

Reducing Dioxin Release

Dioxins are substances not manufactured industrially. They are formed unintentionally, most often during the course of processes such as incineration. This explains why these substances are ubiquitous in the environment, although in very small quantities.

The level of exposure to dioxins in everyday life in Japan does not lead to health effects.

However, citizens still have questions and express concerns. To address these concerns, Ministries and Agencies that are members of the Ministerial Council on Dioxin Policy have formed the core of a government effort to work in a unified way to promote dioxin responses. This public information leaflet has been created by the government as part of this effort.

We sincerely hope that this leaflet will promote public understanding about dioxins.

Main Sources and Emission Amounts

● Properties of Dioxins

Dioxins in general are colorless solids with properties of very low water solubility and low vapor pressure. On the other hand, dioxins characteristically exhibit a high degree of solubility in fats and oils. They are generally stable, not reacting easily to other chemical substances, acids and alkalis, but are thought to gradually decompose in the presence of solar ultraviolet light.

Dioxin is not produced intentionally, other than for research purposes, such as to prepare standard material for analysis. Dioxins are by-products generated from processes when heat is applied to substances containing carbon, oxygen, hydrogen and chlorine.

● Main Sources of Dioxins

The main source of dioxins at present is waste incineration, with most being generated in combustion processes and released to the ambient air without being fully captured by waste-gas treatment equipment. Other sources exist, such as emissions from electric steelmaking furnaces, cigarette smoke, and automobile exhaust. Some reports also indicate that dioxins may have accumulated in the environment due to the past use of PCBs and some types of agricultural chemicals, which contained dioxins as impurities.

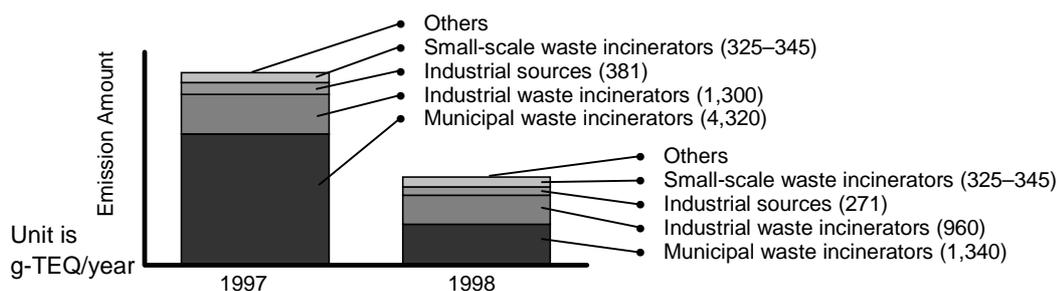
The behavior of dioxins in the environment is not fully known. Taking the atmospheric pathway, for example, dioxins in the air are associated with particulate matter and fall to the ground, contaminating soil and water. It is thought that over long periods of time these dioxins, together with those released into the environment via other pathways, ultimately accumulate in aquatic sediments and enter the food chain when ingested by plankton and fish, thereby starting to concentrate in organisms.

One estimate of the yearly emission of dioxins in Japan in 1998 was between approximately 2,900 and 2,940 g, excluding co-planar PCBs.

Natural sources of dioxins are thought to exist. Forest fires and volcanic activities, for example, are said to produce dioxins.

In coming years, it will be important to get a better grasp of the state of dioxin emissions, including those of co-planar PCBs whose origins are not yet clear.

Dioxin Emissions from Various Sources in Japan



Definition of Dioxins

- **PCDDs** Polychlorinated Dibenzop-Dioxins
- **PCDFs** Polychlorinated Dibenzofurans
- **Co-planar PCBs**

The term "Dioxins" is used to refer to the above three kinds of substances.

- * Industrial sources include electric steelmaking furnaces, steel industry sintering processes, zinc recovery industries, aluminium alloy production, and other industries.
- * Small-scale waste incinerators are those with an incineration capacity of less than 200 kg/h.
- * Others include crematoriums, cigarette smoke, automobile exhaust, final waste disposal sites, etc.

Dioxin Concentrations and Intake

● Concentrations in the Environment

The average dioxin concentrations in the environment in Japan revealed in a 1998 survey are about 0.23 pg-TEQ per cubic meter (pg-TEQ /m³) on average for the ambient air and about 6.5 pg-TEQ per gram (pg-TEQ /g) on average for the soil.

Although the concentrations in the ambient air in Japan was high compared with those in other countries, these concentrations have been decreasing recently.

No significant change was observed during the past 10 years in dioxin concentrations in the sediment of seas, lakes and rivers, or in tissues of animals and plants, based on surveys by the Environment Agency.

Since dioxins are detected everywhere in the environment, investigations are to be continued.

● Intake

The average dietary intake of dioxins including co-planar PCBs in Japan amounts to 100 pg-TEQ a day which means 2.0 pg-TEQ for each kilogram of body weight based on an average body weight of 50 kg, according to a 1998 survey by the Ministry of Health and Welfare (Survey on Daily Intake).

In addition to the dietary intake, with an assumed intake of about 0.07 pg-TEQ from the ambient air, and about 0.0084 pg-TEQ from the soil via dirt on hands, etc., the total dioxin intake of a person in Japan amounts to 2.1 pg-TEQ per kg of body weight/day on average.

This level is below the Tolerable Daily Intake (TDI) and thereby regarded below the level to cause adverse effects on human health.

Daily Intake of Dioxins in Japan (Converted to amounts per kg of body weight)

Total approx. 2.1 pg-TEQ/kg/day

Ambient air	0.07 pg-TEQ /kg/day		Ambient air	↑	Estimated daily intake
Soil	0.0084 pg-TEQ /kg/day		Soil		
Seafood	1.41 pg-TEQ /kg/day		2.0 pg-TEQ /kg/day Food	↓	Tolerable daily intake (TDI) 4 pg-TEQ /kg/day
Meat and eggs	0.31 pg-TEQ /kg/day				
Milk and dairy products	0.17 pg-TEQ /kg/day				
Highly-pigmented vegetables	0.03 pg-TEQ /kg/day				
Rice	0.001 pg-TEQ /kg/day				
Others	0.08 pg-TEQ /kg/day				

Units for Extremely Small Quantities

Units for measuring weight

kg (kilogram)

g (gram)

mg (milligram) = 10^{-3} g (thousandth of a gram)

μ g (microgram) = 10^{-6} g (millionth of a gram)

ng (nanogram) = 10^{-9} g (billionth of a gram)

pg (picogram) = 10^{-12} g (trillionth of a gram)

If water were held in a container the size of Tokyo Dome baseball stadium, it would weigh about 10^{12} g. If a lump of sugar (1 g) were dissolved in the water, the result would be 1 pg of sugar in each gram of water.

About the Tolerable Daily Intake (TDI) of Dioxins

The Tolerable Daily Intake (TDI) is the amount of daily intake that is judged not to have harmful effects on the health even if a human being continues taking in that amount day after day over an entire lifetime.

The TDI of dioxins is set at 4 pg-TEQ/kg/day (that is, 200 pg for a person weighing 50 kg).

However, even a temporary slight excess of intake will not affect the health if intake remains within the average over the long term.

Measures being Taken to Reduce Dioxin Release

In order to reduce dioxin release into the environment, measures have been taken under the existing Waste Management and Public Cleansing Law and the Air Pollution Control Law to impose emission gas controls on waste incinerators and other sources and to improve incineration facilities.

As a result of these efforts, dioxin emissions in Japan in 1998 had been reduced by approximately half from 1997, excluding co-planar PCBs, while dioxin emissions from municipal waste incinerators for ordinary household waste and so on had been reduced by approximately 70%. Further reductions are expected.

In the meeting of Ministerial Council on Dioxin Policy held in March 1999, the Basic Guidelines of Japan for the Promotion of Measures against Dioxins were established, setting a target of reducing total dioxin emissions by approximately 90% of the 1997 level by fiscal 2002. The Ministries and Agencies concerned are now diligently promoting various unified measures aiming for significant reductions in dioxin emissions.

The Law Concerning Special Measures Against Dioxins was approved and promulgated in July 1999, and went into effect in January 2000.

The Law Concerning Special Measures Against Dioxins states: "Businesses shall take necessary measures to prevent environmental pollution by dioxins that are generated in the course of conducting their business activities, as well as measures to remove such dioxins, and must also cooperate with measures taken by the Government and local governments for prevention of environmental pollution by dioxins and for their removal."

In addition, stricter standards were imposed on the disposal of ash and dust emitted by waste incinerators, measures were established for prevention of scattering or spillage of incineration soot and dust at the final landfill site of waste and emission standards were set for effluent spillage from these sites. In connection with the soil, it was decided that measures to remove polluted soil could be taken in designated areas. These are those areas falling short of environmental standards where general citizens are able to enter.

Obligations for monitoring and surveillance of the level of pollution caused by dioxins were also determined, and their fulfillment is to be promoted.

Summary of Standard Values and Regulations Imposed under the Law Concerning Special Measures Against Dioxins

Tolerable Daily Intake (TDI)

4 pg-TEQ per kilogram of body weight per day (pg-TEQ/kg/day)

Environmental Standards

Ambient Air	→	0.6 pg-TEQ per cubic meter (pg-TEQ/m ³) and under (in annual average)
Water	→	1 pg-TEQ per liter (pg-TEQ/L) and under (in annual average)
Soil	→	1000 pg-TEQ per gram (pg-TEQ/g) and under

Regulations for Emission Gas and Effluent Relating to Dioxins

- Notification to prefectural governors upon changes in the establishment or construction of specified facilities
- Surveillance of dioxin concentrations (emission gas, effluent, ash, dust, etc.) at least once annually
- Reporting surveillance results to prefectural governors

Other Regulations, Etc.

- Designate ash, dust, cinders, etc. as specially controlled waste, and obligate processing to lower the amount of dioxins
- Formulate concrete measures for prevention of scattering or spillage of incineration soot, dust, and cinders at final waste disposal sites and set standards for maintenance and management from the perspective of measures against dioxins
- Implement removal of polluted soil, etc. in areas designated for measures against dioxins

Emission Standards for Emission for Gas

(Unit: ng-TEQ/m³N)

Facilities	Incinerator capacity (C)	New facilities	Existing facilities	
			January 15, 2001-November 30, 2002	December 1, 2002
Waste incinerators (C ≥ 50 kg/h)	C ≥ 4 t/h	0.1	80 *Apply from December 1, 1998 (Note 1)	1
	2 t/h ≥ C ≥ 4 t/h	1		5
	C < 2 t/h	5		10
Electric steelmaking furnaces		0.5	20	5
Steel industry sintering processes		0.1	2	1
Zinc recovery industries		1	40	10
Aluminium alloy production		1	20	5

Note 1: Waste incinerators (C ≥ 200 kg/h, but 100 kg/day for waste plastic incinerators) and electric steelmaking furnaces are already subject to regulation, and those with capacity 50 kg/h ≤ C < 200 kg/h will become subject to regulation from January 15, 2001.

Emission Standards for Effluent

(Unit: pg-TEQ/L)

Specified Facilities Note 4	New facilities	Existing facilities Note 2
<ul style="list-style-type: none"> • Facilities for bleaching using chlorine or chlorinated compounds for use in the manufacture of sulfate pulp (Kraft pulp) or sulfite pulp • Decomposition facilities for spent PCB or treated PCB • Washing facilities for PCB polluted materials or treated PCB 	10	10
<ul style="list-style-type: none"> • Waste gas washing facilities or wet dust collectors of aluminium and aluminium alloy roasting furnaces, dissolving furnaces or drying furnaces • Washing facilities for ethylene dichloride used in vinyl chloride monomer manufacturing 		10 (20) Note 3
<ul style="list-style-type: none"> • Waste gas washing facilities, wet dust collectors or ash landfill facilities for discharging polluted effluent of municipal waste incinerators (only those with capacity equal to or higher than 50 kg/h) • Waste gas washing facilities, wet dust collectors or ash landfill facilities for discharging polluted effluent of industrial waste incinerators (only those with capacity equal to or higher than 50 kg/h) 		10 (50) Note 3
<ul style="list-style-type: none"> • Sewage treatment plants that treat the effluent from the facilities above • Facilities for treating effluent from the business establishments that set up the facilities above 		10

Note 2: Existing facilities will become subject to regulation from January 15, 2001.

Note 3: The figures between brackets indicate a provisional effluent standard in use for 3 years after the enforcement of the Law.

Note 4: The standard for effluent spillage from final waste disposal sites is 10 pg-TEQ/L as provided in the order setting standards for maintenance and management of final waste disposal sites.

What Can We Do Now?

Since dioxins are generated in combustion processes, reducing the amount of waste is an effective way to lessen dioxin release.

Accordingly, it is most important for each of us to become concerned with dioxin issues, try to reduce waste by using products as long as possible and by avoiding disposable goods, and taking part in reuse, segregated disposal and recycling.

In view of reducing the total amounts of dioxins, the incineration of household waste using simple incinerators for home use is not appropriate. It is desirable that the waste be treated at municipal incineration facilities that meet legal standards. For the disposal of household waste, your cooperation is highly requested in efforts to dispose of waste according to the rules of the municipality such as segregated disposal.

The problem of dioxins is closely related to our everyday lives.

There is much that is still not fully understood about dioxins, and in the government, for its part, the Ministries and Agencies concerned are united in their commitment to take active measures for dealing with this problem in coming years. We consider it very important to gain your correct understanding and cooperation on this problem, and that is the reason we are disclosing accurate information about dioxins in clear, understandable form and in a timely manner.

Ministerial Council on Dioxin Policy: Member Ministries and Agencies

Cabinet Secretariat, Environment Agency, Ministry of Health and Welfare, Ministry of Foreign Affairs, Ministry of Education, Science, Sports and Culture, Ministry of Agriculture, Forestry and Fisheries, Ministry of International Trade and Industry, Ministry of Transport, Ministry of Posts and Telecommunications, Ministry of Labor, Ministry of Construction, Ministry of Home Affairs, National Police Agency, Hokkaido Development Agency, Economic Planning Agency, Science and Technology Agency, Okinawa Development Agency, National Land Agency

* For more detailed information about dioxins, please see *Dioxins*, a joint informational brochure by the Ministries and Agencies concerned.

<Provisional Translation by Environment Agency of Japan>

Public Information from the Government

Please address your opinions and inquiries to:

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