

The Health Hazards of an Industrial Wood Waste Facility

Rachel Densler

Relevant Professional Background

Education:

MSW- Health Care Concentration
West Virginia University

Ed.S- Science Education
Services for
Florida Institute of Technology
(research-based degree)
college)

PhD Student-STEM Education
Florida Institute of Technology

Career Experience

Medical Social Worker

Coordinator of Disability

students for over 30 years
(elementary, high school,

Howard County, Maryland

- Medical Literature of the Health Hazards of Industrial Wood Waste and the Woodbine Case Study, Taskforce Presentation for County Council-Dr. Velculescu, Professor of Oncology, Johns Hopkins University School of Medicine, Co-Director of Cancer Biology at Sidney Kimmel Comprehensive Cancer Center
- Dayton Conditional Use of Industrial Wood Waste Facility- County Council Hearing with testimony from a geologist and Dr. Velculescu

Health Hazards of Industrial Wood Waste

Victor Velculescu, M.D., Ph.D.
Sidney Kimmel Comprehensive Cancer Center
Johns Hopkins University

Health Hazards

Industrial mulch processing results in increased health risks

- Infectious agents – fungi and bacteria
- Wood dust – allergic and mucosal effects
- Wood dust – cancer
- Exposure and risk

Studies of mulch related infections in medical literature

1: Ameratunga R, Woon ST, Vyas J, Roberts S. Fulminant mulch pneumonitis in undiagnosed chronic granulomatous disease: a medical emergency. Clin Pediatr (Phila). 2010 Dec;49(12):1143-6. doi: 10.1177/0009922810370057. Epub 2010 Aug 19.

2: Siddiqui S, Anderson VL, Hilligoss DM, Abinun M, Kuijpers TW, Masur H, Witebsky FG, Shea YR, Gallin JI, Malech HL, Holland SM. Fulminant mulch pneumonitis: an emergency presentation of chronic granulomatous disease. Clin Infect Dis. 2007 Sep 15;45(6):673-81. Epub 2007 Aug 8.

3: Veillette M, Cormier Y, Israël-Assayaq E, Meriaux A, Duchaine C. Hypersensitivity pneumonitis in a hardwood processing plant related to heavy mold exposure. J Occup Environ Hyg. 2006 Jun;3(6):301-7.

4: Nagai K, Sukoh N, Yamamoto H, Suzuki A, Inoue M, Watanabe N, Kuroda R, Yamaguchi E. [Pulmonary disease after massive inhalation of Aspergillus niger]. Nihon Kokyuki Gakkai Zasshi. 1998 Jun;36(6):551-5. Japanese.

5: Weber S, Kullman G, Petsonk E, Jones WG, Olenchock S, Sorenson W, Parker, Marcelo-Baciu R, Frazer D, Castranova V. Organic dust exposures from compost handling: case presentation and respiratory exposure assessment. Am J Ind Med. 1993 Oct;24(4):365-74.

6: Johnson CL, Bernstein IL, Gallagher JS, Bonventre PF, Brooks SM. Familial hypersensitivity pneumonitis induced by Bacillus subtilis. Am Rev Respir Dis. 1980 Aug;122(2):339-48. PubMed PMID: 6774642.

Dozens of examples of scientific articles from throughout the world related to infectious agents in mulch.

Particularly important and dangerous for immune compromised individuals.

Recent study found that of patients with fulminant mulch pneumonitis, half of those died of due to infection and underlying kidney disease.

Health Effects of Wood Dust

From Centers for Disease Control and Prevention:

“Exposure to wood dust has long been associated with a variety of adverse health effects, including dermatitis, allergic respiratory effects, mucosal and nonallergic respiratory effects, and cancer. The toxicity data in animals are limited, particularly with regard to exposure to wood dust alone; there are, however, a large number of studies in humans.”

Health Effects of Wood Dust

From *Ann Agric Environ Med* 2010, **17**, 29–44.

- **Abstract:** This paper reviews the literature on associations between dry wood dust exposure and non-malignant respiratory diseases ... The results support an association between dry wood dust exposure and asthma, asthma symptoms, coughing, bronchitis, and acute and chronic impairment of lung function. In addition, an association between wood dust exposure and rhino-conjunctivitis is seen across the studies.”

Cancer

- “The association between occupational exposure to wood dust and various forms of cancer has been explored in many studies and in many countries.” (CDC)
- “There is *sufficient evidence* in humans for the carcinogenicity of wood dust. Wood dust causes cancer of the nasal cavity and paranasal sinuses and of the nasopharynx. Wood dust is *carcinogenic to humans (Group 1)*.” (WHO, IARC)

Lung Cancer

- “Pulmonary cancer. A number of studies investigating the association between wood dust exposure and the development of lung cancer have been conducted.”
- Milham (1974/Ex. 1-943) found a significant excess of malignant tumors of the bronchus and lung in workers who exposed to wood dust.

Hodgkin Lymphoma

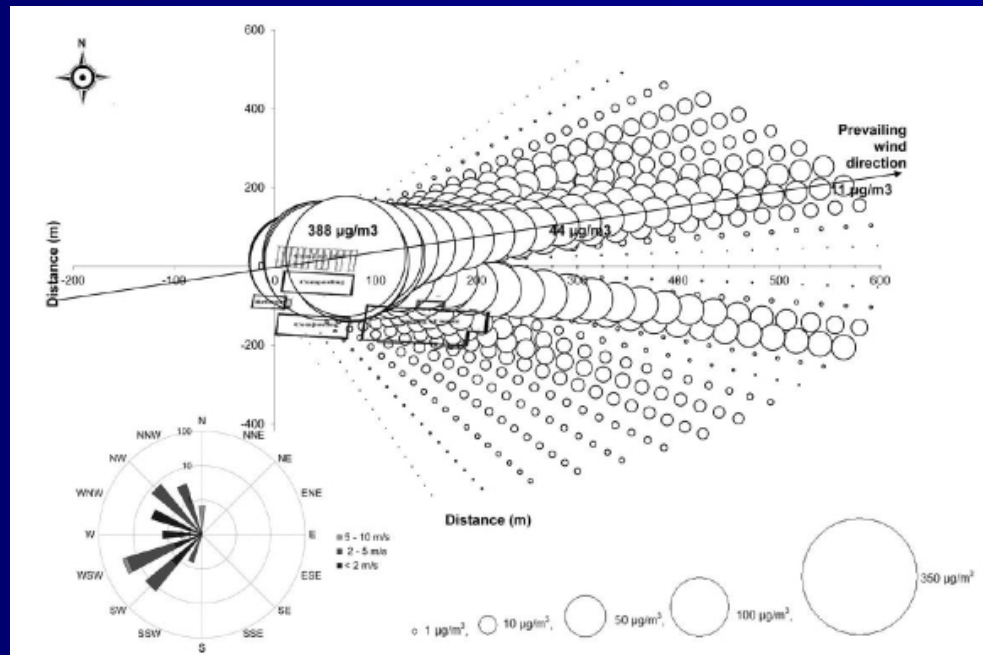
- “Hodgkin's disease. Milham and Hesser concluded, on the basis of a case-cohort study of 1,549 white males dying of this disease ... that there was an association between Hodgkin's disease and exposure to wood dust.”
- Other studies concluded that men working in the wood industries in the eastern United States as well as Washington state were at special risk for Hodgkin's disease.

Significant Medical Literature of Effects of Emissions from Waste Facilities

- Chalvatzaki E, Aleksandropoulou V, Glytsos T, Lazaridis M. The effect of dust emissions from open storage piles to particle ambient concentration and human exposure. *Waste Manag.* 2012 Dec;32(12):2456-68.
- Nadal M, Inza I, Schuhmacher M, Figueras MJ, Domingo JL. Health risks of the occupational exposure to microbiological and chemical pollutants in a municipal waste organic fraction treatment plant. *Int J Hyg Environ Health.* 2009 Nov;212(6):661-9.
- Domingo JL, Nadal M. Domestic waste composting facilities: a review of human health risks. *Environ Int.* 2009 Feb;35(2):382-9.
- Herr CE, Nieten Az Az, Stilianakis NI, Eikmann TF. Health effects associated with exposure to residential organic dust. *Am J Ind Med.* 2004 Oct;46(4):381-5.
- Herr CE, zur Nieten A, Stilianakis NI, Gieler U, Eikmann TF. Health effects associated with indoor storage of organic waste. *Int Arch Occup Environ Health.*
- Herr CE, Zur Nieten A, Jankofsky M, Stilianakis NI, Boedeker RH, Eikmann TF. Effects of bioaerosol polluted outdoor air on airways of residents: a cross sectional study. *Occup Environ Med.* 2003 May;60(5):336-42.

Dust Emissions and Distance

- Dust emissions from open piles of mulch / organic waste can be measured at distances >500 m (>1500 feet) (Waste Management 32 (2012) 2456–2468)



Microorganisms and Dispersion Distance

- High levels of molds, fungi, thermophilic fungi, bacteria and other microorganisms (concentrations of $>10^4$ colony forming units) could be measured >300 m (>1000 feet) in residential air neighboring outdoor organic waste (Am. J. Ind. Med. 46:381–385, 2004)
- Examples of infectious agents have been shown to be dispersed at distances >5 km (J Infect Dis. 2006 Jan 1;193(1):102-11)

Summary

- Mulch processing can pose risks for human health due to increased exposure of infectious and hazardous agents. These include
 - infections due to fungal spores
 - Increased risk of dermatitis, allergic respiratory effects, and mucosal and nonallergic respiratory effects
 - Increased risk of cancer, including nasal, lung, and Hodgkin lymphoma
- Exposure risks can occur at significant distances from waste processing area

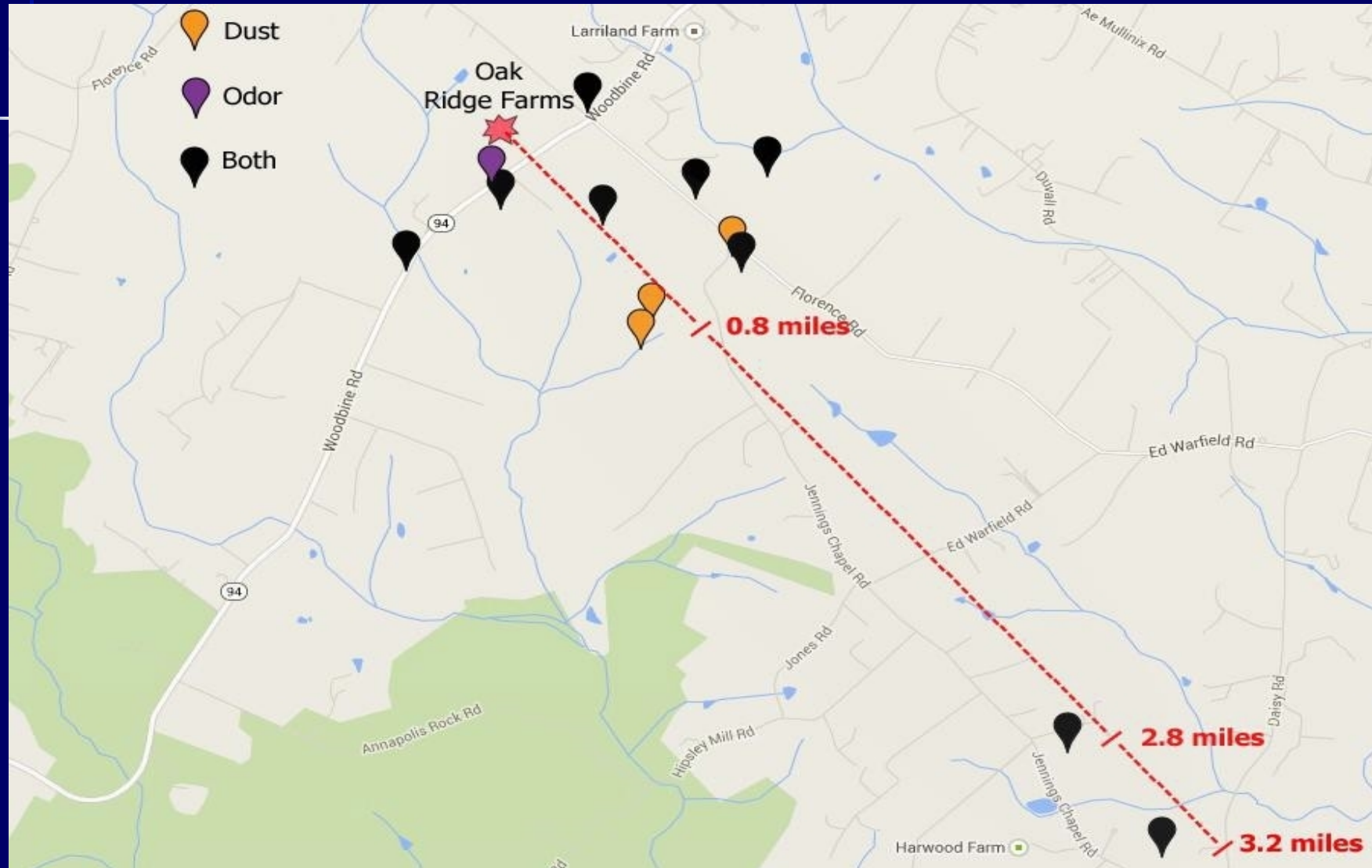
Background of Woodbine Case Study

- Unapproved facility had operated for several years
- Residents submitted at least 17 requests for zoning inspection
- Complaints identified possible health and quality of life issues
- Self-initiated an informal study
 - Researched known health issues of wood and mulch
 - Mapped the location of residents who submitted complaints
 - Attempted to get Howard County Health Department involved
- Oak Ridge Farms was temporarily shut down, but not due to health or quality of life issues.
 - They were shut down because mulch manufacturing was not allowed on RC zoned property
 - They had two refuse/recycling/shipping containers not allowed on RC zoned property

Requests to DPZ for Zoning Inspections Oak Ridge Farms

- Residents of Woodbine made 17 requests to DPZ [Nov-Dec 2013]
- 9 Requests explicitly stated respiratory related issues
 - All with health issues were age 51 and older
 - 2 residents under care at Johns Hopkins were tested and found to have wood particulate matter in their respiratory system
 - Distance between the Oak Ridge facility and most distant health issue was over 3 miles [airborne fungi spores can travel longer distances than wood dust]
- 8 Requests were of a general nature
 - Traffic
 - Pollution & contaminants
 - Decline in air quality
 - Odor
 - Noise, e.g., “louder than a combine”
 - Residents can feel the vibrations of the grinding equipment
 - Occurring 6 or 7 days a week

Dust and Odor Distribution



Woodbine Case Study Summary

- Woodbine Residents have been unwitting participants in a “test” resulting from operations by Oak Ridge Farms, LLC
- Indications are that Oak Ridge Farms was a large scale operation
- In a relatively short period of time, residents and livestock were showing symptoms commonly associated with fungal spore contamination and wood dust inhalation
- The clustering of those affected in line with the path of prevailing winds
- Residents experienced wood dust and odors at distances greater than three miles

Health Hazards of Industrial Wood Waste.

<https://cc.howardcountymd.gov/sites/default/files/migrate/files/Mulch%2520Factory%2520Health%2520Effects%2520Velculescu%2520100514.pdf>

Conditional Use for Wood Recycling Facility

Howard County Council Hearing
Conditional Use for JBRK, LLC



Groundwater Metals Contamination from Wood Waste Recycling Facilities

Jeff Harp

Manganese Health Risk

- Recently published research identifies exposure to manganese via drinking water causes adverse health effects such as neurological disorders similar to Parkinson's disease
- Neuro-developmental disabilities including autism, attention deficit, hyperactivity, dyslexia and other cognitive impairments
- Epidemiological studies document manganese as a developmental neuro-toxicant
- Maternal manganese levels are associated with low birth weight

Harp, J. (n.d.). Proposed Mulching Facility in Dayton, MD by JBRK, LLC.

<https://cc.howardcountymd.gov/sites/default/files/migrate/files/Taskforce%2520Mulch%2520Pres%2520on%2520Water%2520final%2528Lober%25208-13-14%2529.pdf>

Groundwater Contamination

- Four distinct sites
 - New York State Department of Environmental Conservation (NYDEC) verified surface and groundwater manganese contamination from more than 12 mulch and natural vegetative composting facilities
 - Bassler Forest Recycling Products site in Howard County, Maryland is identified with groundwater metals contamination

Groundwater Contamination

- Oregon State Engineers Office and Oregon Department of Environmental Quality published a research paper titled “Groundwater Pollution by Wood Waste Disposal”- identified Manganese groundwater contamination
- Connecticut Department of Energy and Environmental Pollution, Remediation Division Chief Bill Warzecha confirmed wood waste leachate as causing significant manganese groundwater contamination

New York Environmental Investigation Report

- New York State Department of Environmental Conservation (NYSDEC)
- NY State Department of Health
- Suffolk County Department of Health Services
 - Horseblock Road Investigation, Yaphank, NY (July 2013)

New York State Investigation Conclusion

- “This data in conjunction with the data from the current investigation suggests that compost/vegetative organic waste site operations can cause an elevation of manganese concentrations in groundwater.”

New York State Response

- Residents using drinking water wells were connected to municipal water supply due to exposure to high levels of manganese
- Tens of millions of dollars was spent to remediate, retrofit facilities, and promulgated new regulations for operations and to limit the amount and type materials allowed at wood waste recycling facilities

Bassler Forest Recycling Products (FRP)

- Howard County Natural Yard Waste Composting Facility
 - Accepted wood waste to naturally decompose through compost processes in static and windrow piles
 - Located west of Clarksville, MD, 1.7-miles east of the proposed Dayton mulch/compost and soil screening facility with the same geologic setting “Wissahickon Schist”
 - Seven wells continue to monitor groundwater quality since at least 2007

Oregon Environmental Investigation

- Groundwater Pollution by Wood Waste Disposal
- Investigation identified:
 - Wood waste leachate-yielded high concentrations of volatile organic acids
 - Leachate was oxygen demanding and created a reducing environment
 - High concentrations of Manganese were identified in the groundwater to 106,000 µg/L

Oregon Environmental Investigation

- Investigation Conclusion:
 - The reducing environment disassociated manganese from the substratum significantly increasing manganese in the groundwater
 - These environmental factors degraded groundwater to non-potable quality
- Response:
 - City of Turner extended community water supply to the affected homeowners.

Connecticut Department of Energy and Environmental Protection

- Remediation Division Chief Bill Warzecha
Tel: 860-424-3776
- Confirmed significant environmental contamination associated with organic leachate
 - Confirmed the process by leachate creating reducing environment
 - Currently gathering data for distribution

Connecticut Factsheet

Connecticut Department of Public Health maintains a factsheet titled “Manganese in Drinking Water.”

- Set a drinking water action level for manganese at 500 $\mu\text{g/L}$ to ensure the protection against manganese toxicity
- “Exposure to high concentrations of manganese over the course of years has been associated with toxicity to the nervous system, producing a syndrome that resembles Parkinsonism.”

Manganese

Manganese (µg/L)	FDA Bottled Water Limit	EPA Regional Screening Level (May 2013)	Connecticut Drinking Water Action Level	ATSDR 1-Day Child Health Advisory	Max Conc. (µg/L)
New York	50	320		1,000	43,000
Bassler (MD)	50	320		1,000	13,000*
Oregon (City of Turner)	50	320		1,000	106,000
Connecticut	50	320	500	1,000	

*Manganese background average for Clarksville West- 20 µg/l

Sources of pollution rich in organic matter such as wood compost can increase the release of manganese and other metals from soil and bedrock into groundwater.

Leaching Mechanism

Natural wood waste recycling/composting operations allow ground up natural vegetation to compost in large windrows. The piles are wetted to help eliminate spontaneous combustion. The water used in wetting operations including rain creates an organic discharge that infiltrates the porous ground surface.

The discharge water is high in organic content (carbohydrates, organic acids, lignin, humic material, carboxylic, hydroxides and amino acids). When the high organic discharge water infiltrates the ground, multiple geochemical reactions occur that mobilize the existing metals from the soil structure

Negative ORP

- Organic material, high in chemical and biological oxygen demand, create a low Eh / negative Oxidation Reduction Potential (ORP) or reducing environment
- Negative oxygen reducing potential allows the manganese (cations) to be electron acceptors
- Metal oxides reduce, allowing the cations to become mobile in a low valence, soluble ionic form



Water Soluble Complexes

- Organics form water-soluble complexes with the metals that are less reactive with the soil structure and become mobile.
- Flushing of metals through the soil to the groundwater table occurs as colloidal particles

References

- “Horseblock Road Investigation,” Yaphank, NY. July 2013.
• http://www.dec.ny.gov/docs/materials_minerals_pdf/horseblockrd072013.pdf
- “Semi-annual Monitoring Report,” Bassler Forest Recycling Products Site. 2014.
- “Ground-Water Pollution by Wood Waste Disposal,” H.R Sweet and R.H. Fetrow, *Groundwater* v13(2), 1975.
- “An experimental study of heavy metal attenuation and mobility in sandy loam soil,” C. Gong and R. J. Donahue, *Applied Geochemistry* v12(3), 1997, p243-254.
- “Leaching of metals into groundwater-understanding the causes and an evaluation of remedial approaches,” Worcester Polytechnical Institute, A. Albright et al, 2012.
- Manganese in Drinking Water, Connecticut Department of Public Health.
• http://www.ct.gov/dph/lib/dph/drinking_water/pdf/manganese.pdf
- Drinking Water Health Advisory for Manganese, Environmental Protection Agency (2004).
• http://www.epa.gov/safewater/cc/pdfs/reg_determine1/support_cc1_magnese_dwreport.pdf
- National Primary Drinking Water Regulations, EPA.
• <http://water.epa.gov/drink/contaminants/>
- Chemical Mixtures and Children’s Health, Clause Henne B et al. 2014.
• <http://www.ncbi.nlm.nih.gov/pubmed/24535499?report=abstract>
- New Insights into manganese toxicity and speciation, Michalcke B et al. 2014.
• <http://www.ncbi.nlm.nih.gov/pubmed/24200516#maincontent>
- Neurobehavioural effects of developmental toxicity, Lancet Neurol. 2014.
• <http://www.ncbi.nlm.nih.gov/pubmed/24556010#maincontent>
- Maternal blood manganese level and birth weight: a MOCEH Birth Cohort Study. 2014.
• <http://www.ncbi.nlm.nih.gov/pubmed/24775401#maincontent>

Testimony for Dr. Velculescu regarding Conditional Use for Industrial Wood Waste Facility

Two Primary Hazards Through Inhalation

- Increased Exposure to Infectious Agents- Fungi and Bacteria
- Carcinogenic Effects of Wood Dust

Testimony (cont.)

“Although we often think of wood fragments as something natural, the amount, the type, and storage of materials that are generated in an industrial mulch facility are no longer on a scale that we would encounter naturally or that are inherently safe.”

Testimony (cont.)- Increased Exposure to Infectious Agents- Fungi and Bacteria

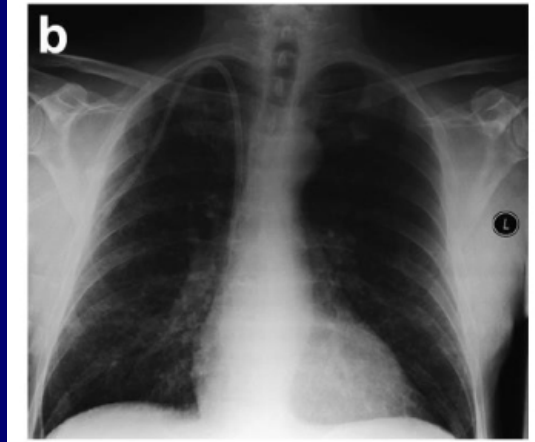
“These are not theoretical risks. I have shared with you in my submitted testimony a recent case report of a healthy retired gentleman that developed fungal pneumonia after exposure to mulch. He developed kidney injury and failure and died months later. It was clear that fungal spores from mulch were the route of the infection. There are dozens of reports from literature from throughout the world that are related to infectious agents in mulch, primarily fungi and bacteria.”

Infectious agents example: acute fungal pneumonia

At presentation



2 months later



A 69 year old retired man with no significant medical history. Developed acute pneumonia after spreading tree bark mulch.

Hospitalized, developed kidney injury and failure. Remained dialysis dependent and housebound.

Died of sepsis 10 months later.

Inhalation of fungal spores from mulch was determined be the likely route of infection.

Testimony (cont.)- Exposure to Wood Dust

- “...wood dust has been characterized by the World Health Organization (WHO) and the Centers for Disease Control (CDC) as a carcinogen.”
- CDC- “The association between exposure to wood dust and various forms of cancer has been explored in many studies and countries.”
- WHO- “Wood dust causes cancer of the nasal cavity and paranasal sinuses, and of the nasopharynx. It is carcinogenic to humans.”

Testimony (cont.)- Exposure to Wood Dust

“There are hundreds of papers in the medical literature that document the increased risk from wood dust for nasal cancers, lung cancers, Hodkin’s lymphoma, and potentially other kinds of cancer. “

Testimony (cont.)- Summary

“Carcinogens by definition increase the risk of cancer, especially to those exposed over longer periods of time. Dayton is in part a residential community where there are a large number of children and many residents that spend a significant amount of time outdoors and would be directly exposed to the health risks I have described.”

Testimony (cont.)- Summary

“To allow exposure to infectious and carcinogenic agents from this type of facility to a large number of individuals in a residential area does not seem to be in the public interest. This would make Dayton the equivalent of a petri dish of health experimentation.”

Recommendations from the Geologist

- If a residential potable well is located nearby and/or connected to the fracture then the manganese would be present in the water and the resident potentially exposed. In a typical Darcian flow system such as coastal plain, I would anticipate migration to at least 1500 feet (For Foundation Park, there are residents on well water within 500 feet of the proposed development).
- The best and easiest way to address woodwaste recycling facilities is to keep them in industrial areas; however, the industrial areas need to be away from residential areas where there are no exposure pathways to water supply.

Conclusion

Numerous studies show the health hazards of an industrial waste facility being located near a residential area.

- Water from spraying mulch piles and rainwater creates a geochemical reaction that occurs in the soil which releases manganese which contaminates ground water. The release is a geochemical reaction caused by the wood waste, not contamination in the wood waste. Manganese results in neurological disorders such as Parkinson's. DEP Inspection (03/05/2025)- Modified fire truck applying water to control dust at All Pro Land Clearing.
- Airborne exposure to Infectious Agents (Fungi and Bacteria). In the Woodbine Case, one of the victims was as far away as 3.2 miles. Other studies have confirmed cases at the same distance.
- Airborne exposure to wood dust- Allergic and mucosal effects (asthma, bronchitis) and Cancer.