Incineration of Municipal Solid Waste
An Update on Pollution
Fact Sheet 2

Lately, the news media has been inundated with claims that incineration and other combustion-based waste treatment technologies are cleaner now than in the past and that they should be considered for both waste disposal and the generation of electricity.

The objective of this fact sheet is to provide decision makers and the public with information about direct and indirect pollution releases from waste combustion technologies, including modern mass-burn incinerators as well as gasification and pyrolysis systems.

Aren't new technologies like "gasification", "pyrolysis" and "plasma arc" much cleaner than traditional mass burn incineration technologies?

Many who promote these technologies claim that they are less polluting than traditional mass burn technologies, but have not provided verifiable evidence to support these claims. As a consequence, proposals are often withdrawn[1].

Only a very few full-scale gasification, pyrolysis or plasma arc plants currently operating. Most proponent companies are promoting the concept or extrapolating from very small facilities to the large-scale plants that they are proposing to build. In this regard, the promise of gasification has not been matched by the reality of the operations of the technology. For example, Thermoselect's MSW gasification plant in Karlsruhe, Germany, began trials in 1999 and full-scale operation in 2002. This plant was permanently closed at the end of 2004 due to technical and financial difficulties. By the time it closed in 2004 it had lost over US$500 million..[2]

What kind of pollution profile for these technologies?

The US Environmental Protection Agency (USEPA) has collected data describing the concentrations of selected pollutants in the stack gas of gasification plants and traditional mass-burn facilities. These data indicate that gasification units emit more nitrogen oxides and dioxins than traditional incineration facilities, and equal amounts of mercury.[3]

Aren't mass burn incineration technologies much cleaner than in the past?

No doubt, municipal waste incineration has improved in facility design, construction and operation over the years. Nonetheless, even the most modern, state-of-the-art MSW incinerator releases toxic pollutants in its stack gases and residues. Some of the pollutants, such as dioxins and similar chemicals, are not only highly toxic but also persistent and bioaccumulative. Those released in stack gases are available for inhalation. They travel through the air and deposit on soils, surface waters and vegetation, entering the food web, where they bioaccumulate and biomagnify so that food, especially fish and animal products, become the primary route of human exposure. Dioxins and similar pollutants as well as volatile metals are concentrated in fly ash and residues of air pollution control residues while less volatile metals are concentrated in the bottom ash. Fly ash and bottom ash, which represent about 25 percent of the original weight of the waste combusted, are commonly sent to special landfills, hazardous waste landfills and/or conventional landfills. Scrubber water also requires treatment, and fugitive emissions will also find their way into the natural environment.[4]

In general, there are a handful of toxins including dioxin 2,3,7,8-TCDD – the most dangerous toxin know to man – that are widely known as the residual pollution from thermally treating municipal solid waste. These include: dioxins, particulate matter, arsenic, beryllium, cadmium, chromium, lead, mercury, acidic gases, and polyaromatic hydrocarbons. [5]

The most serious environmental and human health concern is from burning plastics such as vinyl (PVC - #3), which contain significant amounts of chlorine. This results in the production of hydrochloric acid and chlorinated chemicals such as chlorinated benzenes and polychlorinated dioxins and furans. [6] This is especially relevant in the Canadian context, because in 2001, our Federal government signed onto the Stockholm Convention on Persistent Organic Pollutants, which clearly states that authorities are obligated to give priority consideration to waste management methods that "avoid the formation and release" of dioxins.[7]

In addition to the six metals previously listed, 19 other metals have been identified in the wastes sent to incineration facilities or in their stack gas and/or ash.[8] In addition, scientists have detected innumerable organic chemicals in incineration outputs. Among these so-called products of incomplete combustion (PICs) are hundreds of semi-volatile chemicals of which only 10-14 percent have been completely identified[9]. Semi-volatile PICs are likely to be persistent in the environment and lipophilic (fat-loving).

More recently, fine and ultra fine particulate matter from combustion technologies, which are a known contributor to cardiovascular disease, pulmonary disease, and cancer have become the focus of research related to the incineration technologies.[10]

In general, how well is the pollution from incineration facilities monitored?
Pollution monitoring varies depending how much money has been spent on the various monitoring technologies. Most incineration facilities continuous monitor for NOx, SOx, CO, HCL, PM, O2, opacity, temperature and amonia. Other pollutants are monitored through stack tests, usually done once annually (as per Ontario A-7 guidelines). Municipalities may request more frequent testing. Tests are always scheduled, so facility engineers can plan for tests to be run during optimum conditions. Technology to continuously monitor heavy metals and dioxin do exist, but can be prohibitively expensive.

Have there ever been studies to measure the health impacts of people living near by, or working in these facilities?
There have been many studies which show a correlation between the toxins released from incineration and their impact on people living near these facilities. For example, a newly published study of adolescent children who lived near two incinerators found: elevated blood levels of PCBs, dioxins and metabolites of volatile organic compounds were in the children's blood; delayed sexual maturation; delayed breast development in girls was positively correlated with serum concentrations of dioxins; delayed genital development in boys was correlated with serum concentrations of PCBs; reduced testicular volume was found among the boys.[11]
Another study showed that mercury levels in the hair of people living near a waste incinerator increased by 44-56% over 10 years and with greater proximity to the facility.[12] Clusters of two cancers associated with dioxin exposure -- soft-tissue sarcomas and non-Hodgkin's lymphomas -- were found in one intricate study.[13] Increased rates of deaths from childhood cancer, all cancers combined, cancer of the larynx, liver, stomach, rectum, and lung were found in a series of studies.[14]

In terms of the health impacts on workers, here too, many studies also exists, among them, several studies showed increased death rates from cancer of the stomach, lungs and oesophagus, [15] and increased death rates from ischemic heart disease.[16]

In Summary

New incineration technologies are un-proven, and while traditional technologies have improved, they too are still very dangerous in terms of the known pollutants, as well as the unknown and unmonitored pollutants.

As we plan for the next 20-years, we must make decisions about waste management which have the lowest possible impact on the environment and human health. This is especially relevant today, as we are learning more about how heavy metals and other toxics are compromising our health.

Recently for example, Environmental Defense Canada released its findings of blood sample tests from random Canadian families. They tested 11 adults from across the country for 88 chemicals and in their latest study, they tested children, parents and grandparents from five families for 68 chemicals. The findings of both studies demonstrate that toxic chemicals contaminate people no matter where they live, how old they are or what they do for a living.

Late in 2006, Dr. Philippe Grandjean, a leading health researcher and Professor of Environmental Health from the Harvard School of Public Health published a study which characterizes the loading of chemicals both known (201) and unknown (over 1,000) as “a silent pandemic that has caused impaired brain development in millions of children worldwide”. Grandjean urges governments worldwide to begin to strictly control these chemicals.

> ***“Even if substantial documentation on their toxicity is available, most chemicals are not regulated to protect the developing brain…Only a few substances, such as lead and mercury, are controlled with the purpose of protecting children. The 200 other chemicals that are known to be toxic to the human brain are not regulated to prevent adverse effects on the fetus or a small child.”*** **– Dr. Phillipe Granjean, November, 2006**

ENDNOTES

[1] Examples of false claims include, but are not limited to:

> 1) North American Power Company's Pyrolysis proposal claimed there would be no hazardous emissions. After the city of Chowchilla, CA requested proof of their claims, the company withdrew their proposal because they could not back-up heir claims.
> 2) Neoteric Environmental Technologies and International Environmental Solution built a plasma arc/pyrolisis facility in Romoland, CA. While company tests using MSW in 2005 were declared a success, the South Coat Air Quality Management District determined that the facility emits more dioxins, NOx, VOCs and particulate matter than two existing mass-burn facilities located in the LA area. 3) Plastic energy LLC received permits for catalytic cracking in Hanford, CA. They claimed that the technology would generate electricity without any emissions. In 2004 company officials admitted that their technology would have toxic emissions and temporarily stopped the project.
> 4) Global Energy Resources began to site a plasma arc facility in Sierra Vista, Arizona. The company claimed that the project would have no emissions. When challenged however, their consultants admitted that there would be emissions. The company has since dropped its proposal.

These and additional case studies can be found in the report*: Incinerators in Disguise, Case Studies of Gasification, Pyrolysis and Plasma in Europe, Asia and the United States*. GreenAction for Health and Environmental Justice, April 2006.

[2] *Incinerators in Disguise, Case Studies of Gasification, Pyrolysis, and Plasma in Europe, Asia, and the United States,* Greenaction for Health and environmental Justice, April 2006.
[3] *Incineration And Gasification: A Toxic Comparison*, April 12, 2002, Blue Ridge Environmental Defense League. Data from: US Environmental Protection Agency, *Compilation of Air Pollutant Emission Factors*, Volume 1, Fifth Edition, AP-42
[4] *Incineration & Health* – power point presentation, GAIA Conference, Penang, Malaysia, 17-21 March 2002, Pat Costner, Senior Scientist, Greenpeace International
[5] Ibid.,
[6] Linda. S. Birnbaum, PhD, DABT, US EPA's lead expert on dioxin effects.
[7] Stockholm Convention On Persistent Organic Pollutants, Article 5 and Annex C of the treaty describe the obligations with respect to dioxins and other unintentionally produced POPs
[8] Source: Pat Costner, Senior Scientist Greenpeace International
[9] Ibid.,
[10] *Origin And Health Impacts of Emissions Of Toxic By-Product And Fine Particles from Combustion and Incineration of Hazardous Wastes and Materials*, Cormier, Lomnicki, Backed, Dellinger, Environmental Health Perspectives, Volume 114, Number 6, June 2006.
[11] Staessen et al., 2001. Lancet 357:1660-1669
[12] Kurttio et al. (1998)
[13] Viel et al. (2000)
[14] Elliot et al. (2000); Knox (2000); Knox and Gilman (1998); Michelozzi et al. (1998); Elliot et al. (1996); Biggeri et al. (1996); Babone et al. (1994); Elliot et al. (1992); Diggle et al. (1990)
[15]Rapiti et al. (1997); Gustavsson et al. (1993); Gustavsson et al. (1989)
[16] Gustavsson (1989)

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