

HEALTH EFFECTS OF REGULATED AIR POLLUTANTS FROM TOXIC WASTE BURNING CEMENT KILNS

Hazardous Air Pollutants - Health Concerns

1. Lead:

Retardation and brain damage, especially in children. Learning disabilities. Endocrine-disrupting and reproductive effects, Anemia, Nervous system, Hearing loss, Joint pain, Kidney diseases, Heart, Spontaneous abortions, Vomiting, Weight loss, Nervousness, Irritability, Sudden infant deaths, Decreased thyroid function, Headaches, Immune system damage, Chromosome mutations.

2. Particulate Matter (PM_{2.5} & PM₁₀):

Eye and throat irritation, Bronchitis, Lung damage, Increased mortality rates, Increased heart attack risk. Increased respiratory problems, increased asthma, Increased emergency room visits, increased use of inhalers and medications.

The particulate matter is harmful due to the presence of dozens of toxic substances carried on the tiny particles like a sponge absorbs water. The PM₁₀ and PM_{2.5} are carrying numerous carcinogens, mutagens, teratogens, immunotoxins, respiratory toxins, neurological toxins, developmental toxins, circulatory toxins, and others.

B. Hazardous Air Pollutants - Metals with Health Concerns

1. Arsenic:

Cancer, Birth defects, Respiratory problems, Suspected mutagen (DNA damage), Heart problems, Gastrointestinal, Headaches, Impaired memory, Nervous system problems, Sexual dysfunction.

2. Beryllium:

Cancer, Primary lung disease, although also affects the Liver, Spleen, Kidneys, and Lymph glands. Enlarged heart, Conjunctivitis, Adrenal gland congestion, Cell mediated immune response, Ricketts, Osteoporosis.

3. Cadmium:

Cancer, Destroys bones by decalcification, Kidneys. Endocrine-disrupting and Reproductive effects. Lung and Gastrointestinal irritation, Behavior problems, Liver, Destruction of cell membrane, Pulmonary edema, Osteoporosis, Immune system problems, Brain and nerve cell damage, Birth Defects, Genetic mutations, Altered libido.

4. Chromium Compounds*:

Cancer, Pulmonary problems, Birth defects, Liver, DNA-Chromosome changes, Headaches, Immune system - problems, Blood changes, Nose bleeds, Low birth weight babies, Nervous system problems, Kidneys.

*Chromium VI and chromium III

5. Dioxin - Organochlorine compounds:

Cancer, Endometriosis, Immune System depressed resulting in increased susceptibility to infections; Immune system hyper-stimulation leading to scleroderma, Graves' disease, Addison's disease, arthritis, asthma, Type I diabetes, Hashimoto's disease, Myasthenia gravis, Lymphocytic adenohypophysitis, and Thyroid diseases; Human Fetal Development, Birth Defects, Sterility, Reduced Liver Function, Decreased size of human reproductive organs, Endocrine system impaired, lower IQ, fatigue, reduced glucose tolerance, emotional problems, and Heart disease.

6. Mercury:

Target organs like the brain, kidneys, central nervous system, eyes, skin, respiratory system and bowels affected, Birth defects, Neurological damage. Endocrine-disrupting and reproductive effects, Emotional disturbances, Headaches, Spontaneous abortions, Immune system damage.

Other Toxic Metals: Selenium, Nickel, Thallium, Antimony, Vanadium likely present in emissions.

7. HCL:

Hydrochloric acid is an eye, skin and lung irritant that damages the mucous membrane promoting complications.

8. Several hundred Volatile Organic Chemicals from incomplete combustion of hazardous waste such as numerous Polycyclic Aromatic Hydrocarbons (PAHs like benzo-a-pyrene) and PCBs (Polychlorinated Biphenyls):

Includes numerous carcinogens, mutagens, teratogens, immunotoxins, respiratory toxins, neurological toxins, developmental toxins, circulatory toxins, and others.

Dangers from Cement Kilns serving as Toxic Waste Incinerators

At least ten general areas of dangers exist (excluding global warming from large CO2 emissions) to human health and the environment from the two cement plant's hazardous waste incineration activities:

1). **Air pollution** transported over the nearby region that is produced by cement kiln's stack and fugitive emissions involving various contaminants such as metals, products of incomplete combustion, particulate matter, sulfur compounds, hydrochloric acid/hydrogen chloride gas, radioactive materials, and miscellaneous contaminants. This includes emissions of ozone precursors such as NOx and VOCs. Also emissions of various sulfates and nitrates that contribute to acid rain impacts.

2). **Ground water pollution** on and off-site produced by cement kiln's toxic emissions, especially metals but also products of incomplete combustion such as dioxins

and furans as well as other products of incomplete combustion, particulate matter, sulfur compounds, hydrochloric acid/hydrogen chloride gas, radioactive materials, and any other miscellaneous contaminants that may be cause for concern.

3). **Soil contamination** on and off-site from airborne fallout produced by cement kiln's stack and fugitive emissions involving metals, dioxins, furans and other products of incomplete combustion, particulate matter, sulfur compounds, radioactive materials, and any other miscellaneous contaminants that may be cause for concern.

4). **Drinking water pollution** in the nearby regional area and its lakes, ponds and rivers produced by cement kiln's toxic emissions, especially metals but also products of incomplete combustion such as dioxins and furans, radioactive materials, as well as any other miscellaneous contaminants that may be cause for concern.

5). **Surface water pollution** in the nearby regional area recreational waters produced by cement kiln's toxic emissions, especially metals but also products of incomplete combustion such as dioxins and furans, radioactive materials, as well as any other miscellaneous contaminants that may be cause for concern.

6). **Agricultural contamination** and damage in the nearby regions produced by the cement kiln's stack and fugitive emissions involving various contaminants such as metals, products of incomplete combustion such as dioxins and furans as well as other products of incomplete combustion, particulate matter, sulfur compounds, hydrochloric acid/hydrogen chloride gas, radioactive materials, and any other miscellaneous contaminants that may be cause for concern.

7). **Toxic cement product** made from cement kiln's hazardous waste firing in its cement kilns; such cement may contain metals, products of incomplete combustion, toxic particulate matter, sulfur compounds, radioactive materials, and miscellaneous contaminants.

8). **Hazardous waste transportation by truck** through the nearby regional area and large scale volume storage, handling and processing (blending) at cement kiln.

9). **Accidents**: Potential for fires, explosions and other accidents at cement kiln involving hazardous waste activities.

10). **Cumulative or aggregate pollution impacts** produced by combining cement kiln's emissions with other polluting manufacturing plants in the nearby regional area.

Why are children so vulnerable to air pollution? Some of the reasons include the following:

1. Children breathe more rapidly than adults, taking in significantly more pollution per body weight than do adults. A resting infant, for example, inhales twice as much air, relative to size, as does a resting adult.

2. Children spend more time outdoors. National data [in the USA] show that children spend an average of about 50% more time outdoors than adults.

3. Children spend more time outdoors in summer when pollution levels are generally highest.

4. Children are more active while outdoors than adults, spending three times as much time engaged in sports and other vigorous activities. Increased activity raises breathing rates and pollution exposure significantly.

5. Children's airways are narrower than those of adults, thus enhancing the inflammatory effect of air pollution.
6. Children are prone to mouth breathing, which significantly increases the dose of pollution reaching the lungs.
7. In adults, respiratory symptoms such as coughing and shortness of breath serve as signals of air pollution exposure and warnings to move indoors or curtail exercise. Children often fail to exhibit these symptoms, making them less likely to reduce exposure (i.e., stop exercising or move indoors).
8. Children are closest to the ground, where air pollutants, especially pesticides and lead, are generally most concentrated.
9. Children are also particularly vulnerable to toxic substances because their bodies are immature and rapidly growing. Children do not have a fully developed immune system, liver, or kidneys to help protect them from the damaging effects of many chemicals. Immature lungs are unable to remove or neutralize contaminants adequately, and developing brains and neural pathways are particularly vulnerable to toxins. In addition, some chemicals affect the endocrine system, potentially disturbing neural, reproductive, and immune development.
10. Airborne carcinogens and mutagens appear to have a greater effect on children, possibly because rapidly growing tissues are less differentiated and more "suggestible" than mature tissues.
11. Children exposed to carcinogens have a longer expected life span over which carcinogenic action may occur.
12. Children of parents exposed to toxic chemicals appear to have a higher incidence of cancer, possibly because they inherit damaged genetic material; additional exposure may then precipitate malignancy in these genetically susceptible children.
13. Fetuses are exposed during gestation to environmental pollutants stored in the mother's body; newborns are further exposed to environmental pollutants excreted in human breast milk. Children of mothers with higher levels of environmental pollutants in their body display an increased incidence of developmental and other adverse health effects.

In addition to these risk factors common to all children, some children, especially those who lack adequate medical care, who are undernourished or malnourished, or who live in crowded or unsanitary conditions, are at even greater risk. Other children at increased risk include those who live close to hazardous waste sites, incinerators, industrial emissions, or heavy traffic, or who are exposed to cigarette smoke or pesticides around the home. Studies have also shown that communities of color are disproportionately exposed to air toxics.

Example of Kinds of Problems Known to Occur in Cement Kilns

Solid Ring Formation Upset Kiln Condition will increase emissions

Solid ring formation ("thick coating") inside the rotary cement kiln (slowly rotating at an angle) is a common problem in most cement kilns, especially the older ones. It's like cookie batter sticking to a pan until it's all clogged up. In this case, the super-hot 3,000

degree F. flowing clinker/pre-cement material becomes sticky and highly viscous on the inside of the kiln where there are refractory bricks forming a protective lining so the outer solid steel shell will not suffer a kiln meltdown. It's easy for the fluidized clinker to start to stick to the refractory lining and a SOLID RING of material begins to form across the whole 8-9 foot diameter of the kiln. This is very, very bad since it totally stops clinker formation! Nothing flows down the kiln. Proper clinker formation will not occur under this condition. This is real bad news for cement kilns.

Another simpler way to think of this problem is when your kitchen sink drain plugs up...nothing flows until you unplug it. A cement kiln is basically a giant pipe with fluidized, 3,000 degree F clinker rolling, flowing down hill as it forms. The solid ring forms on the hotter end and I used to see the cement plants with a 10 or 12-gauge shotgun mounted onto a large stationary turret and they would fire hundreds of shotgun shells into the SOLID RING in order to break it up. The floor would be covered with hundreds of empty shotgun shells. I observed this every single year I inspected cement kilns for the state of Texas from 1980-1992 and it's fairly standard at many cement kilns, but the public will never see it.

Cement kiln operators are supposed to be watching 24/7/365 the interior of the kiln for solid ring formation buildup.

Cement Kilns emit more Criteria and Toxic Air Pollutants than Hazardous Waste Incinerators

Plant Total Annual Emissions Difference

TXI* = 23,995 tpy 12X higher than all 3 Commercial HWI combined

AEI* = 744 tpy 32X lower than TXI

LAI* = 645 tpy 37X lower than TXI

CWM* = 598 tpy 40X lower than TXI

TPY = tons per year

Hazardous waste incinerator data is 1995 annual tons; TXI's is 1997 draft air permit.

* TXI is Texas Industries Inc. Midlothian, Texas Cement Kiln Complex. Data from draft TNRCC air permit. Permit approved as proposed.

* AEI is American EnviroTech's commercial hazardous waste incinerator in Channelview, Harris County, Texas that was permitted by TNRCC but never built. Data

from final TNRCC air permit.

* LAI is Laidlaw's (formerly Rollins Environmental Services) commercial hazardous waste incinerator in Deer Park, Harris County, Texas. Now called Safety-Kleen. Data from final TNRCC air permit.

* CWM is Chemical Waste Management's commercial hazardous waste incinerator at Port Arthur, Jefferson County, Texas. Data from final TNRCC air permit.

Why Cement Kilns are typically more dangerous than incinerators

1. Air Pollution Differences between HW burning Cement Kilns & Incinerators (HWI)

- * Cement Kilns typically emit higher dioxin levels and have higher food chain impacts.
- * Chlorinated waste burned in cement kilns leads to the creation of far more harmful compounds than in original HW waste due to inherent plant design and operation.
- * Cement Kilns have no secondary afterburner (unlike HWI) to try to get better waste destruction with longer residence burn time. HWI's burn in two chambers in sequence & so combustion upsets can be better handled in the afterburner.
- * Combustion upsets. Unlike commercial incinerators, Cement Kilns must run a kiln thru each combustion upset (due to very hot raw mix present: shale, limestone, etc.) and thru process malfunctions, thereby making it impossible to contain products of incomplete combustion. This poses a significant risk to the community because upset emissions have been proven to be more toxic than the original waste to be burned, by creating more harmful products of incomplete combustion like dioxin.
- * Cement Kilns run at low oxygen concentrations needed for complete combustion, because oxygen (as excess air) is costly to heat to 3,000 oF and excess air is kept as low as possible.
- * Higher respirable PM10, total particulate emissions and stack opacity allowing more public health, nuisance and property damage from airborne cement dust.
- * Frequently higher toxic heavy metal emissions and off-site contamination.
- * Frequently higher total hydrocarbons & volatile products of incomplete combustion.
- * Frequently higher hydrochloric acid emissions with no HCl scrubbers required and more corrosion, vegetation damage and health effects observed due to acidic gases.
- * Higher carbon monoxide (CO) emissions are another sign of poor combustion.
- * Higher acid gas emissions of sulfur oxides, nitrogen oxides and hydrogen sulfide.
- * Higher air flow volumes thru the Cement Kilns allow higher mass emission rates.

2. Waste Ash and Cement Kiln Dust Differences between HWI and Cement Kilns

- * No EPA restrictions on CKD disposal (exempted by Bevill amendment) while HWI must ship ash to RCRA approved landfills; EPA proposing some CKD rules.
- * CKD is used as sham fertilizers on farmland and as inert ingredient in livestock feed & pet foods, without warning public that HW byproducts are present.
- * CKD is causing ground water contamination and runoff pollution near waste piles.
- * Inadequate testing of blended HW routinely burned (some probably illegally).

- * Produce more tons of waste CKD than actual tons of HW burned, which is not true recycling or true energy recovery. (burning does not reduce the metals).

3. Permitting Differences (RCRA Part B permits are being required):

- * Cement Kilns are older existing plants seeking back doors permits to burn HW as a fuel substitute by minimum retrofitting, whereas HWI are new plants seeking front door permits to construct units specifically designed from the ground up to burn HW with more controls and with new technology.
- * Less restrictive provisions on upsets & malfunctions since plants make cement.
- * Cement Kilns usually do Trial Burns in only 1 of 2, 3, or 4 similar kilns.
- * Cement factories may burn HW in multiple kilns without siting scrutiny giving consideration to area impacts and higher concentrations.
- * No Public Hearing opportunity prior to burning HW under interim status. Unlike commercial HWI going through public notice before construction and operation, existing neighborhood Cement Kilns can start burning HW virtually over night without public scrutiny.
- * Fuel blending allows low Btu HW, sludges, PCBs, etc. to be blended with high Btu HW so a toxic cocktail can be burned in Cement Kilns, allowing tons of unburnable HW to be disposed of like toxic heavy metals (lead, chromium, cadmium, mercury, etc.).

4. Product Differences:

- * No warning label required on cement products made with hazardous waste.

Interim recommendations for living near a cement kiln to reduce toxic chemical exposure

Avoid breathing the outside air as much as possible when the wind is blowing from the cement factory toward your home and so be sure to observe local wind conditions. Avoid exercise outdoors at these times or higher volumes of air breathed during the physical exercise activity will expose you to greater concentrations of harmful air pollution. When outside, it's appropriate for children and persons with respiratory conditions to wear at least a paper mask and even better is a gas mask to prevent exposures of harmful air contaminants.

People living near cement kilns need to be exceptionally cautious about allowing harmful cement kiln air pollution and tracking in dangerous cement dust particles into their homes where they can accumulate. Once inside the homes, the toxic dust can be inhaled or ingested, especially by young children who are prone to put their fingers in their mouths from the floor. Children are at the greatest risk. Children have rapidly developing nervous systems, lungs, brains, hearts and organs that are all exceptionally vulnerable to the toxic insults from air pollution.

Best to keep all windows and doors closed as much as possible. Homes need HEPA air filtration systems to capture even the tiniest dust particles which cement kilns emit in large quantities and it is recommended that all shoes be thoroughly cleaned before being worn into the house or leaving them outside to avoid tracking in toxic cement dust. Homes must be kept exceptionally clean or the toxic cement dust particles will be ingested and inhaled by family members.

Be careful about eating vegetables from your garden as they may contain harmful metals from the cement kiln dust blowing from the cement kiln. Cement kiln dust particles include microscopic PM2.5 sized particulate matter that is invisible to the human eye.

Avoid eating local animal, dairy and fruits and vegetables that have been grown directly downwind of the cement kilns. The meat and dairy products will potentially contain the highest concentrations of toxins like dioxins, furans, PCBs and others due to bioaccumulation through the food chain. Cows are consuming huge quantities of grass every day and the dioxins are collected from the grass they fed on.

It's tragic and unfortunate that any families should be exposed to the harmful gases and toxic dust pollution wafting out of cement kilns when they are burning hazardous waste. The cement companies are irresponsible. They generally can not meet or comply with new standards for toxic waste incinerators, even though none of us like the incinerators either. What I am saying is that cement kiln toxic waste incinerators are even worse and many times dirtier than modern dual-chambered incinerators, which have their own problems.

Bottom line: Nothing emitted by the cement kiln into the community air supply is safe to breathe. Zero emissions is the only safe level of pollution.