Human Health Effects of Biomass Incinerators:

A Pediatrician’s Perspective on Air Pollution and Children, with a Focus on Inflammation

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Washington, Indiana

For crying out loud, when are we gonna learn. . .
We can’t breathe what we burn.

J. Bruce Liles, Jasper, Indiana
Education and Credentials

University of Notre Dame, BS Preprofessional Studies with Honors 1982

Indiana University School of Medicine 1986

Los Angeles County/USC Medical Center

Internship & Residency in Pediatrics 1986-89

Diplomate, American Board of Pediatrics 1989


Fellow, American Academy of Pediatrics
Professional Experience

Private Practice Jasper, Indiana -- 1989-2012
Memorial Hospital & Health Care Center -- currently courtesy staff
  Medical Staff President – 1994, 2001
  Medical Staff Vice President – 2000
  Primary Care Chairman – 1991-1993
  Credentials Committee Chairman – 1998, 2006-2007

Private Practice Washington, Indiana -- July 2012
Grand Avenue Pediatrics of Daviess Community Hospital

Clinical Associate Professor of Pediatrics
Indiana University School of Medicine
Volunteer Teaching Junior and Senior Year Outpatient Pediatrics
Where I Come From

Norman & Leona Kitten Schue Farm
The Kitten family homestead since 1852
~200 acres near Ferdinand, Indiana
Farmhouse c. 1860 -- 8 kids -- 1 bathroom
Dad earned 2010 Dubois County & 2011 Indiana
Soil and Water Conservation Farmer of the Year
14 years Boy Scouting -- 2 Eagle Scouts
Severe, Visible Air Pollution
Where I Live and Work

• **Photo I took** – 07:56 am Sept 6, 2012, between Otwell and Washington, Indiana. The air pollution covers my region.

• **MY PATIENTS BREATHE IN THIS AIR POLLUTION**

• Monitors do not adequately protect children since exposure has already occurred.
More Pollution EQUALS More Patients

- Older sister coughing and sore throat since last pm; Mom asks “Why?”
- Mom worried about 5 wk old with Tetralogy of Fallot (blue baby heart defect; ozone pollution increases risk)
- Mennonite family self pay
- Mom buys either $200 of pulmicort for the cough or oral steroids for $30
- Strep antibiotic $5.00
- Air pollution further increases cost of care and shortens the baby’s life

And EACH PATIENT is a real person in a real family, NOT just a diagnosis, statistic, or cost liability.
American Lung Association
Opposes Biomass Incinerators

“The Lung Association urges that the legislation not promote the combustion of biomass. Burning biomass could lead to significant increases in emissions of nitrogen oxides, particulate matter and sulfur dioxide, and have severe impacts on the health of children, older adults, and people with lung diseases.”
Biomass Incineration Produces AIR POLLUTION

- Biomass burning produces air pollution.
- Air pollution triggers inflammation.
- Inflammation is responsible for disease.
- Disease from air pollution is difficult to treat.
- Treatment is expensive.
  - Children often miss school, activities & life opportunities.
  - Parent often misses work to care for sick children.
  - Many can’t pay medical costs.
Inflammation Is a Disease Process

• Inflammation is a **primary immune response** to a trigger.
• Inflammation **becomes** a disease when the trigger, air pollution, doesn’t go away.
• Inflammation is a **CASCADE**, not a tightly regulated feedback loop compared to other body processes.
Particulate pollution is a potent inflammatory trigger.

Both acute and chronic inflammation cause damage and play critical roles in many disease processes by stimulating clot and scar formation.

DISEASE RISK and DAMAGE CAUSED are DOSE RELATED TO POLLUTANT LEVELS and worsen or become irreversible with severe acute or chronic ongoing exposure.
How a Pollutant Becomes a Chronic Disease

Published online 2008 October 11. doi: 10.1016/j.mrgentox.2008.09.016
Special Pediatric Considerations

• Kids spend time outside and breathe in more air pollutants per pound of body weight.

• Children’s barriers less effective—lung, skin

• Child’s cumulative lifetime exposure
  – Affects child’s DEVELOPING body especially lungs, brain, and immune system.
  – Affects child’s family and future.
Acute vs. Chronic Diseases

• Modern medicine effective at treating trauma, infections, and preventing disease with vaccines and public health initiatives

• Medicine NOT EFFECTIVE at “curing” chronic diseases caused by ONGOING POLLUTION

• Only in past 20 years beginning to understand the role of inflammation in chronic disease progression and pollution as its trigger.

• Chronic = Progressive, expensive, devastating
Progression of Airway Disease from Pollutants

ASTHMA

- Bronchial muscle spasm constricts airways.

- Inflammation causes airway swelling and MORE mucus limiting air flow and clearance.
Progression of Airway Disease from Pollutants

- Long term **epithelial injury** triggers irreversible scarring (AIRWAY REMODELING).

- Pollutants also **damage cilia**, reducing clearance.
Progression of Airway Disease from Pollutants

- Hagen-Poiseuille equation states air flow $\sim$ radius.$^4$
- Kids’ airways smaller so any swelling is more significant to airflow and clearance

[Diagram: Why asthma makes it hard to breathe]
Limitations of Asthma Treatment

• ALBUTEROL relaxes bronchial muscle spasm.
  • Provides temporary relief only
  • Side effects are frequent.

• STEROIDS treat inflammation.
  • Inhaled steroids SAFER but weaker & EXPENSIVE.
  • Systemic steroids treat and affect the WHOLE BODY.
    • Oral steroids and steroid shots cheap
    • IV steroids part of expensive hospitalization
    • SIDE EFFECTS are FREQUENT.
Vicious Cycle

• Deciding when to start or stop inhaled steroids
  – Can’t directly measure or feel amount of inflammation
  – The trigger (AIR POLLUTION) is ongoing.
• Many families CAN’T AFFORD the inhalers ($40-200/mo), tests, or doctor visits.
• Chronic ongoing inflammation leads to irreversible AIRWAY REMODELING.
Normal Healthy Cilia Line Airways

Cross Sectional View of Normal Cilia

Inhaled Pollutants Damage Cilia

Sulfur Dioxides Cause “Compounding”

- Cilia melted together cannot move mucus—STAGNATION
- MORE particulate absorption
- Bacteria and viruses MORE likely to invade and reproduce
- MORE inflammation and LESS airflow
- ADDS INSULT TO INJURY for heart baby already short of breath

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Further Damage over Time

Mucus cells replace cilia.
Squamous Metaplasia

Still reversible ONLY if trigger (POLLUTION) is removed

Next step is cancer.

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Bronchogenic Carcinoma

LUNG CANCER

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Actual Patient: 14 y/o Boy “N” with Chronic Allergies, Asthma, Sinusitis

- Mom runs home day care.
- N’s School Air Pollution ranked worst 5% in US (2008 USA Today)
- Juvenile Diabetes for past 8 years
- Pollution increases sinus disease and asthma flares.
- Coughs, vomits, gets dehydrated, leads to Diabetic Ketoacidosis
- Inpatient hospital stays for IV insulin and fluids
- Can’t take cheap oral steroids because of diabetes
- Allergy shots, inhalers, visits: pollutants, especially particulates, increase total cost of care
Actual Patient: 12 yo Girl “H” with Cough Variant Asthma

• Has coughed continuously for 3 weeks
• Steroids make her violent; she punches walls even on inhaled low dose steroids.
• Marked improvement with expensive air cleaner demonstrates link to ambient air pollution.
How Pollutants Damage the Brain

Increased % Learning Problems Found in Industry and Power Generator Region

• “Kentuckiana” as a “state” would rank #3 most toxic in USA

• Higher percentage of children needing Special Education services
  – 20% along Ohio River
  – 26% in Mount Vernon

• Studies show AIR POLLUTION increases LEARNING DISABILITIES

From press release by John Blair, Valley Watch, August 14, 2012 and Steven Higgs, NUVO/Bloomington Alternative, July 24, 2011
Biomass Incinerators Emit a Wide Variety of Air Pollutants
INCREASE POLLUTION=INCREASE RATES OF DISEASES
No Safe Threshold for Particulates or Dioxins

• Brain
  – Learning disabilities
  – Lower IQ
  – Stroke
  – Alzheimer’s symptoms
  – Parkinson’s symptoms

• Lung
  – Asthma
  – Decreased lung growth
  – COPD
  – Lung Cancer

• Appendicitis

• Reproduction
  – Preterm birth/low weight
  – Chromosomal damage
  – Birth defects
  – Decreased sperm production

• Heart/circulation
  – Congenital heart defects
  – Heart attack
  – Cardiac arrest
  – Arrhythmia
  – Heart failure
  – Ischemic heart disease
  – High blood pressure
  – Peripheral vascular disease

Briefing Website Lists Supporting Articles & Information
Please Stop Subsidies for POLLUTING BIOMASS INCINERATORS

• We should not BREATHE what THEY BURN.
• BIOMASS INCINERATORS ARE NOT clean energy
  – READ THEIR PERMITS.
  – CHECK THEIR SMOKESTACKS.
  – DO THE MATH—don’t forget to ADD THE HEALTH COSTS.
• We can’t AFFORD the inevitable inflammatory avalanche.
• Air quality affects EVERYONE—for a long time!
• We are smart enough to find better answers.
• First do no harm: protecting children is priceless.
Biomass Incinerators
The Human Health Effects

- Copy of this PowerPoint
- Supporting scientific articles
- More information