

ToxCat^{SPECIAL}

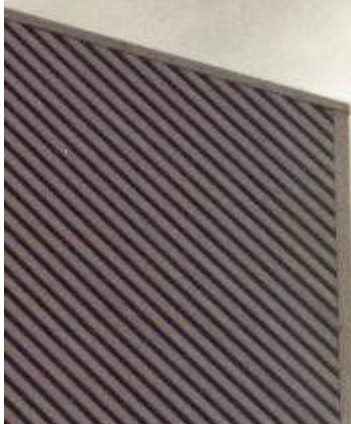


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A Beginners Guide to: Epidemiological Studies Around Incinerators

“Ah yes, truth. Funny how everyone is always asking for it but when they get it they don’t believe it because it’s not the truth they want to hear.”

Helena Cassadine



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"He who does not bellow out the truth when he knows the truth makes himself the accomplice of liars and forgers."

Charles Peguy (1873-1914) French poet, essayist and editor



Communities Against Toxics (CATs) is a national network of the long suffering citizens and communities in Great Britain and Ireland living with incinerators, waste treatment plants, toxic waste landfills, chemical installations and other unsafe, polluting industrial facilities.

Founded in 1990 CATs operates as a non-profit making, non-party political organisation dedicated to increasing public and political awareness on environmental issues and strengthening democracy at a local level.

To help communities protect the environment from industrial pollution and political apathy and indifference. CATs endeavours to provide information and expertise at reasonable cost and whenever possible free of charge to members of the poorer sections of society and groups in country's with transitional economies.

Despite helping 42 communities to resist planning applications for toxic, municipal, medical, crematorium and animal waste burners since its foundation, CATs struggles to get financial support from grant giving Foundations and has to rely on membership subscriptions and donations to survive. It receives no financial support from government sources or industry.

CATs members newsletter **ToxCat** is published every two months.

ToxCat 'Beginners Guide' to: Incinerator Emissions & some of the known impact on human health

ToxCat 'Beginners Guide' to: Dioxin

ToxCat 'Beginners Guide' to: Endocrine Disrupters

ToxCat 'Do You Want a Boy or a Girl?'

In the pipeline:

ToxCat 'Living with Incinerators' - Community Case Studies

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“Children are the main sufferers of environmental hazards. It is unacceptable from every point of view that the most vulnerable members of a society should be the ones who pay the price for failures to protect health from environmental dangers.”

Dr. LEE Jong-wook, WHO Director-General, June 2004.

One UK chemicals expert has a completely different point of view to Dr Jong-wook.

...[T]he other factor sir, which needs to be taken into account is the existing pollution in a locality and the incinerator will provide an increment on top of that. A small increment would be more tolerable in a already heavily polluted location...”

Professor Roy Harrison, OBE. Birmingham University.
Statement to House of Lords Select Committee
inquiry into Waste Incineration, 1999.

“It is sheer folly to expect justice from the unprincipled”: **Proverb**

A great many toxic and possibly neurotoxic agents are emitted hourly by incinerators and circulate freely in the environment: all people and potential progeny are constantly exposed to these complex mixtures and have been for many decades, making it neither reasonable nor prudent to assume a cumulative zero effect on the health of the human population.



Sign outside a now closed medical waste incinerator in Oakland, California. It is scientifically acknowledge that many of the compounds emitted by incinerators pass easily through the placenta and the blood brain barrier of the developing foetus. However, you will never see a warning sign like this outside a British or European incinerator as UK and EU politicians refuse to accept these plants pose any danger to *any* section of society, including the developing foetus. They have voted energy from waste incineration a 'recovery' operation, rather than a 'disposal' one, and are using huge amounts of EU citizens money to subsidise a massive building program of energy from waste incinerators throughout Europe.

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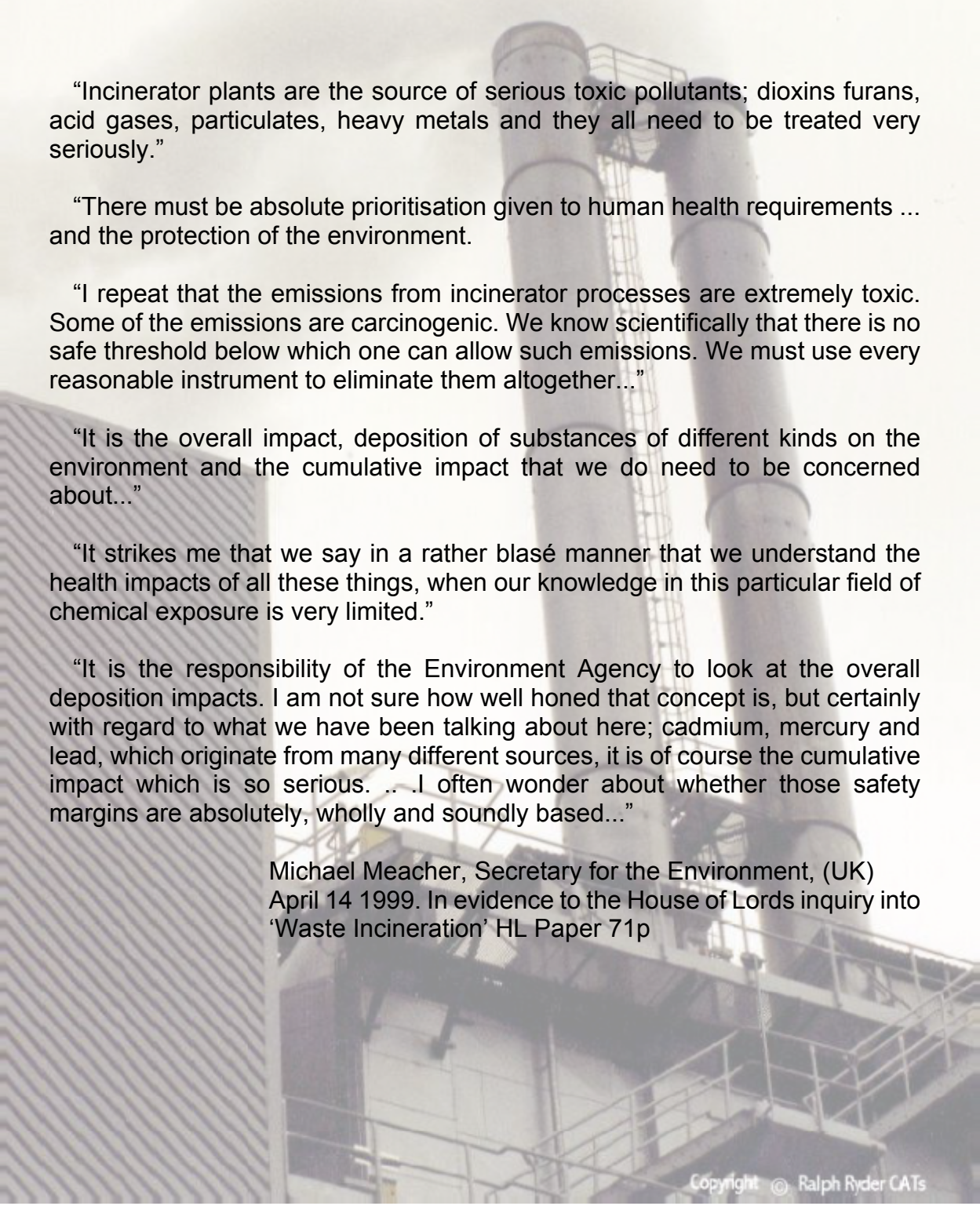
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“Incinerator plants are the source of serious toxic pollutants; dioxins furans, acid gases, particulates, heavy metals and they all need to be treated very seriously.”

“There must be absolute prioritisation given to human health requirements ... and the protection of the environment.

“I repeat that the emissions from incinerator processes are extremely toxic. Some of the emissions are carcinogenic. We know scientifically that there is no safe threshold below which one can allow such emissions. We must use every reasonable instrument to eliminate them altogether...”

“It is the overall impact, deposition of substances of different kinds on the environment and the cumulative impact that we do need to be concerned about...”

“It strikes me that we say in a rather blasé manner that we understand the health impacts of all these things, when our knowledge in this particular field of chemical exposure is very limited.”

“It is the responsibility of the Environment Agency to look at the overall deposition impacts. I am not sure how well honed that concept is, but certainly with regard to what we have been talking about here; cadmium, mercury and lead, which originate from many different sources, it is of course the cumulative impact which is so serious. ... I often wonder about whether those safety margins are absolutely, wholly and soundly based...”

Michael Meacher, Secretary for the Environment, (UK)
April 14 1999. In evidence to the House of Lords inquiry into
‘Waste Incineration’ HL Paper 71p

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Kay and Steiglitz published a paper in *Chemosphere* identifying the following volatile organic chemicals emitted from a municipal waste incinerator: pentane; trichlorofluoromethane; acetonitrile; acetone; iodomethane; dichloromethane; 2-methyl-2-propanol; 2-methylpentane; chloroform; ethyl acetate; 2,2-dimethyl-3-pentanol; cyclohexane; benzene; 2-methylhexane; 3-methylhexane; 1,3-dimethylcyclopentane; 1,2-dimethylcyclopentane; trichloroethene; heptane; methylcyclohexane; ethylcyclopentane; 2-hexanone; toluene; 1,2-dimethylcyclohexane; 2-methylpropyl acetate; 3-methyleneheptane; paraldehyde; octane; tetrachloroethylene; butanoic acid ethyl ester; butyl acetate; ethylcyclohexane; 2-methyloctane; dimethyldioxane; 2-furanecarboxaldehyde; chlorobenzene; methyl hexanol; trimethylcyclohexane; ethyl benzene; formic acid; xylene; acetic acid; aliphatic carbonyl; ethylmethylcyclohexane; 2-heptanone; 2-butoxyethanol; nonane; isopropyl benzene; propylcyclohexane; dimethyloctane; pentanecarboxylic acid; propyl benzene; benzaldehyde; 5-methyl-2-furane carboxaldehyde; 1-ethyl-2-methylbenzene; 1,3,5-trimethylbenzene; trimethylbenzene; benzonitrile; methylpropylcyclohexane; 2-chlorophenol; 1,2,4-trimethylbenzene; phenol; 1,3-dichlorobenzene; 1,4-dichlorobenzene; decane; hexanecarboxylic acid; 1-ethyl-4-methylbenzene; 2-methylisopropylbenzene; benzyl alcohol; trimethylbenzene; 1-methyl-3-propylbenzene; 2-ethyl-1,4-dimethylbenzene; 2-methylbenzaldehyde; 1-methyl-2-propylbenzene; methyldecane; 4-methylbenzaldehyde; 1-ethyl-3,5-dimethylbenzene; 1-methyl-(1-propenyl)benzene; bromochlorobenzene; 4-methylphenol; benzoic acid methyl ester; 2-chloro-6-methylphenol; ethyldimethylbenzene; undecane; heptanecarboxylic acid; 1-(chloromethyl)-4-methylbenzene; 1,3-diethylbenzene; 1,2,3-trichlorobenzene; 4-methylbenzyl alcohol; ethylhexanoic acid; ethyl benzaldehyde; 2,4-dichlorophenol; 1,2,4-trichlorobenzene; naphthalene; cyclopentasiloxane-decamethyl; methyl acetophenone; ethanol-1-(2-butoxyethoxy); 4-chlorophenol; benzothiazole; benzoic acid; octanoic acid; 2-bromo-4-chlorophenol; 1,2,5-trichlorobenzene; dodecane; bromochlorophenol; 2,4-dichloro-6-methylphenol; dichloromethylphenol; hydroxybenzotriazole; tetrachlorobenzene; methylbenzoic acid; trichlorophenol; 2-(hydroxymethyl) benzoic acid; 2-ethylnaphthalene-1,2,3,4-tetrahydro; 2,4,6-trichlorophenol; 4-ethylacetophenone; 2,3,5-trichlorophenol; 4-chlorobenzoic acid; 2,3,4-trichlorophenol; 1,2,3,5-tetrachlorobenzene; 1,1'-biphenyl (2-ethylnaphthalene); 3,4,5-trichlorophenol; chlorobenzoic acid; 2-hydroxy-3,5-dichlorobenzaldehyde; 2-methylbiphenyl; 2-nitrostyrene(2-nitroethylbenzene); decanecarboxylic acid; hydroxymethoxybenzaldehyde; hydroxychloroacetophenone; ethylbenzoic acid; 2,6-dichloro-4-nitrophenol; sulphonic acid m.w. 192; 4-bromo-2,5-dichlorophenol; 2-ethylbiphenyl; bromodichlorophenol; 1(3H)-isobenzofuranone-5-methyl; dimethylphthalate; 2,6-di-tertiary-butyl-p-benzoquinone; 3,4,6-trichloro-1-methylphenol; 2-tertiary-butyl-4-methoxyphenol; 2,2'-dimethylbiphenyl; 2,3'-dimethylbiphenyl; pentachlorobenzene; bibenzyl; 2,4'-dimethylbiphenyl; 1-methyl-2-phenylmethylbenzene; benzoic acid phenyl ester; 2,3,4,6-tetrachlorophenol; tetrachlorobenzofurane; fluorene; phthalic ester; dodecanecarboxylic acid; 3,3'-dimethylbiphenyl; 3,4'-dimethylbiphenyl; hexadecane; benzophenone; tridecanoic acid; hexachlorobenzene; heptadecane; fluorenone; dibenzothiophene; pentachlorophenol; sulphonic acid m.w. 224; phenanthrene; tetradecanecarboxylic acid; octadecane; phthalic ester; tetradecanoic acid isopropyl ester; caffeine; 12-methyltetradecanecarboxylic acid; pentadecanecarboxylic acid; methylphenanthrene; nonadecane; 9-hexadecene carboxylic acid; anthraquinone; dibutylphthalate; hexadecanoic acid; eicosane; methylhexadecanoic acid; fluoroanthene; pentachlorobiphenyl; heptadecanecarboxylic acid; octadecadienal; pentachlorobiphenyl; aliphatic amide; octadecanecarboxylic acid; hexadecane amide; docosane; hexachlorobiphenyl; benzylbutylphthalate; aliphatic amide; diisooctylphthalate; hexadecanoic acid hexadecyl ester; cholesterol.

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Products of Incomplete Combustion From Hazardous Waste Incineration.

Acetone (1,3) Acetonitrile (5) Acetophenone (1) Benzaldehyde (1,4) Benzene (1,3,4,5) Benzenedicarbox-aldehyde (1) Benzofuran (4) Benzoic acid (1) Bis(2-ethylhexyl) phthalate (1,5) 1-Bromodecane (4) Bromofluorobenzene (4) Bromoform (3) Bromomethane (3,5) Butylbenzyl phthalate (1) Isooctane (3) Carbon tetrachloride (1,2,3,4,5) Chlorobenzene (1,3,4) 1-Chlorobutane (4) Chlorocyclohexanol (1) 1-Chlorodecane (4) Chlorodibromomethane (3) 2-Chloroethyl vinyl ether (3) Chloroform (1,2,3,4,5) 1-Chlorohexane (4) Chloromethane (3,5) 1-Chlorononane (4) 1-Chloropentane (4) Cyclohexane (1) Cyclohexanol (1) Cyclohexene (1) 1-Decene (4) Dibutyl phthalate (1) Dichloroacetylene (2) Dichlorobromomethane (3) 1,2-Dichlorobenzene (4,5) 1,4-Dichlorobenzene (4,5) 1,1-Dichloroethane (5) 1,2-Dichloroethane (3,4,5) 1,1-Dichloroethylene (3,5) Dichlorodifluoromethane (5) Dichloromethane (1,3,4,5) 2,4-Dichlorophenol (5) Diethyl phthalate (1) Dimethyl ether (3) 3,7-Dimethyloctanol (4) Dioctyl adipate (1) Ethenylethylbenzene (1) Ethylbenzaldehyde (1) Ethylbenzene (1,3) Ethylbenzoic acid (1) Ethylphenol (1) (Ethylphenyl)ethanone (1) Ethynylbenzene (1) Formaldehyde (5) Heptane (4) Hexachlorobenzene (2,5) Hexachlorobutadiene (2) Hexanal (4) 1-Hexene (4) Methane (3) Methylcyclohexane (4) Methyl ethyl ketone (5) 2-Methyl hexane (4) 3-Methyleneheptane (4) 3-Methylhexane (4) 5,7-Methylundecane (4) Naphthalene (1) Nonane (4) Nonanol (4) 4-Octene (4) Pentachlorophenol (5) Phenol (5) Polychlorinated biphenyls (PCBs) (2) Polychlorinated dibenzo-p-dioxins (PCDDs) (2,5,6) Polychlorinated dibenzofurans (PCDFs) (2, 5, 6) Pentanal (4) Phenol (1,5) Phenylacetylene (1) Phenylbutenone (1) (1,4-Phenylene) bisethanone (1) Phenylpropenol (1) Propenylmethylbenzene (1) 1,1,2,2-Tetrachloroethane (4,5) Tetrachloroethylene (1,2,3,4,5) Tetradecane (4) Tetramethyl-oxirane (1) Toluene (1,3,4,5) 1,2,4-Trichlorobenzene (4,5) 1,1,1-Trichloroethane (1,3,5) 1,1,2-Trichloroethane (5) Trichloroethylene (1,2,4,5) Trichlorofluoromethane (3) Trichlorotrifluoroethane (4) 2,3,6-TVimethyldecane (4) Trimethylhexane (1) 2,3,5-Trichlorophenol (5) Vinyl chloride (3,5)

(1) Trenholm 1986 (eight full-scale hazardous waste incinerators)
(2) Dellinger 1988 (turbulent flame reactor)
(3) Treoholm 1987 (full-scale rotary kiln incinerator)
(4) Chang 1988 (turbulent flame reactor)
(5) U.S. EPA. "PIC database" in U.S. EPA 1989b (review of available data at varied units) (6) U.S. EPA 1987c (two full-scale rotary kiln incinerators).

Fossil fuels contain little or no halogens and associated compounds. As detailed in PICs resulting from the incineration of halogenated material (such as the chlorinated dioxins, furans, and PCBs) are far more toxic than PICs from fossil fuel burners. One study of incinerator bottom ash identified 37 PICs, some of which were chlorinated species. The concentrations of these PICs in the ash ranged from 0.1 to 500 parts per million (ppm) (Van Buren 1985).

Source: *'Playing with Fire'* by Pat Costner & Joe Thornton. A Greenpeace Report

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THE HOLY GRAIL OF EPIDEMIOLOGICAL STUDIES?

Pyromaniacs claim that the performances of old incinerators cannot be compared to that of a modern plant due to the introduction of new technologies.

However, the disturbing number of incidents at the most modern incinerators in the UK generates serious doubt as to the safety and efficiency of these plants.

Twelve of these modern state of the art incinerators exceeded their authorised limits no less than 899 times between them in the space of 5 years. These were industry reported figures, so no doubt the true amount is higher.

We should also consider that the majority of the older generation of incinerators had much smaller capacities than today's 500,000 to 800,00 tonnes per annum facilities. Today's incinerators can handle four or five times more waste than the older plants. Consequently the overall total of many pollutants emitted will be greater.

Whereas even the most hardened critic of incineration will admit the technology might have generally improved. It should not be overlooked that a incinerator today has to handle a far more complex, ever-changing chemical waste stream than a plant of 20 years ago.

This is because of the introduction of something like 1,000 new chemicals each year about which the industry has no toxicological data - either on their individual or synergistic effect, or their impact on human health and the environment.

Despite the technological improvements no incinerator facility can change the toxicity, persistence and biaccumulative nature of the chemicals and by-products emitted. Better combustion can also result in more ultra fine particulates being emitted, as was the case with the

The two biggest obstacles to science are the illusion we have all the knowledge and the people who peddle that illusion.

Cleanaway hazardous waste incinerator in Ellesmere Port (As reported in ENDS but denied by regulatory officials).

Due to the increased input of this highly complex ever-changing waste stream, the number of pollutants emitted during upset conditions will be increased. There is little or no data on these periods, something even the hand-picked 'experts' selected by the British government to downgrade epidemiological evidence showing elevated levels of ill health around incinerators had to admit in their latest desk-top summary of selected epidemiological studies.

However, they did play-down the importance and reality of the possible impact of these upset periods by stating simply that: "It was agreed that the report could not study in detail emissions under abnormal operating conditions.

This is firstly because of a lack of information on abnormal conditions. Secondly, in discharging their obligations with regard to the planning process, DEFRA and local authorities work on the basis that processes will be operated in compliance with their permits/licences.

"...[H]owever, field data on the health or environmental effects of waste management operations in general reflect the effects of operating under abnormal and operating conditions."

As already mentioned, on 899 times that we know of in five years, these plants didn't comply with their authorisation permits, and there is no way on earth those experts have

taken that amount of incidents into consideration.

Also, it should not be overlooked that as the quantity and concentrations of so many pollutants whose toxicity and impact on human health is unknown, this missing data surely throws serious doubts on the scientific value of 'Environmental Impact Assessments' (EIA) conducted on such facilities?

The unauthorised releases and the lack of data show these expensive EIA reports are simply a public relations exercise devised by industry to allow industry to claim the facilities are safe and will have only a minimal impact on the environment and public health.

The reality is there are simply too many 'unknowns' about the chemicals emitted hourly by incinerators, their toxicity, what concentration caused what damage, either as individual compounds or when mixed with others, for any EIA or Risk Assessment to be any thing more than a guesstimate of little genuine 'scientific' value.

As Mary O'Brian wrote in her book *Making Better Environmental Decisions*, "Risk assessment is industry's way to make the unacceptable acceptable" while Dr Paul Connett maintains "no risk is acceptable if it is avoidable."

Of course EIA's are never revealed as the guesswork they are with dozens of assumptions being made rather than sound scientific facts.

Those people shouting the wonders and safety of incineration (Pyromaniacs) will go to extraordinary lengths of deception to get these facilities built. They will present carefully selected information to gullible and lazy politicians, while governments keen to go down the incinerator route will hand-pick members of the

scientific community whose views run with their own.

These will try to discredit the findings of any epidemiological study that goes against the interests of the government and industry.

Looking through summaries of epidemiological studies written by pyromaniacs we find sentences like: "The work relates to the older generation of incinerators"...

"The majority of published studies concentrate on the effects of exposure to emissions from the older generation of incinerators..."

"However, little weight can be given to this study..."

"...even if such a link could be established, this excess relates to historical exposure patterns around older incinerators and not current or future incinerators..."

"...It cannot therefore be taken as representing more modern combustion plants..."

Of course any epidemiological study will be based on the impact of older incinerators - that is the nature of epidemiology. But even the study heralded as the 'Holy Grail of Scientific Certainty' by some pyromaniacs concluded "This doesn't mean that there will not be similar effects but perhaps at lower levels of incidence from newer incinerators." [1]

Cancers can take 25-30 years or longer to develop, and we are seeing increased cancer rates around incinerators. We now know that many of the chemical compounds released in what the incinerator industry call "insignificant" and "minuscule" amounts are persistent and bioaccumulative in the environment and human body, and as such are more than capable of damaging human health.

Pyromaniacs will never admit the thousands of compounds released hourly by incinerators pose any threat to health. Given the past experiences of communities living with incinerators I doubt the impact of today's facilities will be vastly different to that of the now closed,

'clapped out' plants, except perhaps in the time it takes for the 'obvious' damage to appear.

This will then no doubt result in the pyromaniac responding with the claim 'it's the life-style of the hostage community that is to blame' as it is a well known fact incinerators are only ever built in poor, working-class areas.

The reality is there have been several published studies of morbidity or mortality in populations living near waste incinerators, specifically municipal waste incinerators. These studies review actual measured human health effects.

There is also some information about occupational studies of incinerator workers as an indication of possible hazards from (most probably) fugitive emissions and ash handling.

The following is taken from: **Summary statement regarding: "IPPC: Incineration Sector; Managing the Implications for the Health Consultee" 4th March 2005, Birmingham.**

The Small Area Health Statistics unit (SAHSU) at Imperial College London studied cancer incidence among 14 million people living near to 72 municipal solid waste incinerators in Great Britain over the period 1974-1967.[1] On considering the study, the independent scientific advisory Committee on Carcinogenicity (COC) advised the Department of Health that it was 'reassured that any potential risk to cancer due to residency (for periods in excess of 10 years) near to municipal waste incinerators was exceedingly low and not measurable by the most modern epidemiological techniques.[2]

Professor Roy Harrison, (now OBE) and a long time supporter of incineration informed attendees that **no further published research warranted a review of this advice.** (Bold emphasis added).

Professor Harrison concluded that epidemiological studies had not demonstrated significant health

problems (including additional cancers) due to incinerators **even when some of the studies examined older installations.** (Bold emphasis added)

Delegates Question: There are not many studies on health effects of incineration - why? Is it publication bias (absence of evidence not evidence of absence)?

Harrison: Cannot say why there are so few studies. It may be that the SAHSU study was so comprehensive; it was thought it couldn't be added to. Publication bias (i.e. it is easier to publish positive results than negative results) is unlikely.

Delegates Question: "Has the time come to say that we should do no further epistemological studies, as we have done them all, and move on to spend time on better risk communication?"

Harrison: Yes. We reached this point a long time ago. Emissions are now much smaller too. Resources would be better spent on communication.

[1]** Elliot P, Shadick G, Kleinschmidt I, Jolley D, Walls P, Beresford J, Grundy C (1996) Cancer incidence near municipal solid waste incinerators in Great Britain. *British Journal of Cancer*, 73, 702-710 [2] <http://www.advisorybodies.doh.gov.uk/coc/munipwst.htm>

**Professor Harrison is on record as saying this particular study was confounded by socio-economic effects. So why is he putting it forward it as the the be all and end all of studies - the Holy Grail of Epidemiological studies?

When we take a closer look at the study we find a number of disturbing points making any reasonable person question even more the reasoning behind Harrison's statements.

Using a post-coded database, the study looked at the cancer incidence of over 14 million people living near 72 MSW incinerators for the years 1974-86 (England), 1974-84 (Wales) and 1975-87 (Scotland). The numbers of

observed cases were compared with regionally-adjusted national rates, after stratification using a deprivation index. Observed / expected ratios were tested for decline in risk with distance, for distances up to 7.5km from the incinerators.

The study was divided into two parts: the first examined 20 incinerators selected at random and the second part looked at the remaining 52.

In both analyses a statistically significant ($p < 0.05$) decline in risk with distance from incinerators was demonstrated for all cancers combined and for stomach, colorectal, liver and lung cancer. In the second part of the study the excess number of cancers within 1 km of an incinerator ranged from 37% for liver cancer (0.95 excess cases/ 105/year) to 5% for colorectal cancer.

Elliot et al footnote: *'These were older incinerators with (generally) higher emission levels than today and, like any epidemiological survey, there are caveats attached to the results. However, when normal insensitivity of epidemiological studies is taken into account it is not possible to say that there will not be similar effects but perhaps at lower levels of incidence from newer incinerators.'*

It is important to recognise that the emission standards set in the

Directive are not strictly based on the health implications of the likely resultant levels of exposure. Rather they are based upon the engineering issues arising from achieving the emissions and the constraints of the political process in drafting the Directive.

It is not possible to conclude, therefore, that simply meeting the Directive standards means that the emissions are 'safe'. Indeed, some pollutants which are of particular concern are those for which no "safe" exposure limit has ever been demonstrated, i.e. a limit below which adverse health effects will not occur. These include pollutants such as dioxins and particulates, which are damaging to health even in minuscule quantities, and those such as metals (and dioxins) which tend to accumulate to toxic levels within living tissues over prolonged periods of exposure.

ToxCat comment:

So the authors actually point out that "some pollutants which are of particular concern are those for which no "safe" exposure limit has ever been demonstrated, i.e. a limit below which adverse health effects will not occur. These include pollutants such as dioxins and particulates, which are damaging to health even in minuscule quantities, and metals (and dioxins) which tend to accumulate

to toxic levels within living tissues over prolonged periods of exposure."

They also say that: "it is not possible to say that there will not be similar effects but perhaps at lower levels of incidence from newer incinerators."

The fact that stomach, colorectal, liver and lung cancers declined as researchers looked further away from the incinerator cannot by any stretch of the imagination be construed as showing the incinerator has no adverse health impact on people living close by, in fact it shows exactly the opposite, as does a 37% increase in liver cancers which is very worrying.

It is my opinion the findings of the study throws considerable doubt on Harrison's interpretation and reasoning in recommending no more epidemiological studies are need. He claims studies had not demonstrated significant health problems (including additional cancers) even around the older generation of incinerators, but the study he is using as evidence to cease research found a 37% increase in liver cancers.

I cannot see the logic in Harrison's reasoning that no more studies are necessary, or am I missing something somewhere?

Epidemiological studies add weight to the concerns of citizens hostage to incinerators by linking respiratory and neurologic problems to working at, or living near, such plants.

Scientists presented their findings in Atlanta in May 1993 at the International Congress On the Health Effects of Hazardous Waste. Charles E. Feigley and his co-workers at the University of South Carolina in Columbia surveyed a random sample of 894 residents - 508 living downwind (Downwinders) or a commercial hazardous-waste incinerator and 386 living upwind. In a demographically similar community 'Downwinders' reported a 50 to 100 percent greater prevalence of coughing, phlegm, wheezing, sore throat, and eye irritation than up-winders. Even after the researchers accounted for age and or exposure to cigarette smoke, mold, and pets, down-winders were 20% to 90% more likely than upwinders to have been diagnosed with emphysema, pneumonia, sinus trouble, asthma, or allergies.

Using the same questionnaire, Dietrich Rothenbacher and his colleagues at the University of North Carolina at Chapel Hill polled some 400 households in two communities near a hazardous-waste incinerator - one upwind, the other downwind. Here, too, down-winders reported more diagnosed emphysema, sinus trouble, and sleep-rousing or morning coughs.

Michael Straight and his Co-workers at the Agency for Toxic Substances and Disease Registry in Atlanta compared 713 people living within 1.5 mile of a hazardous-waste Incinerator to 588 people about 8 miles from the plant. The closer community reported almost nine times more coughing and wheezing, 2.4 times as much neurologic disease (such as seizures and tremors), and 40 percent more neurologic symptoms (including tingling, blackouts, and in-coordination).

Continued on next page

Melody M. Kawamoto of the National Institute for Occupational Safety and Health In Cincinnati followed up documented reports of headaches, hot flashes, irritability, memory problems, tremors, and erratic blood pressure changes in workers from a then-closed hazardous-waste incinerator. All 14 symptomatic former employees ultimately examined suffered head- aches, dizziness, and memory problems.

Researchers led by Woodhall Stopford of Duke University Medical Center In Durham, N.C., examined 29 men who complained of chronic nausea, headache, dizziness, and feeling of intoxication. Between 23 and 50 years of age, all the men had worked at hazardous-waste incinerators. "Eight of the 15 men with joint pain had arthritis of unknown cause; more than half the men had middle-ear disease causing vertigo or gait problems; roughly half had memory problems; and 22 exhibited abnormal sweating or wide fluctuations in pulse and blood pressure. Moreover, sleep disorders, severe depression, and recurring suicidal thoughts plagued 27 of the 29. All (27) had difficulty controlling impulses -rage reactions - either verbally or physically," Stopford says. Indeed, he notes 16 described "homicidal" thoughts.

None of these studies proves that incinerators harm health. But they do raise strong suspicions that the apparent links are real, Felgley says. He and many other researchers will now begin correlating individuals' symptoms with specific exposures to pollutant plumes or particular chemicals.

Science News Vol. 143 May 22, 1993. Environment, Hazardous incinerators? Page 334

The following is a pc translation of a study published in French:

...One remembers that, at the time of the incinerators former generation, the administrative authorities affirmed us that there was not a risk.

Subject: C2DS - the *Physician's Daily*

INCINERATORS BETWEEN 1970 AND 1990. Le surrisque of cancers is confirméLes definitive results of the retrospective ecological survey on the impact of the cancers close to the factories of incineration of garbage, published by the Sanitary Eve Institute (InVS), confirm the statistical tie between the atmospheric dismissals of the years 1970-1980 and the increase of the cancers of all localizations at the woman and some cancers at the man. They justify the measures of reduction of the broadcasts of pollutants setting up at the end of the years 1990.

The norms have been changed in 1997s TOUBON / "THE DAILY" during the years 1970-1980, France had extensively resorted to incineration to eliminate garbage in incinerators operating in conditions less stern than those imposed today. The first incinerator started in 1972. The first studies to have brought some arguments in favour of the possibility of a surrisque of some cancers date 1996 in Italy and in the United Kingdom.

In France, the first ecological survey in general population has been achieved close to Besançon by the team of Jean-François Viel in 2000. She/it showed an excess of the incidental cases of sarcomas of soft tissues and lymphomas shrewd non-Hodgkiniens in the exposed cantons. Since, the reduction of the boundary values of broadcast of pollutants in the atmosphere has been imposed (at the end of the years 1990). In the same way, the number of factories of incineration of garbage (UIOM) decreased meaningful way: 292 factories in 1985, 213 in 2000 and 130 in 2004.

A meaningful association. However, the obstinate concern as for the impact of the incineration dismissals on the health of the riparian populations drove the InVS, to the demand of the general Direction of health (DGS), to throw in 2003 a survey on the topic. Financed in the setting of the plane Cancer, it had an objective to analyze to a collective level the impact of the cancers according to the exhibition passed to the atmospheric dismissals. The definitive results, that have just been published, confirm the available data 2006 ("the Daily" of December 1st, 2006): a meaningful association exists well between the intervening of the cancers and the exhibition on a long length to the dismissals of the incineration of the garbage. At the women, the risk is increased for the cancers all disconcerted localizations, the breast cancers and the lymphomas shrewd non hodgkiniens. Thus, a strong exhibition in the years 1970-1990 is associated to an increase during the years 1990 of 6% of all feminine cancers, of 9% of the breast cancers and 18% of the lymphomas non hodgkiniens. "The statistical relation between the exhibition to the dismissals of the incinerators of garbage and the impact, at the woman, of the cancers all disconcerted localizations had not been put again in evidence in general population", indicate the authors of the survey.

The breast, for the first time. Why such an increase only in the feminine population? "We can make the hypothesis that the women, notably in the years 1970 and 1980, were more sedentary and especially subject than the men to a professional exhibition or to some factors of risk, for example the alcohol-tobacco addiction.

That could conceal the effect of the exhibition to the smokes of incinerators at the men in this survey”, they explained.

Some hormonal differences could be also in game (tie between estrogènes and receiving intranucléaire hydrocar- boné aryl, Ahr, again called receiving of the dioxin, that is implied at a time in the control of the cellular proliferation and in the hormonal balance).

It is also “for the first time in “general population that the exhibition to the agents emitted by the incinerators appears like a factor of breast cancer risk.

At the man, the excess of risk is only recovered for the multiple myelomas (of 23% for the levels of elevated exhibition), but when the analysis is about the two united sexes, a surrisque appears for the lymphomas shrewd non hodgkiniens.

Of the non-meaningful associations, but near of the significativité (statistical doorstep of 5%), have also been observed for three other localizations when data on the men and the women are analyzed together: the sarcomas of the soft tissues, cancers of the liver and multiple myelomas (surrisque of 23%). He/it has not been put in meaningful association evidence for the cancer of the lung.

2,5 Million People.

Considering the importance of the survey, 135,123 cases of accounted cancers within a population of 2,5 millions of people on one period of ten years in the four departments of the survey (Isère, High-Rhine, Low Rhine and the Tarn), and of the quality of the introverted data (registers of the cancers; effective methods of evaluations of the past exhibition), the sanitary impact of the atmospheric dismissals must be considered. It could even be underestimated. Indeed, the latency time between the exhibition and the apparition of the cancer has been estimated in the survey to five and ten years for the leukemias and the strong cancers, according to the average values recovered in the literature. However, some recent publications evoke of the even longer latency time, of fifteen or even twenty years. “So such was the case, all cancers led by the exhibition to the pollutants emitted by the incinerators would not have had the time to occur or to arrive to a detectable stage.” In look of this uncertainty, one is not able to either to “exclude that the exhibitions of the years 1970 can encourage again today the intervening of cancers”, makes to notice the authors.

However, it is important to underline that, the survey carrying on a past situation, its results would be difficult to be transposed to the present context with its new norms. In the same way, a tie of causality cannot be deducted of the statistical tie that has just been demonstrated. Finally, the survey permitted to identify nor the substances nor the ways of exhibition in reason.

In conclusion, the authors estimate that the relative risk excess is weak and that it doesn't justify the setting up of particular measures of secondary prevention for the already exposed populations (tracking, precocious, medical follow-up). They recommend a large diffusion of the results of the survey.

Dr LYDIA ARCHIMÈDE Privilégier the alternatives to the incinération. Dr Jean-Michel Calut, one of the 531 opposite physicians to the implantation of an incinerator of garbage in the center of the agglomeration of Clermont- Ferrand, said of the views of the president of Republic. “Nicolas Sarkozy had said, at the time of the Grenelle of the environment, that the incinerator had to be considered in ultimate recourse. For Puy-de-Dôme, there are some alternatives that the president of Clermont-Community already presented. We want to become an exemplary region”, explained Dr Calut to the “Daily.”

For the physician, who has battled for several years against the building of an incineration in the name of the precautionary principle the last results of the InVS are “even more troubling than foreseen. One remembers that, at the time of the incinerators former generation, the administrative authorities affirmed us that there was not a risk. Today, it is necessary to know that the new norms only concern some pollutants. However the InVS doesn't incriminate a pollutant in particular, but the plume in general. The volatile organic compounds always were not the subject of study on health. Otherwise, the present norms of dismissal don't correspond to a sanitary reality, but to the technical feasibility of the moment. These are norms fixed to the ladle.”

For the physicians of the collective clermontois, so much that the innocuité of the combustion system is not demonstrated, the constitutional principle of precaution must apply.

S. H.Le Quotidien of the Physician of the: 09/04/2008.

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Exposure to Polychlorinated Biphenyls and Levels of Thyroid Hormones in Children

Osius et al., present findings on the impact of living near a toxic incineration plant with license to burn PCB contaminated material on thyroid hormone levels in children. The study reports a significant positive association between the PCB congener 118 and thyroid stimulating hormone, and a significant negative correlation between five PCB congeners (138, 153, 180, 183 and 187) to the thyroid hormone, triiodothyronine (unbound to a protein) in children between 7-9 years of age. This thyroid hormone makes up about 9% of the thyroid hormones secreted from the thyroid. The study found no significant correlation with PCB and thyroxine, which accounts for 90% of the thyroid hormones. However, they did report an association between cadmium and increasing levels of thyroid stimulating hormone and decreasing levels of thyroxine.

The authors examined two areas north and south east of the region in immediate proximity to the incinerator for comparison. The levels of both thyroxine and triiodothyronine were significantly decreased in the incinerator region, as compared with the two other regions.

Osius, N, W Karmaus, H Kruse and J Witten. 1999. **Exposure to Polychlorinated Biphenyls and Levels of Thyroid Hormones in Children.** *Environmental Health Perspectives* 107(10) October

Study of the Health Effects of Air Pollution Produced by the Incineration of Industrial and Household Wastes

This paper describes a 1981 study of health effects of air pollution caused by incineration of industrial and household waste. The study lasted two months and took place in a village of France's Isere department. A retrospective comparison was made of the consumption of medicines for respiratory problems over a two-year period among three matched groups of residents. The groups represented three areas of the village situated, respectively, at 200 meters, one kilometre and two kilometres from the incinerator (the relative distance from the incinerator being used as an indicator of degree of exposure). The consumption of medicines was determined by analysing Social Security forms filed by the residents after each purchase. The study revealed a strong heterogeneity in the consumption of medicines among the three groups: the variances in the number of medicines prescribed decrease significantly ($p < 1\%$, Bardett test) as the distance of the residents' homes from the incinerator increases. The authors attribute this fact to the presence, in the group most directly exposed to the pollution, of subjects most affected by the respiratory effects of the polluted air.

Zmirou, D., B. Parent, and J. L. Potelon. "Etude epidemiologique des effets sur la sante des rejets atmospheriques d'une usine d'incineration de dechets Indus trie ls et menagers (**Epidemiological study of the health effects of air pollution produced by the incineration of industrial and household wastes**)." *Revue Bpidemiologie et Sante Publique* 32 (1984): pp 391-397. (in French).

Urinary Mutagens in Municipal Refuse Incinerator Workers and Water Treatment Workers.

Municipal refuse incineration workers may be exposed to mutagenic compounds from gaseous and particulate emissions and during ash removal operations. The frequency of urinary mutagens was measured by the Ames test among a sample of 104 refuse incinerator workers in seven incinerator plants during March-May 1988... Incinerator workers had a significantly higher risk for urinary mutagens and promutagens as compared to water plant workers after controlling for age. Among incinerator workers, increased risk of having urinary mutagens was associated with workers who wore protective clothing (defined as clothing other than masks or gloves) or whose job classification was equipment repair. It also showed a weak positive association with increasing age. There was an increased risk of urinary promutagens associated with not wearing gloves. The presence or absence of mutagenicity in workers' urine varied with plant location. Incinerator operating conditions affecting the production of toxicants and mutagens are discussed and the results of other studies involving toxicant exposure of humans near incinerators are cited.

Scarlett, J., Babish, J., Blue, J., Vockler, S., and Lisk, D., "Urinary Mutagens in Municipal Refuse Incinerator Workers and Water Treatment Workers." *Journal of Toxicology and Environmental Health*, 31 (1990) 11-27.

Incineration of Wastes and Implications for Human Health

In a review of waste incineration and its implications for human health, Gatrell and Lovett reported their own study on the association between the incidence of laryngeal cancer and proximity to an incinerator burning solvents and oils at Charnock Richard, near Coppull in Lancashire. The plant had operated between 1972 and 1980, during which time there had been many public complaints relating mostly to the release of irritant gases. Data on cancer registrations were available for the period 1974-1984 (England & Wales). From an initial descriptive mapping exercise it appeared that the distribution of most cancers was similar to that of the population as a whole. The exception was laryngeal cancer with 323 in males and 67 in females (197 cases at ages less than 65 and 193 in ages greater than 65).

A statistical model was used to test whether proximity to the incinerator had a significant influence on the distribution of laryngeal cancer. The researchers assumed that there was no link between the incinerator and lung cancer, so that rates of lung cancer simply reflected the spatial distribution of the population, and that in the absence of the incinerator the distribution of laryngeal cancer would follow the same pattern.

On this basis they found a statistically significant association between laryngeal cancer and proximity to the incinerator. By 'moving' the location of the incinerator across a map of the area and fitting the model to the 'new[1] source each time, the only location linked to intensity of laryngeal cancer was the incinerator site. Stomach cancer showed a similar association.[2]

However, the authors stated that in the absence of considerably more information it was not possible to claim a causal link between laryngeal cancer and living near an incinerator. Data that were not available included residential histories of cases, the latent period over which laryngeal cancer develops, personal details including smoking habits, alcohol consumption and other risk factors, and information on background air pollution.

[1] Gatrell, A.C., Lovett, A. A., 'Burning Questions: Incineration of Wastes and Implications for Human Health', in M. Clarke, A. Blowers, and D. Smith (eds.), *Waste Location: Spatial Aspects of Waste Management, Hazards and Disposal*. (Routledge & Kegan Paul, London, 1991)

[2] Diggle, P. J., Gatrell, A.C., Lovett, A.A., 'Modelling the Prevalence of Cancer of the Larynx in Part of Lancashire: A New Methodology for Spatial Epidemiology', in R. W. Thomas (ed.), *Spatial Epidemiology* (Pion, London, 1990).

Low Sex Ratios of Births in Areas at Risk from Air Pollution from Incinerators

Earlier research in environmental and occupational health has suggested that fluctuations in the sex ratios of births might provide a useful early warning to the possible health effects of toxins or other stresses in the environment. To examine further this hypothesis, the authors investigated the sex ratios of births in an area in central Scotland which contained two incineration plants (one chemical waste, the other municipal waste). Analyses of the sex ratios, at various levels of geographical detail and using 3-dimensional mapping techniques, in the residential areas at risk from airborne pollution from these incinerators showed locations with statistically significant excesses of female births.

The work was undertaken in 1988, Lloyd and co-workers published a study investigating the incidence of twinning in both cattle and human populations exposed to air pollution from two incinerators near Bonnybridge in central Scotland. It was suggested that the twinning may have been related to the release of polychlorinated hydrocarbons (PCHs) from the incinerator.[1]

Some PCHs has oestrogenic and fertility-related properties; either endogenous or exogenous oestrogens-from within or outside the body - may affect the frequency of twinning. At the Bonnybridge plant PCHs were incinerated and tissues from local cows showed traces of PCHs and related dioxins.

The geographical distribution of twinning was analysed for each year between 1975 and 1983 using information on single and twin births. Areas around the incinerators were designated as being at primary or secondary risk, based on a knowledge of wind direction in the area and the resulting predicted movement of fumes from the incinerators.

For human twins, background values of twinning for the area showed rates between 3 and 13 per 1000. The highest rates (20 and 16 per 1000 respectively) were found in the two primary risk sectors during 1980-83. The mean age of mothers in the 'at risk' areas was similar to that in the total study area (twinning rates increase considerably in mothers aged over 35). In the cattle population studied, the rate of twinning increased in the late 1970s (by 2%, representing three twin births) and reached a maximum in 1983 of 22%, (or 31 twin births) at the farm in the primary 'at risk' area. [2][3]

The authors concluded that the human twinning results were consistent with the introduction into the local environment in the late 1970's of polychlorinated hydrocarbons, some of which have oestrogenic and fertility related properties, or other chemicals with similar actions.

Another report noted evidence of adverse human health effects in the Bonnybridge area. This report included reports of a rise in the incidence of leukaemia and an increased rate of bronchitis,[4] a disease that has been linked with exposure to PCHs. [5]

[1] Lloyd, O. L., Lloyd, M. M., Williams, F. L. R., Lawson, A. **'Twinning in Human Populations and in Cattle Exposed to Air Pollution from Incinerators'**, *Br J, of Ind. Med.* 45 (1988) 556-60

[2] Williams F.L., Lawson A.B., Lloyd O.L., Department of Epidemiology and Public Health, Ninewells Hospital and Medical School, University of Dundee, UK. *Int. J. Epidemiol* 1992 Apr; 21(2):311-9

[3] Low sex ratios of births in areas at risk from air pollution from incinerators, as shown by geographical analysis and 3-dimensional mapping.

[4] Lenihan, J., Scottish Home and Health Department Report: Bonnybridge/Denny Morbidity Review (SHHD, Edinburgh, 1985).

[5] Reggiani, G., Bruppacher, R., **'Symptoms, Signs and Findings in Humans Exposed to PCBs and their Derivatives'**, *Environ. Health Perspect.* 60 (1985), 225-32.

See also: 'Hazardous Waste & Human Health.' British Medical Association, Oxford University Press, ISBN 0-19-286142-5 (1991)

Lymphoblastic Leukaemia (ALL) in Gateshead

One study investigated a reported 'cluster' of cases of acute lymphoblastic leukaemia (ALL) in the North East of England.[1]

A higher than expected number of cases was reported between the years 1968 and 1977. In a number of cases pairs of children living very close to each other developed ALL within a very short period of time - a phenomenon which is statistically highly unusual.

An investigation by the council dismissed the linking of the clusters of ALL to pollutants from the incinerator since tests shown that levels of heavy metals, known to be a risk factor for leukaemia,[2] were within control limits. However it should be noted that particulate matter was above the standard set by the Department of the Environment on grit and dust emissions but this was considered more of a 'nuisance' factor than a serious hazard to health.[3]

[1] Gateshead Metropolitan Borough Council, **Incidence of Acute Lymphoblastic Leukaemia in Gateshead (1988)**

[2] International Agency for Research in Cancer, Monograph 29 (Lyon. IARC, 1982).

[3] Dept of the Environment, Report of the Second Working Party on Grit and Dust Emissions, (HMSO, London, 1974)

Risk of adverse reproductive outcomes associated with proximity to municipal solid waste incinerators with high dioxin emission levels in Japan.

Tango T, Fujita T, Tanihata T, Minowa M, Doi Y, Kato N, Kunikane S, Uchiyama I, Tanaka M, Uehata T. *J Epidemiol.* 2004 May;14(3):83-93. Department of Technology Assessment and Biostatistics, National Institute of Public Health, Wako, Saitama, Japan.

BACKGROUND: Great public concern about health effects of dioxins emitted from municipal solid waste incinerators has increased in Japan. This paper investigates the association of adverse reproductive outcomes with maternal residential proximity to municipal solid waste incinerators.

METHODS: The association of adverse reproductive outcomes with mothers living within 10 km from 63 municipal solid waste incinerators with high dioxin emission levels (above 80 ng international toxic equivalents TEQ/m³) in Japan was examined. The numbers of observed cases were compared with the expected numbers calculated from national rates adjusted regionally. Observed/expected ratios were tested for decline in risk or peak-decline in risk with distance up to 10 km.

RESULTS: In the study area within 10 km from the 63 municipal solid waste incinerators in 1997-1998, 225,215 live births, 3,387 fetal deaths, and 835 infant deaths were confirmed. None of the reproductive outcomes studied here showed statistically significant excess within 2 km from the incinerators. However, a statistically significant peak-decline in risk with distance from the incinerators up to 10 km was found for infant deaths ($p=0.023$) and infant deaths with all congenital malformations combined ($p=0.047$), where a "peak" is detected around 1-2 km.

CONCLUSION: Our study shows a peak-decline in risk with distance from the municipal solid waste incinerators for infant deaths and infant deaths with all congenital malformations combined. However, due to the lack of detailed exposure information to dioxins around the incinerators, the observed trend in risk should be interpreted cautiously and there is a need for further investigation to accumulate good evidence regarding the reproductive health effects of waste incinerator exposure.

Incidence of cancers of the larynx and lung near incinerators of Waste solvents and oils in Great Britain.

In 1992 the Small Area Health Statistics Unit (SAHSU) published a study of the incidence of lung and laryngeal cancers near ten waste solvent and oil incinerators in Great Britain, including the one at Charnock Richard mentioned above. Postcoded cancer registration data were available for the years 1974-1984 (England and Wales) and 1975-1987 (Scotland). Lag periods of five and ten years from the start-up of each incinerator were used when analysing the cancer incidence. Standardised observed/expected (O/E) ratios were assessed within distances of 0-3 km. and 3-10 km of each incinerator and then aggregated over all sites. Expected values were based on regionally- adjusted national rates, with and without socio-economic stratification.

For the period corresponding to a five-year lag, the total number of cases of cancer of the larynx was 323 in males and 67 in females (197 cases at ages less than 65 and 193 in ages greater than 65). For the ten-year lag the corresponding numbers were 60 and 10,28 and 42. For the Charnock Richard incinerator none of the O/E ratios, either within 3 km, or between 3-10 km, was significantly different from unity for either type of cancer or lag period. A similar result was found when sites were stratified socio-economically. There was also no evidence, for either cancer, that risk decreased at greater distance from the incinerator.

The authors discussed several limitations in their data and methods. These included possible biases in cancer registration at the small area level and the use of a maximum lag period of only ten years -a relatively short development period for solid tumours. In addition, it was not possible to account for factors such as stack height, abatement equipment and prevailing wind. However, it was concluded that the study presented no evidence to suggest an excess risk of cancers of the larynx or lung in residents living near waste solvent and oil incinerators.

Elliott, P., Hills, M., Beresford, J, Kleinschmidt, L, Jolley, D., Pattenden, S., Rodrigues, L., Westlake, A. & Rose, G. (1992) **Incidence of cancers of the larynx and lung near incinerators of waste solvents and oils in Great Britain.** *Lancet*, 339,854-858

Increased risk of Anencephalus & Spina Bifida Around Crematoriums

In England a 2003 report was published showing women living near incinerators have a higher risk of having a baby with spina bifida, brain damage or a heart defect.

The study, by a team of researchers lead by Professor Louis Parker of Newcastle University, also found an increased risk of stillbirths among women who lived close to a crematorium.

The research analysed births in Cumbria between 1956 and 1993. There were almost 245,000 births, of which 3,234 were stillborn and 1,569 had congenital abnormalities. The risk of neural tube defects, particularly spina bifida, for babies of women who lived near incinerators was 17% higher, and heart defects 12% higher. For women who lived near a crematorium, the risk of stillbirth was 4% higher and the chance of the baby having a brain abnormality known as anencephalus was 5% higher.

Their findings stressed that they did not find conclusive evidence that living near an incinerator or crematorium caused birth defects or stillbirths, but they said the issue should be investigated further, especially as incineration was becoming a widely used method of waste disposal.

Paediatr Perinat Epidemiol. 2003 Jul;17(3):250-5. **Prevalence of adverse pregnancy outcomes around hazardous industrial sites in Cumbria, northwest England, 1950-93.** Dummer TJ, Dickinson HO, Parker L. *Journal of Epidemiology and Community Health*, 2003.

Morbidity among municipal waste incinerator workers

Bresnitz evaluated medical and exposure data for an actively employed cohort of incinerator workers in Philadelphia. The incinerator was built in 1959 with two mass burning furnaces, each of which burned 375 tons/ day of waste. Male workers (n = 86) were divided into potential high- and low-exposure groups based on work site analysis by an industrial hygienist. Those in the high exposure category had worked for at least seven months in high- exposure jobs, with a median of 15-9 years of high exposure. The study included a questionnaire (for job histories and tobacco and alcohol use), medical histories, blood and urine analyses, and physical examinations which included chest radiographs and measurement of PEVI, forced vital capacity (FVC), FEV1/FW%, and forced expiratory flow between 25% and 75% of vital capacity (FEF25-75%).

A greater number of workers in the high-exposure group consumed alcohol on a regular basis (78.9% compared with 32.4% in the low-exposure group). The blood test results and the prevalence of haematuria were similar in the two exposure groups, and there were no clinically significant differences between the two groups. Although two parameters (creatinine and haematocrit) showed statistically significant differences between the groups, the mean differences were clinically trivial.

Blood and urine analysis for mercury, lead, arsenic and cadmium demonstrated no significant differences between the two groups, and fewer than 2% of the 471 individual blood and urine tests showed levels above the expected range for the unexposed population. The pattern of pulmonary function was similar in both groups, except that spirometric changes suggestive of small airway obstruction (SAG) in the high-exposure group were almost twice as common as in the low exposure group. When adjusted for smoking status, the odds ratio for SAG in the high versus low-exposure groups was 1.19 (95% CI = 0.45 to 3.16). Among never- smokers the same analysis produced an odds ratio of 1.85 (95% CI = 0.27 to 13.1).

X-ray analysis showed that five workers, all in the low-exposure group, had changes suggestive of pleural plaques or thickening. Three of these workers were also in a group of eight individuals (five in the high-exposure and three in the low exposure groups) having pulmonary interstitial opacifications. All eight were either current or ex-smokers or obese.

No significant difference in numbers of workers with symptoms was noted between the two groups, although hypertension was diagnosed in 34% of an the workers and in 57.5% of those aged 45-64, a level higher than that for the same age range in the US population as a whole. This was tentatively related to greater alcohol consumption in this group and/ or excessive noise levels. Although the analysis was limited to current workers, the authors considered the likelihood of individual exposure misclassification to be minimal.

Bresnitz, E.A., Roseman, Becker, D., & Gracely, E. (1992) **Morbidity among municipal waste incinerator workers.** *Am. T Ind. Med.*, 22, 363-378

Mortality among workers at a municipal waste incinerators.

Gustavsson investigated mortality in a group of 174 male workers employed for at least one year between 1920 and 1985 at a municipal waste incinerator near Stockholm in Sweden. Before 1955 both household and industrial wastes were incinerated at the plant, but after this date only household waste was incinerated until the plant closed in 1986. The workers had been employed for a mean of 18.7 years and a range of 1-52 years.

Of the 174 workers, 91 were alive at the end of the study in 1985. Causes of death for those who had died since 1951 were obtained from death statistics. Standardised mortality ratios (SMRs) were computed as O/E numbers of deaths x100. Two sets of reference values were calculated, based on national and local mortality rates respectively. Total mortality was slightly above national rates (SMR for all causes 113; 95% CI = 90-140); when local rates were used, there was no difference (SMR for all causes 99; 95% CI = 79-122). Mortality from lung cancer was higher than both national (SMR 355; 95% CI = 162-675) and local rates (SMR 197; 95% CI 90-374), although the latter was not statistically significant.

There was also a tendency toward increased mortality from ischaemic heart disease and liver cirrhosis. When analysed by time of follow-up (1-19, 20-39 and 40+ years from first employment), a high excess risk for ischaemic heart disease was found in workers with 40 years or more since first employment. For lung cancer, an excess risk was shown for all three periods of follow-up, but the small number of cases precluded an analysis for trend. Using numbers of years employed as a measure of exposure, the excess risk for ischaemic heart disease depended entirely on those with more than 30 years of employment; for those with less than 30 years of employment, the SMRs were not significantly elevated.

Although compatible with an occupational origin, the small number of lung cancer cases precluded any definite conclusions from being made regarding the cause of the excess risk. The data supported the hypothesis that the excess of ischaemic heart disease was of occupational origin. The author considered neither the excesses of lung cancer nor those of ischaemic heart disease to be due to smoking. Emissions of PAHs from the study incinerator were said to have been higher than those from more modern incinerators because of poor combustion control, but the author was not able to attribute the excess cancers to any particular chemical exposure.

Gustavsson, P. **Mortality among workers at a municipal waste incinerator.** Am. J Ind. Med., 15 (1989) 245-253

Internal exposure to pollutants measured in blood and urine of Flemish adolescents in function of area of residence.

Abstract

The Centre for Environment and Health in Flanders, the Northern part of Belgium, started a biomonitoring program on adolescents in 2003. 1679 adolescents residing in nine areas with different patterns of pollution participated in the study. Possible confounding effects of lifestyle and personal characteristics were taken into account.

The geometric mean levels of cadmium and lead in whole blood amounted to 0.36 and 21.7 $\mu\text{g l}^{-1}$, those of PCBs, DDE and HCB in serum to 68, 94 and 20.9 ng g^{-1} fat, and those of 1-hydroxypyrene and t,t'-muconic acid in urine to 88 ng g^{-1} creatinine and 72 $\mu\text{g g}^{-1}$ creatinine. Significant regional differences in internal lead, cadmium, PCBs, DDE and HCB exposure were observed in function of area of residence, even after adjustment for age, sex, smoking (and body mass index for the chlorinated compounds). Compared to a reference mean, internal exposure was significantly higher in one or more of the areas: Cd and Pb in the Antwerp agglomeration, Cd in the Antwerp harbour, PCBs in the Ghent agglomeration, PCBs, DDE and HCB in the Ghent harbour, Cd, PCBs, DDE and HCB in the rural area, DDE in Olen and in the Albert canal areas. Adolescents living in an area with intensive fruit cultivation (showing overall the lowest values) and, surprisingly, in areas around household waste incinerators (average of six areas), had no significantly increased internal exposures. Subjects from separate areas around waste incinerators showed significant differences in body load of various environmental contaminants.

[from body of text]

The mean biomarker values of the area composed of six areas around waste incinerators were not significantly different from the RM values. However, if the six areas were considered individually, some of them had significant higher internal exposure values (after adjustment for confounders) compared to the RM and differences among the areas showed up as well (Table 4). Adolescents living in the neighbourhood of the incinerator of Wilrijk had significant higher lead concentrations in their blood and those of Harelbeke showed higher cadmium levels. Mean levels of PCBs and HCB were highest in blood samples of adolescents from Menen. The mean values of DDE and cadmium were also high in Menen, but due to the small population group (large confidence intervals) the significance level was not reached. The benzene-marker t,t'-muconic acid was significantly increased in urine samples of adolescents living nearby the incinerator of Roeselare.

... Consumption of locally produced food was associated with higher concentrations of persistent chlorinated compounds in serum. The latter compounds were also increased in adolescents who had received breast-feeding as newborns: breast fed and non-breast fed adolescents had PCB concentrations of 74.0 and 55.2 ng g^{-1} fat, respectively.

Schroijen *et al.*, 2008. **Internal exposure to pollutants measured in blood and urine of Flemish adolescents in function of area of residence.** *Chemosphere*.

Belgian Study Affirms Incinerator-Cancer Link

A study by the Belgian Platform for Environment and Health in Sint-Niklaas, Belgium, affirmed links between incinerator emissions and health problems, including various types of respiratory ailments and cancers.

Sint-Niklaas, a commercial, industrial and transportation center in the Waas region of Belgium with a population of 40,000, is host to a 55,500 ton/year waste incinerator built amidst a residential area. The report entitled: "De Mispelstraat (Medlarstreet): Living Under the Smoke of a Waste Incinerator," is dedicated to children who have died of cancer and to those who are suffering from diseases caused by the incinerator in Sint-Niklaas. The incinerator is the only industrial source of dioxin emission in the affected neighbourhood.

For 21 years, the ashes from the incinerator were stored and transported in open containers. Until now, (January 2002) the plant has been operating without a nitrogen filter.

The Belgian NGO conducted the health investigation in January 1998 in Medlarstreet, which is situated within 300 to 900 meters from the waste incinerator and in the dominant wind direction. The survey, administered by a doctor from the Catholic University of Louvain and an independent anaesthetist, drew the participation of 281 individuals from 88 of the target 145 families.

Records indicate that 9 boys out of 10, between 2 to 9 years old, had one or more health complaints that includes, breathing disturbances, infections of the bronchial tubes, asthma, allergies to dust or cow's milk, non-closing of stomach valve etc.

The study uncovered 33 cancer occurrences among 145 residents (18 males and 15 females), one out of 4.4 persons on the average. Twenty-nine of the 33 cancer occurrences appeared during the last 10 years. What is very striking is the number of young people with leukaemia and gland cancer, eight of whom live less than one kilometer from the waste incinerator.

While cancer frequency was more or less equal to normal occurrence expectations from 1986-1988, it was 4.8 times more than the normal occurrence expectations for Belgium during the 1995-1997 period.

Cancers occur mainly in the dominant wind directions and in the immediate neighbourhood of the incinerator plant. Cancer occurrences decrease when the distance from the incinerator increases.

The study also indicated that many young people (mostly women) who used to live in the neighbourhood of the incinerator have problems with fertility, pregnancy and birth.

As a result of their own observations and the findings by other groups, the Belgian NGO was able to outline a pattern of health complaints resulting from the toxic emissions of the Sint-Niklaas waste incinerator

A Belgian court ordered the incinerator to shut down by 31 December 2002, six years before the termination of its license, on the basis of Precautionary Principle.

Based on the Report by the Belgian Platform Health and Environment. For the complete report please see: <http://www.milieugezondheid.be>

Abstracts of Scientific Studies relating to Incinerators and their impact In situ monitoring of mutagenic effects of the gaseous emissions of a solid waste incinerator in metropolitan Sao Paulo, Brazil, using the Tradescantia stamen- hair assay.

Abstract

The present work was designed to determine the potential genotoxicity at the vicinity of a solid waste incinerator in the metropolitan area of São Paulo, using the Tradescantia stamen-hair bioassay. Experiments were carried out between December 1998 and April 1999 in four regions (40 pots of plants per site) selected on the basis of their pollution levels predicted by theoretical modelling of the dispersion of the incinerator's plume. The exposure sites were defined as follows: highest level (incinerator); a high level (museum) located 1.5 km from the emission point; a moderate level (school, at a distance of 3.5 km from the incinerator); and a control (at Jaguariúna countryside). The difference in genotoxicity among the groups was statistically significant ($p < 0.001$).

The frequency of mutations observed in the countryside was significantly lower [2.25 ± 1.55 , mean \pm SD (standard deviation)] than that of the sites close to the incinerator. The frequency of mutations measured at the school (3.70 ± 1.36) was significantly lower than that measured at both the museum (4.89 ± 1.12) and the incinerator (5.69 ± 1.34). In conclusion, we found a positive correlation between the spatial distribution of the emissions of the incinerator located in an urban area and the mutagenic events measured by the Tradescantia stamen-hair assay. The in situ approach employed in this study was simple, efficient, and of low cost. No air or chemical extraction of pollutants was necessary for genotoxicity testing as required by other assays.

Implications

The finding of a positive association between the emissions of a waste incinerator situated in a densely populated area and mutations in a sentinel system indicates that the presence of a stationary source may cause harmful effects on the exposed population. These results indicate that control measures should be implemented to improve the air quality in São Paulo by controlling incinerator emissions in an area already contaminated by millions of vehicles.

Ferreira, M., Petrenko, H., de Araujo Lobo, D., 2000. **In situ monitoring of mutagenic effects of the gaseous emissions of a solid waste incinerator in metropolitan Sao Paulo, Brazil, using the Tradescantia stamen-hair assay.** *J. Air & Waste Manage. Assoc.* 50: 1852-1856.

'Renal function, cytogenetic measurements, and Sexual Development in Adolescents in Relation To Environmental Pollutants

The authors of this paper investigated whether biomarkers adolescents can show exposure to, and health effects of, common environmental pollutants.

They recruited 200 17-year-olds, (of which 120 were girls), from a rural control area and from two suburbs polluted by a lead smelter and two waste incinerators.

They measured biomarkers of exposure and of the effect in blood and urine samples along with data from a questionnaire. School doctors measured testicular volume and staged sexual maturation.

Concentrations of lead and cadmium in blood, Polychlorinated biphenyls (PCBs) and dioxin-like compounds in serum samples, and metabolites of volatile (VOCs) in urine were higher in one or both suburbs than in control areas.

Children who lived near the waste incinerators matured sexually at an older age than the others, and testicular volume was smaller in boys from the suburbs than the control group.

Biomarkers of glomerular or tubular renal dysfunction in individuals were positively correlated with blood lead. Biomarkers of DNA damage were positively correlated with urinary metabolites of Polycyclic aromatic hydrocarbons (PAHs) and VOCs.

The authors interpretation of the data is: Biomarkers can be used to detect environmental exposure to pollutants and measure their biological effects before overt disease develops. Their findings "...[Suggest that current environmental standards are insufficient to avoid measurable biological effects.]"

Jan A Staessen, Tim Nawrot, Elly Den Hond, Lutgarde Thijs, Robert Fagard, Karel Hoppenbrouwers, Gudrun Koppen, Vera Helen, Greet Schoeters, Dirk Vanderschueren, Etienne Van Hecke, Luc Verschaeve, Robert Vlietinck, Harry A Roels, for the Environment and Health Study Group. **'Renal function, cytogenetic measurements, and sexual development in adolescents in relation to environmental pollutants: a feasibility study of biomarkers.'** *Lancet* May 2001

Risk Factors Affecting Blood PCDDs and PCDFs in Residents Living near an Industrial Incinerator in Korea.

Abstract. The contamination sources of polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), such as industrial incinerators, can potentially change the blood levels and isomer patterns of PCDD/DFs in residents living near the incinerators. In this study, we estimated whether the blood levels and isomer patterns of PCDD/DFs in residents living near an incinerator were affected by its presence and investigated factors that characterize the risk of high exposure to PCDD/DFs in the area. We estimated the blood levels and homologue patterns of PCDD/DFs in a group of 40 residents living within 5 km of an industrial incinerator and in a group of 20 residents living 20 km away from an incinerator. We cannot assert that the operation of incinerator facilities was only cause of increased PCDD/DFs in these residents; however, the operation of incinerator facilities in agricultural areas increased PCDD/DF exposure to individuals. The group living next to the industrial incinerator especially represented the typical isomer pattern in which the proportions of OCDDs were lower and those of PCDFs higher than those in the other groups. The high-risk population with increased blood levels of PCDD/DFs included those who had lived longer in the contaminated area as well as those who frequently ate contaminated foods.

Leem *et al.*, 2006. **Risk Factors Affecting Blood PCDDs and PCDFs in Residents Living near an Industrial Incinerator in Korea.** *Arch. Environ. Contam. Toxicol.* 51:478–484 . DOI: 10.1007/s00244-004-0191-0

Childhood Cancers, Birthplaces, Incinerators and Landfill Sites

The author examined 70 municipal incinerators, 307 hospital incinerators and 460 toxic waste landfill sites in Great Britain for evidence of effluents causing childhood cancers.

Using newly developed technique of analysis comparing distances from suspect sources to the birth address and to the death address of cancer-children who had moved house.

The author used case material from a file of 22,458 cancer deaths occurring before the 16th birthday in Great Britain between 1953 and 1980.

The child-cancer/leukaemia data showed highly significant excesses of migrations away from birthplaces close to municipal incinerators. Relative risks within 5.0 km of these sites were about 2:1. (Meaning a child born within 5 km is twice as likely to die of cancer). Hospital incinerators gave analogous results. The ratios greatly exceed findings around 'non-combustion' urban sites.

Because of their locations, the specific effects of municipal incinerators could not be separated clearly from those of adjacent industrial sources of combustion.

The author however concluded that: "It is difficult to say whether the apparent carcinogenic risks near incinerators might stem from (some of) the plants themselves or from other hazards in their near environment."

Toxic incinerators were situated close to other industrial sources of combustion but "...concordance with hospital incinerators suggests a common direct effect: as does the observed limitations to the operational time spans of municipal facilities. For the time being we must probably suppose that the effect stems from large-scale combustion processes as a whole, of which incinerators are but one component."

Knox, E.G. 'Childhood Cancers, birthplaces, incinerators and landfill sites'. *International Journal of Epidemiology* 29: 391-397 (2000)



“..[I]t is not up to us to make decisions regarding the fate of unborn children; the future generations must fend for themselves like everyone else”.

André Rico, former Chairman Pesticide Safety Committee,
Conference UIPP 28th June 2001, Paris.

Biomarkers in maternal and newborn blood indicate heightened fetal susceptibility to procarcinogenic DNA damage.

Polycyclic aromatic hydrocarbons (PAHs) such as benzo[a]pyrene (BaP) are widespread air contaminants released by transportation vehicles, power generation, and other combustion sources. Experimental evidence indicates that the developing fetus is more susceptible than the adult to carcinogenic effects of PAHs, although laboratory studies in rodents suggest that the dose to fetal tissues is an order of magnitude lower than that to maternal tissues. To assess fetal versus adult susceptibility to PAHs and environmental tobacco smoke (ETS), we compared carcinogen- DNA adducts (a biomarker associated with increased cancer risk) and cotinine (a biomarker of tobacco smoke exposure) in paired blood samples collected from mothers and newborns in New York City. We enrolled 265 nonsmoker African-American and Latina mother–newborn pairs in New York City between 1997 and 2001 (estimated average ambient air BaP concentrations < 0.5 ng/m³). Despite the estimated 10-fold lower fetal dose, mean levels of BaP- DNA adducts as determined by high-performance liquid chromatography–fluorescence were comparable in paired New York City newborn and maternal samples (0.24 adducts per 10⁸ nucleotides, 45% of newborns with detectable adducts vs. 0.22 per 10⁸ nucleotides, 41% of mothers with detectable adducts). However, by the Wilcoxon signed-rank test, the levels in newborns were higher ($p = 0.02$). Mean cotinine was higher in newborns than in mothers (1.7 ng/mL, 47% detectable vs. 1.28 ng/mL, 44% detectable). Consistent with our prior study in a Caucasian Polish population, these results indicate increased susceptibility of the fetus to DNA damage and reduced ability to clear ETS constituents. The findings have implications for risk assessment, given the need to protect children as a sensitive subset of the population.

Perera, F., Tang, D., Tu, Y.-H., Cruz, L., Borjas, M., Bernert, T., Whyatt, R., 2004. **Biomarkers in maternal and newborn blood indicate heightened fetal susceptibility to procarcinogenic DNA damage.** *Environ Health Perspect* 112:1133–1136. doi:10.1289/ehp.6833 available via <http://dx.doi.org/> [Online 22 March 2004]



Nearly half of all pregnancies in the United States result in the loss of the baby or a child born with a birth defect or chronic health problem.

Source: National Research council Scientific frontiers in developmental toxicology and risk assessment. National Academy Press: Washington DC, 2000

Interaction Between Genetic Polymorphism of Cytochrome P450-1B1 and Environmental Pollutants in Breast Cancer Risk

Cytochrome P450 1B1 (CYP1B1) is implicated in the activation of potentially carcinogenic xenobiotics and oestrogens. The polymorphism of the CYP1B1 gene at codon 432 (Val/Leu) is associated with change in catalytic function. In a case-series study of breast cancer patients, the authors investigated the interaction between this polymorphism and environmental exposure.

The implication of oestradiol in breast tumourgenesis is widely documented. Dioxin and pesticides are environment organochlorine pollutants with oestradiol activity thought to interfere with oestradiol metabolism. Experiments with animals has shown that these chlorinated hydrocarbons bind to the aryl hydrocarbon receptor (AhR)

A case study was conducted in Montpellier on breast cancer patients admitted to the surgical wards of the Cancer Centre in Montpellier (southern France) from 1998 to 2001. A questionnaire elicited information on environmental exposure, socio-demographic characteristics, reproductive events, medical and familial histories of breast cancer. For subjects who had lived in the vicinity of a waste incinerator the authors noted the age at first and last exposure, the name of the municipality and department. They verified the presence of an incinerator in the municipality from air quality network data (1999). In Languedoc-Roussillon, two municipal solid waste incinerators (MSWI) with a capacity of about 7 tonnes/h were located in Perpignan and Sete: the other sites had lower capacity (<3 tonnes/h).

The cohort studied consisted of 282 breast cancer patients. The average age of the women was 52 years (38-87) and 59% of women had been at menopause for at least one year. A total of 65% of tumours were receptor-oestrogen positive.

The median of the duration of incinerator exposure was 14 years, the lower and upper quartiles were equal to 7 years and 22 years respectively. The frequencies of the Val/Val CYP1B1, Val/Leu CYP1B1 and Leu/Leu CYP1B1 genotypes in this sample were respectively: 17.7%, 50.3%, and 32%. The frequency of any Val CYP1B1 carriers was higher among patients exposed to incinerator pollutants than among unexposed ones (84% versus 64.6% $P < 0.01$).

Results show Val CYP1B1 patients who had lived near a waste incinerator for at least 10 years had a 3.3 fold increased risk of breast cancer compared with a reference group.

While this study concerned few patients exposed to either contaminate, the odds ratio of interaction (OR_i) reach significance. These results are in agreement with the hormone-disrupting activity of the pollutants of incinerators.

Saintot, M, Malaveille, C, Hautefeuille, A, Gerber, M.C. **Interaction Between Genetic Polymorphism of Cytochrome P450-1B1 and Environmental Pollutants in Breast Cancer Risk.** *European Journal of Cancer Prevention*, 13:83-86 2004

Dioxin emissions from a municipal solid waste incinerator and risk of invasive breast cancer: a population- based case-control study with GIS-derived exposure.

Abstract

Background

To date, few epidemiologic studies have examined the relationship between environmental PCDD/F exposure and breast cancer in human populations. Dioxin emissions from municipal solid waste incinerators (MSWIs) are one of the major sources of environmental dioxins and are therefore an exposure source of public concern. The purpose of this study was to examine the association between dioxins emitted from a polluting MSWI and invasive breast cancer risk among women residing in the area under direct influence of the facility.

Methods

We compared 434 incident cases of invasive breast cancer diagnosed between 1996 and 2002, and 2170 controls randomly selected from the 1999 population census. A validated dispersion model was used as a proxy for dioxin exposure, yielding four exposure categories. The latter were linked to individual places of residence, using Geographic Information System technology.

Results

The age distribution at diagnosis for all cases combined showed a bimodal pattern with incidence peaks near 50 and 70 years old. This prompted us to run models separately for women aged 20–59 years, and women aged 60 years or older. Among women younger than 60 years old, no increased or decreased risk was found for any dioxin exposure category. Conversely, women over 60 years old living in the highest exposed zone were 0.31 time less likely (95% confidence interval, 0.08–0.89) to develop invasive breast cancer.

Conclusion

Before speculating that this decreased risk reflects a dioxin anti-estrogenic activity with greater effect on late-on- set acquired breast cancer, some residual confounding must be envisaged.

Jean-François Viel. Marie-Caroline Clément. Mathieu Hägi. Sébastien Grandjean. Bruno Challier. and Arlette Danzon. *International Journal of Health Geographics* 2008, 7:4doi:10.1186/1476-072X-7-4

Solid Waste Incinerator and Risk of Non-Hodgkin Lymphoma.

A recent study whose authors had previously detected a cluster of patients with non-Hodgkin lymphoma around a French municipal solid waste incinerator with high dioxin emissions. Undertook a study to explore the environmental route suggested by these findings and carried out a population-based case-control study in the same area. They compared 222 incident cases of non-Hodgkin lymphoma diagnosed between 1980 and 1995 and controls randomly selected from the 1990 population census, using a 10-to-1 match. They discovered the risk of developing non-Hodgkin lymphoma was 2.3 times higher (95% confidence interval 1.4–3.8) among individuals living in the area with the highest dioxin concentration, (as estimated by an airborne dispersion model) than among those living in the area with the lowest dioxin concentration. No increased risk was found for the intermediate dioxin exposure categories. Adjustment for a wide range of socio-economic characteristics at the block group level did not alter the results. **Their conclusion** was “although emissions from incinerators are usually not regarded as an important source of exposure to dioxins compared with other background sources, their findings support the hypothesis that environmental dioxins increase the risk of non-Hodgkin lymphoma among the population living in the vicinity of a municipal solid waste incinerator.”

This finding, together with the non-Hodgkin lymphoma mortality excess reported by Bertazzi *et al* around Seveso, lends support to the hypothesis that airborne dioxin exposure may be a public health concern.

Floret, N., Mauny, F., Challier, B., Arveux, P., Cahn, J.-Y., Viel, J.-F., 2003. **Dioxin emissions from a solid waste incinerator and risk of non-Hodgkin lymphoma.** *Epidemiology* 14: 392–39828

Non-Hodgkin's Lymphoma in France

Staying with studies revealing increased levels of Non-Hodgkin's Lymphoma we look again to France and a study conducted by Jean François Viel *et al* where the authors examined the spatial distribution of soft-tissue sarcomas and non-Hodgkin's lymphomas around a French municipal solid waste incinerator with high dioxin emissions (16.3ng international toxic equivalency factor /m³(ITQ)

The authors write "Soft tissue sarcoma is a rare event but during the 16 year study 110 cases were accrued, corresponding to a crude incidence rate of 1.4 per 100,000. the focused test found a significant cluster around the incinerator. An excess of 14 cases was observed and the standardised ration was 1.44.

Clusters were found at a number of census areas around the incinerator as follows

45 observed, 31.22 expected.

12 observed, 3.49 expected.

45 observed, 31.22 expected.

286 observed, 225.25 expected.

109 observed, 59.09 expected.

The authors wrote, "On the whole the consistency of our findings for soft tissue sarcoma and non-Hodgkin's lymphoma is remarkable. Moreover, the fact we found no specific cluster for the control cancer category of Hodgkin's disease reinforces previous, positive results. These finding together with the consistency of the results across genders for non-Hodgkin's lymphoma (cluster involving only males would have favoured an occupational exposure) makes us suspect, at least for this type of cancer, an environmental pathway involving dioxin.

Viel, Jean –Francois. Arveux, Patrick. Baveret, Josette. Cahn, Jean Yves. '**Soft Tissue Sarcoma and non- Hodgkin's Lymphoma Clusters Around a Municipal solid Waste Incinerator with high Dioxin Emission Levels.** *Am J Empidemiol* Vol. 152 No 1. 2000

Non Hodgkin's lymphoma risk and past dioxin emissions from municipal solid waste incinerators

Dioxin emissions from municipal solid waste incinerators are one of the major sources of dioxins and therefore are an exposure source of public concern. There is growing epidemiologic evidence of an increased risk for non-Hodgkin's lymphoma (NHL) in the vicinity of some municipal solid waste incinerators (MSWI) with high dioxin emission levels. The purpose of this study was to examine this association on a larger population scale. A total of 3974 NHL incident cases was observed (2147 among males, and 1827 among females) during the 1990-1999 time period. A statistically significant relationship was found at the block group level between NHL incidence and dioxin exposure, with a relative risk (RR) of 1.120 (95% confidence interval [CI] 1.003 - 1.250) for persons living in highly exposed census blocks compared to those living in slightly exposed block groups. Post-hoc subgroup analyses per gender yielded a significant RR for females only (RR=1.187, 95% CI 1.020 - 1.382). This study, in line with previous results obtained in the vicinity of the incinerator located in Besancon (France), adds further evidence to the link between NHL incidence and exposure to dioxins emitted by municipal solid waste incinerators. However, the findings of this study cannot be extrapolated to current incinerators, which emit lower amounts of pollutants.

Viel, et al., **Non Hodgkin's lymphoma risk and past dioxin emissions from municipal solid waste incinerators** *Environmental Health*, October 28, 2008

Malformations Around Incinerators in France

In France a study [1] compared the number of births of deformed babies before and after the instillation of incinerators: they concluded that within a 10 year period in the Rhone-Alpes region, an excess of 220 children were born with malformations after the construction of the incinerators. Therefore, according to the authors "for the total of congenital malformations and the large categories on minor and non-genetic malformations, a significant difference in incidence is observed with a greater risk for the population exposed after the start of the incinerator than before". This temporal correlation is matched by geographical correlation. Still according to the authors, "The general objective ...consists of assessing the risk of congenital malformations among the neighbours living in the surroundings of municipal solid waste incinerators.

...Globally, significant risks for the exposed population are observed regarding two types of malformations; chromosomic anomalies and other major malformations."

With that spatial approach they actually find an excess of over 300 deformed children.

Even taking into account the data from the French ministry of the environment, clearly underestimated, one realises that the problem is not limited to 'small, dirty or old incinerators'" as supporters of the process claim.

Among the worst French incinerators in terms of dioxin emissions are the biggest and most beautiful ones; St-Ouen (just outside Paris) emits 4.99g/year. Strasbourg emits 8.75 g/year, and Lyon emits 4.49g/year (just to give some examples).

[1] **Risques de malformations congènetales autour des incinérateurs d'ordures ménagères, Inserm, Institut européen des gènomutations, Afssaps, 2002**

Hazard proximities of childhood cancers. (Not directly targeting incinerators but interesting as to the mechanisms affecting children.)

This study concluded that children living within 2 to 3 miles from certain kinds of industrial facilities are 20% more likely to die of leukaemia or other forms of cancer. Looking at data on 22,458 children who died of leukaemia or solid cancers during the years of 1953 to 1980, scientists found that the danger is greatest within a few hundred yards of pollution sources and tapers off with distance. The authors concluded that childhood cancers cluster around two general kinds of facilities.

*Producers, refiners, distributors of petroleum fuels and volatile petroleum products.

*Manufacturing processes using high temperature furnaces, kilns and combustion chambers.

The authors think their study might have missed local sources of petroleum exposure of children, these sources included school or hospital chimneys and municipal incinerators.

The authors of the study say there may be three mechanisms by which childhood cancers are caused.

*Gases and volatile organic compounds reaching children or pregnant mothers directly;

*Parent's germ cells being harmed during occupational exposures giving rise to children who are predisposed to cancers;

Occupational contamination carried home on clothing, skin or breath.

Of the three the authors believe direct exposure of children or their pregnant mothers is the most likely. Childhood cancers could be caused by at least three mechanisms,

**Pollutants damaging the inherited genetic material (DNA) in cells,

**Pollutants damaging the immune system which would otherwise prevent cancer cells from surviving. *Pollutants damaging mechanisms of cell division. {Cancer is uncontrolled cell division.

Among children who had changed addresses between birth and death the cancer hazard could only be seen near the address of their birth implying that exposure to pollutants shortly before or after birth caused the cancers.

Knox, E.G., Oilman, E.A., "Hazard proximities of childhood cancers in Great Britain from 1953-80." *Journal of Epidemiology and Community Health*. Vol. 51 (1997) 151-159

Approaching gas-particle partitioning equilibrium of atmospheric PCDD/Fs with increasing distance from an incinerator: measurements and observations on modelling.

Abstract

A comprehensive sampling campaign was carried out around a municipal solid waste incinerator (MSWI) in central Taiwan in order to evaluate the impact of polychlorinated dibenzo-p-dioxins and furans (PCDD/Fs) emissions on the ambient air and describe their spatial variation of gas-particle partitioning. Stack flue gas samples from the MSWI were also analysed to investigate the relationship between the source and the impacted sites. Results showed that the PCDD/F emissions from the MSWI were a major source for PCDD/Fs in the ambient air. Moreover, PCDD/Fs in the ambient air tended to be distributed between the gaseous and particulate phases based on molecular weight; the higher chlorinated congener occupied a higher particulate fraction. There was an increase in the proportion of particle-bound PCDD/Fs with increasing distance from the MSWI. This observation supports the assumption that PCDD/Fs emitted were initially more associated with gaseous phase and the gaseous PCDD/Fs would gradually migrate to particles via either adsorption or absorption process.

The results obtained were also applied and compared with the subcooled liquid vapour pressure (POL)-based model and with the octanol-air partition coefficients (K_{oa})-based model. These two models were found to be excellent descriptors for the gas-particle partitioning of PCDD/Fs. Regressions for log partition coefficient (K_p) versus log POL and log K_p versus log K_{oa} both demonstrated that PCDD/Fs were approaching equilibrium partitioning with increasing distance from the MSWI in the current study.

[from text]

This incinerator has three rotary furnaces with a nominal capacity rating of 300 ton day⁻¹ each and it employs semidry scrubber and bag filter as air pollution control devices. Finally, the fumes are emitted through a 120m high stack

Chao, M.-R., Hu, C.-W., Chen, Y.-L., Chang-Chien, G.-P., Lee, W.-J., Chang, L., Lee, W.-S., Wu, K.-Y., 2004. **Approaching gas-particle partitioning equilibrium of atmospheric PCDD/Fs with increasing distance from an incinerator: measurements and observations on modelling.**

Sarcoma risk and dioxin emissions from incinerators and industrial plants: a population-based case-control study (Italy).

Abstract

Background: It is not clear whether environmental exposure to dioxin affects the general population. The aim of this research is to evaluate sarcoma risk in relation to the environmental pollution caused by dioxin emitted by waste incinerators and industrial sources of airborne dioxin. The study population lives in a part of the Province of Venice (Italy), where a population-based cancer registry (Veneto Tumour Registry – RTV) has been active since 1987. Methods: Two hundred and five cases of visceral and extravisceral sarcoma, confirmed by microscopic examination, diagnosed from 01.01.1990 to 31.12.1996, were extracted from the RTV database. Diagnoses were revised using the actual pathology reports and clinical records. For each sarcoma case, three controls of the same age and sex were randomly selected from the population files of the Local Health Units (LHUs). The residential history of each subject, whether case or control, was reconstructed, address by address, from 1960 to the date of diagnosis. All waste incinerators and industrial sources of airborne dioxin in the Province of Venice were taken into account, as was one very large municipal waste incinerator outside the area but close to its boundaries. The Industrial Source Complex Model in Long Term mode, version 3 (ISCLT3), was used to assess the level of atmospheric dispersion. A specific value for exposure was calculated for each point (geo-referenced address) and for each calendar year; the exposure value for each subject is expressed as the average of specific time-weighted values. The analysis takes into account 172 cases and 405 controls, aged more than 14 years.

Results; The risk of developing a sarcoma is 3.3 times higher (95% Confidence Interval – 95% CI: 1.24 – 8.76) among subjects, both sexes, with the longest exposure period and the highest exposure level; a significant excess of risk was also observed in women (Odds Ratio OR = 2.41, 95% CI: 1.04 – 5.59) and for cancers of the connective and other soft tissue (International Classification of Diseases, ninth Revision – ICD-IX 171), both sexes (OR = 3.27, 95% CI: 1.35 – 7.93).

Conclusion: Epidemiological evidence of the carcinogenic effect of dioxins is essentially supported by studies carried out on populations exposed to high levels of dioxins due to occupation or accident. We believe that the results of our study support the association between modelled dioxin exposure and sarcomas in a general population exposed for a prolonged period of time to what are, in all likelihood, much lower concentrations. Zambon et al., 2007. Sarcoma risk and dioxin emissions from incinerators and industrial plants: a population-based case-control study (Italy).

Paola Zambon. Paolo Ricci. Emanuela Bovo. Alessandro Casula. Massimo Gattolin. Anna Rita Fiore. Francesco Chiosi. Stefano Guzzinati. **Sarcoma risk and dioxin emissions from incinerators and industrial plants: a population-based case-control study (Italy).** *Environmental Health* 2007, 6:19doi:10.1186/1476-069X-6-19

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Health effects of waste incineration: A review of epidemiological studies.

There is an increasing trend toward using incineration to solve the problem of waste management; thus, there are concerns about the potential health impact of waste incineration. A critical review of epidemiologic studies will enhance understanding of the potential health effects of waste incineration and will provide important information regarding what needs to be investigated further. This study reviews the epidemiologic research on the potential health impact of waste incineration. Previous studies are discussed and presented according to their study population, incinerator workers or community residents, and health end points. Several studies showed significant associations between waste incineration and lower male-to-female ratio, twinning, lung cancer, laryngeal cancer, ischemic heart disease, urinary mutagens and promutagens, or blood levels of certain organic compounds and heavy metals. Other studies found no significant effects on respiratory symptoms, pulmonary function, twinning, cleft lip and palate, lung cancer, laryngeal cancer, or esophageal cancer. In conclusion, these epidemiologic studies consistently observed higher body levels of some organic chemicals and heavy metals, and no effects on respiratory symptoms or pulmonary function. The findings for cancer and reproductive outcomes were inconsistent. More hypothesis-testing epidemiologic studies are needed to investigate the potential health effects of waste incineration on incinerator workers and community residents.

[from text]

Lloyd *et al.*, investigated the frequency of twinning in areas exposed to airborne pollution from a municipal waste incinerator and a chemical waste incinerator (the type of waste burned was not specified), and in neighbouring control areas. Wind direction was taken into account to differentiate areas potentially exposed to the emissions. The frequency of twinning was increased, particularly after 1979, in the areas at most risk of being exposed to air pollution from the incinerators. The authors speculated that polychlorinated hydrocarbons, some of which have estrogenic properties and have been burned in the chemical incinerator between 1975 and 1977, might be related to increased twinning.

Hu, S.-W., Shy, C., 2001. **Health effects of waste incineration: A review of epidemiologic studies.** *J. Air & Waste Manage. Assoc.* 51: 1100-1109.



Death rates for young children are related seasonal levels of particulate air pollution and cold temperatures

Seasonal variations in death rates for young children are related to high levels of particulate air pollution and cold temperatures during the winter months, and to high levels of particulate pollutants and nitrogen dioxide during the summer months, according to a Spanish study in the August *Journal of Occupational and Environmental Medicine*, official publication of the American College of Occupational and Environmental Medicine.

Led by Dr. J. Díaz of Universidad Autónoma de Madrid, the researchers reviewed weather and pollution monitoring data for Madrid from 1986 through 1997. They sought to determine how these environmental factors affect death rates among children less than 10 years old.

The results showed significant interactions between daily temperatures and levels of specific air pollutants. In the wintertime, child mortality rates rose a few days after cold days with high levels of particulate air pollutants (“total suspended particles,” or TSP). Death rates increased dramatically after cold days with temperatures less than 43° Fahrenheit (6° Celsius).

In the summertime, child mortality rates rose also along with TSP levels, as well as with levels of nitrogen oxide pollutants. Most of the temperature- and pollution-related increases in death rates were limited to children between 1 and 5 years old.

The effects of temperature and pollution in children differed from those in adults, based on previous studies from Madrid. For adults, death rates increased on both the warmest and coldest days, whereas temperature-related risks in children were limited to cold days.

In contrast, the effects of pollution were greater in children. Child mortality rates were especially high on days with TSP levels of more than 100 micrograms per square meter, which occur mostly during the winter. Children’s airways are narrower, meaning that they are exposed to a higher concentration of pollutants with each breath. Children are also more likely to be outdoors and physically active on warm summer days when pollutant levels are high.

Recent years have seen “exceptionally abnormal” world weather patterns, including very cold winters on the east coast of North America and hot summers in Western Europe. These patterns have raised concerns about possible climate changes and their effects on human health. The study found no relationship between ozone levels high in the atmosphere—which have been linked to “global warming”—and child mortality rates.

However, the results provide new insights into how daily environmental conditions at ground level might affect health in infants and young children. High TSP levels are a hazard to children in both the winter and summer months, while temperature is a factor mainly on cold days. The public health policies needed to reduce the health dangers of pollution in infants and young children may not be the same as for older adults or the general population, the researchers conclude.

ACOEM, an international society of 6,000 occupational physicians and other healthcare professionals, provides leadership to promote optimal health and safety of workers, workplaces, and environments. <http://www.lww.com/>

This and other important daily news on health and environmental issues can be found on the Environmental Health News website <http://www.environmentalhealthnews.org/> News-Medical.Net

Posted By: News-Medical in Child Health News. Published: Sunday, 15-Aug-2004



“...[S]ustainable development rests on three pillars, namely the economy, the society and the environment. Humankind stands in the centre of the prosperous economy, the future oriented society, and the sound environment. Our children and grandchildren, the heart and the soul of sustainable development, will inherit the future society, operate the future economy and manage the environment for the future of mankind. Therefore, it is an intrinsic component of sustainable development to protect the health of children and ensure that children live in environments that allow them to reach their full potential as individuals and contributing members of these societies.

World Health Organisation Budapest 2004

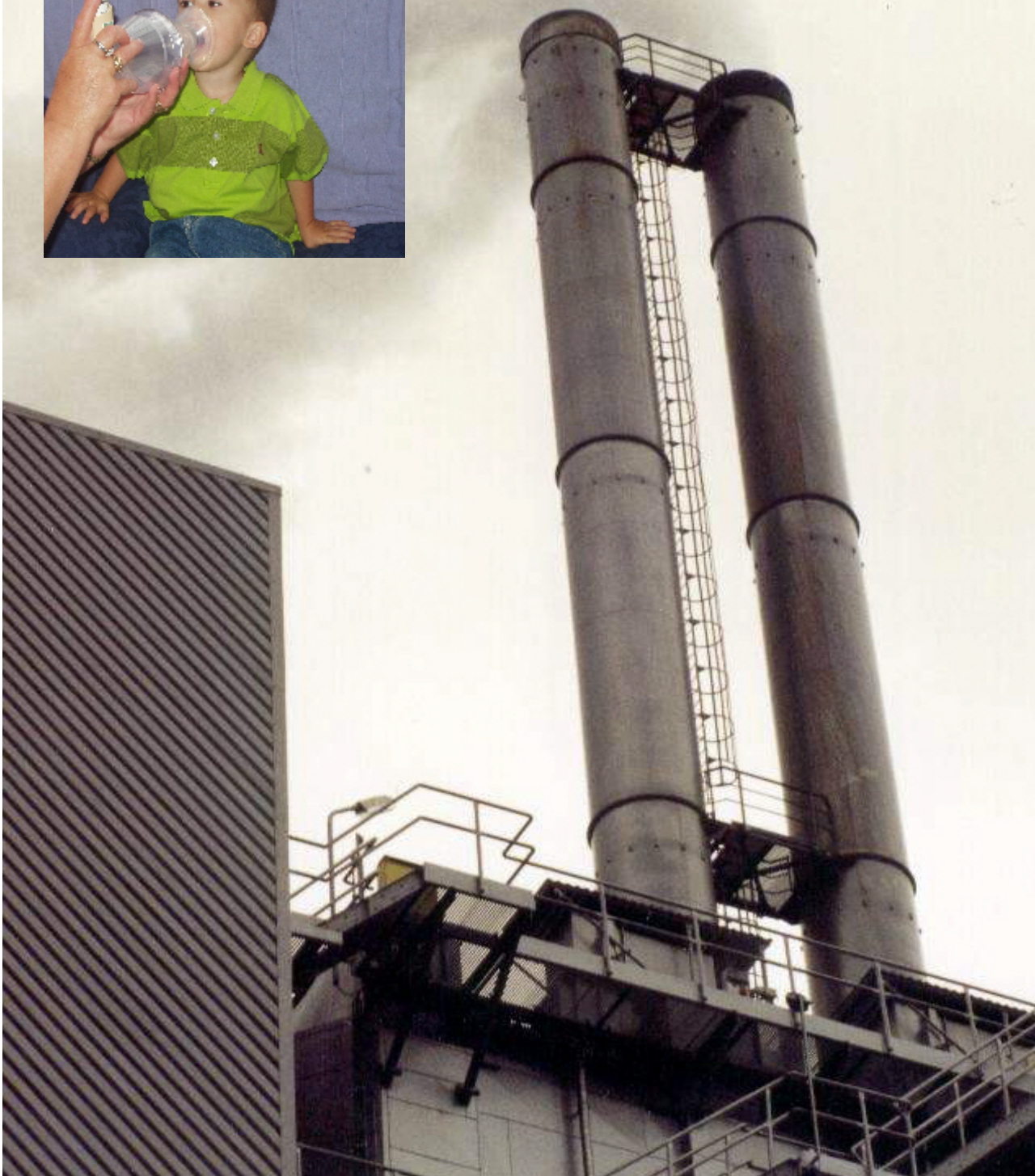
More information on epidemiological studies around incinerators can be found at http://www.greenpeace.org/~toxics/html/content.action_incinreport.html

Communities Against Toxics acknowledges the help of Mr Alan Watson of Public Interest Consultants in compiling the summaries in this report. Communities Against Toxics
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It is important that publications like this are made freely available to groups fighting the increase of incineration. Due to the lack of funding CATs web site is no longer running which means of course this important information is not as widely distributed as it should be.

If you would like to sponsor the web site of CATs for one year or make a donation towards it contact Ralph Ryder at the above email address.

“We can easily forgive a child who is afraid of the dark; the real tragedy of life is when men are afraid of the light.” *Plato*



**“During times of universal deceit, telling the truth becomes a revolutionary act.”
George Orwell**