>
<td>vanadium</td>
<td></td>
<td></td>
<td>0.05</td>
</tr>
</tbody>
</table>

There was strong community opposition in Muncie to the Waelz proposal once information on the air emissions got out\(^3\). Waelz Sustainable Products withdrew their proposal on August 20, 2019\(^4\). The remainder of this document covers the health implications had the proposal gone forward.

### Air emissions of lead

Across the US, approximately 950 tons of lead are released into the air each year. The top source is piston-engine aircraft that burn leaded fuel. The second largest source is metal processing facilities\(^5\).

Lead air emissions enter the body either through the lungs or because the lead settles out of the air onto crops, soil, and other surfaces. If lead settles on crops, people might eat it. If it settles on soil or surfaces, it becomes part of the dust which gets on people’s hands or dishes and they

---


accidentally eat it. The EPA estimates that adults accidentally eat 100 milligrams of dust every day and children accidentally eat 200 milligrams\(^6\).

Lead is toxic to the human body. Its toxicity is well established. The first cases of lead poisoning due to lead paint were more than 100 years ago\(^7\). Its toxicity happens at the cellular level where it alters ion status and binds proteins which damages and sometimes kills the cell\(^8\). These cellular changes cause a number of health effects. At high levels, lead is lethal. At low levels, it has permanent effects, particularly for the unborn or young child, as listed in Table 2.

<table>
<thead>
<tr>
<th>Children(^9)</th>
<th>Nervous system</th>
<th>Immune system</th>
<th>Hematologic</th>
<th>Reproductive system</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cardiovascular system</td>
</tr>
<tr>
<td></td>
<td>Lower IQ</td>
<td>Possible increase in allergies</td>
<td>Anemia</td>
<td>Delayed puberty</td>
<td>Hypertension</td>
</tr>
<tr>
<td></td>
<td>Attention deficits</td>
<td>Decreased resistance to infection</td>
<td></td>
<td></td>
<td>Risk of heart attack</td>
</tr>
<tr>
<td></td>
<td>Hyperactivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor impulse control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Higher risk criminal behavior later in life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hearing damage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduced coordination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Health effects that are associated with lead. From the EPA’s Integrated Science Assessment for Lead (2013).

---

\(^6\) US Environmental Protection Agency Standard Default Exposure Factors.

\(^7\) Landrigan, P.J. and Etzel, R.A. (2014). *Textbook of Children’s Environmental Health*

\(^8\) Klaassen, C.D. (2008). *Toxicology: The Basic Science of Poisons*

\(^9\) Table of health effects was derived from EPA’s Integrated Science Assessment for Lead
The US Centers for Disease Control recommend taking action if a child’s blood lead level is 5 micrograms per deciliter or more. This is a very, very small amount of lead. It takes 28,350,000 micrograms to make just one ounce.

Children living in areas with lead contaminated soil have an increased risk of lead poisoning, and the higher the lead in the soil, the higher the risk\(^{10,11}\).

Waelz Sustainable Products requested a permit to emit 1,000 pounds of lead to the air per year, though their air permit application states that the facility would have a potential to emit up to 1,800 pounds per year. Lead tends to settle out of the air in the first few miles\(^{12,13}\), and lead is a forever pollutant that doesn’t break down over time. If 1000 pounds were emitted this year and again next year and the next, the lead would accumulate and the soil nearby would get increasingly contaminated.

Better control of lead emissions is possible. For comparison, the Exide lead smelter in Muncie used to have air emissions of up to 1700 pounds per year\(^{14}\). After a 2013 EPA enforcement action\(^{15,16}\), Exide brought additional pollution controls online and reduced their annual lead emissions to about 250 pounds per year. The Quemetco lead smelter in Indianapolis uses an additional pollution control device called a “wet electrostatic precipitator” or WESP, and their lead emissions are around 130 pounds per year\(^{17}\).

The US EPA has regulated air emissions of lead under the Clean Air Act since the early 1970s. The Clean Air Act has significantly decreased lead in US air, but it has limits. For example, during settlement of the EPA enforcement action against Exide, the Hoosier Environmental Council was part of a coalition that formally requested that Exide be required to install a wet electrostatic precipitator to get the tightest possible control of their lead emissions\(^{18}\). The request was denied because it went beyond what was required under the Clean Air Act\(^{19}\).

\(^{11}\)Morrison, D, et al.(2012). Spatial relationships between lead sources and children’s blood lead levels in the urban center of Indianapolis (USA). \textit{Env Geochem Health}, DOI 10.1007/s10653-012-9474-y
\(^{13}\)Ketterer, M.E. (2006). The ASARCO El Paso Smelter: A source of local contamination of soils in El Paso (Texas), Ciudad Juarez (Chihuahua, Mexico), and Anapra (New Mexico), Summary Report.
\(^{14}\)US Toxics Release Inventory
\(^{15}\)United States of America and the State of Indiana v. Exide Technologies, Civil Action No. 15-cv-433, Complaint https://www.justice.gov/sites/default/files/enrd/legacy/2015/04/13/Exide_COMPLAINT.PDF
\(^{17}\)US Toxics Release Inventory
As medical science has better defined lead’s effect on the body, there has been a call from the public health community to strengthen the Clean Air Act when it comes to lead. In 2008 the EPA’s Children’s Health Protection Advisory Committee recommended lowering the National Ambient Air Quality Standard (NAAQS) for lead from 0.15 to 0.02 ug/m$^3$, nearly a 10-fold reduction$^{20}$. As of this writing, the EPA has not made that change.

There are some very good people working at the Indiana Department of Environmental Management (IDEM) who do all that they can to protect Indiana’s environment. However, because of policies from the Indiana legislature$^{21}$ and the Governor’s office, IDEM does what is required under the Clean Air Act, but no more. IDEM was unlikely to write an air permit for Waelz that would be fully protective, and was even less likely to deny the permit.

**Air Emissions of Mercury**

Waelz Sustainable Products, as proposed, would have had the potential to emit 1,540 pounds of mercury per year. According to the US Toxics Release Inventory, that would have been the highest mercury emissions of any industrial facility in the country. The next highest emits 1,277 pounds per year and the next after that is Waelz’s sister steel dust facility in Alabama with 1,139.

There have been extensive studies of where mercury lands after it is released into the air$^{22,23,24}$. The studies show that a significant portion of it lands near where it was released. Exactly how much depends on a number of factors like what form the mercury is in when it is released, how tall the smoke stack is, and the local weather. It is safe to say that the mercury from the Waelz plant proposed for Muncie would have contributed to increased mercury in soil and water in east central Indiana and more widely in the Northeastern United States.

After mercury lands on soil or water, microbes convert it to an organic form called methylmercury. Methylmercury accumulates up the food chain as larger organisms eat the bacteria and then even larger organisms eat them$^{25}$. People are most often exposed to mercury

---


by eating fish, especially fish that are the top predators in their food chain. That is true of both fish caught in streams and lakes and fish caught in the ocean.

Indiana has Fish Consumption Advisories that let you know how much fish is safe to eat based on how much mercury or PCBs are found in a particular species of fish26. For the West Fork of the White River, including Delaware County, Indiana’s Fish Consumption Advisory has the following list:

**Sensitive Population Advisory:**
The sensitive population includes females under the age of 50 excluding women who are no longer capable of becoming pregnant, males under age 15, and people with compromised immune systems.

**Channel Catfish**
All Sizes: Do Not Eat

**Common Carp**
All Sizes: One meal per month

**Crappie Species**
All Sizes: One meal per week

**Largemouth Bass**
All Sizes: One meal per week

**Redhorse Species**
All Sizes: One meal per month

**Rock Bass**
All Sizes: One meal per week

**Smallmouth Bass**
All Sizes: One meal per month

**Sunfish Species**
All Sizes: One meal per week

**General Population Advisory:**
The general population includes adult men over the age of 15 and women over the age of 50 who are no longer capable of becoming pregnant.

**Channel Catfish**
All Sizes: Do Not Eat

**Common Carp**
All Sizes: One meal per month

**Crappie Species**
All Sizes: One meal per week

**Largemouth Bass**
All Sizes: One meal per week

**Redhorse Species**
All Sizes: One meal per month

**Rock Bass**
All Sizes: One meal per week

**Smallmouth Bass**
All Sizes: One meal per week

**Sunfish Species**

26 [https://www.in.gov/isdh/23650.htm](https://www.in.gov/isdh/23650.htm)
Studies have shown that local pollution sources affect local fish. For example, in Florida over ten years as local mercury emissions were reduced by over 90%, the mercury in local fish declined 60%\(^\text{27}\). Some of the mercury from the Waelz plant would have wound up in Indiana fish, including fish in the White River.

Mercury in its elemental form is a health hazard when it is inhaled. It is uncertain how much of the Waelz mercury emissions would have been in the elemental form. It is also uncertain how the Waelz emissions would have dispersed. Elemental mercury tends to stay in the air for months, so the wind can transport it far from where it was emitted.

Where ever the Waelz mercury emissions wound up, they would have contributed to a toxic pollution problem. Mercury is toxic to the brain in very small amounts. The adult lethal dose of methylmercury is just one gram (it takes 454 grams to make one pound). The amount of methylmercury in fish is measured in micrograms.

Low doses of mercury cause the following\(^\text{28}\):

- In adults: decreased coordination, decreased visual sensitivity
- In children: decreased memory, attention, and language skills

A young child or unborn baby’s developing brain is especially sensitive to mercury. There is no cure for mercury damage to the brain.

The National Academy of Sciences and the EPA carefully reviewed all of the health data on mercury and concluded that to protect her children, a woman should have no more than 0.1 micrograms of methylmercury per kilogram of her body weight per day\(^\text{29}\). For example, a woman who weighs 60 kilograms (132 pounds) should have no more than 6 micrograms of methylmercury. In 2005 the average mercury concentration in the bass tested by the state of Indiana was 276 micrograms of mercury for every kilogram of fish\(^\text{30}\). To stay within the safe level of mercury, a 60 kilogram woman should eat no more than three-quarters of an ounce of bass per day. If she eats bass once per week, then she could safely eat 5 ounces, or just over a quarter of a pound.

---

\(^{27}\) Florida Department of Environmental Protection (2002). Integrating atmospheric mercury deposition with aquatic cycling in South Florida.


\(^{29}\) Committee on the Toxicological Effects of Methylmercury, Board on Environmental Studies and Toxicology, National Research Council, National Academy of Sciences. (2000). Toxicological Effects of Methylmercury.

\(^{30}\) Data acquired by the author from the Indiana Department of Environmental Management in December 2008.
The US has been working hard since 1990 to reduce mercury emissions. In some locations where mercury sources were shut down or put on pollution controls, mercury in the local fish has gone down. The proposed Waelz plant emissions would have been a step backward.

**Air Emissions of Dioxins and Furans**

The Waelz process is known to release dioxins and furans to the air. Dioxins and furans are chemical byproducts of high temperature processes. They cause cancer and can interfere with hormones and the immune system.

Where the dioxins and furans wound up would depend on the height of the smoke stack and whether they were bound to particles.

There have been a number of publications over the last 20 years about methods for controlling dioxin and furan emissions from Waelz facilities. Here are a few:

- In 2000, a symposium on metal recycling included a report from Recytech in France on how a Waelz plant reduced dioxin emissions by 99%.
- In 2003, an article on reducing dioxin and furan emissions from Waelz facilities was published by a research team in Germany.
- In 2005, Waelz facility using activated carbon injection to reduce dioxin.
- In its air permit application, Waelz Sustainable Products said it would not be using carbon injection (page 143).

**Greenhouse Gas Emissions**

Waelz Sustainable Products’ air permit application states that the facility will have the following emissions of greenhouse gases (page 217):

---


<table>
<thead>
<tr>
<th></th>
<th>tons per year, potential emissions</th>
<th>global warming potential</th>
<th>Total warming potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon dioxide</td>
<td>417,932</td>
<td>1</td>
<td>417,932</td>
</tr>
<tr>
<td>methane</td>
<td>0.97</td>
<td>30</td>
<td>29.1</td>
</tr>
<tr>
<td>nitrous oxide</td>
<td>0.1</td>
<td>270</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>417,988</td>
</tr>
</tbody>
</table>

According to the EPA, the typical passenger car emits 4.6 tons of carbon dioxide per year\(^{37}\), so this facility would have been the equivalent of adding 90,867 cars to the road.

Greenhouse gases contribute to climate change. Purdue University Climate Change Research Center has published a series of reports on how Indiana’s climate is changing and what effects this is having\(^{38}\). Briefly, Indiana is seeing increasing numbers of days over 90 degrees and increasing precipitation in the winter and spring. This is impacting Hoosiers’ health by increasing the risk of heat stroke, flooding, poor air quality, and certain ‘tropical’ diseases like West Nile and Zika\(^{39}\).

Indra N. Frank, MD, MPH
Director of Environmental Health and Water Policy
Hoosier Environmental Council
www.hecweb.org

---

36 [https://www.epa.gov/ghgemissions/understanding-global-warming-potentials](https://www.epa.gov/ghgemissions/understanding-global-warming-potentials)
38 [https://ag.purdue.edu/indianaclimate/](https://ag.purdue.edu/indianaclimate/)