October 25, 2012

Factsheet from the Partnership for Policy Integrity: the proposed Green Energy Partners biomass plant, Lithonia, Georgia

1. **Emissions from the GEP plant**
    a. The Lithonia region already has polluted air – see below for details on how the region is failing to meet EPA health standards for particulate matter (PM) and ozone. That means the air is already unhealthy – adding new sources of pollution is a real threat to human health and the environment.
    b. Biomass energy is not "clean". GEP will emit as much particulate matter (PM) as a coal plant of the same size. Particulate matter penetrates into the lungs and worsens asthma and other respiratory problems. There are many studies that show that hospital admissions and death rates increase on bad air pollution days. PM is the worst offender.
        i. The technology that Green Energy Partners is using to control particulate matter is not the most effective available. While claims by the developer that the ceramic filter technology will remove 95% of particle mass may sound impressive, this is actually very poor performance compared to a fabric filter, which can remove more than 99% of particles by mass. This difference adds up to many tons of PM emissions per year.
        ii. There is no emissions control technology that is truly effective for capturing ultra-fine particulate matter, which is the most dangerous size because of how it penetrates deep into the lungs and crosses the blood-brain barrier.
    c. GEP will emit tons of hazardous air pollutants that are known to cause cancer and birth defects.
    d. Although they claim no painted or chemically treated wood will be accepted, the facility claims it will use "visual inspection" to make sure that no "non-conforming" wood is burned. The absurdity of thinking that it's possible to determine contamination in the approximately 20 tons of woodchips per hour that the facility will burn is evident.
    e. GEP will also emit as much or more carbon monoxide (CO) than a coal plant, and further, has likely underestimated its emissions of this gas. Carbon monoxide is a product of incomplete combustion, and is accompanied by other products of incomplete combustion, including hazardous air pollutants (HAPs) like formaldehyde and benzene.
    f. GEP will emit as much nitrogen oxides (NOx) as a coal plant. Nitrogen oxides combine with volatile organic compounds (VOCs), another pollutant emitted by the GEP plant, to form ground-level ozone, a respiratory irritant (more details below). The Lithonia area is already out of attainment with EPA's health standard for ozone. The plant appears to have seriously underrepresented the amount of NOx it will emit.
    g. The GEP plant is using a very low smokestack, which according to their latest filing is only 98 feet in height. Typically, smokestacks for facilities like this are much higher. A low smokestack means emissions won't disperse – instead, they'll contaminate the air near the ground in the vicinity of the plant.
    h. It's not just stack emissions that will increase. The facility will require about 7,500 tractor-trailer truckloads of wood chip fuel per year, or close to one per hour. Diesel

emissions from these trucks will be significant. It's important to note that much of f DeKalb's pollution is already traffic-related.

Background

2. **There are two main kinds of air pollutants regulated under the federal Clean Air Act): Criteria Pollutants and Hazardous Air Pollutants (HAPs)**
    a. **Criteria pollutants**: There are six **criteria pollutants**: carbon monoxide (CO), sulfur dioxide (SO_2), lead, ozone, nitrogen dioxide (NO_2), and particulate matter (PM). (See section below titled "Air pollutants from biomass burning" for more details – last part of document).
        i. The concentrations of the criteria pollutants in air are each supposed meet a "National Ambient Air Quality Standard" (NAAQS) which is health-based (this is discussed in more detail below). Concentrations above the standard are considered unhealthy for sensitive groups."[1]
    b. **Hazardous air pollutants (HAPs):** EPA maintains a list of 187 compounds that are considered especially toxic in air. The list includes heavy metals like mercury, arsenic, chromium and cadmium, and organics like benzene and formaldehyde. Dioxins are another class of HAP (more details on the main types of HAPs is provided in more detail below).
        i. The Georgia "Ambient Air Surveillance Report"[2] states: "*There are currently 187 hazardous air pollutants (HAPs), or air toxics, with emissions regulated under the Clean Air Act (CAA). These compounds have been associated with a wide variety of adverse human health and ecological effects, including cancer, neurological effects, reproductive effects, and developmental effects. According to the Government Performance Results Act (GPRA), the U.S. Environmental Protection Agency (U.S. EPA) is committed to reducing air toxics emissions by 75 percent from 1993 levels in order to significantly reduce Americans' risk of cancer and of other serious health effects caused by airborne toxic chemicals."*
    c. The Green Energy Partners facility (GEP) will emit **both criteria pollutants and hazardous air pollutants.** Because the plant will burn construction and demolition-derived wood (CDD), which can contain pressure-treated, painted, and glued wood products, emissions of HAPs may be particularly high (the pressure-treatment "cocktail" includes arsenic, chromium, and copper). Sorting CDD to remove pressure-treated wood is never fully effective – studies have shown it is impossible to generate a truly "clean" fuel supply from this wood. The GEP developer claims that no painted or treated wood will be burned, but given that the plant will burn around 18 tons of chipped wood (close to one tractor-trailer load) per hour, it is impossible to screen out contaminated chips. The developer has made a statement that is impossible to live up to, because no testing program can be designed that will find all contaminated wood and remove it from the fuel stream before it is burned.

3. Federal and state air standards are set for criteria pollutants. **Federal air quality standards for criteria pollutants are called "National Ambient Air Quality Standards" (NAAQS)**

[1] Page vi of 2010 ambient air report
[2] Available at http://www.air.dnr.state.ga.us/amp/report10.pdf

a. The Georgia Environmental Protection Division (GA EPD) and the federal EPA monitor air pollution levels. A region is in "nonattainment" when background air pollution exceeds the National Ambient Air Quality Standards (NAAQS). DeKalb County is in nonattainment for PM2.5 and ozone, as discussed in more detail below.
b. Air quality modeling estimates how emissions from a new facility will increase local air pollution. Taking into account local terrain, weather conditions, and windspeed, a computer model estimates how emissions of the main pollutants emitted at the plant's smokestack will disperse. The resulting concentrations of pollutants in air are added to background levels and the summed total is compared to the NAAQS to determine if the facility will push the area out of attainment.
    i. In cases such as that of Lithonia, where the area is out of attainment *already*, power plant developers typically try to downplay the contribution of the emissions from their particular facility to make the case that they will only worsen air quality by an insignificant amount.

4. **DeKalb County is already out of attainment with EPA's 1997 health standard for PM2.5[3] – since then, PM2.5 standards were lowered further (2006) and are about to be lowered again.**

    a. Particle pollution is noted for being high in the region, and exceptionally high particle pollution events are common in the Lithonia area.
    b. Not only is the area in nonattainment for the old, 1997 standard - EPA recognizes that the *current* NAAQS for PM are not protective.
        i. As acknowledged by EPA's own Science Advisory Committee: *It is the CASAC's consensus scientific opinion that the decision to retain without change the annual PM2.5 standard does not provide an "adequate margin of safety … requisite to protect the public health" (as required by the Clean Air Act), leaving parts of the population of this country at significant risk of adverse health effects from exposure to fine PM.*
        ii. That's why EPA is lowering the PM NAAQS even further. Building new emissions sources of particle pollution will make it even harder for the area to come into attainment with the health standard.

5. **DeKalb County is already out of attainment with EPA's health standard for ozone**
    a. The region is officially out of attainment with the old 1997 standard for ozone (http://www.epa.gov/oaqps001/greenbk/map8hr.html), which is 0.085 ppm. The 2010 ambient air quality report states that "data show that the Atlanta area will be in attainment with the 1997 standard of 0.085 pppm, but has not been officially redesignated as attainment". The Atlanta area has numerous days when it fails to achieve attainment with the new 0.075 ppm ozone standard (page 32 of Ambient AQ report for 2010).

6. The state sets health standards for some hazardous air pollutants (HAPs), but these do not carry the same legal force that the federal NAAQS for criteria pollutants carry. The Georgia "Ambient Air Surveillance Report" states, *"**Currently, there are no attainment standards for the air toxics compounds**, with the exception of lead, which has its designation as a criteria pollutant. Air toxics measurements are performed to support the regulatory,*

[3] http://www.epa.gov/pmdesignations/1997standards/final/region4desig.htm

*analytical, and public health purposes of the program. While it is understood that these compounds are toxic, **it is not well understood** what airborne concentrations of each compound may be harmful. By collecting data about their current concentrations, researchers can later compare GA EPDs data with health data to determine what levels of each compound may be safe."*

a. The state is here admitting that they don't know how much of something is really harmful. Thus building a new emissions source of HAPs and criteria pollutants in an area already known to have unhealthy air is a threat to health.
b. Georgia derives its health standards for HAPs from various sources, including EPA, the Occupational Safety and Health Administration (OSHA) and others. The health standards for toxics that were used by the GEP plant are found in the company's air permit application.
c. When a facility evaluates how its emissions of HAPs will impact air quality, they typically do NOT add the facility's emissions to the background concentrations of HAPs. Instead, they treat the background concentrations as if they don't exist. This is partly because there are very few sites in the entire United States that collect data on a large suite of HAPs, so reliable data on the actual background concentrations of HAPs is hard to come by at many sites.
    i. However – it happens that there is an **EPA HAPs monitoring station less than 15 miles from Lithonia – the "South DeKalb" monitoring site**, in Decatur, GA. This means that we have access to a lot of air monitoring data on HAPs that are likely to be highly representative of the actual air quality in Lithonia.

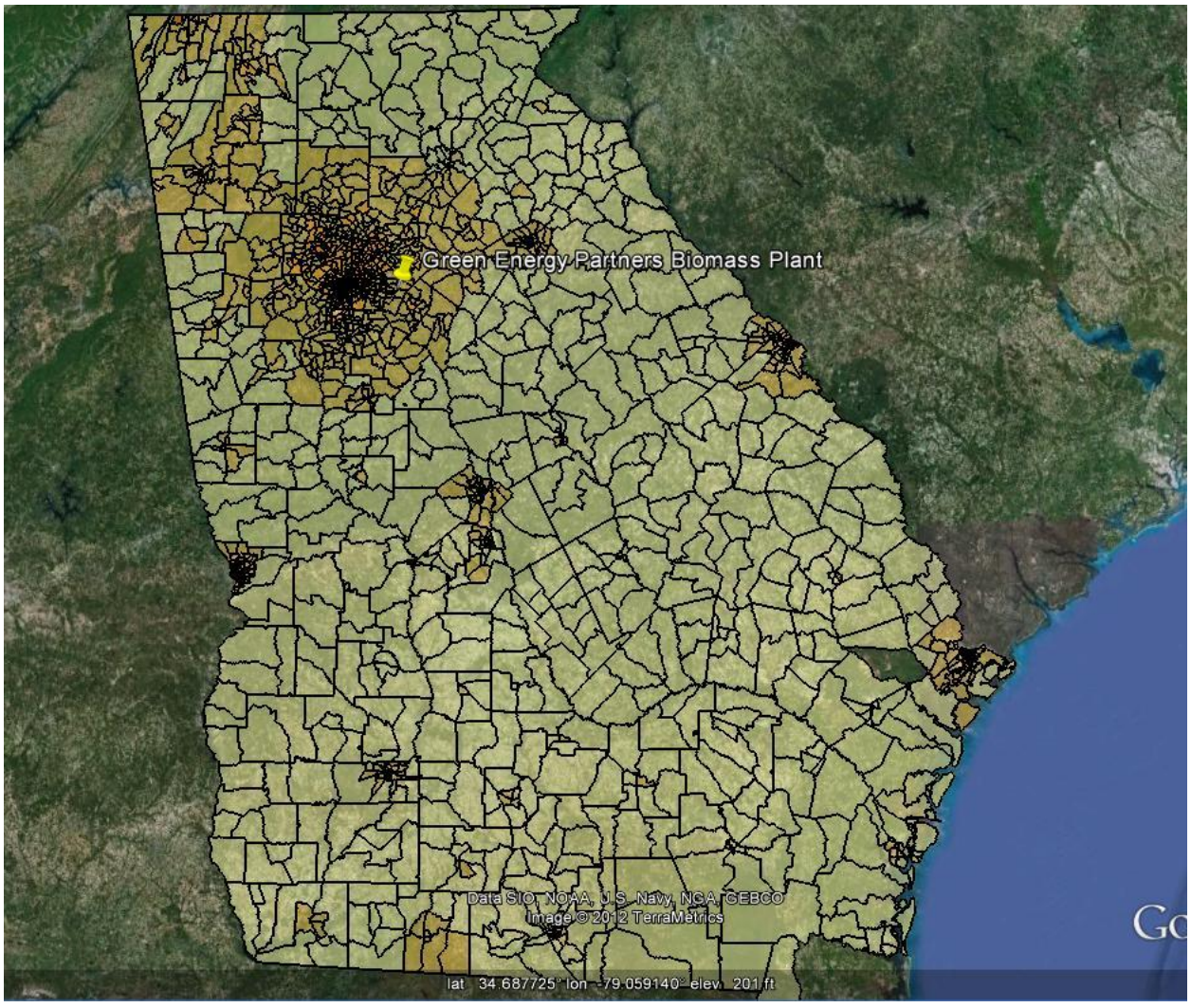
7. Background levels of Hazardous Air Pollutants (HAPs) *already* exceed health standards in DeKalb County

a. Concentrations of hazardous air pollutants, or air toxics as they are sometimes known, already exceed health guidelines even before GEP is built. Data from the South DeKalb monitoring site for 2010 show that ambient concentrations of key HAPs already exceed EPA health guidelines. Arsenic is 2.9 times the EPA guideline; formaldehyde is 58 times the EPA guideline, etc. (guidelines for toxics except acrolein are based on 1 in a million increased cancer risk; acrolein standard is based on risk of respiratory irritation).

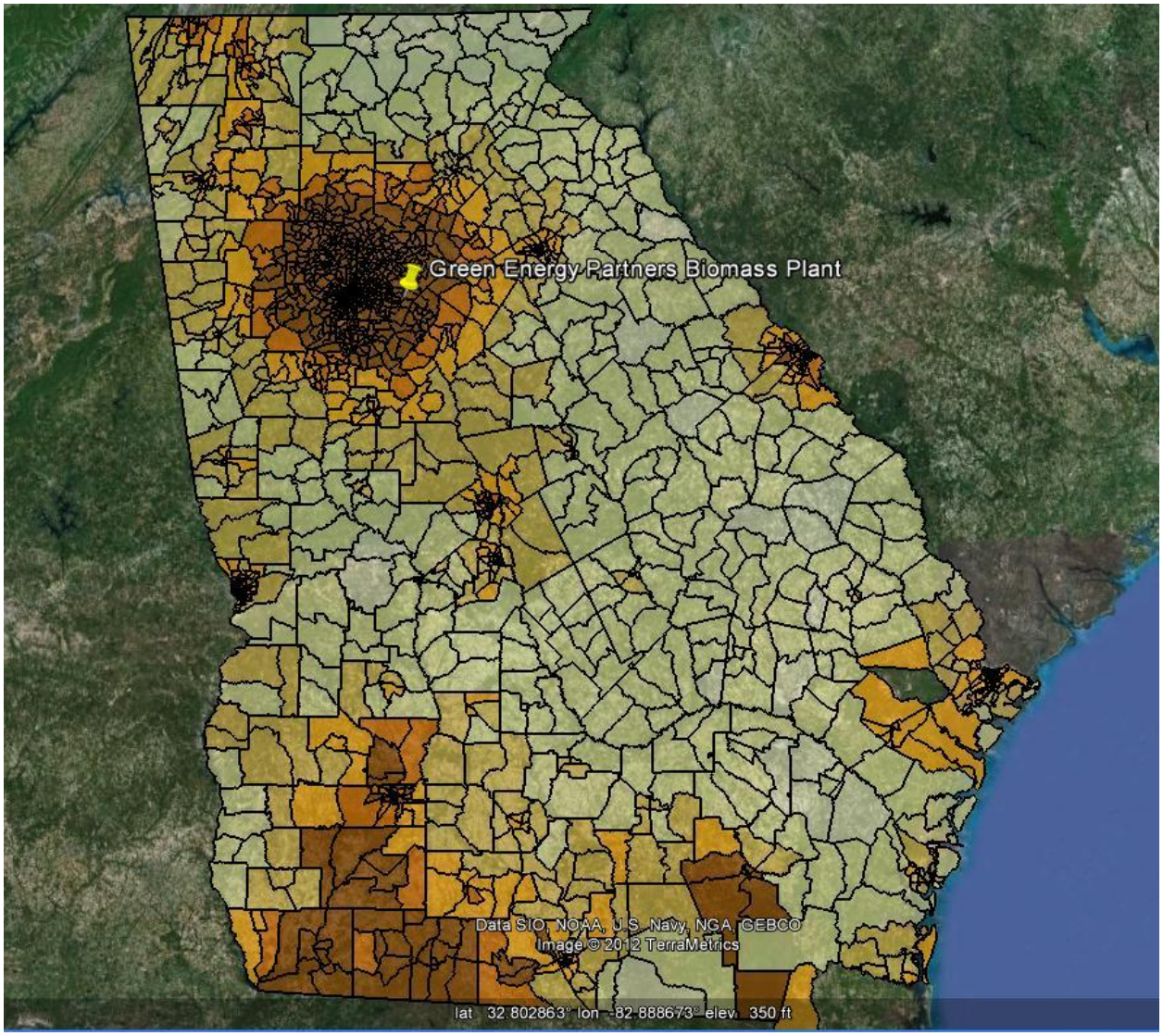
HAP	ambient (ug/m3)	EPA standard (ug/m3)	Ratio
arsenic	0.0006	0.0002	2.90
formaldehyde	4.65	0.08	58.09
benzene	0.59	0.13	4.55
acrolein	1.52	0.02	76.02
acetaldehyde	1.91	0.50	3.83
chromium VI	0.00002	0.00008	0.25

While hexavalent chromium, designated “chromium VI” or “Cr VI” (the “Erin Brockovich” toxin) is below its respective risk threshold, the fact that this plant will burn C&D means it will be burning wood that potentially contains chromium (some contaminated wood always makes it into the fuel stream). There are relatively few studies of how much of total chromium gets emitted in the most deadly hexavalent (Cr VI) form, but EPA’s assumption for chromium emissions from industrial wood-burning boilers is that 56% of the chromium emitted is in the most toxic hexavalent form.

The whole Atlanta region is a hotspot for elevated cancer and respiratory risk. These maps are from EPA’s “National Air Toxics Assessment”, which makes a downloadable map that loads into Google Earth.



NATA Map for Cancer Risk.



NATA map for Respiratory risk.

More background: Air pollutants from biomass burning

Nitrogen dioxide (NO_2)
Nitrogen dioxide (NO_2) is the indicator species for the NOx group of gases, which includes nitrous acid and nitric acid. It primarily forms when fuels are burned at high temperatures. These acidic gases directly impact respiratory health, and also contribute to formation of ozone and condensable particulate matter. Nationwide, the majority of NO_2 is from the transportation sector, but utilities and other sources of combustion account for about 34% of total emissions.[4]

As of January 2010, EPA set a new 1-hour standard for NO_2 of 100 ppb, and retained the annual standard of 53 ppb.

[4] http://www.epa.gov/air/nitrogenoxides/pdfs/20100124presentation.pdf

Ozone

A principle component of smog, ground level ozone doesn't come out of a smokestack directly, but is formed in the atmosphere when nitrogen oxides (NOx), volatile organic compounds (VOCs), carbon monoxide (CO), and methane react, energized by UV light. The main sources of NOx and VOCs are industrial facilities, electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents. As a highly reactive oxidant gas, ozone aggravates the airways, causing respiratory distress and exacerbating asthma. It also damages vegetation and is increasingly recognized as a threat to forest health.

EPA has proposed revising its eight-hour standard for ozone from 0.075 ppm to 0.06 – 0.07 ppm, acknowledging that the ozone standards set in 2008 were not as protective as recommended by EPA's panel of science advisors, the Clean Air Scientific Advisory Committee (CASAC).[5] EPA has also proposed a new "seasonal secondary standard" for ozone exposure that represents cumulative exposure during peak ozone season.[6]

Sulfur dioxide (SO_2)

Sulfur dioxide (SO_2) exposure causes breathing difficulty for people with asthma, and is also plays a role in regional haze and acid rain formation.[7] A recent EPA risk assessment[8] of SO_2 concludes that definite health risks to asthmatics occur at concentrations significantly lower than the current 24-hour health standard for SO_2. The document further notes that "over 20 million people in the U.S. have asthma, and therefore, exposure to SO_2 likely represents a significant health issue." The main sources of SO_2 are fossil fuel combustion at power plants and industrial facilities. Along with its direct effects, SO_2 also contributes to the formation of fine particulate matter. EPA concluded that a new SO_2 standard with a 1-hour averaging time would be more protective. As of June 2, 2010, EPA strengthened the National Ambient Air Quality Standards (NAAQS) for SO_2 by adding a 1-hour standard set at 75 ppb.

Particulate matter (PM)

Particulate matter is derived from direct ash emissions at energy plants, but also forms in the atmosphere from emissions of sulfur dioxide, nitrogen oxides, ammonia, and volatile organic compounds.[9] Particulate air pollution has long been known to be associated with increased cardiopulmonary symptoms, asthma attacks, days lost from work due to respiratory disease, emergency room visits, hospitalization rates, and mortality. Two size classes are recognized in regulatory schemes: PM10 and $PM_{2.5}$, with the numeric value referring to the particle size in microns (a micron is one millionth of a meter). PM units of measurement in air are expressed as micrograms per cubic meter ($\mu g/m^3$). "Ultra-fine" particulate matter, with particle diameters of 0.1 ug down to 0.01 ug and below, is not separately regulated from PM2.5, but an increasing body of research indicates that this is the most dangerous size class of all. Ultra-fine PM is even more poorly controlled by emissions control technology, and in terms of particle number, is present in the millions

[5] Fact sheet: EPA to reconsider ozone pollution standards. Available at http://www.epa.gov/groundlevelozone/pdfs/O3_Reconsideration_FACT%20SHEET_091609.pdf

[6] http://www.epa.gov/air/ozonepollution/pdfs/20100106present.pdf

[7] http://www.epa.gov/oar/urbanair/so2/hlth1.html

[8] US EPA. Risk and exposure assessment to support the review of the SO2 Primary National Ambient Air Quality Standards. EPA-452/R-09-007, July, 2009.

[9] http://www.epa.gov/air/particles/fs20091119.html

to billions of particles per cubic centimeter of air, orders of magnitude greater in abundance than the particle number for the larger size classes.

There is no current health standard for $PM_{10.}$ In 2006, EPA lowered the 24-hour exposure standard for $PM_{2.5}$ from 65 µg/m^3 to 35 µg/m^3. The current annual exposure standard is 15 µg/m^3. However, EPA's most recent risk assessment for PM acknowledges that the current standards are not protective enough,[10] and the agency will soon be lowering the annual standard for PM2.5, likely to the 12 – 13 ug/m^3 range.

A recent EPA reanalysis of data on long-term health effects of PM exposure has determined that health impacts of PM are worse than previously thought, finding that higher concentrations of PM are associated with significantly greater risk of death from cardiopulmonary disease, ischemic heart disease (reduction of blood supply to the heart, potentially leading to heart attack), lung cancer, and other causes.[11] Ambient levels of PM are also associated with low fetal birthweight, as determined in a recent study (abstract pasted at end of factsheet).

The classes of particulate matter classed as "black carbon" are also implicated as having up to 60% of the climate warming effect of CO_2, by both creating "brown clouds" and darkening and thus increasing the heat absorption of snow and ice in polar regions.[12] Controlling soot emissions and thus lessening albedo effects appears to be a faster way to mitigate sea ice melting than controlling greenhouse gas emissions.[13]

Volatile organic compounds (VOCs)

According ot the EPA, volatile organic compounds are any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, that participates in atmospheric photochemical reactions [14] – in other words, a compound that is activated to change its form, or merge with other compounds, simply through light energy. VOCs are of general concern because they interact in the atmosphere with other compounds, including NOx, to form smog. The VOCs emitted from biomass and other fuel combustion are also of concern because several of the main VOCs emitted by combustion, such as benzene and formaldehyde, are carcinogenic and can cause other health problems.[15] In some areas, ambient levels of VOC HAPs such as benzene can exceed health thresholds.

[10] U.S. Environmental Protection Agency, 2009. Risk assessment to support the review of the PM primary national ambient air quality standards – external review draft. EPA 450/P-09-006. September, 2009.
[11] Health Effects Institute, 2009. Synopsis of Research Report 140: Extended analysis of the American Cancer Society study of particulate air pollution and mortality. Boston, MA.
[12] Ramanathan, V. and G. Carmichael. 2008. Global and regional climate changes due to black carbon. Nature Geoscience 1: 221- 227.
[13] Jacobson, Mark Z. 2010. Short-term effects of controlling fossil-fuel soot, biofuel soot and gases, and methane on climate, Arctic ice, and air pollution health. Journal of Geophysical Research, 115, D14209, doi 10.1029/2009JD013795
[14] EPA definition taken from http://www.epa.gov/ttn/naaqs/ozone/ozonetech/def_voc.htm
[15] While the majorityof hazardous air pollutants (HAPs) are VOCs, there are many more kinds of VOCs than there are HAPs.

Lead
Lead exposure primarily occurs from paint that has not been remediated. Lead exposure in children is linked to a variety of developmental and neurological problems. A recent study concluded that

> "long-term trends in population exposure to gasoline lead were found to be remarkably consistent with subsequent changes in violent crime and unwed pregnancy. Long-term trends in paint and gasoline lead exposure are also strongly associated with subsequent trends in murder rates going back to 1900. The findings on violent crime and unwed pregnancy are consistent with published data describing the relationship between IQ and social behavior. The findings with respect to violent crime are also consistent with studies indicating that children with higher bone lead tend to display more aggressive and delinquent behavior. This analysis demonstrates that widespread exposure to lead is likely to have profound implications for a wide array of socially undesirable outcomes."[16]

EPA recently dropped the NAAQS for lead from 1.5 $\mu g/m^3$ to 0.15 $\mu g/m^3$.

Carbon monoxide (CO)
Carbon monoxide is a product of incomplete combustion that when inhaled, interferes with oxygen absorption in the blood. Emissions of CO from biomass boilers generally increase with fuel moisture; "good combustion practices" are frequently cited as the best control for CO emissions. Carbon monoxide can accumulate in closed spaces and could be a problem in the vicinity of improperly ventilated combustion sources, particularly given that biomass fuel variability can cause very large changes in CO concentration in exhaust gases. Carbon monoxide It is treated under EPA's boiler rule as a proxy for certain organic toxics that are assumed to increase as CO emissions increase, since both are products of incomplete combustion.

Hazardous Air Pollutants (HAPs)
Hazardous air pollutants (HAPs) is the group name for 187 compounds which are known to have highly harmful health or environmental effects. The list includes metals like chromium, lead, and mercury, as well as compounds like dioxins (products of combustion that are widely considered to be among the most toxic chemicals known), benzene (a constituent of gasoline) and methylene chloride, a widely used solvent. EPA has classified two HAPs as human carcinogens (arsenic and the hexavalent form of chromium, CrVI) and four as probable human carcinogens (cadmium, lead, dioxins/furans, and nickel). All of these HAPs, as well as others, can be emitted in significant amounts by biomass energy facilities that burn construction and demolition waste ("urban wood") as fuel, which contains lead-painted wood, wood treated with copper chromium arsenate, and non-wood materials that exacerbate dioxin/furan formation. Monitoring for these pollutants is rare, but emission levels can be high in the vicinity of specific emitters.

<u>Arsenic</u>
Considered a human carcinogen by EPA, arsenic is highly toxic, and is a principle component of copper-chromium-arsenate (CCA) mixture that was used for pressure-treating lumber. Facilities that proposed to burn waste wood generally rely on visual sorting techniques to remove arsenic-containing pressure-treated wood from the C&D that it burns. However, such detection can be

[16] Quoted from abstract of Nevin, R. 2000. How lead exposure relates to temporal changes in IQ, violent crime, and unwed pregnancy. Environmental Research 83:1-22.

difficult, as noted by the Massachusetts Department of Environmental Protection website, which states

> "You can usually recognize pressure treated wood by its greenish tint, especially on the cut end, and staple-sized slits that line the wood. However, the greenish tint fades with time, and not all pressure treated wood has the slits".[17]

Hexavalent chromium

Chromium is also a constituent of pressure-treated wood, and is toxic, particularly in the hexavalent form (CR VI). EPA's website states: "The respiratory tract is the major target organ for chromium (VI) toxicity, for acute (short-term) and chronic (long-term) inhalation exposures. Shortness of breath, coughing, and wheezing were reported from a case of acute exposure to chromium (VI), while perforations and ulcerations of the septum, bronchitis, decreased pulmonary function, pneumonia, and other respiratory effects have been noted from chronic exposure. Human studies have clearly established that inhaled chromium (VI) is a human carcinogen, resulting in an increased risk of lung cancer. Animal studies have shown hexavalent chromium to cause lung tumors via inhalation exposure."[18] EPA's conversion constant for the proportion of total chromium from biomass burning that is emitted in the hexavalent form is 56%.[19]

Mercury

Mercury is a significant and dangerous contaminant that damages neurological development and other organ functions. It accumulates up food chains, presenting the greatest threat to humans and fish-eating birds like loons. Mercury is transported in the atmosphere but a significant amount from a point source can be deposited nearby, contaminating soils and water bodies. Biomass burning can emit surprisingly high amounts of mercury, though in comparison to coal as a source, biomass emissions are not significant.

Dioxins/Furans

Dioxins/furans are "persistent, bioaccumulative, and toxic" (PBT) compounds that are created as by-products of chemical manufacturing, and also from combustion. Dioxin/furans are known to affect hormone levels and functions, as well as affecting fetal development, the immune system, and reproduction. They are toxic at levels that already exist in the environment. EPA states: "Because dioxins are widely distributed throughout the environment in low concentrations, are persistent and bioaccumulated, most people have detectable levels of dioxins in their tissues. These levels, in the low parts per trillion, have accumulated over a lifetime and will persist for years, even if no additional exposure were to occur. This background exposure is likely to result in an increased risk of cancer and is uncomfortably close to levels that can cause subtle adverse non-cancer effects in animals and humans."[20]

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[17] http://www.mass.gov/dep/toxics/ptwoodqa.htm#one

[18] http://www.epa.gov/ttn/atw/hlthef/chromium.html

[19] EPA's value is from the 2005 National Emissions Inventory database, available at http://www.epa.gov/ttn/chief/net/2005inventory.html#inventorydata

[20] http://www.epa.gov/opptintr/pbt/pubs/dioxins.htm

New Study: Satellites show air pollution influences fetal development.
Sep 17, 2012

Kloog, I, SJ Melly, WL Ridgway, BA Coull and J Schwartz. 2012. **Using new satellite based exposure methods to study the association between pregnancy pm2.5 exposure, premature birth and birth weight in Massachusetts**. Environmental Health http://dx.doi.org/10.1186/1476-069X-11-40.

Synopsis by Beth Feingold

Breathing particulates during pregnancy may increase a woman's risk of giving birth to premature or low birth weight babies, according to the first study that uses satellite data to assess pollution levels. The study, conducted in Massachusetts, provides a more detailed picture of the risks than community pollution monitors.

A Harvard study suggests that exposures to fine air pollution during pregnancy increases the risk for preterm delivery and low birth weight in newborns. Further, the findings suggest particles from industrial sources may play a bigger role in exposures than traffic pollution.
This study – the first of its kind – shows that satellites offer a more accurate and comprehensive way to measure exposure and, therefore, health risks from particulate air pollution, especially in rural areas.

Previous studies suggest a link between particulate air pollution and pregnancy – that expectant mothers exposed to air pollution have increased risks of delivering a low birth weight or premature baby. These earlier studies mostly relied on ground-based monitors to measure air pollution, a method that can easily over or under estimate exposures for people who live far away from the monitors.

Satellite data allow researchers to estimate pollutant levels more accurately over large geographic areas. Additionally, since satellites capture information daily, levels can be measured over long periods of time.

In this study, the researchers were also more certain that their measurements of particulate matter (PM2.5) were not directly emitted from traffic, since emissions from cars and trucks are on too fine a scale to be captured by the pixels in the satellite image.

They determined that the fine particulate pollution they did capture was likely sulfates that are released when coal is burned or that formed in the air potentially from traffic sources farther away.

In this study, Dr. Etai Kloog and his colleagues analyzed 634,244 births from the Massachusetts birth registry. The data represented all single live births from 2000-2008 in seven Massachusetts counties. The mothers' residences were mapped and estimates of fine particulate matter (PM 2.5) concentrations for the locations were derived from images taken by NASA's MODIS satellite. The expectant mothers' average exposures to PM 2.5 were estimated for three time periods: the entire term of pregnancy, the last trimester and the final month.
From the data, Kloog and his colleagues determined if increased exposure to pollution during these three times increased the risk of delivering a pre-term baby or having a low birth weight full-term baby (defined as less than 2500 grams, or about 5.5 pounds). Figuring out ways to reduce chances of

these adverse birth outcomes is important since they can lead to adverse health problems later in childhood and adulthood.

To isolate the association between PM 2.5 and adverse birth outcomes, the researchers accounted for health, socioeconomic status, traffic density and the amount of open space near where they lived.

On average, for every 10 percent increase in the mother's exposure to PM 2.5 during the entire pregnancy, the baby's birth weight dropped almost an ounce (14 grams). The same 10 percent elevation in exposure also increased the odds of a premature birth by 6 percent.

PM2.5 could indirectly affect the fetus by potentially affecting the mother’s ability to deliver nutrients due to constriction of blood vessels. Particulate matter can also have direct effects, as the particles often contain toxics, such as metals and chemicals.

As satellite technology improves, satellite measures of air pollution – like particulate matter – will become more commonplace in human studies, the authors suggest. The images offer a robust way to look at air pollution over space and time, especially in regions not well covered by the national air pollution monitoring systems.