This field is mandatory!

The problem

Background - November 30, 2004

Burning was once considered the most effective method for disposing waste materials. However, since industrialisation the nature of waste has changed dramatically. Mass production of chemicals and plastics means that burning or incinerating today's waste is a complex, costly and highly polluting method of disposal.

Local protest on the site of a proposed waste disposal plant and incinerator

Incineration impact | Toxic metals | Unburned toxic chemicals | New pollutants | Dioxins | Fugitive emissions | Ash | Asia | Health & environment | Failings | Theory vs practice | Medical waste | Cement kilns | Pollution control devices | Incentive to recycle

The myth that burning makes waste disappear has lead to incineration emerging as a widely used method for disposing many kinds of waste, including hazardous wastes.

Rather than making waste disappear, incinerators create more toxic waste that pose a significant threat to public health and the environment.

Incineration is often touted as an alternative to land filling. However, what many people do not realise is that incinerator ashes are contaminated with heavy metals, unburned chemicals and new chemicals formed during the burning process. These ashes are then buried in landfill or dumped in the environment.

Incineration is a method where industry can break down its bulk waste and disperse it into the environment through air, water and ash emissions. It is a convenient way for industry to mask today's waste problems and pass them onto future generations.

Incineration impacts - emissions

Existing data shows that burning hazardous waste, even in "state-of-the-art" incinerators, will lead to the release of three types of dangerous

pollutants into the environment:

1 - Heavy metals;

2 - Unburned toxic chemicals; and

3 - New pollutants - entirely new chemicals formed during the incineration process.

Toxic Metals

Metals are not destroyed during incineration and are often released into the environment in more concentrated and dangerous forms.

High temperature combustion releases toxic metals such as lead, cadmium, arsenic, mercury and chromium from waste products containing these substances, including batteries, paints and certain plastics.

These metals are released as tiny gas particles, which increase the risk of inhalation. An average-sized commercial incinerator (32,000 tonnes per year) burning hazardous waste with average metals content, emits these metals into the air at the rate of 92 tonnes a year. This is the total amount permitted annually for metals (including lead, cadmium, arsenic, mercury and chromium), and yet a further 304 tonnes a year will be found in residual ashes and liquids.

Pollution control equipment can remove some but not all heavy metals from stack gases. However, the metals do not disappear; they are merely transferred from the air into the ash, which is then land filled.

Subsequently, metals in the ash may leach into and contaminate soils and potentially groundwater. Presently, ash from incinerators is sometimes used in construction material such as asphalt and cement.

This practice can also have implications for the environment and for human health, as metals can leach out of these construction materials. Ash from a municipal waste incinerator in Newcastle, UK, was used on local allotments and paths between 1994 and 1999. Recently, it was removed, as was found to contain unacceptably high levels of heavy metals and dioxins.

Unburned toxic chemicals

No incineration process operates at 100 percent efficiency. Unburned chemicals are emitted in the stack gases of all hazardous waste incinerators. They also escape into the air as fugitive emissions during storage, handling and transport.

While incinerators are designed to burn wastes, they also produce more waste in the form of ash and effluent from wet scrubbers and/or cooling processes.

Incinerator ash carries many of the pollutants that are emitted as stack gases. Studies have identified up to 43 different semi-volatile, organic chemicals in incinerator ash, and at least 16 organic chemicals in scrubber water from hazardous waste incinerators.

Ash is commonly buried in landfill, while effluent is often treated before being discharged into rivers or lakes.

New pollutants - dioxins and furans

One of the most insidious aspects of incineration is the new and highly toxic chemicals formed during combustion.

Fragments of partially burned waste chemicals recombine within incinerator furnaces, smokestacks, and/or pollution control devices. Hundreds, possibly thousands, of new substances are created, and many of these substances are more toxic than the original waste.

Very little research exists on the multitude of pollutants emitted from incinerators. One study identified 250 volatile organic compounds, many of which are known to be highly toxic or carcinogenic. It is likely that many other compounds are emitted during incineration that are yet to be identified.

Among the possible compounds are dioxins and furans, often referred to as just dioxins.

Dioxins are created when materials containing chlorine are burned. They have no useful purpose and are associated with a wide range of health impacts including, cancer, altered sexual development, male and female reproductive problems, suppression of the immune system, diabetes, organ toxicity and a wide range of effects on hormones.

Dioxins - global killers

Once emitted into the environment, dioxins can travel vast distances via air and ocean currents, which makes them a global contaminant.

Dioxins are distributed into the environment as part of incinerator stack gases, bottom ash, fly ash and in the effluent of pollution control devices.

The main route of exposure to dioxins in humans is through food intake. Once in the body they are only excreted very slowly and build up in fatty tissues. Studies suggest that people in the US and some European countries now carry dioxins and furans at or near those levels suspected of causing health effects in humans.

Dioxins released from an incinerator can be readily consumed by grazing animals and fish. In 1989, 16 dairy farmers downwind of a Rotterdam incinerator in the Netherlands were banned from selling their milk because it contained dioxin levels three times higher than anywhere else in the country.

Residents of a property downwind of a chemical waste incinerator in Pontypool, South Wales, UK, were advised not to consume duck or bantam eggs from their property.

Fugitive emissions

Some waste is accidentally released when:

· Chemicals are removed from storage containers at the incinerator site;

· It is moved to transportation vehicles; and

· It is shipped to and moved about within the incineration facility.

An average incinerator burning 32,000 tonnes of waste per year will receive over 1500 trucks of waste. This amounts to over 28 trucks per week.

According to the US Environmental Protection Authority: "Fugitive emissions and accidental spills may release as much or even more toxic material into the environment than direct emissions from incomplete waste incineration." There is also the risk of catastrophic waste releases in fires and explosions.

Incinerator ash is hazardous waste

Leftover incinerator ash is extremely toxic, containing concentrated amounts of lead, cadmium and other heavy metals. It can also contain dioxins and other toxic chemicals.

Toxic ash disposal in an environmentally sound manner is problematic and expensive. If handled properly, ash makes incineration prohibitively expensive for all but the wealthiest communities.

If handled improperly it poses short and long-term health and environmental dangers. The better the pollution-trapping device in an incinerator smokestack, the greater the quantity and toxicity content of the residues.

A hundred times more dioxin may leave an incineration facility via ash, than in air emissions.

The average cost in the Midwest US for disposing a tonne of hazardous waste, is US$210. This compares to US$23 for ordinary waste. Some experts recommend burying this ash in a landfill equipped with a plastic liner to prevent leaching into groundwater. However, all landfill liners will eventually leak.

Incineration in Asia

Developing countries in Asia are being swamped with proposals for waste incinerator plants. Faced with shrinking markets in pollution-conscious northern countries, incinerator companies are turning to Asia where they see a lucrative market for their out-dated and poisonous technology.

Today, incinerators are sold under a variety of guises. Some of these include fluidised bed incinerators, thermal treatment plants or waste-to-energy systems.

Yet in countries, such as the Netherlands and Germany, where pollution regulations are stringent, incinerators continue to incur monumental costs to clean up the pollution they cause.

Many industrialised countries cited by incinerator salespersons as proponents of incineration technology, are rapidly shutting down their incinerators. By the end of 1998, over 2000 industrial waste incinerators were closed in Japan, either permanently or temporarily.

This was a direct result of tougher limits on the emission of cancer causing dioxins introduced by the Japanese Government.

However, following developments in technology for controlling emissions to air, new incinerators are again being proposed in some European countries. Governments charged with managing industrial waste stand at a critical juncture.

They can continue to approve and promote incineration, or they can encourage the development and use of clean production methods that eliminate toxic processes, products and waste.

Impacts of incineration - health and environment

Increased cancer rates, respiratory ailments, reproductive abnormalities and other health effects are noted among people living near some waste-burning facilities, according to scientific studies, surveys by community groups and local physicians.

Cancer, birth defects, reproductive dysfunction, neurological damage and other health effects are also known to occur at very low exposures to many of the metals, organochlorines and other pollutants released by waste-burning facilities.

Many pollutants released in incinerator air emissions have been shown to accumulate in and on food crops. This is most notable on crops where the edible portion is exposed such as leafy vegetables. While thorough washing of produce may remove a portion of pollutants on crop surfaces, a significant amount (typically from 15 to 50 percent) will remain.

Incineration failings

Incineration relies upon the continued generation of waste to support the high operating costs. Pressure to pay back the high cost of building incinerators has had the effect of encouraging and perpetuating waste generation.

Continued investment in incineration inhibits the development of more sustainable waste minimisation practices, as well as the exploration and development of products and processes that do not use toxic chemicals in the first place.

Dispersing persistent, bioaccumulative pollutants into the air from incinerator emissions creates more pollution problems.

Incineration - theory versus practice

In theory, a properly designed incinerator should convert simple hydrocarbons into nothing other than carbon dioxide and water.

Practical experience, however, has shown that even the best combustion systems usually produces Products of Incomplete Combustion (PICs), some of which highly toxic.

Even under the most stringent standards, incinerators emit chemicals that have escaped combustion as well as newly-formed PICS. Newly formed products refer to the thousands of different chemicals, which only a small fraction has been identified.

Different countries monitor and measure incinerator performance in various ways and to different degrees. Actual incinerator performance can deviate radically due to combustion upsets such as:

· Equipment failure;

· Human error; and

· Rapid changes in the type of waste fed to an incinerator.

Only a small fraction of the waste needs to experience a combustion upsets for there to be significant deviations from the targeted destruction efficiencies.

Medical waste - useful waste into hazardous waste

Only 10 percent or less of a typical hospital's waste stream is potentially infectious. It is possible to sterilise this waste with heat, microwaves and other non-burn disinfection technologies.

The remaining waste is not infectious and is similar to the same waste generated by hotels, offices or restaurants because hospitals serve all of these functions.

By burning medical waste in an incinerator, the basic biological problem of disinfecting infectious material, which can be dealt with by various other technologies, becomes a formidable chemical pollution problem that is costly to manage and difficult to contain.

Cement kilns

Throughout the world about 60 cement kilns have been modified so that various wastes can be burned along with conventional fuels. But cement kilns are designed to make cement and not to dispose of waste.

According to a study by the US Centre for the Biology of Natural Systems, emissions of dioxins are eight times higher from cement kilns burning hazardous waste, compared with those that do not.

Pollution control devices

Pollution control technologies for different pollutants are often incompatible. Scrubbers designed to filter out particulate and heavy metals will cool the exhaust gas to the ideal range for dioxin formation.

This means that decreasing the emission of one pollutant often increases the emissions of others and no pollution control device can eliminate dioxin or heavy metal emissions completely.

Incineration removes the incentive to recycle and reuse

Incinerators with pollution control equipment are prohibitively expensive, and once authorities have invested in incineration they often do not have the money to invest in waste reduction. In this way, incineration directly competes with efforts to reduce and recycle waste.

Incineration actually perpetuates the use of landfills because of the large quantities of leftover ash produced by incinerators.

It is estimated that for every three tonnes of waste that is incinerated, one tonne of ash is generated. This ash is very toxic, containing concentrated amounts of heavy metals and dioxins which, when buried, will eventually leach into the soil, potentially polluting groundwater.

Very few jobs are created in return for the huge economic investment in incineration. Most of the jobs are temporary, created during the building of the plant.

A large incinerator may employ about 100 workers. Whereas, community efforts into waste separation, reuse and repair as well as recycling and composting, can create more jobs, both in the handling of the waste and in secondary industries using recovered material.

Also, most of the money invested in the incinerator leaves the community. The huge engineering firms that build incinerators are seldom located within a community and so most of the money invested does not benefit the local community.

In comparison, money invested in the low-tech alternatives stays in the community, thereby creating local jobs and stimulating other forms of community development.

Recycling saves more energy than incineration yields. For instance, if the US burned all its municipal waste in incinerators, it would contribute less than one per cent of the country's energy needs.

Two studies performed in the US in 1993 and 1994 show that if the current recyclable material were recycled instead of burned in an incinerator, some three to five times as much energy would be saved.

The reason for this is that incineration can only recover some of the calorific value contained in the waste.

It cannot recover any of the energy invested in the extraction, processing, fabrication and chemical synthesis involved in the manufacture materials present in the waste stream.

However, re-use and recycling can do this. In fact, a cost-benefit study conducted for the European Commission in 1997 concluded that even land filling was better and more energy efficient than incineration, for managing household waste.