

Greenpeace Research Laboratories**Incineration and Human Health****State of Knowledge of the Impacts of Waste Incinerators on Human Health
(Executive Summary) ***

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After pollutants from an incineration facility disperse into the air, some people close to the facility may be exposed directly through inhalation or indirectly through consumption of food or water contaminated by deposition of the pollutants from air to soil, vegetation, and water. For metals and other pollutants that are very persistent in the environment, the potential effects may extend well beyond the area close to the incinerator. Persistent pollutants can be carried long distances from their emission sources, go through various chemical and physical transformations, and pass numerous times through soil, water, or food. National Research Council (2000)

Management of municipal and industrial waste is a growing problem throughout the world. In the European Union, while waste output is continually increasing, new regulations are imposing more stringent restrictions on the amount of waste permitted to go to landfill. At the same time, many incinerators have been closed over the past few years because of stricter regulations on their atmospheric emissions. In Europe, all incinerators will soon have to comply with new standards set out in a recent EC draft directive.

Fortunately, there are alternative solutions to turn around the waste crisis on a long-term basis. Primarily, this means the implementation of waste prevention strategies, and in conjunction with this, waste re-use and recycling. Despite this option, there is an emerging trend for constructing, and planning to construct, new incinerators in an attempt to provide a 'quick fix' solution to the waste crisis. Incinerators are deemed as favourable in this respect because they are perceived as reducing waste to one tenth of its original volume, and therefore reduce the volume of waste going to landfill sites.

Incinerators, however, are controversial in terms of their potential impacts on the environment and human health, as well as in terms of the economic considerations which do not favour this technology. They are known to emit numerous toxic chemicals into the atmosphere and produce ashes and other solid waste residues. One country, the Philippines, has taken

serious note of the many concerns about incineration at a governmental level. Following strong public opposition to incinerators, the Philippine Clean Air Act of 1999, banned the incineration of municipal, medical and hazardous waste.

Waste reduction, re-use and recycling are being promoted while non-burn technologies are recommended for waste that needs some form of treatment. Meanwhile, some governments in Europe are advocating the construction of even more incinerators.

This report was undertaken to draw together scientific findings on incinerator emissions and their impacts on human health. A broad range of health effects have been associated with living near to incinerators as well as with working at these installations. Such effects include cancer (among both children and adults) adverse impacts on the respiratory system, heart disease, immune system effects, increased allergies and congenital abnormalities. Some studies, particularly those on cancer, relate to old rather than modern incinerators. However, modern incinerators operating in the last few years have also been associated with adverse health effects.

Despite reductions of some chemicals in stack emissions, modern incinerators nevertheless still emit numerous toxic substances to the atmosphere as well as in other residues such as fly ash and bottom ash. Moreover, reductions of dioxins and other chemicals in stack gases commonly leads to increased releases of these same chemicals in the other incinerator residues. In most cases, health effects which have been associated with incinerators cannot be tied down to a particular pollutant. Together with the limited data available, it is, therefore, impossible to predict health effects of incinerators including new or updated installations. With such factors in mind, this report demonstrates that there is an urgent need for the complete phase out of incineration and the implementation of sound waste management policies based on waste prevention, re-use and recycling.

Incinerators – Waste Generators

It is a common misconception that things simply disappear when they are burned. In reality, matter cannot be destroyed – it merely changes its form. This can be exemplified by looking at the fate of some substances in wastes which are

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burned in municipal solid waste (MSW) incinerators. These incinerators are typically fed mixed waste streams that contain hazardous substances, such as heavy metals and chlorinated organic chemicals. Following incineration, heavy metals present in the original solid waste are emitted from the incinerator stack in stack gases and in association with tiny particles, and are also present throughout the remaining ashes and other residues. Incineration of chlorinated substances in waste, such as polyvinyl chloride (PVC) plastic, leads to the formation of new chlorinated chemicals, such as highly toxic dioxins, which are released in stack gases, ashes and other residues. In short, incinerators do not solve the problems of toxic materials present in wastes. In fact they simply convert these toxic materials to other forms, some of which may be more toxic than the original materials. These newly created chemicals can then re-enter the environment as contaminants in stack gases, residual ashes and other residues.

All types of incinerators release pollutants to the atmosphere in stack gases, ashes and other residues. A multitudinous array of chemicals is released, including innumerable chemicals that currently remain unidentified. The chemicals present in stack gases are often also present in ashes and other residues. Such chemicals include dioxins, polychlorinated biphenyls (PCBs), polychlorinated naphthalenes, chlorinated benzenes, polyaromatic hydrocarbons (PAHs), numerous volatile organic compounds (VOCs), and heavy metals including lead, cadmium and mercury. Many of these chemicals are known to be persistent (very resistant to degradation in the environment), bioaccumulative (build up in the tissues of living organisms) and toxic. These three properties make them arguably the most problematic chemicals to which natural systems can be exposed. Some of the emitted chemicals are carcinogenic (cancer-causing) and some are endocrine disruptors. Others such as sulphur dioxide (SO₂) and nitrogen dioxide (NO₂) as well as fine particulate matter, have been associated with adverse impacts on respiratory health.

It is a popular misconception that the weight and volume of the original raw waste are reduced during incineration. It is often quoted that the volume of waste is reduced by about 90% during incineration but the actual figure is closer to 45%. The weight of waste is supposedly reduced to about one-third during incineration. However, this refers only to ashes and negates other in-cinerator emissions in the form of gases, which result in an increased output in weight. In sum, if the mass of all the outputs from an incinerator, including the gaseous outputs, are added together, then the output will exceed the input.

Environmental and Human Exposure to Incinerator Releases

The research carried out on environmental contamination and human exposure to pollutants released by incinerators is limited and has focused mainly on dioxins and heavy metals. Research has demonstrated that both older and more

modern incinerators can contribute to the contamination of local soil and vegetation with dioxins and heavy metals. Similarly, in several European countries, cow's milk from farms located in the vicinity of incinerators has been found to contain elevated levels of dioxins, in some cases above regulatory limits.

Populations residing near to incinerators are potentially exposed to chemicals through inhalation of contaminated air or by consumption of contaminated agricultural produce (e.g. vegetables, eggs, and milk) from the local area and by dermal contact with contaminated soil. Significantly increased levels of dioxins have been found in the tissues of residents near to incinerators in the UK and Japan most likely as a result of such exposure. Two studies in the Netherlands and Germany however, did not find increased levels of dioxins in body tissues of residents living near incinerators. At an incinerator in Finland, mercury was increased in hair of residents living in the vicinity, most likely due to incinerator releases.

Several studies have reported elevated levels of dioxins (total TEQ), and/or certain dioxin congeners, in the body tissues of individuals employed at older incineration plants. This is thought most likely to be a consequence of exposure to contaminated ashes in the workplace. Similarly, some studies have reported increased levels of chlorinated phenols, lead, mercury and arsenic in the body tissues of incinerator workers.

Health Impacts

Experimental data confirm that incinerators emit toxic substances and that humans will be exposed as a consequence. Studies on workers at incinerator plants, and populations residing near to incinerators, have identified a wide range of associated health impacts (see the tables p. 143). These studies give rise to great concerns about possible health impacts from incinerators even though the number of studies (particularly those that have been conducted to appropriately rigorous scientific standards) is highly limited. These should be seen, however, as strongly indicative that incinerators are potentially very damaging to human health.

Incinerator Releases and Regulation

Stack Gases. As previously mentioned, numerous chemicals are emitted to the atmosphere from incinerators through the stack gases. Important points regarding some of these chemical emissions are given below.

Dioxins. Extensive research has demonstrated that dioxins can cause a diverse array of toxic effects. They have become widespread contaminants throughout the globe and are present in the body tissues of human beings across the whole globe. Research suggests that, in industrialised countries, dioxins have now reached levels in tissues of the women which may cause subtle, adverse effects upon the immune system, and nervous system of their babies.

