

Money to Burn

Pollution and health impacts of incinerating resources.

Misleading Terms

The UK Government, some local authorities and incinerator operators have recently embarked on a campaign to persuade the public into believing that waste incineration is somehow a green option for waste management.

The authorities and the industry are using words such as "renewable", "recycling", and "sustainable" to describe the burning of mixed streams of municipal waste. Incinerators are now called "Energy from Waste" plants, the toxic ash they produce is "recycled" into road aggregate and burning discarded products and packaging is no longer a method of waste disposal but, according to the Government, a renewable energy source.

This attempt to shift attention away from the fundamental problems of incineration itself threatens human health and the environment, by ignoring the serious pollution generated by incinerators. It also undermines targets for reducing waste and increasing re-use and recycling of resources. The UK Government's waste strategy could allow local authorities to meet recycling targets by increasing incineration and disposing of contaminated ash far and wide over the country - using it to build roads and cycle tracks, for example.

New incinerators - old technology.

No matter what the Government calls them, incinerators are nothing more than huge, fires in which mixed rubbish is burnt. Filters are added to capture some of the pollutants in the smoke and transform them into filter ash. Sometimes the heat is used to make steam and generate electricity, but essentially the process is no different from burning rubbish in a bonfire.

Whether this process is called incineration or "energy recovery", it releases hazardous substances to the air, water and soil.

Incineration – what goes in must come out.

Things do not disappear when they are burned. Matter cannot be destroyed; it can only be transformed into new forms.

Roughly two and a half million tons of waste are incinerated in the UK every year.¹

¹ ENDS report 293 June 1999 p 24

Where does waste go when it is incinerated?

A third of the waste burnt ends up as ashes and slag. The rest goes up into the air. The ashes are sooner or later dispersed into water, air and soil from the landfills where they are deposited. Whatever goes up into the air, in the form of flue gases remains in the air until sooner or later it is deposited in water and soil.

What is the incinerated waste transformed into?

The full extent of the transformation of products burnt in an incinerator is not yet known. However, we do know that during incineration of household waste the intense heat causes chemical reactions in which new, and often extremely toxic, compounds are formed. For example chlorine found in products made from PVC combines with organic molecules to form dioxins and other highly toxic and carcinogenic compounds. The number of organic substances in the releases from waste incinerators can be counted in thousands: these include some of the most toxic substances in the environment today, many of which have been listed for priority action by governments and international bodies. These include

- dioxins
- furans
- lead
- cadmium and other metals
- particulate matter including PM10s, benzene, phenols and polyaromatic hydrocarbons.²

Some of the harmful gases generated by incinerators are removed via filter systems and the addition of ammonia and lime. Controlled temperatures of the burn, and in the flue gas scrubbers, help to control the formation of hazardous substances. But significant amounts of toxic substances remain in the gases that come out of the incinerators' chimneys. These gases are emitted at a rate of around 80 cubic metres every second: this is the "flow rate", and is equivalent to about 80 wheelie bins full of contaminated gases, flowing from the incinerator's chimney every second.³

Emissions from incinerators

Each tonne of waste burnt releases around 5000 cubic meters of contaminated exhaust gasses into the air.⁴

² European Environment Agency Technical report no 38, Feb. 2000. Dangerous Substances in Waste. p18

³ Figures based on the SELCHP incinerator in SE London. See Environment Agency report "Measurements of gaseous and particulate releases to atmosphere from Onyx SELCHP Ltd". Report No, 8467/990804, 7 March 2000 (average flow rate 40m³/s for each of 2 burners)

⁴ Calculated from Environment Agency report "Measurements of gaseous and particulate releases to atmosphere from Onyx SELCHP Ltd". Report No, 8467/990804, 7 March 2000 (average flow rate 40m³/s for each of 2 burners operating 6 days a week, burning 420 000 tonnes of rubbish per year).

Even though the gases coming out may appear clean, and it may often look as though there is nothing coming out at all, they contain very fine particles of dust.⁵ The heat in an incinerator turns metals into gases, which condense and attach themselves to these dust particles. Some are caught in filters and become fly ash. The rest are emitted into air through the chimneys.

The European Environment Agency note that "because of the high vapour pressure of elemental mercury, there is almost no binding of mercury in slags or filter dust. Almost 100% of elemental mercury present in the waste is therefore emitted (to air)"⁶

Incineration regulations.

SELCHP, a "waste to energy" incinerator in South East London is a flagship among the dozen municipal waste incinerators currently operating in the UK. Environment Agency figures (from measurements of the gases it emitted in November 1999) show that by and large it operates within limits set by the European Union.

But these limits are more concerned with what incinerators can practically achieve than what is good for human health and the environment.

Air

Every day SELCHP releases 100 kg of dust particles into the air. 7 grams of this daily amount is made up of lead (banned in petrol due to its poisonous nature), and there are also significant amounts of cadmium and mercury present.

As well as heavy metals, dioxins and particulate matter, incinerators also emit acid gases. These cause environmental damage via "acid rain" and can cause respiratory problems like asthma. SELCHP also releases

- more than 24 tonnes of hydrogen chloride (aka. hydrochloric acid), into the air each year
- 800 tonnes of nitrous oxides
- significant amounts of other acid gases including sulphur dioxide and hydrogen fluoride⁷.

Land

Incinerating municipal waste produces ash that has about one-third the mass of the rubbish entering the incinerator. This ash is also contaminated with heavy metals (lead, cadmium, mercury, chromium and others⁸), dioxins and other toxic compounds. Most of it is landfilled in ordinary waste dumps where the ashes' leachable pollutants pose a long-term threat to groundwater. According to the European Commission

⁵ including PM10s and PM2.5s

⁶ European Environment Agency, Feb 2000 *op cit* p19

⁷ Environment Agency Pollution Inventory, Details for Authorisation AE7236, May 2000

⁸ European Environment Agency, Feb 2000. Technical report No 28, Dangerous Substances in Waste p19

incineration is a major contributor to overall emissions of mercury and cadmium.⁹ Ash is increasingly being mixed with concrete blocks and asphalt for use in the construction of roads and cycle paths. This practice spreads hazardous chemicals across the country, posing a threat to the workers who dig up roads, and leaving a heritage of contamination for future generations. The UK Government has not ruled out including this dangerous practice in its official *recycling* figures.

Municipal waste incinerators in the UK currently create about a million tonnes of contaminated ash every year. The need to dispose of this has led not only to bogus "recycling", but to reckless schemes, such as one in Newcastle, in which ash from the Byker incinerator has for 5 years been spread over 27 allotment sites and numerous public footpaths throughout the city. Tests in May 2000 not surprisingly revealed high levels of dioxins and heavy metals in the soil of affected allotments. Residents have now been told not to eat food produced on the allotments and children are barred from them.

So incinerators leave a legacy of contaminated ground across the whole country and threaten water, food and the health of current and future generations.

Residues from the gas cleaning filters are even more hazardous than the bottom ash (from the grates at the bottom of the fire itself). Filter ashes are classified as hazardous waste and have to be transported across the country and disposed of in special landfills.¹⁰ According to the European Environment Agency (EEA) "the disposal of filter dust/fly ash from waste incineration plants is a serious problem".¹¹ It contains very high concentrations of heavy metals and chlorinated organic compounds, which pose serious carcinogenic and other health-related risks.

Health effects of incinerators

The European Commission and the European Environment Agency have listed some of the better studied pollutants emitted to air land and water from incinerators, and their health effects:

1. *Dioxin* - A Class 1 Human Carcinogen (known to cause cancer in humans) and a reproductive toxicant¹². A recent study of dioxin exposure in Seveso, Italy associates it with an imbalance in the sex ratio of babies born, (50 males to 81 females for fathers who were exposed to dioxin when they were under 19).¹³ The European

⁹ European Commission proposal for a Council Directive on the incineration of waste 07/10/98 p. 7

¹⁰ Air Pollution Control (APC) residues are classified as hazardous waste... APC residue has therefore to be managed in accordance with the hazardous waste regulation and placed in appropriate storage (landfill or mines). European Commission report - "The influence of PVC on the quantity and hazardousness of flue gas residues from incineration", April 2000.

¹¹ European Environment Agency, Feb 2000. Technical report No 28, Dangerous Substances in Waste p.20

¹² The Lancet. Vol 355 May 27 2000 p1839

¹³ Paolo Mocarelli et al. "Paternal concentrations of dioxin and sex ratio of offspring". In *The Lancet*. Vol 355 May 27 2000

Commission states dioxins and furans "are known to produce chloracne at high exposures and a wide-range of non-cancer effects are thought to occur at extremely low levels of chronic exposure, including adverse effects on reproduction, impacts on development of the unborn foetus and associations with impaired mental ability".¹⁴ The World Health Organisation says that general pollution from dioxin is already at a level at which it can have adverse effects on human health.¹⁵ The US Environmental Protection Agency has recently stated that the risk of contracting cancer from dioxin pollution may be as high as one in a hundred.¹⁶ Their 8-year study also states that dioxins produce a variety of non-cancerous effects in animals and humans including developmental toxicity, immunotoxicity, endocrine effects and chloracne.

2. *Acid Gases* (hydrogen chloride, sulphur dioxide, Nitrogen oxides (NOx), hydrogen fluoride - exposure to acid gases can cause respiratory problems.

3. *Heavy Metals* Lead is associated with learning impairment¹⁷ and behavioural problems in children¹⁸. High levels of cadmium are associated with lung cancer and a range of other effects and mercury exposure has been found to affect behaviour and lead to renal damage even at low levels.¹⁹

4. *Particulate matter (dust)*.

A typical modern incinerator releases around 5kg of contaminated particulate matter into the air every hour it operates.²⁰ According to the European Commission "particulate matter in the atmosphere has been associated with large-scale chronic adverse effects on human health". Operators of the South East London incinerator themselves estimated it released 8.6 tonnes very fine dust particles (PM10s) into the surrounding area in 1998.²¹ The European Commission believes that this type of emission may be having health impacts on local populations.²²

Incineration also leads to the generation and release of a number of other highly toxic and carcinogenic organic compounds such as:

- benzene
- phenols
- polyaromatic hydrocarbons
- benzo(a)pyrene
- chlorinated organic compounds
- soot.²³

¹⁴ European Commission proposal for a Council Directive on the incineration of waste 07/10/98 p6

¹⁵ WHO paper submitted to the Dioxin 98 conference, reported in ENDS 281 June 1998 p5

¹⁶ Dioxin Briefing for the EPA Senior Management May 10 2000, leaked to the *Washington Post*.

¹⁷ European Commission proposal for a Council Directive on the incineration of waste 07/10/98 p7

¹⁸ see eg. *The Independent* 16 May 2000 p11

¹⁹ European Commission proposal for a Council Directive on the incineration of waste 07/10/98 p7

²⁰ Figure based on EA report 8467/990804 OF sampling done at the SELCHP incinerator in SE London 9 -11 Nov. 1999

²¹ UK Environment Agency Pollution Inventory Details for Authorisation AE7236 Feb 2000

²² European Commission proposal for a Council Directive on the incineration of waste 07/10/98 p7

²³ European Environment Agency, Feb 2000 *op cit* p18

Energy "recycling" and recovery.

Incinerators are now often called "waste to energy" facilities or sometimes "combined heat and power" stations. "Waste to energy" facilities use some of their heat to produce electricity: an inefficient way to generate electricity. To replace (re-manufacture) the materials that are burnt in an incinerator uses much more electricity than can be produced by burning it.

"Renewable energy" and "sustainability".

The Government's and operators' classification of "waste to energy" incinerators as "renewable energy" or "sustainable waste management" cause harm to *genuinely* renewable energy sources and sustainability programs. Waste incinerator operators have for years received Non Fossil Fuel Obligation Subsidies intended to aid the development of genuine renewable energies.²⁴ Between the 1997 and 2000, over **25%** of the total payments *intended* for electricity generated from **renewable** sources, went to incinerators.

The Solution

Incineration is a logically flawed and technologically backward approach to waste. Recovering some energy from heat generated during burning does nothing to bring it into the 21st century. Neither do increasingly complex and expensive filter systems, which merely transfer some of the pollutants from exhaust gases to fly ash. Throwing municipal waste into huge holes in the ground is no less primitive and has a whole set of problems of its own. So what is the modern, forward thinking solution to the waste problem?

The UK is currently bottom of the table of recyclers in Europe, recycling 8% of municipal waste (the Netherlands recycles 46% of municipal waste). If the UK is to meet European Landfill Directive targets, source separation of waste (at household and commercial level) must be implemented across the country. Separate waste streams (of organic waste, paper, metals, etc) are immediately easier to deal with. It is the mixed nature of the waste stream we have got used to that creates many of the waste disposal headaches.

This drive to re-use and recycle must include:

- Financial and legal mechanisms to increase re-use of packaging (e.g. bottles, containers) and products (e.g. computer housings, electronic components).
- Financial mechanisms (such as the landfill tax) used directly to set up the necessary infrastructure for effective recycling.

²⁴ The raw materials, resources and energy that go into making the disposable products and packaging that create our waste mountains are often not renewable. Nor is it in any way "sustainable" to squander resources by burning them, while producing many millions of tonnes of hazardous ash dust and gases in the process.

- Stimulating markets for recycled materials (legal requirements for packaging and products to contain minimum amounts of recycled materials, where appropriate).
- Materials that cannot be safely recycled or composted at the end of their useful life (for example PVC plastic) must be phased out and replaced with more sustainable materials.

In addition, materials and products that add to the generation of hazardous substances in incinerators must be removed from the waste stream and reused, recycled or dealt with in an environmentally sound manner at the cost of the producer. Such products would include electronic equipment, metals and products containing metals such as batteries and florescent lighting and PVC plastics (vinyl flooring, PVC electrical cabling, PVC packaging, PVC-u window frames etc).

These are short-term measures that can eliminate the need for any more incinerators while enabling the UK to meet targets set by the European Landfill Directive.

The ultimate target must be to eliminate the production of waste and products that cannot be re-used or efficiently and safely recycled. This means rethinking and redesigning products, packaging and production processes. Consumers, manufacturers and retailers all need to play their part in this. The Government must set the process in motion by bringing in tangible incentives for clean production including producer responsibility for end of life products and packaging.

This challenge offers tremendous opportunities to British industry, including

- huge savings through minimisation of waste
- value recaptured through re-use of materials and jobs created through booming re-use and recycling industries.
- UK firms at the leading edge of innovative product design that eliminates hazardous materials and waste from product life cycles.
- decreased pollution
- better public health

In order to grasp these opportunities, we must ditch an old-fashioned "burn or bury" attitude to waste, and work towards making resources available to truly modern, innovative solutions.