IDEA **Irish Doctors Environmental Association**

IDEA Position on Incineration

We are a throwaway society that has forgotten that there is no place called 'away'.

The Irish Doctors' Environmental Association has serious concerns regarding incineration, which we do not regard as a solution to our waste management problem. We are opposed to incineration for three reasons.

First of all, it does not make sense to burn the Earth's resources; resources that we should not destroy, but instead, share with future generations. Secondly, the very presence of incinerators creates it's own demand, and allows us to continue with our throwaway habits. Thirdly, we are concerned about proven adverse health effects. Incineration does not destroy municipal waste; on the contrary, it transforms it into emissions into the environment and converts household waste to hazardous waste.

Health effects

There are many types of compounds in our domestic waste, which contain numerous chemicals. We do not know enough about the chemicals that we already have in our environment; for example, the European Environment Agency has said that of the 100,000 chemicals on the European market, there is insufficient toxicity information available for even the most basic risk assessments on 75% of them. These are the chemicals that will be present in our waste.

Even more worryingly, 10,000 of these chemicals are at present on the EU list for priority assessment, of which 42 had been prioritized for EU assessment between 1996 and 2000. However, to our most recent knowledge, only 21 risk assessments were publicly available. And these are the chemicals that we already have! It does not make sense to burn unknown and unquantified chemicals, which will combine in the furnace forming new compounds, whose composition and effects we know little or nothing about about, and disperse them widely in our air, food and water.

With such little knowledge, it is impossible to predict adverse health effects of incinerators, new or updated. The decrease in waste volume, seen by it's proponents as the advantage of incineration arises from the dispersal of gasses and particulate aerosols into the environment, and by the formation of ash. Our association is concerned about adverse health effects from these emissions, and from the ash remaining, both bottom and fly ash removed from the stacks. Incineration transforms municipal waste into hazardous waste, producing toxic ash from household waste. The issue of where this is to be stored has not yet been resolved in the Irish context.

The emissions include organic compounds, e.g. dioxins (which have recently been classified as a human carcinogen), polychlorinated bi-phenyls (PCBs), volatile organic compounds (VOCs), and other chemicals, heavy metals, particulates, inorganic gasses and other gasses. With regard to the emission of chemicals from incinerator stacks, it is generally regarded that setting maximum concentrations to allow 'dilution and dispersion' strategies, are adequate for substances of acute toxicity. This is only suitable in situations where the compound is water soluble, with established NOAEL (no observed adverse effect level), and where it is rapidly degraded. Dilution and dispersal will not work in the situation where dioxins and other compounds are soluble in fat, and are persistent and/or bio-accumulate. The human body is not designed to cope with the carbon/chlorine compound. The concentration of these compounds simply increases as they ascend through the food chain and the compounds accumulate in fat tissue. Every living creature on earth now has persistent carbon/chlorine based compounds in it's fat. It is conservatively estimated that the average person in the 'developed' world has between 300 and 500 discernible residues in their bodies, the so-called body burden of chemicals.

We do not need any more. The effect of individual compounds, let alone a mixture is completely unknown and unmeasurable by current technology.

Many of the chemicals produced, by incineration are persistent, bioaccumulative (they accumulate in the body, because the body is not designed to excrete them), and toxic. Furthermore, there may be a long latency period before any adverse health effects become visible. Emissions of dioxins from incinerators may be said to be 'low', but the emissions to air only account for what is inhaled; these chemicals will also be found on vegetation and soil and intake will be increased in this way, as well as by absorption from the skin. The concentration of these chemicals is increased each time a step in the food chain is traversed. The longest food chains are found in marine ecosystems, e.g. a small fish contaminated by chemical pollutants will be eaten by a larger fish. As the larger fish will eat many small fish, the concentration of the chemicals will therefore be higher in the larger fish. There are other food chains in nature. These chemicals return to us when we consume the food.

For the general population of industrialized countries, research indicates that dioxins are exerting effects on people at current background levels found in the environment. Such effects include altering the levels of certain hormones, enzymes, and immune system cells. Recent research has shown that calculations of the amounts of dioxin released from incinerators may have been seriously underestimated, by up to thirty times. A list of the known toxicological effects of dioxin is found at the end of this article (1). It does not make sense to increase the exposure of people to these compounds, in fact we urgently require to REDUCE the exposure.

PCBs are a mixture of compounds with a dioxin-like effect and also a phenobarbitone-like effect. Both PCBs and dioxin are toxic to the developing brain of babies, both before and after birth.

Exposure to PCB in the womb is associated with decreased intelligence, suppression of the immune system and interference with the hormonal system of the body. It is possible that some of the effects of PCBs may be related to a 'dioxin' like effect. A summary of the effects of exposure to dioxin and PCBs on infants and children is appended at the end of this article (2).

A list of approximately 250 chemicals released from one incinerator is appended at the end of this article (3). This list is not exhaustive; many of the chemicals released from incinerators remain unidentified.

The toxicological significance of many volatile organic compounds is unknown. However, they are known to contribute to ozone formation, when they combine with nitrogen oxides in sunlight to produce ground level ozone. This is a respiratory irritant.

Apart from mercury, the heavy metals generally remain in the fly and bottom ash. Mercury is found in the emissions to air, and depending on its chemical state, may either be water soluble and remain close to the incinerator, or be carried long distances. Mercury is now being found in humans throughout the world in concentrations which are known to be toxic.

Most natural small particles are greater than 20 microns in size. Those, which are less than 10 microns are generally sea-salts and if inhaled, are reabsorbed.

Combustion processes, however, produce much smaller particles.

Although much attention has been given to the chemical discharges from incinerators, recently the fine particulates (less than 10 microns) and ultrafine particulates (less than 0.05 microns) are giving rise to serious concern. The ultrafine particulates are chemically highly reactive tiny particles and increase the coagubility of blood and the risk of cardiovascular disease. This has recently [Nov 2004] and uniquely been endorsed by the American Heart Association - the largest and one of the most prestigious groupings of cardiovascular disease physicians in the world. Only 5-30% less than 2.5 microns are collected by the mechanisms currently in use. At this size, the particles travel extremely far down into the lungs, to the site where oxygen exchange occurs; in fact they behave physiologically as a gas. Particulate pollution is associated with worsening respiratory disease, cardiovascular disease and an increase in premature mortality. Possible means for their effects include the small size of the particle relative to their surface area, leading to a large area for release of metals, dioxins and other chemicals, their insolubility and the possible generation of free radicals. There appears to be no ‘safe’ level, below which adverse effects from these particles will not occur. As far back as 1997, the US EPA added two new PM-2.5 standards, for the annual and 24-hour standards. Furthermore WHO recently adopted a recommendation to use fine particulate matter 2.5 as an indicator for pollution induced health effects. We have no guidelines in Ireland for the regulation of these particles, and the issue was not addressed in the Health Research Board’s report.

It also appears that methods used to reduce the emissions of nitrogen oxides from incinerators may increase the levels of particulates in the emissions. There is an urgent requirement for research into the environmental and health effects of the particulate aerosols emitted by current incinerators, which because of the large volumes of gas they produce, will have a significant local effect on air quality.

It is also of concern that for every one ton of waste incinerated, one ton of carbon dioxide is produced. This will have a deleterious impact on our commitments to the Kyoto protocol on climate change. The numerous adverse health effects associated with climate change are already evident throughout the world, and these will inevitably become more severe unless greenhouse gas emissions are reduced.

Emissions are said to be regulated, and we are told that there are 'safe levels', which will not be exceeded. However we have 5 concerns regarding the regulations.

Firstly, it does not make sense to talk of 'safe levels' of cancer causing agents.

Secondly, for many substances, no 'safe' standards exist. For example, regulations consider chlorinated dioxins. However, there are similar dioxin-like chemicals for which there are no 'safe levels' estimated. A case in point is mixed chloro and bromo-dioxins, which are also released in appreciable quantities and appear to have equal toxicological significance. There is no obligation to monitor these chemicals, as there is no standard 'safe limit'.

Thirdly, most environmental standards are based on what is feasible, in a BATNEEC framework (best available technology not exceeding excessive cost). This framework has no direct health significance.

Fourthly, there is no ‘standard’ person, people vary genetically and from an environmental exposure standpoint. The foetus and young child being, of course the most sensitive. It is disturbing to note that the blood-brain barrier is only fully developed at six months of age. Therefore, the foetus and young baby are acutely sensitive to the effects of these largely fat-soluble chemicals. This is even more worrying when we note that the brain is composed largely of fatty material, and know the devastating effects that these chemicals have on neurological development.

Finally, a fundamental problem with risk assessments is that estimation of the health consequences of pollution, as we have seen is still poorly understood. Risk assessments are only as good as the assumptions that they are based upon, and there are many assumptions. There is huge uncertainty with regard to the toxicological significance of low-dose, long-term exposure to the developing foetus and infants. There is uncertainty at every stage of the risk assessment process - e.g. how much of the chemical is released, (generally estimates of releases are taken under optimal operating conditions, not during starting up or running down of the incinerator when emissions may increase), individual human exposure, etc. Furthermore, risk assessments generally concentrate on chemicals in isolation and omit to take into account possible reactions with other chemicals. There are studies from different laboratories which indicate that the effects of some chemicals may be enhanced by up to ten times when mixed with other chemicals. It has been estimated that to test just the commonest 1,000 toxic chemicals, in unique groups of three, would require at least 166 million different experiments and would take 180 years (and this study would disregard the need to study varying doses). The U.K. National Research Council noted that ‘there is a dauntingly wide spectrum of inadequacies and uncertainties inherent in the process of risk assessment, each of which alone, could fatally compromise risk assessment procedures'. Therefore the only safe decision is to apply the 'precautionary principle' and not produce any of these compounds in the first place.

For every three tons of waste incinerated, on average one ton of ash is produced. The safe disposal of this also poses a problem, because it also contains dioxins and other chemicals, and heavy metals.

This aspect of waste incineration has yet to be satisfactorily resolved.

Although requested by the European Environment Bureau, there is no requirement for health related surveillance of incinerators in the licensing arrangements, and in Ireland the Health Research Board report of Mar 2003 has stated that we do not have either the manpower or the facilities to support such a surveillance system.

We have a problem with waste production.

Our municipal waste production doubled from the mid-1980s to the present time and continues to increase by approximately 4.5% annually. Two million tons of municipal waste were produced in 1998.

In keeping with this, the government set waste management targets in 1998, largely based on EU guidelines, these include:

*A reduction of 65% reduction in biodegradable waste going to landfill.

*Recycling of 35% of municipal waste

*Recycling of 50% of demolition waste in a five-year period.

*Diversion of 50% of household waste away from landfill

There are two problems with this approach

Firstly, these targets are far too modest; for example, our association would like to see no compostable waste on a landfill site.

Secondly, and more importantly, the structures whereby people may recycle and reuse are not, as yet, widely available. This piecemeal approach by local and national government departments results in the shameful fact that our recycling rates are the lowest in the EU. It is a disgrace that we are even considering any incinerator when we have such an unstructured approach to the implementation of the waste hierarchy.

The waste hierarchy is, of course, reduce (consumption), reuse and recycle. To this, we may add rethink!

We welcome the long overdue tax on plastic bags, which was such a success and is frequently cited around the world. At least one country (South Africa) has recently been reported to be considering the introduction of a 'Disposal Tax' on all consumer goods, which will be refunded to the purchaser on correct end-of-life disposal of the item. Perhaps worth considering?

It is our responsibility to ensure that we deal effectively with the problem, so as not to leave this legacy to future generations.

Any risk that is avoidable is unacceptable. It is therefore wrong to gamble on the health of future generations.

There is sufficient evidence of the dangers of health and environmental contamination to stop incineration now.

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(1) DIOXINs

There are 210 dioxins/furans, 17 of which are known to be toxicologically significant. 2,3,7,8 tetrachlorodibenzo-p-dioxin [TCDD] is taken as the reference standard and dioxin/furan emissions are toxicologically weighted to this.

Class 1 carcinogen

Immune system

Suppression of cell-mediated and humeral immunity, increased susceptibility to infectious challenge, auto immune response.

Male reproductive toxicity

Reduced sperm count, testicular atrophy, abnormal testis structure, reduced size of genital organs, feminized hormonal responses, feminized behavioural responses

Female reproductive toxicity

Decreased fertility, inability to maintain pregnancy, ovarian dysfunction, endometriosis

A general increase in both bacterial and viral infections, including ear infections.

Developmental impacts

Birth defects, foetal death, impaired neurological development and subsequent cognitive deficits, altered sexual development.

Modulation of hormones, receptors and growth factors

Steroid hormones and receptors (androgens, oestrogens, and steroids), thyroid hormones, insulin, melatonin, vitamin A,

Other effects

Organ toxicity (liver, spleen, thymus and skin), diabetes, weight loss, wasting syndrome, altered fat and glucose metabolism.

(2) Effects of perinatal exposure to dioxins and PCBs on infants and children

Central nervous system

Deficits in short-term memory on children whose mothers were exposed to background levels of PCBs and dioxins

Delayed motor development, hypotonia and hyporeflexia in children exposed to background levels

Hypotonia, lower psychomotor developmental indices, lower cognitive scores in children whose mothers were exposed to background levels.

Immune system

More frequent ear infections and alteration in immune mechanisms with background levels

Growth, sexual development and reproductive health

Lower birthweight and smaller head circumference among children exposed to background levels.

(3) K. Jay and L. Steiglitz, "Identification and Quantification of Volatile Organic Components in Emissions of Waste Incineration Plants," CHEMOSPHERE Vol. 30, No. 7 (1995), pgs. 1249-1260, identified the following volatile organic chemicals emitted from a solid waste incinerator stack:

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; methyl decane; 4-methylbenzaldehyde; 1-ethyl-3,5-dimethylbenzene; 1-methyl-(1-pro-penyl)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; ethylhex anoic acid; ethyl benzaldehyde; 2,4-dichlorophenol; 1,2,4-trichlorobenzene; naphthalene; cyclopentasiloxanedecamethyl; 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; hydroxybenzonitrile; 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-ethenyl-naphthalene); 3,4,5-trichlorophenol; chlorobenzoic acid; 2-hydroxy-3,5-dichlorobenzaldehyde; 2-methylbiphenyl; 2-nitrostyrene(2-nitroethenylbenzene); 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-methyl-phenol; 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; cholesterol; heptadecane; fluorenone; dibenzothiophene; pentachlorophenol; sulphonic acid m.w. 224; phenanthrene; tetradecanecarboxylic acid; octadecane; phthelic ester; tetradecanoic acid isopropyl ester; caffeine; 12-methyltetradecacarboxylic acid; pentadecacarboxylic acid; methylphenanthrene; nonedecane; 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.

REFERENCES

Grateful appreciation to Greenpeace UK, Canonbury Villas London N1 2PN whose publication ‘Incineration and Human health State of knowledge of the impacts of waste incinerators on human health’ Greenpeace 2001 provided much of the information for this article.

Health Impacts of Waste Management policies

Edited by P.Nicolopoulou-Stamati, L.Hens and C.V. Howard

Environmental Science and Technology Library 1999

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See Also:

Incinerators and their Health Effects

Recycling of Household Waste: IDEA Submission to the Joint Oireactas Committee, Aug 2005

The Zero Waste Alliance website
