INCINERATION & HEALTH *skill-sharing workshop 24 March 07*

QUOTES for Discussion

1. "Though not technically a "renewable" option in the same way as solar or wind, **energy from waste** is also included... – and is also very controversial. … we are concerned that environmental opposition to energy from waste has simply not kept up with the degree to which the technology has moved on from the kind of mass burn incinerators that inflicted so much damage on the environment in the past. These days, *energy from waste*, particularly at smaller scale… could be introduced with *minimal pollution* and minimal impact on recycling or waste minimisation strategies."

2. Research commissioned by DEFRA in 2004 concluded that there was "No evidence to suggest that the current generation of municipal solid waste incinerators is likely to have an effect on human health". If you live in a rural area and still have a garden bonfire you should reflect that one person burning his or her waste is releasing the same amount of dioxins as an energy-from-waste facility treating the same waste from everyone in an area the size of Torbay. Another way of putting it is that waste burned in the open for one day releases as many dioxins as burning the same amount of waste every day in an energy-from-waste plant for more than 325 years.

3. controls on incinerators have had a major effect on reducing emissions. For example, emissions of dioxins have reduced by 99% between 1993 and 2004, and now account for less than 0.5% of total UK emissions. The emissions are insignificant in comparison with other combustion sources. In particular there are significant releases of dioxins from bonfires, barbeques, and accidental fires.

More than 90% of exposure to dioxins is through food, and FSA has shown that between 1982 and 2001, average UK adult intake of dioxins has decreased by a factor of 10. The Health Protection Agency has concluded that incinerators which comply with modern regulatory requirements under the Waste Incineration Directive have little effect on human health.

1. Jonathon Porritt – Sust. Dev. Commission report – "Is Nuclear the Answer?" 2006

2. Caroline Jackson *Britain's Waste: the lessons we can learn from Europe* 2007

3. Tamsin Dunwoody, Welsh Deputy Minister presentation to CIWEM-ICE Wales Waste Conference, Feb.2007

HCWH/Gaia Policy Briefing
Lay the foundations of a healthy and sustainable Europe February 2007
Incinerators are dangerous for human health.
Incinerators, *regardless* of how modern and efficient they are, emit toxic chemicals into the atmosphere and produce ashes and other residues.
emit nanoparticles which cannot efficiently be captured by air pollution control devices.
Nanoparticles can travel long distances and penetrate deep into the respiratory system causing cardiovascular diseases, pulmonary diseases, and cancer. (4)
…… PM_{10} / $PM_{2.5}$ / PM_{1} / $PM_{0.1}$ / Ultrafine particles
Diagram Penetration of lung lining; capture by macrophage

Of the *thousands* of chemicals which incinerators emit into the environment, only a few are controlled. Of the rest neither the quantity in which they are emitted from incinerators, nor their effects on health, have been investigated.
Incinerators cannot solve the problem of toxic materials present in waste. Incinerators *just* convert toxic residues from one form to another (ashes, and stack gases).
Many of these toxic chemicals, such as dioxins and heavy metals, are persistent and bioaccumulative (build up in the tissues of living organisms). (5)
POPs List 1 List 2 metals

Pollution of the environment with dioxins, heavy metals, and other persistent, bioaccumulative and toxic chemicals, and *endocrine disruptors* is of particular concern because there is no exposure level to these chemicals which can be considered safe.
A number of studies have shown that communities living close to incinerators suffer higher rates of *cancer and respiratory problems*.(6)
The recent and well-publicised Paris Appeal Memorandum, supported by the European Standing Committee of Doctors (which represents 2 million doctors), urged a moratorium on building any new incinerators .(7)

Compare doctors/trusted with 'experts' and 'scientists'

Dioxins still an Issue
POPs directive says avoid production not just meet emission limits: Production ~600g/yr; emission ~0.5g/yr ignores emission at start-up (100s times up – dominate if daily start-up
Flyash blow; flyash in landfill emits to air; leach to water even if stabilised with cement (Taiwan)
Ash used in building projects – spread around like Gerrards Cross Tesco.
Drax test burn with Petcoke in 2005; 1000x increase over coal, ~100g in year; yet not stopped
Official fuss over Bonfire night – claim of 6.8 g is small (and uncertain)

BSEM: *The Health Effects of Waste Incinerators*
4th Report British Soc. Ecological Medicine, 2006 (Dr Jeremy Thompson & Dr Honor Anthony)

Many of the compounds are known to be not only toxic but bio-accumulative and persistent. … may affect the immune system, attach to chromosomes, disrupt hormone regulation, trigger cancer, alter behaviour, and lower intelligence. The very limited toxicity data on many of these substances is a matter of concern. The changing nature of waste means new substances are likely to be emitted and created. For example *polybrominated* diphenyl ethers (PBDEs) are found in many electrical goods and are increasingly finding their way into incinerator waste. They have been found to affect brain development and affect the thyroid gland and cause behavioural and learning defects in animals.

Neurotoxins

(4) S. A. Cormier; S. Lomincki; W. Backes and B. Dellinger. "Origin and Health Impacts of Emissions of Toxic By-Products and Fine particles from Combustion and Thermal Treatment of Hazardous Wastes and Materials. " Environmental Health Perspectives Volume 114. www.ehponline.org/members/2006/8629/8629.html
(5) Michelle Allsopp, Pat Costner and Paul Johnston "Incineration and human health: Greenpeace, State of knowledge and state of knowledge of the impacts of waste incinerators on human health." Greenpeace http://archive.greenpeace.org/toxics/reports/euincin.pdf

---------- Anti Incineration Network 24 March 2007

(6) Étude d'imprégnation par les dioxines des populations vivant à proximité d'usines d'incinération d'ordures ménagères : French epidemiological study: http://tinyurl.com/y7dteo
(7) Paris Appeal Memorandum http://www.artac.info/static.php?op=MemorandumParisAppeal.txt&npds=1
(8) A changing climate for Energy from Waste?. Eunomia reseach and consulting. Dr Dominic Hogg. http://www.foe.co.uk/resource/reports/changing_climate.pdf

this is a very recent (good) expert review
Origin and Health Impacts of Emissions of Toxic By-Products and Fine particles from Combustion… Cornier et al. 2006 (4)

toxic combustion or reaction by-products.
Emissions of polycyclic aromatic hydrocarbons (PAHs); chlorinated hydrocarbons (CHCs), including polychlorinated dibenzo-*p*-dioxins and dibenzofurans; and toxic metals (e.g., chromium VI) have historically been the focus of combustion and health effects research.
However, fine particulate matter (PM) and ultrafine PM, which have been documented to be related to cardiovascular disease, pulmonary disease, and cancer, have more recently become the focus of research.

Fine PM and ultrafine PM are effective delivery agents for PAHs, CHCs, and toxic metals.
recently realized that brominated hydrocarbons (including brominated/chlorinated dioxins), redox-active metals, and redox-active persistent free radicals are also associated with PM emissions from combustion and thermal processes.

In this article - the origin of each of these classes of pollutants, the nature of their association with combustion-generated PM, and the mechanisms of their known and potential health impacts.

Ongoing Research Programme – still a lot is uncertain

Inhalation of airborne fine and ultrafine PM has been identified as a major route of exposure to toxic combustion by-products; research should address this poorly understood area.
From a combustion and environmental chemistry perspective, key research issues include:

- How are combustion-generated fine PM and ultrafine PM formed?
- How do their chemical properties differ from larger PM?
- What is the nature of association of chemicals with these particles?
- How is the chemical and biological reactivity of these chemicals changed by association with the particles?
- What is the role of PM-associated persistent free radicals in the environmental impacts of fine and ultrafine PM?

From a health effects perspective, key research issues associated with combustion-generated fine and ultrafine PM include:

- the role of PM on cell/organ functioning at initial sites of exposure?
- the bioavailability of these particles to other tissues?
- How are these particles translocated to these secondary sites, and do their chemical properties change en route?
- How does acute/chronic exposure lead to adverse organ pathophysiology? Is developmental timing of exposure important?
- What effect does exposure have on predisposing to disease states or on disease progression?
- Most important, what are the specific cellular and molecular mechanisms associated with airborne exposures?

Royal Society on Nanoparticles *http://www.nanotec.org.uk/report/summary.pdf*

"The evidence suggests that at least some manufactured nanoparticles will be more toxic per unit of mass than larger particles of the same chemical. This toxicity is related to the surface area of nanoparticles (which is greater for a given mass than that of larger particles) and the chemical reactivity of the surface (which could be increased or decreased by the use of surface coatings). It also seems likely that nanoparticles will penetrate cells more readily than larger particles."

Recommendation 8

"We recommend that all relevant regulatory bodies consider whether existing regulations are appropriate to protect humans and the environment from the hazards outlined in this report and publish their review and details of how they will address any regulatory gaps."

press the Environment Agency etc. what they have done to follow this

Children are highly vulnerable

WHO for Europe (2005) *Monograph: the Effects of Air Pollution on Children's health and development: a review of the evidence*

reviewed air pollutant effects on pregnancy outcomes, infant and childhood mortality, lung function development, asthma and allergies, neurobehavioural development and childhood cancer.

due to the widespread nature of the exposure and relatively high incidence of many of the relevant health outcomes, the amount of ill-health attributable to air pollution among European children is high.

. the same for environmental chemicals PINCHE project

European policy – new priority for Children

the EU's Sixth Environmental Action Plan has four priorities:

childhood respiratory disease *neurodevelopment disorders*
child cancers *endocrine disrupting chemicals*

WHO - CEHAPE – *Children's Environment and Health Action Plan for Europe (2004)*

- interests of children firmly on the policy-making agenda
- air pollution included in increasing concern about environmental effects on children's health
- developing organisms, especially during embryonic and foetal periods and early years of life, are often particularly susceptible.

Economic Valuation

Customs & Excise 2004 *Combining the Government's two health and environment studies to calculate estimates for the external costs of landfill and incineration.*

Health costs , under 1p per tonne. Eunomia says £3.19

FoE's *Eunomia report* declares *no support* for the view that the impacts of dioxins can be completely overlooked. "One Norwegian study suggested that pollutants such as chromium, manganese and dioxins account for up to 85-95% of the total socioeconomic costs of waste incineration. NERI also modelled the impact of dioxin emissions from incinerators (modern ones) for the Nordic Ministry. The range of damages referred to equates to a range from £0.93 to £11.85 per tonne of waste incinerated."

Health 'costs' calculated for the EU-CAFÉ assessment (Eunomia Table 8) give "in excess of £15.00 per tonne for incineration" at the high end. $PM_{2.5}$ is the major part of this. CAFÉ costs are based on the WHO recommended ill-health coefficient, 6% per 10µg/m^3 of $PM_{2.5}$.

Table 8: Unit Damage Costs Used / Derived in Different Studies (£ = 1.5 Euros)

Pollutant	**Enviros and EFTEC (2004)**		**EU-CAFÉ (2005)**	
	Low	*High*	*Low*	*High*
PM (landfill)	161	1,025	-	-
PM (incineration)	6,119	39,425	24,667	73,333
SOx	643	2,941	4,400	12,667
NOx	154	977	2,600	6,667
VOCs	263	665	759	2207

Sources: Enviros and EFTEC (2004*) Valuation of the External Costs and Benefits to Health and Environment of Waste Management Options* Final Report for Defra, December 2004*:* AEAT Environment (2005) *Damages per tonne Emission of PM2.5, NH3, SO2, NOx and VOCs from Each EU25 Member State (excluding Cyprus) and Surrounding Seas,* Report to DG Environment / European Commission, March'05.

The "6%" sensitivity. The UK was using 1%. WHO's review of 2005 gave the range 2% - 11%. The major US review in June 2006 found the 6% to be a lower bound: the real range – measuring longer term effects over years or a decade – is from 6% to 17% (*Harvard Six Cities, extended analysis + Prospective cohort studies*) C A Pope & D W Dockery *Journal of the Air & Waste Management Association* Volume **56**, 709–742, June 2006.

Conclude: health 'costs' could total £30-40 per tonne waste incinerated

- far in excess of the 'costs' of the ~0.25t CO2 saved from coal-fuelled generation.

Max Wallis 24 March 07 (amended 28 Mar)