

Rachel's Democracy & Health News #915

Thursday, July 12, 2007

From: Rachel's Democracy & Health News #915
July 12, 2007

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THE DEADLIEST AIR POLLUTION ISN'T BEING REGULATED OR EVEN MEASURED

[Rachel's introduction: For 20 years, scientific and medical studies have been showing that the tiniest particles of airborne soot are by far the most dangerous ones. But the government has consistently refused to regulate or even measure these invisible killers. Now there is evidence that "stricter" government regulations are allowing the numbers of these particles to increase.]

By Peter Montague

In the U.S., the deadliest air pollution is not being regulated or even measured as it kills tens of thousands of people each year.

The culprit is the smallest particles of airborne soot, known as "ultrafines," which are emitted routinely by diesel engines, automotive traffic, garbage incinerators, and power plants burning coal, oil, natural gas, and biomass.[1,2]

Ultrafine particles kill in at least a half-dozen different ways, including (but not limited to) cancer, heart attack and stroke (initiating and worsening atherosclerosis), by narrowing the airways (contributing to chronic obstructive pulmonary disease (COPD) and asthma), and by causing a systemic inflammation response and initiating "oxidative stress," which drastically alters the chemistry inside cells and sets off a cascade of serious problems. Damaged lungs retain a higher proportion of ultrafines, compared to healthy lungs, and retaining more ultrafines causes more lung damage -- a positive feedback loop with negative consequences. For the past 20 years, new dangers from ultrafines have come to light each year, with no end in sight.
[3,4,5,6,7,8,9,10,11,12,13]

The people most endangered by ultrafines are urban dwellers, especially the elderly and anyone with a chronic illness (e.g., asthma, diabetes, COPD, heart problems)[14,15] but there is evidence that commuters in their cars[16] and children at play[17] are also being harmed. Children exposed continuously to low levels of ultrafines can grow into adults with diminished lung function and shortened lives.[18]

Furthermore there is growing evidence that women are affected somewhat more than men,[19] and that people of color are affected more than whites,[20] women probably because of smaller lung volume and people of color probably because of stress piled on more stress in their lives.[21,22]

Finally, there is no observable safe level -- no threshold level below which symptoms disappear. Any exposure to ultrafines seems to cause some harm.[18] The only safe level of exposure is zero.

Research over the past 18 years has revealed again and again that the greatest damage from air pollution is coming from the very smallest airborne particles of soot, yet government regulators continue to focus attention on the larger and less harmful particles, which are easier to measure. It's like the drunk searching for his keys under a street lamp, even though he knows he lost them many blocks away. "The light's better over here," he explains.

Airborne particles are classified into three groups -- coarse, fine and ultrafine. Coarse particles are those that measure between 10 micrometers in diameter down to 2.5 micrometers. A micrometer is a millionth of a meter and a meter is about 39 inches. A human hair typically measures about 100 micrometers in diameter, so the largest particles are about 1/10th the thickness of a human hair. These coarse particles are usually referred to as PM10 (particulate matter 10).[1]

Your nose and throat can trap these large particles (on sticky surfaces, for example), to prevent them from entering your lungs. After they are trapped, you eventually excrete them.

"Fines" are particles that measure between 2.5 micrometers and 0.1 micrometers; they are typically referred to as PM2.5. The smallest of these particles are small enough to get into the lower portions of your lungs. There they may be removed by several clearance mechanisms, but very slowly. Their "half-life" in the human lung is five years, meaning that a certain dose today will have diminished by half five years from now.[23] At

that rate, a dose today will stay with you for 50 years.

Some fine particles can cause serious harm before they are excreted because their surfaces are typically covered with organic chemicals and metals, which are carried into your airways. And some of these PM2.5 particles can pass directly into your blood stream, carrying their load of metals and organics with them, and distributing them throughout your body.

The federal government began setting standards for PM10 in 1987 and for PM2.5 in 1997 after several studies revealed that fines were killing an estimated 60,000 people each year in the U.S.[8] -- far more than were being killed by traffic accidents. A much larger number of people were (and are) being made sick with lung and heart problems. Corporations challenged the 1997 rules, which were finally upheld by the U.S. Supreme Court in 2001.[18]

But long before the government began to regulate "fines," many studies had revealed that the actual killing was really being done by the smallest particles of all, called "ultrafines," which the government has so far refused to regulate or even measure.[8]

Ultrafines vary in size from 0.1 micrometers down to 0.001 micrometers (or 100 nanometers down to 1 nanometer in diameter; a nanometer is a billionth of a meter). The largest of these particles has a diameter 1/1000th of the width of a human hair, and the smallest has a diameter 1/100,000th of a human hair. Relatively few such particles occur in nature, so our bodies have evolved no efficient means for protecting us against them.[1]

In typical urban air, ultrafines account for only 1 to 5 percent of all airborne particles by weight, yet a typical person breathing the air in Los Angeles will inhale 200 billion (2E11) ultrafine particles every day and retain half of those in their lungs.[26]

As particles get smaller, their surface area gets larger in relation to their volume (a physicist might say, as their diameter decreases, their surface-to-volume ratio increases). The very smallest particles, which are present in the largest numbers, have an enormous surface area compared to larger particles. This large surface area provides a perfect place for airborne toxicants to glom on and be carried efficiently into the deepest portions of your lungs.[1]

Of course your lungs are in the business of transferring oxygen from the air directly into your blood stream. Unfortunately, they do the same thing with ultrafines. healthy lungs retain about of 50% of the ultrafines you breathe[26] and a substantial number of those are passed directly into your blood stream. While in your lungs, ultrafines cause an inflammation response by creating "free radicals" from oxygen, which then combine with your lung tissues in destructive ways.[13,4] Ultrafines in your blood stream provoke an immune response that can include coagulation (thickening) of the blood -- leading in some cases to heart attacks and strokes.

Current government regulations do not take into consideration the number of particles present in air -- only the total weight of the particles. So, for example, the government says it is OK for local air to contain 35 micrograms of PM2.5 in each cubic meter of air averaged over one hour, or 15 micrograms of PM2.5 in each cubic meter averaged over a year's time. A microgram is a millionth of a gram and there are 28 grams in an ounce.

The assumption of this approach is that the total weight of particles is related in some consistent way to the number of particles in the air. Unfortunately in the few cases where this assumption has been tested, it has found to be false.[15,24,25,26] The total number of particles in the air can vary independently of the total weight of particles in the air. This means that, if you want to know the level of danger from fine particles in the air, you need to count particles, not weigh them. [9,15]

Worse, regulating the weight of particles instead of the number of particles may actually make air pollution more dangerous. Reducing the number of large particles (which is the easiest way to reduce the weight of pollution, to comply with the law) can lead to an increase in the release of ultrafine particles because larger particles serve as a "magnet" for the smallest particles. As the larger particles are removed from air emissions, ultrafine particles have fewer "magnets" to hook onto and thus can enter the ambient air in greater numbers, increasing the danger to human health.

A writer in Science magazine observed in 2005, "Controlling only mass [of airborne particles], as EPA does now, might actually be counterproductive. For example, if larger PM2.5 particle levels go down but levels of ultrafines do not, "that could make things worse," [Mark W.] Frampton says. That's because ultrafines tend to

glom onto larger PM2.5 particles, so they don't stay in the air as long when more larger particles are around." [8]

So the most dangerous forms of air pollution -- ultrafines -- which are killing tens of thousands of people each year, are not regulated and are not even being measured.

Worst of all, the "nanotechnology" industry is now ramping up manufacturing facilities to intentionally make ultrafines in ton quantities. Until recently, ultrafines have been created as an unwanted byproduct of combustion. But now ultrafines are being purposefully manufactured for use in tires, fuel cells, electronics, personal care products like sun screens, and many other products. [1,2] This will certainly create new occupational hazards -- and will certainly lead to release of ultrafines into the general environment, through products discarded and through spills, leaks and other glitches.

Do we know everything we need to know about the hazards of ultrafines? We do not. Do we know enough to act? We certainly do. As Jocelyn Kaiser summarized it in Science magazine in 2005, "Environmental and health groups, as well as many scientists, say that, as with tobacco smoke and lung cancer, policymakers can't wait for all the scientific answers before taking action to prevent deaths from dirty air." [8] Tens of thousands of lives stand to be saved each year by aggressive action to curb ultrafines. Prevention is possible - - and that's good news. [18]

With 20 years of data to rely on, it is long past time for ultrafines to be strictly controlled -- and controlled by number, not merely by weight.

Citizens concerned about new power plants, new diesel engines, or new incinerators have a right to insist on detailed information about ultrafine emissions. Will new technologies make things worse by emitting larger numbers of deadly ultrafines, even as they reduce the total weight of emissions? Given the available data, it's a fair question.

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From: Washington Post (pg. A2)
July 8, 2007

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RESEARCH LINKS LEAD EXPOSURE, CRIMINAL ACTIVITY

[Rachel's introduction: This research analyzes crime rates and lead poisoning levels across a century. The United States has had two spikes of lead poisoning: one at the turn of the 20th century, linked to lead in household paint, and one after World War II, when the use of leaded gasoline increased sharply. Both times, the violent crime rate went up and down in concert, with the violent crime peaks coming two decades after the lead poisoning peaks.]

By Shankar Vedantam, Washington Post Staff Writer

Rudy Giuliani never misses an opportunity to remind people about his track record in fighting crime as mayor of New York City from 1994 to 2001.

"I began with the city that was the crime capital of America," Giuliani, now a candidate for president, recently told Fox's Chris Wallace. "When I left, it was the safest large city in America. I reduced homicides by 67 percent. I reduced overall crime by 57 percent."

Although crime did fall dramatically in New York during Giuliani's tenure, a broad range of scientific research has emerged in recent years to show that the mayor deserves only a fraction of the credit that he claims. The most compelling information has come from an economist in Fairfax who has argued in [a series of little-noticed papers](#) that the "New York miracle" was caused by local and federal efforts decades earlier to reduce lead poisoning.

The theory offered by the economist, Rick Nevin, is that lead poisoning accounts for much of the variation in violent crime in the United States. It offers a unifying new neurochemical theory for fluctuations in the crime rate, and it is based on studies linking children's exposure to lead with violent behavior later in their lives.

What makes Nevin's work persuasive is that he has shown an identical, decades-long association between lead poisoning and crime rates in nine countries.

"It is stunning how strong the association is," Nevin said in an interview. "Sixty-five to ninety percent or more of the substantial variation in violent crime in all these countries was explained by lead."

Through much of the 20th century, lead in U.S. paint and gasoline fumes poisoned toddlers as they put contaminated hands in their mouths. The consequences on crime, Nevin found, occurred when poisoning victims became adolescents. Nevin does not say that lead is the only factor behind crime, but he says it is the biggest factor.

Giuliani's presidential campaign declined to address Nevin's contention that the mayor merely was at the right place at the right time. But William Bratton, who served as Giuliani's police commissioner and who initiated many of the policing techniques credited with reducing the crime rate, dismissed Nevin's theory as absurd. Bratton and Giuliani instituted harsh measures against quality-of-life offenses, based on the "broken windows" theory of addressing minor offenses to head off more serious crimes.

Many other theories have emerged to try to explain the crime decline. In the 2005 book "Freakonomics," Steven D. Levitt and Stephen J. Dubner said the legalization of abortion in 1973 had eliminated "unwanted babies" who would have become violent criminals. Other experts credited lengthy prison terms for violent offenders, or demographic changes, socioeconomic factors, and the fall of drug epidemics. New theories have emerged as crime rates have inched up in recent years.

Most of the theories have been long on intuition and short on evidence. Nevin says his data not only explain the decline in crime in the 1990s, but the rise in crime in the 1980s and other fluctuations going back a century. His data from multiple countries, which have different abortion rates, police strategies, demographics and economic conditions, indicate that lead is the only explanation that can account for international trends.

Because the countries phased out lead at different points, they provide a rigorous test: In each instance, the violent crime rate tracks lead poisoning levels two decades earlier.

"It is startling how much mileage has been given to the theory that abortion in the early 1970s was responsible for the decline in crime" in the 1990s, Nevin said. "But they legalized abortion in Britain, and the violent crime in Britain soared in the 1990s. The difference is our gasoline lead levels peaked in the early '70s and started falling in the late '70s, and fell very sharply through the early 1980s and was virtually eliminated by 1986 or '87.

"In Britain and most of Europe, they did not have meaningful constraints [on leaded gasoline] until the mid-1980s and even early 1990s," he said. "This is the reason you are seeing the crime rate soar in Mexico and Latin America, but [it] has fallen in the United States."

Lead levels plummeted in New York in the early 1970s, driven by federal policies to eliminate lead from gasoline and local policies to reduce lead emissions from municipal incinerators. Between 1970 and 1974, the number of New York children heavily poisoned by lead fell by more than 80 percent, according to data from the New York City Department of Health.

Lead levels in New York have continued to fall. One analysis in the late 1990s found that children in New York had lower lead exposure than children in many other big U.S. cities, possibly because of a 1960 policy to replace old windows. That policy, meant to reduce deaths from falls, had an unforeseen benefit -- old windows are a source of lead poisoning, said Dave Jacobs of the National Center for Healthy Housing, an advocacy group that is publicizing Nevin's work. Nevin's research was not funded by the group.

The later drop in violent crime was dramatic. In 1990, 31 New Yorkers out of every 100,000 were murdered. In 2004, the rate was 7 per 100,000 -- lower than in most big cities. The lead theory also may explain why crime fell broadly across the United States in the 1990s, not just in New York.

The centerpiece of Nevin's research is an analysis of crime rates and lead poisoning levels across a century. The United States has had two spikes of lead poisoning: one at the turn of the 20th century, linked to lead in household paint, and one after World War II, when the use of leaded gasoline increased sharply. Both times, the violent crime rate went up and down in concert, with the violent crime peaks coming two decades after the lead poisoning peaks.

Other evidence has accumulated in recent years that lead is a neurotoxin that causes impulsivity and aggression, but these studies have also drawn little attention. In 2001, sociologist Paul B. Stretesky and criminologist Michael Lynch showed that U.S. counties with high lead levels had four times the murder rate of counties with low lead levels, after controlling for multiple environmental and socioeconomic factors.

In 2002, Herbert Needleman, a psychiatrist at the University of Pittsburgh, compared lead levels of 194 adolescents arrested in Pittsburgh with lead levels of 146 high school adolescents: The arrested youths had lead levels that were four times higher.

"Impulsivity means you ignore the consequences of what you do," said Needleman, one of the country's foremost experts on lead poisoning, explaining why Nevin's theory is plausible. Lead decreases the ability to

tell yourself, "If I do this, I will go to jail."

Nevin's work has been published mainly in the peer-reviewed journal Environmental Research. Within the field of neurotoxicology, Nevin's findings are unsurprising, said Ellen Silbergeld, professor of environmental health sciences at Johns Hopkins University and the editor of Environmental Research.

"There is a strong literature on lead and sociopathic behavior among adolescents and young adults with a previous history of lead exposure," she said.

Two new studies by criminologists Richard Rosenfeld and Steven F. Messner have looked at Giuliani's policing policies. They found that the mayor's zero-tolerance approach to crime was responsible for 10 percent, maybe 20 percent, at most, of the decline in violent crime in New York City.

Nevin acknowledges that crime rates are rising in some parts of the United States after years of decline, but he points out that crime is falling in other places and is still low overall by historical measures. Also, the biggest reductions in lead poisoning took place by the mid-1980s, which may explain why reductions in crime might have tapered off by 2005. Lastly, he argues that older, recidivist offenders -- who were exposed to lead as toddlers three or four decades ago -- are increasingly accounting for much of the violent crime.

Nevin's finding may even account for phenomena he did not set out to address. His theory addresses why rates of violent crime among black adolescents from inner-city neighborhoods have declined faster than the overall crime rate -- lead amelioration programs had the biggest impact on the urban poor. Children in inner-city neighborhoods were the ones most likely to be poisoned by lead, because they were more likely to live in substandard housing that had lead paint and because public housing projects were often situated near highways.

Chicago's Robert Taylor Homes, for example, were built over the Dan Ryan Expressway, with 150,000 cars going by each day. Eighteen years after the project opened in 1962, one study found that its residents were 22 times more likely to be murderers than people living elsewhere in Chicago.

Nevin's finding implies a double tragedy for America's inner cities: Thousands of children in these neighborhoods were poisoned by lead in the first three quarters of the last century. Large numbers of them then became the targets, in the last quarter, of Giuliani-style law enforcement policies.

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From: Associated Press
July 3, 2007

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ASIA-PACIFIC COUNTRIES SEE EFFECTS OF CLIMATE CHANGE ON HEALTH

[Rachel's introduction: The World Health Organization estimates climate change has already directly or indirectly killed more than 1 million people globally since 2000.]

By Margie Mason

KUALA LUMPUR, Malaysia (AP) -- Rising temperatures are contributing to more landslides in Nepal, dengue fever cases in Indonesia and flooding in India, threatening to put an even greater strain on health systems across the Asia-Pacific region.

Health officials from more than a dozen countries, ranging from tiny Maldives to China, met Tuesday in Malaysia to outline health problems they are experiencing related to climate change. They discussed ways to work together to limit the impact in a region expected to be hit hard by flooding, drought, heat waves, and mosquito- and waterborne diseases.

The World Health Organization estimates climate change has already directly or indirectly killed more than 1 million people globally since 2000. More than half of those deaths have occurred in the Asia-Pacific, the world's most populous region. Those figures do not include deaths linked to urban air pollution, which kills about 800,000 worldwide each year, according to WHO.

"We're not going to have a magic bullet to fix climate change in the next 50 years. We need to motivate an awful lot of people to change their behavior in a lot of different ways," said Kristie Ebi of WHO's Global Environmental Change unit, a lead author of the health chapter in a report by the Intergovernmental Panel on Climate Change, a U.N. network of 2,000 scientists.

Ebi said health officials are about a decade behind other sectors, such as water and agriculture, in taking a look at what climate change could mean and how to deal with it. She said countries seeing the effects firsthand are now starting to realize that any problems with air, water or food will directly affect people's health. The poorest countries in Asia and Africa are expected to suffer the most.

Scientists have predicted droughts will lower crop yields and raise malnutrition in some areas, dust storms and wildfires will boost respiratory illnesses, and flooding from severe storms will increase deaths by drowning, injuries and diseases such as diarrhea. Rising temperatures could lead to the growth of more harmful algae that can sicken people who eat shellfish and reef fish. People living in low-lying coastal areas will also face more storms, flooding, and saltwater intrusion into fresh groundwater that is vital for drinking.

Many health systems in poor Asian countries are already overwhelmed with diseases like HIV/AIDS and tuberculosis, and officials have been under intense international pressure to combat bird flu outbreaks and prepare for a pandemic despite limited resources.

But tackling current pressing diseases, and investing more in public health systems overall, will help prepare countries for the future effects of global warming while saving money in the long run, said Dr. Shigeru Omi, head of the WHO's Western Pacific region.

"The economic impact will be seen eventually," he said, adding water scarcity could create a worst-case scenario that produces political instability. "I think it will pay off if we take action now."

Globalization, urbanization and the rapid development of many Asian countries are also fueling climate change that's already noticeable. Last month, China passed the United States to become the largest greenhouse gas emitter, according to the Netherlands Environmental Assessment Agency.

Singapore saw mean annual temperatures increase 2.7 degrees Fahrenheit between 1978 and 1998, while the number of dengue fever cases jumped 10-fold during the same period.

Malaria has recently reached Bhutan and new areas in Papua New Guinea for the first time. In the past, mosquitoes that spread the disease were unable to breed in the cooler climates there, but warmer temperatures have helped vector-borne diseases to flourish.

Melting of glaciers in the Himalayas has also created about 20 lakes in Nepal that are in danger of overflowing their banks, which could create a torrent of water and debris capable of wiping out villages and farms below.

Omi said governments can offer tax incentives to help motivate companies to become more environmentally friendly, while pushing for energy-efficient technologies and greener buildings. Promoting walking and bicycling, instead of driving, can also improve overall health while saving the environment.

The four-day workshop in Malaysia lays the groundwork for a ministerial-level meeting on the topic next month in Bangkok, Thailand.

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Rachel's Democracy & Health News (formerly Rachel's Environment & Health News) highlights the connections between issues that are often considered separately or not at all.

The natural world is deteriorating and human health is declining because those who make the important decisions aren't the ones who bear the brunt. Our purpose is to connect the dots between human health, the destruction of nature, the decline of community, the rise of economic insecurity and inequalities, growing stress among workers and families, and the crippling legacies of patriarchy, intolerance, and racial injustice that allow us to be divided and therefore ruled by the few.

In a democracy, there are no more fundamental questions than, "Who gets to decide?" And, "How DO the few

control the many, and what might be done about it?"

Rachel's Democracy and Health News is published as often as necessary to provide readers with up-to-date coverage of the subject.

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