# Rezoning for Heavy Industry

## Righting the Wrong

Jefferson County Foundation, Inc.

### Air Pollution Near Schools and Families

Rockwool has said many times that the pollution they are emitting is less than that of the car and truck traffic in Jefferson and Berkeley County combined. The issue is this position is coming out of one giant tailpipe right next to a school.

Air pollution created by heavy industry consists of both gaseous and particulate-matter pollutants. The gaseous includes nitrogen dioxide (NO2), ozone (O3 emitted as VOC and NOx that interact to release O3), and sulfur dioxide (SO2). Particulate matter includes particulate matter of varying diameter, and classified by cutoff points — less than 10 μm (PM10), less than 2.5 μm (PM22.5), and that of more recent focus less than 0.1 μm (PM0.1). Because of their small size, these particles can be inhaled deeply into the lungs and deposited in the alveoli. This particulate matter is a complex mixture of many things including metals, elemental and organic carbon. The PM0.1 have a higher carbon content, larger combined surface area (increasing contact area), and greater potential for carrying toxic compounds. While not usually measured, the other air contaminants referred to as hazardous pollutants are also very important as they contain among others neurotoxins and carcinogens. (1) Key drivers of the air pollutants are mining, smelting, and petroleum combustion. These are all processes undertaken or supported by the industry provided for by this rezoning.

Proizvodnja zraka prve kategorije 15. 12. 2010 (Rockwool Istra)

*Source: Screenshot of video from Croatia Rockwool factory showing smoke plume that carries for as far as they eye can see. https://www.youtube.com/watch?v=WTP5-k88TKM*

Humans are exposed to air pollution through inhalation, ingestion, and contact with skin and mucus membranes. Children are especially vulnerable to the latter two since they are more likely to play on the ground outdoors and more likely to put things from their environment in their mouth. Air pollution is the most significant cause of pollution related disease (6.4 million deaths/year). (2) This pollution increases the risk of multiple non-communicable diseases in children including asthma, low birth weight, cancer, birth defects, obesity, diabetes, cardiovascular disease, mental health problems and neurodevelopmental disorders, and increases the risk of chronic obstructive pulmonary disease, cardiovascular disease, stroke and cancer across the lifespan of a person exposed as a child. (3) In fact, in 2015, pollution was responsible for 21% of deaths from all cardiovascular disease, 51% of deaths due to chronic obstructive pulmonary disease (COPD), and 43% of deaths due to lung cancer. (4)

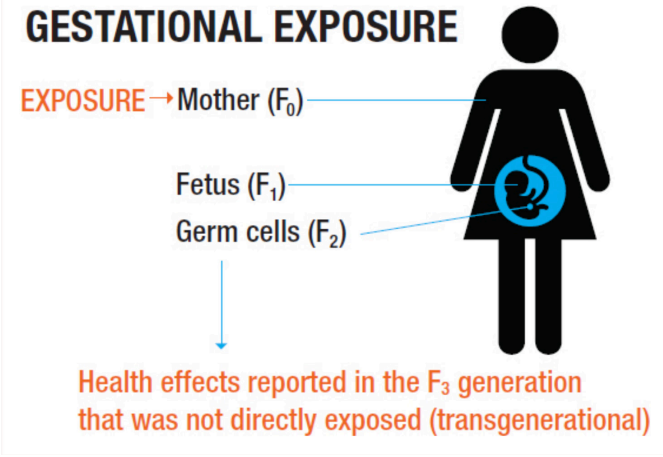
According to the National Academy of Science, children are inherently more sensitive to the effects of air pollution for four distinct reasons. (5)

1. Children breathe more air on a per pound basis each day, thus increasing their exposure.
2. The pathways by which mammals detoxify and excrete toxic substances are not fully mature in children and thus less efficient.
3. There are periods in early development with exquisitely delicate developmental processes that are exceedingly sensitive to disruption, and exposure to even low doses of pollutants during this time can increase risk of disease in childhood and across one's lifespan.
4. Exposure in childhood leaves more years of life for diseases to develop that require longer times to develop (long latency period diseases).

Exposure to air pollution in early human development, especially exposure to fine particulate pollution, can be extremely deleterious to children's health and development.

## In Utero Development

Cells that make up the embryo and fetus (germ and fetal cells) divide and replicate rapidly and so are more sensitive to outside pressures from exposure to foreign substances and disruptions in cellular communications. (6) When polluted air is inhaled some components may cross the blood-air barrier of the lungs into the circulation. The circulation carries them to the placenta. Some of these pollutants cross the placental barrier, affecting the embryo and depositing in the fetus creating permanent fetal abnormalities. (7) This leads to impaired organ development, disturbed development of the immune system, premature birth, lower birth weight, and increased infant mortality. (8 These early changes lead to long-term effects including increased disease development in multiple organ systems throughout life, cognitive defects, achievement deficits, and negative psychological social and economic effects. (9) Fetuses may also be affected by the socioeconomic status and life choices of their families both of which have been shown to be affected by air pollution their family members were exposed to (see below). Even worse, there seems to be a generational effect, with offspring being affected by the air pollution to which their grandmothers were exposed. (10)

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Exposed

Affected

## Respiratory

The human respiratory system develops in utero, through adolescence, and does not actually stop until late teens early twenties depending on sex. The first six years of life represent the most extensive period of growth and account for 80% of development. This time period is therefore the most sensitive both because the lungs are developing rapidly and because they are not developed yet so the airways are narrower and there are fewer alveoli. (11) Exposure to air pollution during the first six years of life can damage the lung tissue, impair lung growth, and alter the development of immune function and repair mechanisms with in the lungs. (12) These effects increase both short- and long-term risk for asthma, chronic obstructive pulmonary disease (COPD), lung cancer, and respiratory infections.

Air pollution increases the rate of asthma development in both children and adults. Particulate matter, ozone, and sulfur dioxide contribute to allergic inflammation and pulmonary immune dysfunction in animal models, both strong contributors to asthma. (13) Change in lung function is also seen with both short- and long-term exposure to air pollution in both children and adults. Air pollution not only causes increased risk of asthma, but even short-term exposure causes asthma symptom exasperation significantly increasing the hospitalization, reduced lung function and increased airway responsiveness in asthmatic children. (14) A 2019 study found, "even within the limits set by the World Health Organization (WHO), the pollutants PM10, SO2, NO2, and O3 are associated with increased risk of treatment for respiratory diseases in children 0 to 6 years of age." It is important to note that the US limits are set higher than the WHO, 300% higher in the case of PM10.

While the development of COPD is most often associated with smoking, outdoor air pollution exposure increases the incidence or cases of COPD. Short term increases of PM10 and other air

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pollutants can cause existing cases of COPD to get worse, increasing the risk of acute exacerbation, hospitalization, and death from COPD symptoms in patients that already suffer from COPD. (15)

Again, smoking is considered the biggest cause of lung cancer, however the International Agency for Research on Cancer designated outdoor air pollution and PM as a Class I human carcinogen. Numerous studies have shown that increased exposure to PM2.5, SO2, NO2, and diesel exhaust cause an increased incidence or risk for multiple types of lung cancer.

While not as extensively studied, it is clear from the studies that do exist that children, the elderly and those with pre-existing conditions are made more susceptible to developing exacerbated respiratory infection symptoms and increased need for emergency intervention when exposed to air pollution.

## Neurodevelopmental

The central nervous system is increasingly recognized as being affected by air pollution. When particulate matter is inhaled, it may cross the blood-air barrier of the lungs into circulation. The circulation carries it to the brain where it has neurodegenerative effects or the placenta where it creates fetal abnormalities. (19) Effects on both the brain and fetus are certainly also affected by air pollution through secondary pathways. (20) Gestational exposure to air pollution and especially ultrafine particulate matter affect both embryonic neurodevelopment and brain growth and maturation in early life. Gestational exposure increases the risk of early cognitive deficits, low birth weight, prematurity, and neurodevelopmental disorders. (21) An association between autism and prenatal exposure to particulate matter in air pollution has been suggested by several case-control studies. (22) A 2019 study (23) looked at a national sample of US children, evaluated the relationship between exposure to air pollution and cognitive outcomes. It found that annual and cumulative measures of air pollution during third grade were significantly associated with lower math test scores. This was likely attributable to exacerbation of asthma symptoms, other decreased health parameters, increased fatigue, or a direct neurodegenerative effect. Two earlier studies found similar outcomes for math and reading/English/language in elementary students exposed to elevated air pollutants including particulate matter, ozone, and nitrogen dioxide. (24) Air pollution has also been linked to several parameters with indirect effect on achievement and cognitive ability including school absences. (25) Ample evidence for other structural and functional changes in the neurological system and neurodevelopmental progression exists in small studies, and animal models. As further study bears out more of the effects of air pollution on these areas, it will only become more obvious how devastating the effect truly is.

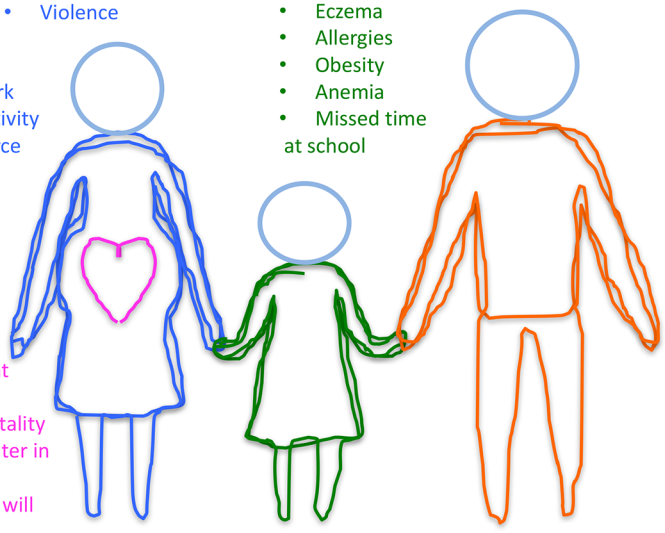
There is a lot weighing on this family from the air.

These are some of the risks from air pollution.

- Psychological problems
- Social problems
- Cancer
- COPD
- Pneumonia
- Asthma
- High blood pressure
- Type 2 diabetes
- High cholesterol
- Stroke
- Allergies
- Eczema
- Obesity
- Missed time at work
- Decreased productivity
- Decreased workforce participation
- Depression
- Anxiety

- Less happiness
- Annoyance
- Metal disorders
- Self-harm
- Suicide
- Cognitive dysfunction
- Poor decision making
- Avoidance
- Defensive
- Desertion
- Violence

- Impaired organ development
- Disturbed immune system development
- Low birth weight
- Elevated Infant mortality
- Increased disease later in life
- The babies children will be at risk too



- Psychological problems
- Achievement deficits
- Social problems
- Cognitive deficits
- Asthma
- Cancer
- Pneumonia
- Autism
- Neurodevelopmental disorders
- Poor scholastic performance
- Decreased achievement
- Eczema
- Allergies
- Obesity
- Anemia
- Missed time at school

- Psychological problems
- Social problems
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- Anxiety
- Less happiness
- Annoyance
- Metal disorders
- Self-harm
- Suicide
- Cognitive dysfunction
- Poor decision making
- Avoidance
- Defensive
- Criminal activity
- Distrust for Government

## Autoimmune

Immune development starts in utero and continues through the first several years of life; disruption in this process can cause autoimmune diseases. Autoimmune diseases are on the rise in developed countries. Studies have shown that oxidant air pollutants, ozone and nitrogen dioxide were associated with an increased risk of incident asthma and eczema in children. (26) Both of these diseases are autoimmune diseases and represent inappropriate immune tolerance development. Furthermore, a review of 36 experimental studies revealed that particulate matter, diesel exhaust particles and ozone fundamentally changed cytokine (cell communication tool or molecule) production and cell functions inducing airway hyper responsiveness increasing susceptibility to infection and allergies. (27) Therefore, air pollution contributes to and increases the rate of autoimmune diseases affecting several body systems and increases susceptibility to further morbidity (disease). This is one of the reasons the 1918 flu pandemic hit Pittsburg so hard. The appropriate cellular communication and immune response had been disrupted by chronic air pollution exposure leaving peoples lungs ill-equipped to deal with the virus. In fact, the hypersensitivity likely made the situation worse.

## Effects on Other Body Systems

Air pollution has deleterious effects on several other organ systems including cardiovascular, endocrine, blood and over all health parameters like weight. Studies have shown increased risk of obesity linked with obesity associated with exposure to air pollution. (28) Many studies have also demonstrated the association of air pollution with increase risk for insulin resistance and diabetes, high blood pressure, high cholesterol, stroke and other cardiovascular and cardiometabolic diseases. (29) An elevated level of anemia is seen in children exposed to elevated air pollution. (30)

## Psychological effects

A review of 178 published articles systematically examined the psychological (affective, cognitive, behavioral), economic, and social effects of air pollution found:

"Affectively, air pollution decreases happiness and life satisfaction, and increases annoyance, anxiety, mental disorders, self-harm, and suicide. Cognitively, it impairs cognitive functioning and decision making. Behaviorally, air pollution triggers avoidance behavior, defensive expenditure, and migration as coping strategies. Economically, it hurts work productivity and stock markets. Socially, it exacerbates criminal activities and worsens perception of the government. Importantly, both actual and perceived air pollution levels matter." (31)

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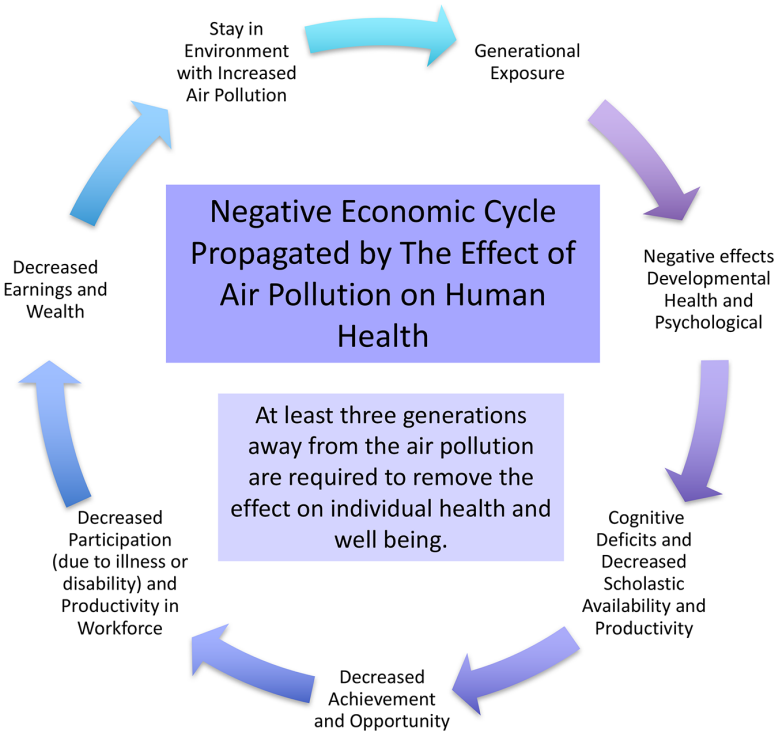
## Economic effect through health effects

These health risks would endanger two of our most valuable resources: our people and our future. Labor is essential to the economy. Through negative health effects, air pollution has been demonstrated to have a negative effect on labor supply, productivity and economic growth. (32) A 2012 study demonstrated a significant direct effect of air pollution on agricultural worker productivity; with a 10 parts per billion change leading to a 5.5 % drop in worker productivity. (33) In the study, they said this conclusion could be applicable to all outdoor workers. Though our tourism, agriculture, and equine industries, Jefferson County has a huge outdoor workforce. Effect of labor supply and productivity are not limited to outdoor workers and or physical labor. (34) As children struggle during their education with attendance, attention, and socialistic ability due to the effects of air pollution on their health, their achievement suffers. As achievement suffers, they are less able to achieve the training needed to achieve a good, well-paying job. Their lifetime earning and overall wealth will suffer. They will consequently own less property and pay less taxes of all types. Air pollution, through its effects on human health, affects business volume and government income depressing our economy. Environmental protection should be seen as an investment in economic growth through advancement of quality labor, availability, capability, and increased productivity.




## Conclusion

A editorial in the New England Journal of Medicine, commenting on several recent studies, stated: “The best control strategy from the standpoint of human health, supported by the scientific evidence to date, is to reduce the levels of all types of air pollutants. Our children’s health depends on it.” (35) The *Lancet* Commission on Pollution and Health citing many sources (36) found that prevention of non-communicable diseases will require pollution prevention and that this will require fundamental changes in societal patterns of production, consumption, and transportation. This will require a paradigm shift to a more sustainable economic model based on recognition of human rights, especially the right of children to health and well being. (37) This is a major unexploited opportunity in in society that many communities are grappling with undertaking. This rezoning would represent a major step in the wrong direction of Ranson and Jefferson County. Ranson needs to do the real work of leadership make the hard decisions to stand up for children’s health and human rights.

## Endnotes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