# The Present Situation of Dioxin Pollution in Japan and Our Proposal;

## For the Revision of the Law Concerning Special Measures against Dioxins

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Organizing Committee for the International NGO Forum on Dioxin Pollution, in Tokyo 2007 and
People's Association for Countermeasures on Dioxins and Endocrine Disrupters(PACDED)

CONTENTS

# Chapter 1. Japan's Dioxins Problem -- A Historical Perspective

## 1 Dioxins Victims

Known as the "Kanemi Yusho (Oil Poisoning) incident," people throughout western Japan were poisoned in 1968 by Kanemi Soko K.K.'s rice bran cooking oil, which was contaminated with PCBs. It was later found that the primary cause of the poisoning was polychlorinated dibenzofuran (PCDF), a kind of dioxin.

In 1973, it was reported that a defoliant (Agent Orange) used in the Vietnam War had caused many cases of liver cancer and birth defects including congenital abnormalities and cystic moles. These were caused by dioxins in the defoliant.

In 1979, Taiwan reported health problems stemming from rice oil similar to those seen in Japan's "Kanemi Yusho Incident." This illness was labeled the "Taiwan Yucheng."

It was only after such health problems in humans emerged that research began on the toxicity of dioxins, which are formed unintentionally. This research showed that, in addition to general toxicity which causes problems such as weight loss, chloracne, thymic atrophy, and liver metabolism problems, dioxins also caused teratogenicity, were carcinogenic and were toxic to both reproductive and immune systems.

Moreover, in recent years, much attention has been focused on the effects of dioxins as "endocrine disrupters," disrupting the body's hormonal activity and severely harming the development of children of the next generation.

## 2. Waste Incinerators as a Dioxins Source

In 1977, it was reported in the Netherlands that such highly-toxic dioxins originated in waste incinerators, which caused a great impact on the countries in Europe and the U.S., they took this opportunity to begin dealing with dioxins, including establishing regulations on emission gases from waste incinerators.

Meanwhile, in 1983, a group of Japanese researchers led by Professor Ryo Tatsukawa of Ehime University detected dioxins in fly ash from municipal waste incinerators. Although this was widely reported in the media, Japanese government significantly lagged behind those in Europe and the U.S. for regulation of dioxin.

## 3. Leaving Legal Regulations over

Following the report by Professor Tatsukawa's group, the Ministry of Health (currently the Ministry of Health, Labor and Welfare) formed an expert committee on waste disposal-related dioxins. However, the following year (1984), the committee recommended that the Tolerable Daily Intake (TDI) should be set at 100 pg TEQ/kg/day (100 pg per each kg of body mass per day), a level 10 times more lenient than the 10 pg TEQ/kg/day recommended by the World Health Organization (WHO) at that time. (Japan's current TDI is 4 pg TEQ/kg/day). Given that Japan's waste incinerators did not cause this TDI level to be exceeded at the time, the committee concluded that the level of the contamination was not so dangerous to make the legal regulations. As a result, regulations on emission gases from waste incinerators, had not been made for 14 years until December 1997.

Meanwhile, in 1985, Sweden decided to stop the construction of municipal waste incinerators temporally, and subsequently legal regulations were placed on emission gases from waste incinerators in countries including Sweden, Denmark, Netherlands, and West Germany. These regulations resulted in the significant reduction of dioxin emissions in these countries.

**4. Dioxin Contamination in Japan – The World's Worst**

Japan has many more incinerators than other countries. In contrast to Japan's 1,800 municipal waste incinerators, Germany has only fifty. The number becomes even larger when industrial waste incinerators and small incinerators are included. Due to the fact that Japan left legal regulations on emission gases over, these incinerators were emitting massive amounts of dioxins each and every day. In 1997, Japan's total annual dioxin emissions were approximately 8,000g. In contrast, Germany's total annual emissions were between several to several dozen grams.

Such a high level of dioxin emissions led to the emergence of areas with severe dioxin contamination. For example, the world's highest concentration of dioxins was detected in Nose Town's waste incinerator in Osaka Prefecture; the cooling tower's residual water had a dioxin concentration of 130,000,000 pg TEQ/L, and the soil in the facility was reported to have a dioxin concentration of 52,000,000 pg TEQ/g. Workers at the facility were found to have been exposed to high concentrations of dioxins.

The area surrounding Tokorozawa City in Saitama Prefecture (just northwest of Tokyo) was home to over 60 of municipal and industrial waste incinerators, emitting massive amounts of dioxins day and night. People became concerned, and television reports of this situation scared people, even leading to a movement across the country to stop buying vegetables cultivated at the Tokorozawa area.

**5. The Law Concerning Special Measures against Dioxins**

This situation led to comprehensive legislation targeting dioxins. The "Law Concerning Special Measures against Dioxins" ("Dioxin Law") was enacted in July 1999 and went into effect in January 2000. The key points of the Dioxin Law are as follows:

(1) Tolerable Daily Intake (TDI)

TDI forms the basic standards for formulating policies on dioxins. The Dioxin Law stipulated that the TDI was to be set by cabinet order at a level not above 4 pg TEQ/kg/day. Currently, the TDI has been set at 4 pg TEQ/kg/day by cabinet order. The WHO recommends a TDI no greater than 4 pg TEQ/kg/day, with a target of below 1 pg TEQ/kg/day.

(2) Environmental Quality Standards

The following environmental standards were set for the air pollution, water pollution (including bottom sediment), and soil pollution.

| | |
|---|---|
| Air | Annual average value: less than 0.6 pg TEQ/$m^3$ |
| Water | Annual average value: less than 1 pg TEQ/ $m^3$ |
| Bottom Sediment | Less than 150 pg TEQ/g |
| Soil | Less than 1000 pg TEQ/g<br>(Research index = 250 pg TEQ/g) |

(3) Regulation for Emission Gas and Effluent Relating to dioxin

(A) Emission Gas

Permissible limits for emission gas were set as shown below. A lenient tentative standard of 80 ng TEQ/ $m^3$ was set until November 2002. This figure was 800 times more lenient than the global standard of 0.1 ng TEQ/$m^3$. A permanent standard has been in place since December 2002, but this is still 2-10 times more lenient on existing facilities than new facilities.

(Unit : ng TEQ/ $m^3$)

| Type of Specific Facility | Facility Scale(incineration capacity) | New Facility Standards | Existing Facility Standard | |
|---|---|---|---|---|
| | | | Until November 2002 | December 2002 onward |
| Waste incinerators | Equal to or greater than 4 t/h | 0.1 | 80 | 1 |
| | 2 t/h～4 t/h | 1 | | 5 |
| | Below 2 t/h | 5 | | 10 |
| Electric steel-making furnaces | | 0.5 | 20 | 5 |
| Sintering facilities for steel industry | | 0.1 | 2 | 1 |
| Facilities for zinc recovery | | 1 | 40 | 10 |
| Facilities for manufacturing aluminum base alloy | | 1 | 20 | 5 |

(B) Effluents

Following the enactment of the Dioxin Law, new sources of dioxins were identified (such as caprolactam manufacturing plants, etc.) and additional facilities were regulated by the Law. The tentative standards for effluents were set at 10-50 ng TEQ/L depending on the facility until November 2002, and tightened to 10 ng TEQ/L for all facilities from December 2002 onwards.

(4) Total Mass Emission Control Standards

The Dioxin Law included provisions which allow the introduction of total mass emission control standards for air pollution applicable to regions such as those with a high concentration of incinerators, since individual controls alone would pose difficulty in clearing environmental standards in those regions.

(5) Disposal of Soot and Dust Relating to Waste Incinerators

The Dioxin Law stipulated the control standards on dioxin concentration in soot and dust relating to the waste incinerators by dioxins, with a ministerial ordinance setting the permissible limit at 3 ng TEQ/g.

(6) Measures against Soil Contamination

The Dioxin Law stipulated that areas with soil contamination levels exceeding the environmental quality standard of 1000 pg TEQ/g were to be designated as controlled areas and that measures should be taken to treat the soil. Up until now, four areas have been designated as controlled areas, including Hashimoto City in Wakayama Prefecture. The indicator for conducting a contamination source investigation was set at 250 pg TEQ/g.

(7) Governmental Plan for the Reduction of Dioxin Emissions

The Dioxin Law also stipulated a national governmental plan for the reduction of dioxin emissions. In September 2000, a target was set to lower overall dioxins emissions by 90% from 1997 levels by the end of fiscal year 2002. The Ministry of Environment estimates that 2003 overall emissions were 95% lower than 1997 emissions, but some experts have argued that there were problems with the measurement method and that actual reductions were less than announced. The current target is to reduce total emissions by 15% from the 2003 level by 2010.

**6. Is the Dioxins Problem Over?**

Japan was the world's worst emitter of dioxins, but comprehensive measures to address the problem have achieved significant result, and this should be highly evaluated. However, the problem is by no means completely solved. Japan's measures of the reduction of dioxin emissions since the enactment Dioxin Law may have made up considerable ground following more than 10 years of delayed response, but Japan has certainly not become the world's "top runner" by any stretch of the imagination. Many issues remain unsolved. For example, fish and shellfish contamination in the ocean waters surrounding Japan remains a serious problem, and zero progress has been made on establishing control standards for food products. Moreover, the problems of dioxins as "endocrine disrupters," have just brought forward in recent years. Much work remains to be done.

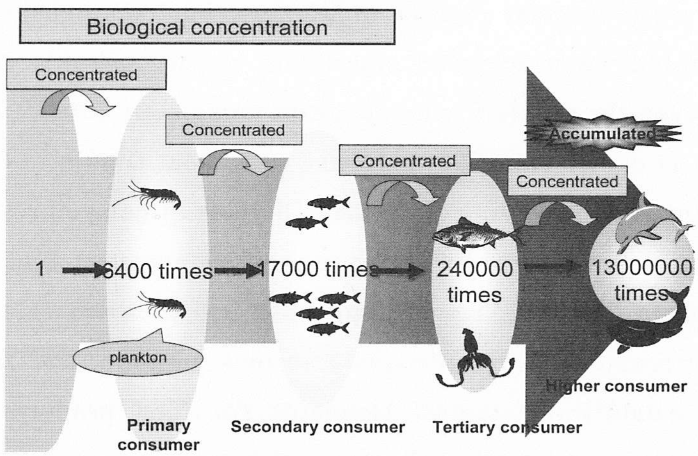
Six years have passed since the Dioxin Law was enacted. We hope that this forum will be a good chance to keep our focus on our next generation and the wild animals that have no voice. Let us take a fresh look at Japan's measures against dioxins, and proactively call for further improvements.

# Chapter 2. Dioxin Contamination in Food

## 1. How Dioxins Contaminate Food

No matter how tiny the amount, dioxins released into the environment accumulate and eventually flow into the oceans, contaminating the seawater and bottom sediment. Because dioxins readily dissolve in oils, they mainly end up in animals' fat tissue, and from there move from animal to animal through the food chain, contaminating each animal along the way at increasingly higher concentrations. This mechanism is particularly active in the oceans, where a diverse range of fishes and shellfish eat and are eaten by one another. In general, the higher up in the food chain, the higher the level of contamination. In this way, dioxin contamination becomes progressively worse as living creatures simply go about their business of living.[1] (See figure 2-1)

**Figure 2-1 Biological Concentration**

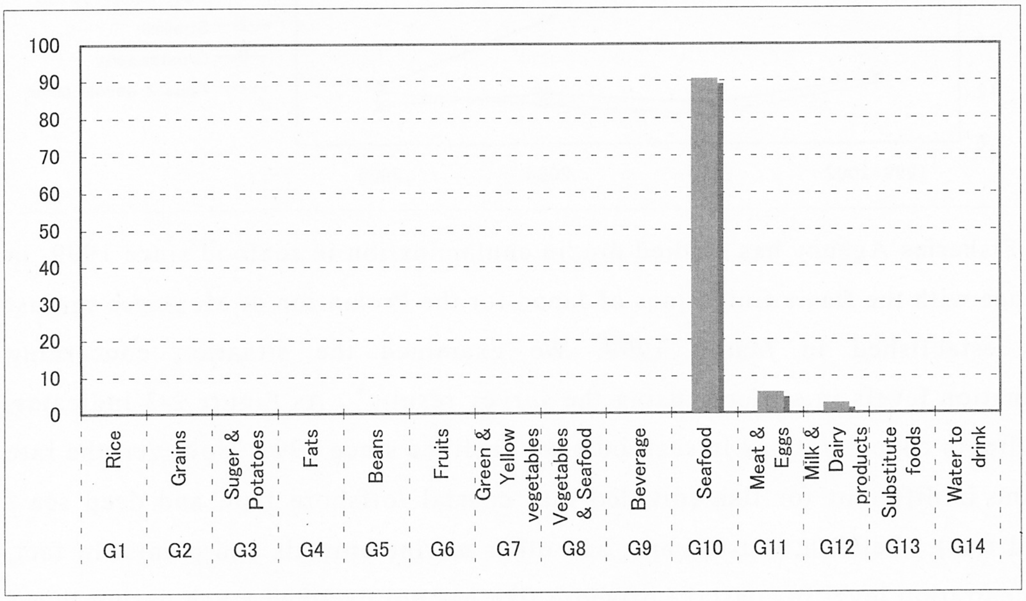



*Harmful substances that have accumulated in animals are repeatedly passed along at higher concentrations to animals higher up in the food chain.*

The Ministry of Health, Labor and Welfare estimates the amount of dioxins people intake daily in what is called the total diet study. This is done by dividing the wide variety of foods we eat into 14 groups, then measuring the concentration of dioxins in each group based on food samples purchased at supermarkets and other food stores, and finally calculating the amount using the food intake volumes reported in the National Nutrition Survey. The results are announced annually. Results for fiscal 2005 are shown below.[2]

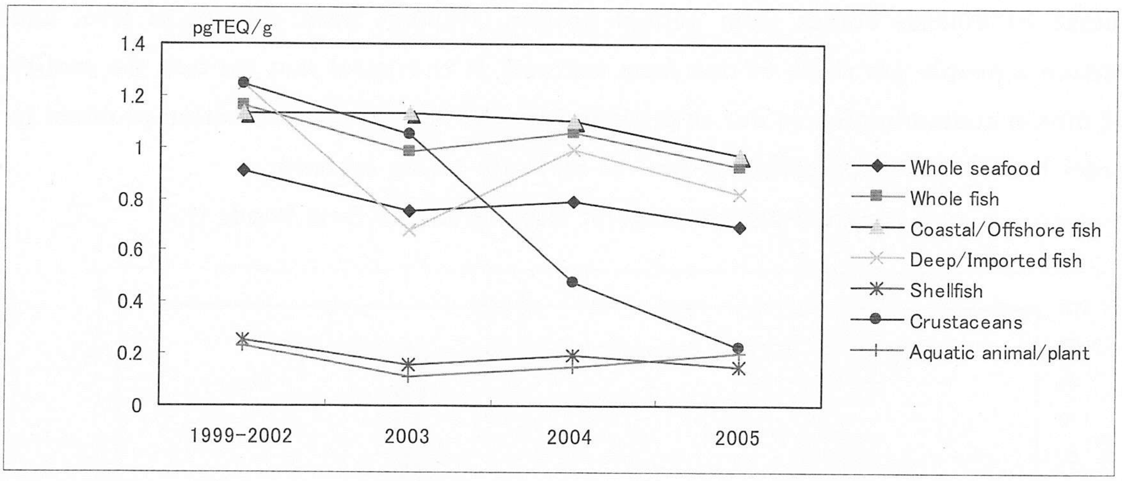
As Figure 2-2 indicates, 91% of dioxin intake comes from seafood, 6% from meat and eggs, and 2% from milk and dairy products. This means that almost all of human intake of dioxins comes from animal protein. Humans need protein to live, and Japanese people get much of this from seafood. It is critical that we face the reality of dioxin contamination in our country and fix the current contamination problem in order for this "seafood-eating nation" to feel safe eating seafood.

Figure 2-2 Percentage of Dioxins Intake from Foods (%)



## 2. The Situation of Dioxin Contamination in Seafood

**Figure 2-3 Trend of Dioxin Concentrations in Seafood**




Japan's Fisheries Agency has studied dioxin contamination in seafood since 1999, in accordance with the Basic Guidelines of Japan for the Promotion of Measures against Dioxins established in March 1999. We examined the situation concerning contamination levels in seafood, using the survey results[3] . As Figure 2-3 indicates, overall dioxin concentrations in seafood have declined since 1999. However, the rate of decline is different for fish (divided into coastal /offshore fish, and deep sea / imported fish), shellfish, crustaceans, and other marine animals and plants. In fact, the concentration level in coastal / offshore fish has not declined much during this 7 years. In other words, it seems the dioxin concentration of the coastal and offshore areas including sediments in Japan has not changed much. Below, we take a look at concentration levels in fishes, on an individual basis, primarily coastal / offshore fish.

In order to judge the level of dioxin contamination in seafood that will be discussed below, let us first look at the limit level of contamination. We assume a TDI of 2 pg TEQ/kg/day, because it is our proposing level as will be discussed below. If a person weighing 50kg eats 100g of fish per day, the fish can have a dioxin concentration of no more than 1 pg TEQ/g, in order for the person to avoid negative health impacts (1pg x 100g / 50kg = 2pgTEQ/kg). In other words, if this person eats 100g of fish that has a concentration of dioxins greater than 1 pg TEQ/g, he/she will intake more that 2 pg TEQ/kg/day. Therefore, we use 1 pg TEQ/g as a rough barometer for judging the degree contamination of fish.

### (1) Coastal and Offshore Fish

The most highly-contaminated fishes include conger eel, sea bass, and gizzard shads, which are found in bays, have high lipid content, and are lived near river mouths and in coastal areas. All of these fishes have seen concentration levels decline slightly during the 7 years. Average levels of dioxins are 4.63 pg TEQ/g for conger eels, 3.72pg TEQ/g for sea bass, and 3.01 pg TEQ/g for gizzard shads. People should be careful about eating these fishes. The most contaminated area is Osaka Bay, followed (in order of high contamination) by Tokyo Bay, the eastern part of the Inland Sea, and the Ise/Mikawa Bay.

Table 2-1 shows dioxin levels in highly-consumed coastal /offshore fish.

Table 2-1 Dioxin Concentrations in Highly-Consumed Coastal / Offshore fish

(pg TEQ/g)

| Name of Fish | 1999-2005 | | 1999-2002 | | 2003-2005 | | of Concent |
|---|---|---|---|---|---|---|---|
| | N | Average | N | Average | N | Average | |
| Dog salmon | 16 | 0.12 | 8 | 0.11 | 8 | 0.12 | 0.08-0.17 |
| Silver salmon (farmed) | | | | | 3 | 1.37 | 0.90-2.25 |
| Pacific Saury | 19 | 0.24 | 5 | 0.35 | 14 | 0.21 | 0.13-1.04 |
| Yellowtail | 25 | 2.01 | 10 | 2.28 | 15 | 1.83 | 0.24-4.04 |
| Yellowtail (wild only | 10 | 1.29 | 3 | 0.74 | 7 | 1.53 | 0.24-3.70 |
| Jack mackerel | 18 | 0.55 | 5 | 0.38 | 13 | 0.61 | 0.22-1.47 |
| Pacific mackerel | 18 | 1.39 | 5 | 0.86 | 13 | 1.59 | 0.24-2.59 |
| Red halibut | 6 | 2.81 | 2 | 1.17 | 4 | 3.68 | 0.88-6.55 |
| Brown sole | 6 | 0.53 | 1 | 0.38 | 5 | 0.56 | 0.36-0.72 |
| Marbled sole | | | | | 7 | 0.76 | 0.63-1.13 |
| Bonito | 19 | 0.28 | 7 | 0.09 | 18 | 0.34 | 0.01-0.79 |
| Sardine | 12 | 1.12 | 6 | 1.44 | 6 | 0.80 | 0.08-2.34 |
| Red sea bream | 17 | 0.64 | 6 | 0.41 | 11 | 0.77 | 0.13-2.05 |
| Red sea bream (wild | 5 | 0.76 | 2 | 0.33 | 3 | 1.04 | 0.13-2.05 |

N: Number of Sample

The average annual seafood consumption per person[4] is as follow; squid, salmon, tuna, Pacific Saury, yellowtail, shrimp, to name but a few (in order of high consumption). But if we limit our scope to coastal / offshore fish, we see that dioxin concentration levels in the majority of the fish have increased during the years. Contamination levels are high in fishes, for example, yellowtail that migrate through coastal and offshore areas, mackerel, and farmed silver salmon. What is strange is the high concentration found in red halibut (caught off the coast of San-in District), a relative of the flounder, which has low fat content. While not shown in the table, average concentrations have risen in fishes from northern sea areas of

Japan, including the bighand thornyhead (3.02 pg TEQ/g), the sandfish (1.84 ), the Atka mackerel (1.13 ) and herring (1.07 ).

**(2) Deep Sea / Imported Fish**

Most fish have a dioxin concentration no higher than 0.5 pg TEQ/g, but salmon, tuna, and Atlantic mackerel (which are respectively 1, 2 and 6, in order of amount consumed) have higher concentrations. As Table 2-2 shows, both Atlantic salmon (imported from Norway) and bluefin tuna (an expensive and delicious tuna used for sashimi and sushi) have extremely high dioxin concentrations, while southern bluefin tuna also exceeds 1.0 pg TEQ/g.

Table 2-2 Dioxin Concentrations in Highly-Consumed Deep Sea and Imported Fish

(pg TEQ/g)

| Name of Fish | N | 1999-2005 Average | Concentration Range | Note |
|---|---|---|---|---|
| Atlantic mackerel | 15 | 0.96 | 0.55-1.27 | North Atlantic Ocean |
| Silver salmon (farmed fish) | 7 | 0.47 | 0.17-1.11 | Southern coast of Chile |
| Red salmon | 6 | 0.27 | 0.22-0.29 | North Pacific Ocean |
| Atlantic salmon (farmed fish) | 6 | 2.14 | 1.30-2.07 | NE Atlantic Ocean |
| Bluefin tuna (including farmed fish) | 17 | 8.74 | 1.38-21.29 | Farmed in Mediterranean Sea |
| Southern bluefin tuna (including farmed fish) | 15 | 1.14 | 0.12-2.57 | Farmed in Southern Indian Ocean |
| Albacore tuna | 17 | 0.42 | 0.01-1.02 | |
| Bigeye tuna | 28 | 0.10 | 0.01-0.42 | |
| Yellowfin tuna | 26 | 0.05 | 0.00-0.08 | |

N=Number of sample

### (3) Other Seafood

Most shellfish have dioxin concentrations no greater than 0.3 pg TEQ/g. Crustaceans such as crab and shrimp are low in lipids, and thus generally have low dioxin concentrations. However, this only holds true for the leg meat, as dioxins readily accumulate in the liver and pancreas. While leg meat of the queen crab (0.13 pg TEQ/g), red tanner crab (0.87), and swimming crab (0.24) have relatively low dioxin concentrations, these crabs in whole contain concentrations of 1.44, 6.38 and 1.81, respectively. Meanwhile, the squilla has an average concentration of 1.53 pg TEQ/g. It is therefore wise not to eat the crabs' organs.

Squid and octopus have also small content of lipids, and thus have dioxin concentrations under 0.01 pg TEQ/g. However, only fired squid has a high concentration (2.4 pg TEQ/g) due to the fact that edible part includes the organs.

### (4) Amount of Dioxin Intake from Diet

The average daily intake of dioxins declined between 1999 and 2005, according to the Total Diet Study (Table 2-3)[5]. However, these are simply averages, and maximum intake was actually more than 3 pg TEQ/kg/day in most years. Furthermore, this average daily intake differs according to the survey method. There was a report of an example in which the maximum intake in 2005 exceeded 4 pg TEQ/kg/day using the duplicated method[6]. In fact some people eat lots of fish, or eat certain kinds of fish (such as tuna).

Table 2-3 Daily Intake of Dioxins (pg TEQ/kg/day)

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|
| Daily Intake (ND= 0 ) | 2.25 | 1.45 | 1.63 | 1.49 | 1.33 | 1.41 | 1.2 |
| Concentration Range (ND= 0 ) | 1.19-7.01 | 0.84-2.01 | 0.67-3.04 | 0.57-3.40 | 0.57-3.05 | 0.48-2.93 | 0.47-3.56 |
| Daily Intake* (ND=LOD/2) | 3.22 | 2.39 | 2.59 | 2.46 | 2.29 | 2.59 | 2.39 |

*: In Japan, dioxin concentrations are calculated using zero (ND=0) for the value of concentration under the non detectable (ND). The numerical values would be much higher if 1/2 value of concentration for the limit of detectable were used (ND=LOD/2), as shown in the bottom line of Table 2-3. In the EU, a value of 1/2 is used for concentrations that are below the detectable limit.

**(5) The Need for Countermeasures against Dioxin Intake**

While certainly not perfect, there are several ways to reduce the amount of dioxins we intake into the body and discharge dioxins already in the body[7]. However, personal effort has its own limitation. We consider it necessary to take measures to aim at assuring that people eat a safe diet and that the next generation is not harmed.

**3. The Need for the Standard Level of Food**

As discussed earlier, Japan's yardstick for TDI is 4 pg TEQ/kg /day. However, in 1998, a meeting of specialists as part of the WHO's International Program of Chemical Safety set the maximum level at 4 pg TEQ/kg/day and the target level at 1 pg TEQ/kg/day. In 2001, the FAO/WHO Joint Expert Committee on Food Additives（JECFA）proposed a monthly limit of 70 pg TEQ/kg (approximately 2 pg TEQ/kg / day). In 2002, the EU Science Committee set the weekly amount at 14 pg TEQ/kg , and used this figure to fix the Standard level of food. Based on these recommendations, Europe and the United States have set targets of 1 pg TEQ/kg/day , with a provisional level of 2 pg TEQ/kg/day.

Although the average daily intake of dioxins in Japan has been on the decline since 1999, as Table 2-3 shows, in the case of ND=LOD/2, the average daily intake exceeds the international standard (up to 2 pg TEQ/kg). Moreover, given the fact that there are large differences in dietary habits between regions and between individuals, there are likely to be great amount seafood eaters who exceed the current TDI standard.

Because there are currently no Standard level of dioxins in food (including seafood), heavily contaminated fishes are able to make their way through the market and into our bodies. In order to protect the health of all Japanese citizens, we believe a TDI of 1 pg TEQ/kg /day should be fixed as a target Standard level, and set 2 pg TEQ/kg as a provisional Standard level until the former is becomes achievable. In addition, the Standard levels should be established for all foods, and regulate the high contaminated foods to keep out of the market. On top of this, pregnant and nursing women should be warned about dioxins, and provided with dietary guidance.

In addition, people wishing to have their blood or breast milk tested for dioxin concentration should be able to receive such a test free of charge, or for a low fee, and to receive advice from a specialist regarding the results.

<Reference (in Japanese: tentatively translated>

1.Thornton, Joe, (2004), *Pandora's Poin,* Translated by Yoshio Inoue, Tokaidaigaku Syuppankai (2004)

2. Ministry of Health, Labour and Welfare. (2006), *Research Concerning Understanding the Reality of Dioxin Contamination in Food, in FY2005* .

3. Fisheries Agency, (2006), *On the Result of Investigation of Dioxin Levels in Seafood.*

4. Association of Agriculture & Forestry Statistics. (May 2007), *Fisheries White Paper,* in *FY2007.*

5. Ministry of Health, Labour and Welfare, (2000—2006), *On the Result of the Investigations of Daily Intake of Dioxins from Food, in FY1999 through FY2007.*

6. Ministry of the Environment, (March 2, 2007), *Survey of Accumulated Amount of Dioxins in Humans.*

7. People's Association on Countermeasures of Dioxin & Endocrine Disruptors. (2003). *Dioxin Contamination in Food – In order Protect the Body from Dioxins*

# Chapter 3. Contamination of Humans by Dioxins

## Section 1. Yusho--Human Disaster caused by PCBs/PCDFs

In 1968, an epidemic of a "strange disease" occurred in Western Japan involving 14,000 people. The epidemic was soon identified to be an unprecedented mass food poisoning caused by the ingestion of rice oil that had been contaminated with PCBs and their related compounds (PCDFs)[1]. The disease was named "Yusho (oil disease). " The standard for recognizing victims was kept to a very limited group of symptoms, and therefore the majority of people affected were not recognized as victims. Although the initial symptoms have faded away after 39 years, most of the patients and their children still suffer seriously from various ailments. No one, not even the experts could have ever imagined what tremendous harm PCBs/PCDFs could inflict on humans and on subsequent generations. The understanding of the effects of the "Yusho" can be roughly divided into two groups. The former was "limited recognition of the symptoms" by a government study group, and the latter was the recognition of Yusho as a "disease of the entire body." Evidence was explored by Yusho Support Center, a non-governmental organization.

### 1. Limited Recognition of the Symptoms focused on Skin Problems

**-The Standards set by the Japanese Government for Recognizing Victims from 1968 through Today-**

The national study group for Yusho set diagnostic criteria for Yusho as follows: Important manifestations of Yusho are acne-form eruptions, pigmentation of the skin, and hypersecretion of the meibomian glands. Many other nonspecific symptoms were seen, but the study group concluded that it was difficult to distinguish these symptoms from similar symptoms seen in other illnesses. Such symptoms included entire body fatigue, feeling of heavy head, decline in concentration, abnormal feeling in limbs, coughing and sputum, loss of appetite, stomach pain, menstrual cycle changes, and other symptoms. The study group subsequently focused its attention primarily on the unusual composition and concentration of PCBs in the blood and PCQ[2], and unusual concentrations of PCDF in the blood. These concentrations declined each year and the group concluded that patients' symptoms were improving. In 2002, it was reported that the concentration of PCDF in the blood of those suffering from Yusho was about 10 times as high as normal levels.

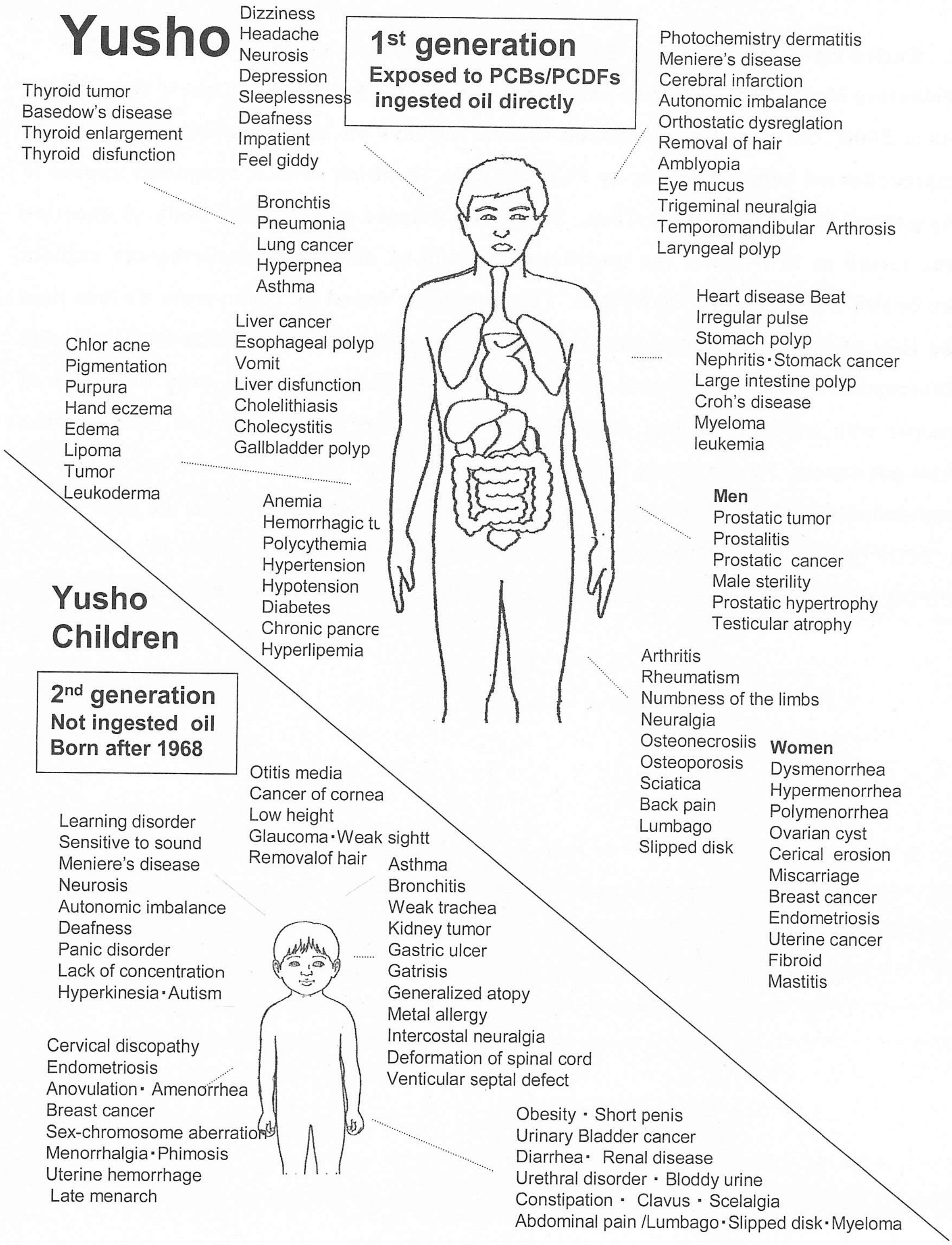
## 2. Entire Body Diseases and Possible Adverse Effects on the Next Generation

**-Voluntary Medical Examinations and Surveys Conducted by YSC and Experts Since 2000-**

Since 2000, the YSC has conducted several surveys on Yusho patients. Yusho is an unprecedented human disaster by PCBs/PCDFs, in which several symptoms appear in the person at the same time. Thus, Yusho is a disease of the entire body. A question was raised as to whether the traditional concept of disease in medicine can explain the health impacts of PCBs/PCDFs. The symptoms found in Yusho were no less than the lists of various symptoms/diseases of entire body described in the Dioxin Health Assessment by U.S. Environmental Protection Agency. There are even examples of people who were exposed as young children and, after getting married, had children who got cancer. Furthermore, the second generation of Yusho, who did not ingest the contaminated oil, has been found to suffer from the diseases listed on the next page.

1: PCDF (polychlorinated dibenzofurans: class of compounds linked to dioxins)

2: PCQ (polychlorinated quarterphenyl: compound formed by 2 PCBs bonded by ether)


Yusho
1st generation
Exposed to PCBs/PCDFs
ingested oil directly
Dizziness
Headache
Neurosis
Depression
Sleeplessness
Deafness
Impatient
Feel giddy
Thyroid tumor
Basedow's disease
Thyroid enlargement
Thyroid disfunction
Photochemistry dermatitis
Meniere's disease
Cerebral infarction
Autonomic imbalance
Orthostatic dysregulation
Removal of hair
Amblyopia
Eye mucus
Trigeminal neuralgia
Temporomandibular Arthrosis
Laryngeal polyp
Bronchtis
Pneumonia
Lung cancer
Hyperpnea
Asthma
Heart disease Beat
Irregular pulse
Stomach polyp
Nephritis・Stomack cancer
Large intestine polyp
Croh's disease
Myeloma
leukemia
Liver cancer
Esophageal polyp
Vomit
Liver disfunction
Cholelithiasis
Cholecystitis
Gallbladder polyp
Chlor acne
Pigmentation
Purpura
Hand eczema
Edema
Lipoma
Tumor
Leukoderma
Anemia
Hemorrhagic tu
Polycythemia
Hypertension
Hypotension
Diabetes
Chronic pancre
Hyperlipemia
Men
Prostatic tumor
Prostalitis
Prostatic cancer
Male sterility
Prostatic hypertrophy
Testicular atrophy
Arthritis
Rheumatism
Numbness of the limbs
Neuralgia
Osteonecrosiis
Osteoporosis
Sciatica
Back pain
Lumbago
Slipped disk
Women
Dysmenorrhea
Hypermenorrhea
Polymenorrhea
Ovarian cyst
Cerical erosion
Miscarriage
Breast cancer
Endometriosis
Uterine cancer
Fibroid
Mastitis
Yusho
Children
2nd generation
Not ingested oil
Born after 1968
Otitis media
Cancer of cornea
Low height
Glaucoma・Weak sightt
Removalof hair
Learning disorder
Sensitive to sound
Meniere's disease
Neurosis
Autonomic imbalance
Deafness
Panic disorder
Lack of concentration
Hyperkinesia・Autism
Asthma
Bronchitis
Weak trachea
Kidney tumor
Gastric ulcer
Gatrisis
Generalized atopy
Metal allergy
Intercostal neuralgia
Deformation of spinal cord
Venticular septal defect
Cervical discopathy
Endometriosis
Anovulation・ Amenorrhea
Breast cancer
Sex-chromosome aberration
Menorrhalgia・Phimosis
Uterine hemorrhage
Late menarch
Obesity ・ Short penis
Urinary Bladder cancer
Diarrhea・ Renal disease
Urethral disorder ・ Bloddy urine
Constipation ・ Clavus ・ Scelalgia
Abdominal pain /Lumbago・Slipped disk・Myeloma

## Section 2. Contamination in Worker's Body

### 1. Exposure to Dioxins in Workplace

The primary professions and workplaces where exposure to dioxins has been a problem include pesticide manufacturing and spraying by agroforestry workers, or waste incineration.

Concerning exposure to agrichemicals, many reports on the patients of chloracne (chlorine pimples) have made between 1945-1964 caused by exposure to a herbicide called pentachlorophenol (PCP), which is known to have contained dioxins as impurities. These reports suggest that many Japanese workers were exposed to dioxins in high levels at the time. As the toxicity of dioxins became increasingly evident, the U.S. and European countries started conducting epidemiological studies on such exposed workers to gain a better understanding of the health impacts of occupational exposure. On the other hand, hardly any such studies were conducted in Japan, and as a result there are no credible scientific data on the matter.

Waste incinerators cause dioxins exposure primarily for workers at municipal waste and industrial waste incinerators. Dioxins are generated by the incineration of waste, and are present in the burned ash. Particularly, they are contained in fly ash in incineration gas emissions in high concentration. This ash accumulates in smoke flues and dust collecting equipments, and it is considered that many workers in charge of cleaning and maintaining such equipments have been exposed highly to dioxins.

### 2. Exposure of Workers to Dioxins at Waste Incineration Facilities

Occupational exposure to dioxins became a well-known problem in 1998, when it was disclosed that the workers of Toyono Clean Center in Osaka prefecture had been contaminated with high concentrations of dioxins. This led to government studies of exposure and associated health problems of workers at municipal waste and industrial waste incinerators. Dioxin concentration in blood of 865 workers in 47 different waste disposal facilities as a total had been measured by 2006. Such a large-scale research for workers on dioxins concentration in the blood is extremely rare in the world, and has a possibility to provide extremely important scientific evidence to be used in establishing measures against the problem. A summary of the results of this research have been published on the Ministry of Health, Labor, and Welfare's website, however, only a few of the health study have been published in academic journals.

It is expected that these findings will be utilized in full-scale epidemiological studies (follow-up studies) in the future.

**3. Remaining Issues**

When waste incinerator workers were found to have been exposed to dioxins, the government prioritized measuring the concentrations of dioxins in their blood, and did not carry out epidemiological research (follow-up studies, etc.). As a result, while they have data on levels of dioxins in blood, they have no way of scientifically showing what the data means, or whether this might give negative impact on workers' health.

Moreover, by the time the government began to study the problem in close look, many incineration facilities (particularly general waste incinerators) had already taken measures to address dioxins-related problems, such as outsourcing the cleaning of incinerators and the insides of gas ducts and other work with a high-risk of exposure. Therefore, an accurate understanding of the extent to how much waste incinerator workers were exposed to dioxins may not have been obtained.

With the release of the overview of the government's study, the public quickly lost interest in the issue, and very little was reported about the results of scientific studies and research. Still, only 10 years have passed since worker exposure to dioxins in Japan became an issue. This is too fast to draw conclusions about the long-term, chronic impacts from this substance.

While workers at waste incinerators are certainly less frequently exposed to dioxins than before, no information exists concerning the extent to contamination of the workers contracted to clean and maintain incineration. There are still many workplaces where continued monitoring of the concentration of dioxins in the working environment is necessary, including facilities for processing PCB-contaminated waste.

＜Reference＞Control Standards for Dioxins Exposure in Workplace Environments (Summary)

| | | |
|---|---|---|
| Control Concentration | | 2.5 pg TEQ/$m^3$ |
| Control Classification | $1^{st}$ Control Classification | Measured value in working environment ＜ 2.5 pgTEQ/$m^3$ (Control concentration) |
| | $2^{nd}$ Control Classification | 2.5 pg TEQ/$m^3$ ≦ measured value ≦ 3.75 pg TEQ/$m^3$ |
| | $3^{rd}$ Control Classification | 3.75 pg TEQ/$m^3$ ＜ measured value |

Notes:

・The control concentration is the concentration used as a reference for controlling the workplace environment.

・Countermeasures differ according to the control classification

・With regards to the $3^{rd}$ control classification, advanced countermeasures (such as using airline masks) are required.

・Detailed countermeasures against exposure to dioxins are set forth depending on the level of contamination in the workplace.

・The reference table shown above was taken from the website of Ministry of Health and Labor, and other sources, and was summarized by the author.

# Chapter 4. Problems with Japan's Dioxin Countermeasures

## 1. What Kinds of Measures are Needed?

The following countermeasures are necessary in order to prevent damage by dioxins.

### (1) Measures to Identify Dioxins Sources

Because dioxins are unintentional products, measures need to be established to grasp the source of dioxins. Similar countermeasures need to be established for halogenated compounds, which are similar to dioxins.

### (2) Measures against Dioxins Accumulation

Due to the fact that dioxins are persistent and big-accumulative, once released they remain in the environment for a long period of time. Therefore, in addition to identifying their sources, measures must be taken to prevent dioxins accumulated in the environment from entering both the human body and the ecosystem. In particular, measures to clean up both contaminated food and contaminated soil and bottom sediment are important.

### (3) Upstream Countermeasures (Changing Materials, Production Processes, etc.)

In addition to gas emissions controls and other "end-of-pipe" measures, upstream countermeasures are needed to prevent the generation of dioxins, changing raw materials and production processes, restricting incineration. Either alternatives for PVC and other products that produce dioxins must be found, or they must stop being incinerated. In addition, waste disposal systems must be revised, with an objective of reducing waste to zero.

### (4) Remedies for Victims

Both research about dioxins-induced health problems and appropriate remedies for victims are needed.

### (5) Promotion of Information Disclosure, Risk Communication, and Public Participation

In order to put effective countermeasures in place, information must be disseminated properly based on citizens' "right to know", risk communication between stakeholders must be established, and citizens should be encouraged to participate in deciding, executing, and evaluating countermeasures.

## 2. Key Problems

Current Japanese measures against dioxins are based on the "Basic Guidelines for the Promotion of Measures against Dioxins" and the "Law Concerning Special Measures against Dioxins." However, when the current measures are examined from the view point of the ideas discussed above, a wide range of problems are revealed. The key problems are discussed below.

### (1) Measures to the Reduction of Dioxins

- Due to the fact that different species have different levels of sensitivity to dioxins, environmental quality standards are also needed in order to protect the entire ecosystem, not just the health of humans.
- In addition to measures for curbing the emissions of chlorinated dioxins, measures for curbing emissions of all halogenated dioxins, including fluorinated and brominated dioxins.
- Facilities that generate dioxins but are not yet regulated need to the studied and included in the scope of regulations.
- The control standard for gas emissions should be set at a uniform 0.1ng-TEQ/Nm3, regardless of whether a facility is new or old, and irrespective of its size.
- In addition to gas emissions, controls should be adopted targeting total dioxin content in effluent from facilities.

### (2) Measures against the Accumulation of Dioxins

#### (A) Food Contamination

- The target TDI should be reviewed to 1 pg TEQ/kg/day, with a provisional TDI set at 2 pg TEQ/kg/day.
- The standard level of food should be set, and food contaminated above the standard level of food should be kept out circulation in the marketplace. In addition, pregnant women and nursing mothers must be warned about dioxin intake, and provided dietary guidance.
- A system should be put in place that enables people who wish to have their blood and/or breast milk tested for dioxin content to do so free of charge or

for a low fee, and receive expert advice regarding the test results.

- Detailed food contamination studies need to be conducted, with the results announced. In addition, techniques must be developed for disclosing this information in an easy-to-understand manner.

**(B) Measures for Contamination of Soil and Bottom Sediment**

- The installers of specified facilities should be required to regularly measure the level of dioxins in the soil within the site, and measures should be put in place for decontaminating the soil if it is found to be contaminated.
- Environmental quality standards for bottom sediment must be strengthened, and measures must be established for decontaminating bottom sediment that exceeds these standards.

**(C) Controls on Fly-Ash, Bottom-Ash, Sludge, and Residue from Chemical and Pharmaceutical Plants**

- Controls should be adopted for total emissions of fly ash, bottom-ash, sludge, and all residues from chemical and pharmaceutical production plants.
- In particular, production plant residues have not come under the scope of regulations thus far, but recent research has shown that such residues contain several thousand to a hundred thousand times more dioxins than bottom-ash. In addition to requiring plant operators to measure and report the amount of dioxins generated, disposal standards must be clarified.

**(3) Upstream Countermeasures**

With regards to the use of halogenated compounds in products and manufacturing processes, mandatory information display and usage restrictions and must be carried out.

**(4) Decommissioning of Waste Incinerators**

Waste incinerators going out of use as a result of not being able to meet gas emissions standards must be treated safely and quickly, as there is a risk of diffusion of contamination if left unattended for long periods of time. However, it is a fact that decommissioning of waste incinerators is expensive and thus often a slow process. Therefore, the national government should set a time limit for decommissioning, provide financial assistance, and otherwise ensure that decommissioning is carried out quickly, appropriately, and in a planned manner. With regards to the method for decommissioning of waste incinerators, the opinions of local residents should be heard, and they must be allowed to attend the work and measuring activities.

### (5) Promotion of Information Disclosure, Risk Communication, and Public Participation

While much about the toxicity of dioxins as an endocrine disrupter has yet to be scientifically understood, studies and research should be advanced, information properly disclosed, and risk communication should be promoted, while the necessary countermeasures are established quickly on the precautionary principle. Citizens must be guaranteed the right to participate autonomously in each process, including deciding, implementing, and evaluating countermeasures.

### (6) Measuring System Improvements

Measurements must be made using an appropriate method in order to accurately grasp the situation. However, the following problems with the current measurement method have been pointed out: 1) There is no system for checking if measurements have got executed appropriately or not, 2) measurements are only taken during times in the steady operating of incineration, and 3) measurements are infrequently-executed. Therefore, the current system for making measurements must be improved.

### (7) Remedies for Victims

- Concerning the health impacts of dioxins, studies need to be advanced, beginning with a follow-up study of Yusho victims and their children. In addition, further epidemiological studies of waste incinerator surroundings and studies of worker exposure at incinerator facilities are necessary.
- We propose quickly establishing an effective remedies for the victims who have suffered from dioxins-related health problems.

These are the key countermeasures that we believe are necessary. In Chapter 5 we discuss the specific items that need to be added to each article, as well as additional concepts, to an amendment of the Law Concerning Special Measures against Dioxins.

# Chapter 5. Proposal for Amendment of the Law Concerning Special Measures against Dioxins (Outline)

Based on the ideas discussed in Chapters 1-4, we propose the Law Concerning Special Measures against Dioxins be amended as follows:

### 1. Article 1 (Purpose)

Add "the prevention of the significant impacts on the ecosystem" in the "Purpose." In addition, from the standpoint of protecting the health of citizens in Japan, measures should be introduced to prevent food contamination by dioxins.

### 2. Article 2 (Definitions)

(1) Expand the scope of coverage to include all halogenated dioxins. (in Paragraph 1, Article 2 of supplementary provision)

(2) Grasp the situation with uncontrolled sources, as well as facilities and industrial sites that have processes that either generate or emit dioxins, and quickly add them to the scope of "specified facilities."

(3) The scope of controls should include not only emissions gases and effluents, but all emitted materials, including sludge and secondary pollutants.

(4) The scope of "specified facilities" should not be limited to factories or industrial sites where a specified facility is installed, but should include all industrial sites with facilities or processes that generate or emit dioxins. (particularly chemicals/pharmaceuticals manufacturing plants, etc.)

(5) The emissions (controlled emissions) from these specified facilities should include not only emission gases and effluents, but all emissions, including sludge (factory residue, etc.) and secondary pollutants.

### 3. Article 3 (Responsibilities of the National Government and Local Governments)

(1) In "formulating basic and comprehensive measures," the national government should listen to opinions of local governments, academics, as well as ordinary citizens.

(2) In implementing measures, local governments should listen to the opinions of academics and residents of the local community.

(3) As a part of implementing and managing the Law, the national government and local governments must establish a standing committee for listening to the opinions of academics and ordinary citizens.
(4) The national government and local governments should proactively release dioxins-related information (including information about companies) and information about policies to the public.
(5) The national and local governments should strive to ensure that information disclosure and communications procedures between the general public and enterprisers are carried out appropriately.

**4. Article 4 (Responsibilities of Enterprisers)**
(1) Enterprisers should establish measures to prevent dioxins from being generated and/or emitted in the course of their activities.
(2) Enterprisers should proactively submit information to the national government, the local government and relevant local residents with regards to dioxins generated in the course of their activities.
(3) When engaged in production, processing, or any other business which creates concerns about the generation and the emission of dioxins, enterprisers must demonstrate, in advance, that the activity in question will not generate and/or emit dioxins, and announce this to the public.
(4) A regulation should be added banning enterprisers from engaging in production, distribution, and/or sales without first confirming that dioxins are not generated and/or contained in the products.

**5. Article 5 (Responsibilities of Citizens)**
(1) Citizens should possess the right to request for an injunction against an activity if there are concerns that the activity (either an activity underway or an activity about to begin) generates dioxins.
(2) Citizens' "right to know" and "right to demand an investigation" should be clearly stated.

**6. Article 6 (Tolerable Daily Intake: TDI)**
The current TDI of 4 pg TEQ/kg/day should be quickly revised to 2 pg TEQ/kg/day, with the final target set at 1 pg TEQ/kg/day. Control standards for food should be set based on a TDI of 2 pg TEQ/kg/day.

**7. Article 7 (Environmental Quality Standards)**

(1) Prefecture governors should be given the authority to set more stringent standards if the area's exceptional circumstances make this necessary.

(2) In addition to the "protection of human health," the government should set "standards desirable to be followed in order to protect the ecosystem."

(3) With regards to (2) above, the soil environmental quality standard of 1000 pg TEQ/g is simultaneously the effective countermeasure standard, and this contradicts the definition of standard. Therefore, environmental quality standards should be set according to the land use to provide a distinction from the countermeasure standard.

(4) With regards to (2) above, the standard for bottom sediment should be revised from the current value of 150 pg TEQ/g to a more appropriate value.

**8. Article 8 (Emissions Standards)**

(1) Current standards should be tightened. In particular, emissions standards of waste incinerators should not differ according to whether a facility is existing or new, and should not depend on the scale of the facility. Rather, the emission standard should be unified to 0.1 ng TEQ/Nm3, the same as in Europe and the United States.

(2) Emissions control standards should be set for all halogenated dioxins.

(3) In addition to emission gases and effluents, total mass emission standards should be set for all other materials discharged from facilities (bottom-ash, fly-ash, sludge, residues from chemical plants, for example).

**9. Article 10 (Total Mass Emissions Control Standards)**

(1) Total mass emission control standards should be set not only for the ambient air, but for water quality as well.

(2) Similar to the recommendations for emissions standards set forth in Article 9, the Minister of the Environmental should make recommendations to prefectural governments with regards to total mass emission control standards.

**10. Article 26 (Continuous Monitoring)**

(1) In addition to air, water quality, and soil, there should be continuous monitoring of seafood and other aquatic life, wild animals, and food.

(2) Announcements of the results of such continuous monitoring should be

mandatory.

**11. Article 28 (Measuring by Person who has Installed a Facility)**

(1) In addition to the installers of industrial sites required to meet air and water quality emissions standards, the scope should be widened to include those of specified facilities as defined in 2. (4) above.

(2) When the installer measures the concentration of dioxins, the measurement must be carried out in the presence of prefecture or city officers and professionals when requested by citizens.

(3) When prefecture or city officers watch an installer conduct a measurement, he/she should provide guidance to ensure that the measurement is appropriately executed.

(4) Measurements should be conducted in a manner that allows understanding of emissions not only during times of normal incineration, but also during start-up and shut-down times. For example, in Japan, where there are lots of incinerators, control standards for total emissions from the time of start-up to shut-down are necessary.

(5) The installers of specified facilities should be required to regularly take measurements of soil within the site.

**12. Article 29 (Designation of Controlled Areas)**

This article should not simply “allow” designation of controlled areas, but it should require prefectures to designate areas as controlled areas that must safely remove soil contamination.

**13. Regulation of Measures concerning Contaminated Soil of Specified Facilities**

(1) Based on 11. (5) above, if soil contamination is found that does not meet control standards, the installer of facilities should be required to decontaminate the soil at his/her own expense.

(2) When decontaminating the soil as discussed above, the installer should be required to write a decontamination plan, and hold a meeting to explain it to local residents, etc.

**14. Article 33 (Government Plan for the Reduction of Dioxin Emissions)**

In order to reduce dioxins emissions, the national government should formulate a plan that includes measures prohibiting the use of halogenated compounds and finding alternatives to products containing halogens.

**15. Countermeasures for Materials**

(1) The national government should require industrial sites which use halogens in production processes, etc. to establish measures for restricting or prohibiting the use of halogens.

(2) The national government should require products, etc. containing halogens to display this fact.

**16. Countermeasures concerning Food**

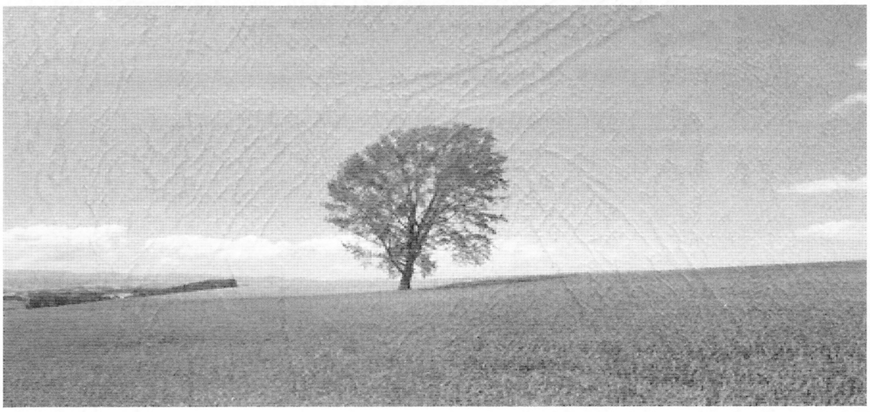
(1) In order to protect the health of citizens, standard level should be set for highly-consumed foods.

(2) On the assumption that standard level for food are set, the national and local governments should conduct detailed studies of dioxins in the water supplied by water utilities, and of the food circulating in the marketplace. The results of these studies should be proactively provided to the public.

(3) Based on the standard level established, government's advisory for the intake of the food contaminated should be provided, and dietary guidance to fertile women, expectant and nursing mothers, as well as children should be provided.

(4) Measures should be enacted to ensure that, in the event studies reveal that dioxin concentrations exceed standards, this information will be announced, that contaminated food will not circulate through the marketplace, and that shipments of such food will be stopped.

(5) Measures ensuring that the person responsible for the contamination (if identified), or the national government (if the person responsible is not identified), will repurchase the contaminated food and/or provide compensation to those affected should be provided for.



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