Human Health Effects of Biomass Incinerators
A Pediatrician's Perspective On Air Pollution And Children, With A Focus On Inflammation

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Congressional Briefing
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Citations and Support Articles

BRAIN

Long-term air pollution exposure is associated with neuroinflammation, an altered innate immune response, disruption of the blood-brain barrier, ultrafine particulate deposition, and accumulation of amyloid beta-42 and alpha-synuclein in children and young adults.

Calderón-Garcidueñas L, Solt AC, Henríquez-Roldán C, et al.
Toxicol Pathol. 2008 Feb;36(2):289-310. Epub 2008 Mar 18.
http://www.ncbi.nlm.nih.gov/pubmed/18349428/##

The adverse effects of air pollution on the nervous system
In the recent past, air pollution has also been associated with diseases of the central nervous system (CNS), including stroke, Alzheimer's disease, Parkinson's disease, and neurodevelopmental disorders

Genc S, Zadeoglulari Z, Fuss SH, Genc K.
J Toxicol. 2012;2012:782462. Epub 2012 Feb 19.
http://www.ncbi.nlm.nih.gov/pubmed/22523490

Air pollution as an emerging global risk factor for stroke
Journal of the American Medical Association. 2011;305(12):1240–1241.

Mateen FJ, Brook RD.
http://www.ncbi.nlm.nih.gov/pubmed/21427378

Brain inflammation and Alzheimer's-like pathology in individuals exposed to severe air pollution

Calderón-Garcidueñas L, Reed W, Maronpot RR, et al.
Toxicologic Pathology. 2004;32(6):650–658.4
Brain inflammation and Alzheimer's-like pathology in individuals exposed to severe air pollution.

Residential Proximity to Freeways and Autism in the CHARGE Study

Conclusions :Living near a freeway was associated with autism. Examination of associations with measured air pollutants is needed.

Environ Health Perspect. 2011 June; 119(6): 873–877. Published online 2010 December 16.
doi: 10.1289/ehp.1002835

Long-term air pollution exposure is associated with neuroinflammation, an altered innate immune response, disruption of the blood-brain barrier, ultrafine particulate deposition, and accumulation of amyloid β-42 and α-synuclein in children and young adults.

Exposure to air pollution causes neuroinflammation, an altered brain innate immune response, and accumulation of Abeta42 and alpha-synuclein starting in childhood. Exposure to air pollution should be considered a risk factor for Alzheimer's and Parkinson's diseases, and carriers of the APOE 4 allele could have a higher risk of developing Alzheimer's disease if they reside in a polluted environment.

Calderón-Garcidueñas L, Solt AC, Henríquez-Roldán C, et al.
Toxicologic Pathology. 2008;36(2):289–310.
http://www.ncbi.nlm.nih.gov/pubmed/18349428

Translocation and potential neurological effects of fine and ultrafine particles a critical update
Morphometric analysis of the CNS indicated unequivocally that the brain is a critical target for PM exposure and implicated oxidative stress as a predisposing factor that links PM exposure and susceptibility to neurodegeneration.

Peters A, Veronesi B, Calderón-Garcidueñas L, et al.
Part Fibre Toxicol. 2006 Sep 8;3:13. .
http://www.ncbi.nlm.nih.gov/pubmed/16961926

Particulate matter, oxidative stress and neurotoxicity Particulate matter (PM), a component of air pollution has been epidemiologically associated with sudden deaths, cardiovascular and respiratory illnesses. The effects are more pronounced in patients with pre-existing conditions such as asthma, diabetes or obstructive pulmonary disorders. Clinical and experimental studies have historically focused on the cardiopulmonary effects of PM. However, since PM particles carry numerous biocontaminants that are capable of triggering free radical production and cytokine release, the possibility that PM may affect organs systems sensitive to oxidative stress must be considered.

MohanKumar SM, Campbell A,
Neurotoxicology. 2008;29(3):479–488.
http://www.ncbi.nlm.nih.gov/pubmed/18289684
Published online 2008 October 11. doi: 10.1016/j.mrgentox.2008.09.016

A Research Strategy to Discover the Environmental Causes of Autism and Neurodevelopmental Disabilities

This susceptibility is greatest during unique “windows of vulnerability” that open only in embryonic and fetal life and have no later counter-part (Miodovnik 2011). “Proof of the principle” that early exposures can cause autism comes from studies linking ASD to medications taken in the first trimester of pregnancy—thalidomide, misoprostol, and valproic acid—and to first-trimester rubella infection (Arndt et al. 2005; Daniels 2006).This “proof-of-principle” evidence for environmental causation is supported further by findings from prospective birth cohort epidemio-logical studies, many of them supported by the National Institute of Environmental Health Sciences (NIEHS).

Philip J. Landrigan, Luca Lambertini, and Linda S. Birnbaum
Environ Health Perspect. 2012 July; 120(7): a258–a260. Published online 2012 July 2. doi: 10.1289/ehp.1104285 Exploration of the environmental causes of autism and other NDDs has been catalyzed by growing recognition of the exquisite sensitivity of the developing human brain to toxic chemicals (Grandjean and Landrigan 2006).

Deficits and brain abnormalities: a pilot study with children and dogs.
Air pollution, cognitive

Calderón-Garcidueñas L, Mora-Tiscareño A, Ontiveros E, et al.
Brain and Cognition. 2008;68(2):117–127

Air Pollution: Mechanisms of Neuroinflammation & CNS Disease

Michelle L. Block and Lilian Calderón-Garcidueñas
Trends Neurosci. 2009 September; 32(9): 506–516

REPRODUCTION

Ambient Air Pollution and Risk of Birth Defects in Southern California (Increased Conotruncal Defects and other Congenital Heart Defects)

Beate Ritz,[1,2] Fei Yu,[3] Scott Fruin,[4,5] Guadalupe Chapa,[4] Gary M. Shaw,[6] and John A. Harris[6]
American Journal of Epidemiology Copyright © 2002 Vol. 155, No. 1

Episodic air pollution is associated with increased DNA fragmentation in human sperm without other changes in semen quality.

Rubes J, Selevan S, Evenson D, Zudova D, Vozdova M, Zudova Z, Robbins W, Perreault S. Human Reproduction Vol.20, No.10 pp. 2776–2783, 2005 doi:10.1093/humrep/dei122. Advance Access publication June 24, 2005.

Ambient air pollution and risk of congenital anomalies: a systematic review and meta-analysis.

DATA SYNTHESIS: Each individual study reported statistically significantly increased risks for some combinations of air pollutants and congenital anomalies, among many combinations tested.

Vrijheid M, Martinez D, Manzanares S, Dadvand P, Schembari A, Rankin J, Nieuwenhuijsen M. Environ Health Perspect. 2011 May;119(5):598-606. Epub 2010 Dec 3

Association between Local Traffic-Generated Air Pollution and Preeclampsia and Preterm Delivery in the South Coast Air Basin of California

Exposure to local traffic-generated air pollution during pregnancy increases the risk of preeclampsia and preterm birth in Southern California women. These results provide further evidence that air pollution is associated with adverse reproductive outcomes.

Jun Wu,1,2 Cizao Ren,2 Ralph J. Delfino,2 Judith Chung,3 Michelle Wilhelm,4 and Beate Ritz4
Environ Health Perspect. 2009 November; 117(11): 1773–1779. Published online 2009 June 23. doi: 10.1289/ehp.0800334

Chronic Air Pollution Exposure during Pregnancy and Maternal and Fetal C-Reactive Protein Levels: The Generation R Study

Conclusions: Our results suggest that exposure to air pollution during pregnancy may lead to maternal and fetal inflammatory responses.

Edith H. van den Hooven,[1,2,3] Yvonne de Kluizenaar,[2] Frank H. Pierik,[2] Albert Hofman,[3] Sjoerd W. van Ratingen,[2] Peter Y.J. Zandveld,[2] Jan Lindemans,[4] Henk Russcher,[4] Eric A.P. Steegers,[5] Henk M.E. Miedema,[2] and Vincent W.V.
Environ Health Perspect. 2012 May; 120(5): 746–751.
Published online 2012 February 3. doi: 10.1289/ehp.1104345

Using new satellite based exposure methods to study the association between pregnancy pm2.5 exposure, premature birth and birth weight in Massachusetts.

Kloog, I, SJ Melly, WL Ridgway, BA Coull and J Schwartz. 2012.
Environmental Health http://dx.doi.org/10.1186/1476-069X-11-40

HEART and CIRCULATION

Air Pollution and Cardiovascular Disease
A Statement for Healthcare Professionals From the Expert Panel on Population and Prevention Science of the American Heart Association

Robert D. Brook, MD; Barry Franklin, PhD, Chair; Wayne Cascio, MD; Yuling Hong, MD, PhD; George Howard, PhD; Michael Lipsett, MD; Russell Luepker, MD; Murray Mittleman, MD, ScD; Jonathan Samet, MD; Sidney C. Smith Jr, MD; Ira Tager, MD
Expand+Circulationcirc.ahajournals.org Circulation. 2004; 109: 2655-2671 doi: 10.1161/01.CIR.0000128587.30041.C8

Ambient Air Pollution and the Progression of Atherosclerosis in Adults

Cross-sectional studies suggest an association between exposure to ambient air pollution and atherosclerosis. We investigated the association between outdoor air quality and progression of subclinical atherosclerosis (common carotid artery intima-media thickness, CIMT).

Kunzil N, Jerrett M, Garcia-Esteban, R, et al.
http://www.plosone.org/article/info%3Adoi/10.1371/journal.pone.0009096

Air pollution related prothrombotic changes in persons with diabetes

Jacobs L, Emmerechts J, et al.
Environ Health Perspect. 2010 Feb;118(2):191-6.

Association Between Changes in Air Pollution Levels During the Beijing Olympics and Biomarkers of Inflammation and Thrombosis in Healthy Young Adults

Rich D, Kipen H, Huang W, Wang G, Wang Y, Zhu P, et al.
JAMA. 2012;307(19):2068-2078. doi:10.1001/jama.2012.3488

Chronic Fine Particulate Matter Exposure Induces Systemic Vascular Dysfunction via NADPH Oxidase and TLR4 ePathways.

Kampfrath T, Maiseyeu A, Ying Z, Shah Z, Deiuliis JA, et al.
Circulation Research, 2011; 108 (6): 716 DOI: 10.1161/CIRCRESAHA.110.237560

Cardiovascular Effects of Ambient Particulate Air Pollution Exposure

Contemporary Reviews in Cardiovascular Medicine:
Qinghua Sun, MD, PhD; Xinru Hong, MD, PhD; Loren E. Wold, PhD
Review article
http://circ.ahajournals.org/content/121/25/2755.full

Cardiovascular Mortality and Long-Term Exposure to Particulate Air Pollution Epidemiological Evidence of General Pathophysiological Pathways of Disease

C. Arden Pope III, PhD; Richard T. Burnett, PhD; George D. Thurston, ScD; Michael J. Thun, MD;
Eugenia E. Calle, PhD; Daniel Krewski, PhD; John J. Godleski, M
10-mcg/m3 elevation in fine PM was associated with 8% to 18% increases in mortality risk,
Circulation. 2004; 109:71-77

LUNG

Inhalation of Environmental Stressors & Chronic Inflammation: Autoimmunity and Neurodegeneration

Sandra E. Gomez-MejibaZili Zhai,[1] Hammad Akram,[1] Quentin N. Pye,[1] Kenneth Hensley,[1] Biji T. Kurien,[2] R. Hal Scofield,[2,3] and Dario C. Ramirez

Figure 1**The lung as a target and source of systemic oxidative stress and inflammation**

Mutat Res. 2009 March 31; 674(1-2): 62–72.

Paediatric Child Health. 2008 October; 13(8): 672–674. Normal cilia slide

http://pediatrics.med.unc.edu/specialties/airid/pcd/injury cilia slides

http://www.youtube.com/watch?feature=endscreen&v=FQwqhblxz3I&NR=1 cilia video

http://www.google.com/imgres?imgurl=http://yousigma.com/health/asthma.jpg&imgrefurl=http://yousigma.com/health/asthma.html&h=548&w=546&sz=59&tbnid=zPWI7AafCL9LOM:&tbnh=90&tbnw=90&prev=/search%3Fq%3Dpictures%2Basthma%26tbm%3Disch%26tbo%3Du&zoom=1&q=pictures+asthma&usg= oQKLDPBXI8c9ohI9OIva2D0dtnw=&sa=X&ei=dCZFUImEMpSE9gSNn4GYBg&ved=0CDgQ9QEwAw&dur=500 asthma image used on slides

http://www.arb.ca.gov/research/chs/chs.htm#new results of California child health study

Major Results of the Study—child health study

- **Air Pollution Harms Children's Lungs for Life** - Children exposed to higher levels of particulate matter, nitrogen dioxide, acid vapor and elemental carbon, had significantly lower lung function at age 18, an age when the lungs are nearly mature and lung function deficits are unlikely to be reversed. [USC]
  N Engl J Med 2004; 351:1057 - 1067 (Link to the article - May require registration)
- Children that were exposed to current levels of air pollution had significantly reduced lung growth and development when exposed to higher levels of acid vapor, ozone, nitrogen dioxide and particulate matter which is made up of very small particles that can be breathed deeply into the lungs. Summary of the Article.
  Am J Respir Crit Care Med 2002; 166:76 - 84 (Link to the article - May require registration)
- Children living in high ozone communities who actively participated in several sports were more likely to develop asthma than children in these communities not participating in sports. Press Release January 31, 2002.
  Lancet 2002; 359:386 - 391 (Link to the article - May require registration)
- Children living in communities with higher concentrations of nitrogen dioxide, particulate matter and acid vapor had lungs that both developed and grew more slowly and were less able to move air through them. This decreased lung development may have permanent adverse effects in adulthood.
  Am J Respir Crit Care Med 2000; 162:1383 - 1390 (Link to the article - May require registration)
- Children who moved away from study communities had increased lung development if the new communities had lower particulate matter levels, and had decreased lung development if the new communities had higher particulate matter levels.
  J Respir Crit Care Med 2001; 164:2067 - 2072 (Link to the article - May require registration)

- Days with higher ozone levels resulted in significantly higher school absences due to respiratory illness. Children with asthma who were exposed to higher concentrations of particulate matter were much more likely to develop bronchitis.
  Epidemiology 2001; 12:43 - 54 (Link to the article - May require registration)

APPENDICITIS

Effect of ambient air pollution on the incidence of appendicitis
We found that the incidence of appendicitis was significantly associated with short-term exposure to air pollution. The effect of air pollution was greatest in the summer months, when individuals were most likely to be outside and exposure estimates from fixed-site monitors better reflected an individual's exposure.

Gilaad G. Kaplan, MD MPH, Elijah Dixon, MD MSc, Remo Panaccione, MD, Andrew Fong, MSc, Li Chen, MSc, Mieczyslaw Szyszkowicz, PhD, PhD, Anthony MacLean, MD, W. Donald Buie, MD MSc, Terry Leung, MD, Steven J. Heitman, MD MSc, Paul J. Villeneuve, PhD

PEDIATRIC SUSCEPTIIBILITY

Children's vulnerability to toxic chemicals: a challenge and opportunity to strengthen health and environmental policy.

Landrigan PJ, Goldman LR.
Mount Sinai School of Medicine, in New York City, NY, USA. phil.landrigan@mssm.edu
CMAJ October 27, 2009 vol. 181 no. 9 First published October 5, 2009, doi: 10.1503/cmaj.082068

WEBSITES CITED:

American Lung Association June 24, 2009
Letter to Chairman Waxman and Chairman Markey
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.

http://www.saveamericasforests.org/Forests%20-%20Incinerators%20-%20Biomass/Documents/Human%20Health/ALA%20national%20letter.pdf

The Ohio Valley's toxic kids & Indiana's toxic air affecting children by Steve Higgs
In the 19 Indiana counties closest to the Ohio, one in five public school children were in special education. In Evansville, it was 22 percent. Twenty miles to the west, in Mount Vernon, it was 26 percent. According to data from the Indiana Department of Education (DoE), 27 percent of the 916 students in the New Harmony Town and Township School Corporation received special education services during the 2008-09 school year.

http://www.nuvo.net/indianapolis/the-ohio-valleys-toxic-kids/Content?oid=1329316

Exposure to cancer-causing toxics National Rank 5th percentile
FERDINAND ELEMENTARY SCHOOL 402 E 8TH ST FERDINAND, IN
Ferdinand Elementary School

http://content.usatoday.com/news/nation/environment/smokestack/search/IN/~/ferdinand/ferdinand/name/~/1/

If the Tri-State were a State, we would be 3rd in the release of toxic chemicals to the air, nationwide.

Posted on August 14, 2012 by John Blair **August 14, 2012 – Press Release of Valley Watch, Inc.**Valley Watch found that this relatively small area, about a third the size of Indiana and a little less than a third the size of Kentucky would place Third if the studied region was a separate State, just ahead of Pennsylvania and far surpassing Indiana as a whole at 31,641,412 pounds of air toxics released in 2010.

http://valleywatch.net/