August 4, 1989

Mr. C. Kelley Crossman
EID
1190 St. Francis Dr.
Santa Fe, NM 87503

Dear Mr. Crossman:

I am writing you to express my concern about the licensing of the hazardous waste incinerator in Los Alamos. I am very worried about its possible negative effects on peoples' health, as a result of long-term breathing of hazardous fine particles (see attached).

Please read the enclosed article and please, please don't compromise the health of the people of this wonderful state. The risk of doing so by licensing this incinerator is a risk that simply should not be taken.

Thank you for your time and consideration.

Sincerely,

diane forsdale

Diane Forsdale

Encl. (1)

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RACHEL'S HAZARDOUS WASTE NEWS #131

Providing news and resources to the Movement for Environmental Justice -- May 30, 1989

FINE PARTICLES--PART 1
THE DANGERS OF INCINERATION

Incineration of anything, including garbage and hazardous chemical wastes, produces a kind of pollution that is uniquely dangerous to humans: fine particles.

In this series, we will first discuss the characteristics of fine particles, and later we will discuss health studies showing the consequences of breathing fine particles.

The process of incineration turns solids and liquids partly into gases and partly into tiny particles of soot or ash. As the gases rise in the smoke stack, they cool and some of the gas molecules come together to form additional fine particles. The resulting particles are exceedingly small when they are emitted into the environment. Scientists who study particles make a distinction between coarse (large) particles and fine (small) particles. Fine particles behave entirely differently from coarse particles and, as we will see, are much more dangerous to humans. Fine particles are also much more difficult and expensive to control. They are also invisible, so when they are not controlled, there is no way to know it except by monitoring with the proper instruments.

Coarse particles are those with a diameter larger than 2 micrometers (um); fine particles are those with a diameter less than 2 micrometers. A micrometer (um) is a millionth of a meter and a meter is about a yard. (An older term for micrometer is micron.)

Incinerators emit large numbers of particles, despite the best available control technology. Half of all the particles emitted will have a diameter less that 2 um, and the majority of these will have a diameter of 0.3 um.

It is difficult to imagine how small these particles are. To help understand what we're talking about, look at the dot over the letter i in this newsletter; that dot measures about 400 micrometers in diameter. You could fit 1590 coarse particles (with a diameter of 10 micro meters) on that dot. In the case of fine particles with a diameter of 2 um, you could fit 40,000 particles on the dot. When the particles have a diameter of 0.3 um, you can fit 1,777,780 (nearly 2 million) particles on the dot over the i.

Unfortunately, U.S. EPA [Environmental Protection Agency] regulations do not take into consideration the sizes of the particles emitted by an incinerator. For regulatory purposes, coarse particles are considered to be the same as fine particles, as if they were all equivalent. The regulations issued as part of the Resource Conservation and Recovery Act (RCRA) allow the emission of 180 milligrams (mg) of particles per dry standard cubic meter of stack gas. Measurements show that half these particles will have a diameter larger that 2.5 micrometers. The remaining 90 mg of particles, however, will have diameters ranging from 2.5 down to 0.1 micrometers. A majority will have a diameter of 0.3 micrometers. If we assume that 25% are 2 um, 25% are 1 um, 35% are 0.3 um and 15% are 0.1 um in diameter, we can develop a general picture of the typical fine particle emissions from an incinerator.

Each gram of fine particles emitted from an incinerator will consist of 311 trillion (3.1×10^{14}) individual particles. There are 28 grams in an ounce and 454 grams in a pound. A trillion (10^{12}) is a thousand billion (or a million million). Over a year's time, an incinerator meeting the federal standards will legally emit anywhere from 10 to 1000 <u>tons</u> of fine particles, depending on the size of the incinerator. One ton of fine particles will be made up of 280,000,000,000,000,000,000 (280 million trillion) individual particles.

Breaking things into fine particles has the effect of vastly increasing their surface area. A single particle weighing a gram (and having the same density as water) would have a surface area of about 5 square centimeters (the size of a small U.S. postage stamp). But when that same gram is broken into 311 trillion fine particles, its combined surface area grows to 8958 square meters (the area of two football fields).

This is important for several reasons: as these fine particles move upward in the smoke stack, they are immersed in a bath of gaseous chemicals that are cooling and are "looking" for a place to turn from a gaseous to a solid state. Fine particles, with their large surface area, provide an inviting place, and so the surfaces of fine particles become covered with pollutants ("enriched" is the technical term for this) before they are released into the local air. In particular, fine particles become coated with toxic metals (lead, cadmium, arsenic, chromium, and zinc, and with sulfur and polycyclic aromatic hydrocarbons--or with whatever else is in the smoke stack at the time).

As the human body evolved throughout its long history, it adapted to the environment. One factor in the environment has always been dust, principally from dust storms. Dust from storms is all larger than 10 um in diameter and the human body evolved mechanisms for protection against such large particles. The hairs inside the nose, the mucous membranes lining the nose, throat and lungs, and even the shape of the throat, help to trap dust. As air is inhaled, the shape of the throat causes the air to swirl, so heavy dust particles are thrown outward by centrifugal force, where they strike the mucous-lined walls. As the tubes and passageways leading to the lungs twist and branch, they provide many opportunities for particles to collide with sticky walls and become trapped before they enter the lungs. Once trapped by mucous, coarse particles are coughed up and excreted.

Nature has gone to great lengths to protect the lungs because the deepest regions of the lung provide places (called alveolar sacs, or alveoli) where oxygen passes into the blood and carbon dioxide passes out of the blood. Thus, the deep regions of the lung provide direct access to the blood stream and, by this means, to every part of the body.

Unfortunately, humans now produce huge numbers of fine particles that elude the body's protective mechanisms entirely. Fine particles pass easily into the deepest regions of the lungs. There they remain indefinitely because no clearance mechanisms effectively remove them.

Once lodged in the deep regions of the lung, fine particles, with their enormous surface area enriched with toxics, provide a particularly efficient means for delivering metals and organic pollutants directly into the blood stream. Their large surface area provides effective contact with moist tissue and the opportunity for dissolving or for other chemical reactions, putting pollutants directly into the victim's blood. Once in the circulatory system, toxics are then distributed throughout the body.

[To be continued.]

The best books on fine particles are those of the National Research Council, National Academy of Sciences: Airborne Particles (Baltimore, MD: University Park Press, 1979) and Controlling Airborne Particles (Washington, DC: National Academy of Sciences, 1980); a short summary appears in Fine Particulate Pollution, a Report of the United Nations Economic Commission for Europe (London and NY: Pergamon Press, 1979). A good, though very technical, introduction is William Hinds, Aerosol Technology; Properties, Behavior and Measurement of Airborne Particles (NY: John Wiley and Sons, 1982).

Rachel's Hazardous Waste News is published weekly by Environmental Research Foundation, P.O. Box 3541, Princeton, NJ 08543. Editor: Peter Montague, Ph.D.; Associate Editor: Maria B. Pellerano; Assistant Editor: Annette Eubank; West Coast Editor: Tim Montague; subscriptions: Abigail Allen, Office Manager. Subscription rates: $25 per year for individuals and citizen groups, $50 for government agencies, $8 for students and seniors, $250 for businesses and professionals. In Canada, add $4.00; in Europe, add $11.00.

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RACHEL'S HAZARDOUS WASTE NEWS #132

Providing news and resources to the Movement for Environmental Justice -- June 6, 1989

FINE PARTICLES--PART 2
INCINERATION'S TINY BYPRODUCTS AGGRAVATE ASTHMA, BRONCHITIS

The most dangerous products of incineration are tiny, invisible, pollution-coated particles released into the atmosphere. In the air pollution business, these are known as "fine particles." Despite the best available control technology, incinerators emit large quantities of such particles, which typically measure two micrometers or less in diameter. A micrometer is a millionth of a meter and a meter is 39 inches. Pollution control devices like Venturi scrubbers and baghouse filters are not very efficient at trapping these small particles, so to save money for incinerator operators (and thus encourage incineration, which is the stated goal of the EPA), the U.S. Environmental Protection Agency has declared it "OK" for incinerators to emit large quantities of the smallest particles.

Federal law says that an incinerator is allowed to emit 180 milligrams of particles with each cubic meter of air (or 0.08 grains with each cubic foot of air). There are 437.5 grains in an ounce. One large incinerator smoke stack may emit 100,000 cubic feet of air every minute, day in and day out, or 52 billion cubic feet per year. It would be legal for such an incinerator to emit 300 tons of particles yearly. Typically, half of these particles will measure 2 micrometers or less in diameter and thus will be "respirable," which means that you and I can breathe them into the very bottom of our lungs because nature has provided us with no defense against particles this small. From our lungs, they can pass directly into our blood. (See RHWN #131, where we discussed the penetration of these fine particles into human lungs.)

The National Academy of Sciences, in Airborne Particles (Baltimore: University Park Press, 1979), discussed the health dangers of fine particles from many points of view. The "background level" of these fine particles in uninhabited regions of Canada is 1 to 3 micrograms in each cubic meter of air; in the rural Midwest, you'll find 5 to 12 micrograms in each cubic meter of air. This is not a "natural" background level; it represents pollution created by humans. Nevertheless, this background level is a good standard against which to judge the allowable emission of particles from incinerators. The allowable emissions from an incinerator exceed background concentrations by anywhere from a factor of 15,000 to a factor of 180,000. The EPA is relying upon dilution to protect you. They will argue that, by the time those particles reach your lungs, they will be diluted in a lot of fresh air and thus won't be quite so far above background levels when you breathe them. But this, of course, depends upon how close you live to an incinerator, how the wind currents go, whether there are thermal inversion conditions in your local atmosphere, and so forth. There is growing evidence (to be presented next week) that the EPA's dilution strategy isn't safe.

Fine particles remain airborne for long periods of time, and before they fall to earth they can travel several hundred miles or even farther. They can present a danger to humans all along their route. Fine particles weigh so little that they do not respond predictably to the pull of gravity. The smallest air current keeps them aloft. These particles are so small that rain drops do not wash them from the atmosphere. You are no doubt familiar with the force of air being pushed ahead of a truck barreling down the highway; it gives your car a push as it goes by. In the same way, raindrops (which measure 500 to 9000 micrometers in diameter) push air ahead of them as they fall, and they knock fine particles aside instead of washing them to earth.

Increasing the concentration of fine particles in the atmosphere is not good for people. Hardest hit are those with bronchitis and asthma, those who are very young or old, and those who exercise outdoors. Breathing through your mouth (which is one of the first things people do when they exercise, play sports, or jog) increases the intake of fine particles into the lungs. In addition, some healthy people absorb 50% more fine particles into their lungs than the average. The reasons for this are not understood.

One particularly important aspect of fine particles is that they carry into our lungs pollutants that could not otherwise get there. In this sense, fine particles have synergistic (multiplier) effects with other pollutants. The Academy said, "The generally accepted view of synergism extends beyond potentiation [increasing a pollutant's power] to include the role of toxic vector [carrier]. Such gases as sulfur dioxide are probably either adsorbed to the particulate surface or absorbed into the particles, and thereby transported into the alveolar regions [in the deep lung], where they exist in high, localized concentrations. These localized high concentrations [in the lung] could not be produced without particles. Accordingly, sulfur dioxide sorption to particulate matter might effectively allow sulfur dioxide penetration into the alveolar regions at even nominal environmental concentrations of the gaseous pollutant." In other words, "normal" or "acceptable" levels of sulfur dioxide may be made dangerous by the presence of fine particles.

"In summary," said the National Academy, "particulate atmospheric pollutants may be involved in chronic lung disease pathogenesis as causal factors in chronic bronchitis, as predisposing factors to acute bacterial and viral bronchitis, especially in children and cigarette smokers, and as aggravating factors for acute bronchial asthma and the terminal stages of oxygen deficiency (hypoxia) associated with chronic bronchitis and/or emphysema and its characteristic form of heart failure (cor pulmonale)."

CORRECTION: RHWN #131 TO BE REVISED, REISSUED

Last week's issue, Rachel's Hazardous Waste News #131, contained errors, so we have printed a revised version, which will reach you in a day or two. Please destroy copies of the original #131. If you sent #131 to friends, please be sure to send them the revised #131.

We regret the errors and any inconvenience we may have caused our readers.

'FRONTLINE' TV BROADCAST WILL FEATURE A NOTORIOUS INCINERATOR IN *WHO'S KILLING CALVERT CITY?*

PBS (the Public Broadcasting System) will air a program about Calvert City, Kentucky June 20. Called *Who's Killing Calvert City?*, the program is part of the network's regular "Frontline" series. This story focuses attention on one of the most shameful and dangerous polluters in America--the LWD Incinerator--and its neighbors (GAF, BF Goodrich and others).

Like many places in the Midwest and South, Calvert City is dominated by good old boys who bristle when anyone suggests there's something wrong with a town that has allowed itself to be victimized by predatory businessmen whose smoke stacks belch tons of poisonous chemicals into the public's airspace. But there is something wrong with towns like Calvert City.

This is a heroic story of grass roots struggle by the Coalition for Health Concern as they battle the poisoners and try to save the children of Calvert City from a legacy of danger and disease.

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