Chapter 4　THE ENVIRONMENTAL QUALITY STANDARDS FOR PROTECTING HUMAN HEALTH

1. The Environmental Quality Standards for Protecting Human Health

The Environmental Quality Standards for Water Pollution was established in 1970, based on the Articles 16 of the Environment Basic Law (the Articles 9 of the former law named the Basic Law for Environmental Pollution Control), as the standards (or standard values) that we should maintain for the purpose of protecting our health and preserving our living environment. Each exhaust, from factories, enterprises and houses, might not be so serious but the result of accumulation of pollutants makes trouble. These standard values are the administrative goals in actual enforcement of policies to prevent pollutions of public waters and groundwater by enterprisers, the government and local authorities. In other words, it is the authority to carry out the countermeasure for protection against pollution in the clean area or low contaminated area. In seriously polluted area, it is the goal to reach the level of the Environmental Quality Standards for Protecting Human Health in public water.

2. Selection of Items for the Environmental Quality Standards for Protecting Human Health

In 1971, the standards (or standard values) were notified by the Environment Agency with regard to syanide, total mercury, alkyl mercury, specified organophosphorus (parathion, methyl parathion, methyl dimeton, EPN), cadmium, lead, hexavalent chromium, arsenic.

The four specified organophosphorus had been already prohibited to use in Japan at that time. But the environmental standard values were set up about four these items. Because these items were strong residual agricultural chemicals and had been still detected in fish and shellfishes. It was pointed out the possiblity that trivalent chromium would be oxdized to hexavalent chromium in public waters. But the environmental standard value of trivalent chromium was not set up, because there were not have data to prove this possiblity in public waters. Inorganic mercury was added one of the items of the Environmental Quality Standards for Protecting Human Health as total mercury, because there was risk that inorganic mercury was accumulated in body.

BHC, trichloroethylene and PCB were investigated because these compounds were thought to be risk of biological accumulation in according to environmental pollution. BHC was stopped producing and using for domestic needs in Japan. Trichloroethylene, for instance, was recovered so that there was no danger of discharge into the environment. Regarding PCB, the analytical methods were not established yet. For these reasons, BHC, trichloroethylene and PCB were not set up the Environmental Quality Standards for Protecting Human Health at that time.

In 1975, PCB and alkyl mercury were added into items of the Environmental Quality Standards for Protecting Human Health.

In 1993, the Environmental Quality Standards for Protecting Human Health was revised on the basis of the scientific data about health effects. After enforcement of this law, various chemicals had been produced and used in according to industrial development. It was worried the quality of public waters and groundwater became worse. In 1992, the Water Quality Srandards for Drinking Water in Japan was revised in parallel with the revise of theGuideline of Water Quality Standards for Drinking Water by WHO, the Clean Water Act (USA), Water Quality Standards for Drinking Water (USA) and Safe Drinking Water Act (USA). The items, which had bad effects on human health, were examined into new scientific data. The examination of un-listed items and the re-examination of listed items were done on basis of the effects on human health with due consideration to the amount of production, the quantity of use, the detected level in public waters and groundwater.

The new Enviromnetal Quality Standards for Water Pollution was established with the following idea. All compounds, which are able to be determined the standard values on the basis of scientific data, should not be determined the standard values. Because it is important to monitor the quality of waters and to consider a counterplane of emission control for the purpose of protecting human health and that of preserving our living environment. Such reasons, only compounds, which were detected actually at near risk level in public water and groundwater, should be listed on the Environmental Quality Standards for Protecting Human Health.

3. Foundation for the Determination of the Standard Values

There is fear of using contaminated public water for the sourse of human's drinking water. So, the standard values of the items listed in the Water Quality Standards for Drinking Water on the basis of Waterworks Law, are calculated with the similar concept to the Water Quality Standards for Drinking Water. About other items, the standard values were calculated with consideration of the contribution of drinking water to total absorption, the other countries' environmental standard values for water quality and new scientific data for health effects. The influence resulted from drinking water were estimated on basis of the idea of WHO's guideline for drinking water. The standard values were determined based on the information of the no-effective level about health,while we intake all our lives continuously.

In 1993, items shown the new data about health effects were assessed whether they were added into the list of the Environmental Quality Standards for Protecting Human Health. Among those items, 16 items were added into the list of the Environmental Quality Standards for Protecting Human Health with consideration of the amount of production, the quantity of using, the concentration in public water and gorundwater. For instance, it was worried that wide area or many points were polluted by simazin, because simazin was used not only as pesticide but also as accelerator for sulfurating rubber. From this worry, simazine was added into the list of the Environmental Quality Standards for Protecting Human Health.

4. Health Risk Assesment

(1) Assesment of Noncarcinogenic Risks

It is based on data about health effects resulting from laboratory animal or human studies that can be used. The value of human investigations is limited, owing to lack of enough information on the concentrations to which people are exposured or on simultaneous exposur to other chemicals. So, the toxicity data from laboratory animals are often used for risk assesment.

For this kind of chemicals, it is believed that there is a highest dose which no adverse effects will oocur (NOAEL) and the lowest dose at which detectable adverse effects is observed (LOAEL). A Tolerable Daily Intake (TDI) about these chemicals is derived using the following formula:

$$TDI = \frac{\text{NOAEL or LOAEL}}{\text{UF}}$$

NOAEL = No-Observed-Adverse-Effect Level
LOAEL = Lowest-Observed-Adverse-Effect Level
UF = Uncertainty Factor

If a NOAEL is not available, a LOAEL may be used with additional uncertainty factor.

The derivation of uncertainty factors is necessary of expert judgement. For instance, in the Guidelines for Drinking-Water Quality of WHO, " In the derivation of the WHO drinking-water quality guideline values, uncertainty factoes were applied to the lowest NOAEL or LOAEL for the response considered to be the most biologically significant and were determined by consensus among a group of experts using the approach outline below:

Source of uncertainty	Factor
Interspecies variation(animals to humans)	1-10
Intraspecies variatio (individual variations)	1-10
Adequacy of studies or database	1-10
Nature and severity of effect	1-10

Inadequate studies or databases include those that used a LOAEL instead of a NOAEL and studies considered to be shorter in duration than desirable. Situations which the nature or severity of effect might warrant an additional uncertainty factor include studies in which the end-point was malformation of a fetus or in which the end-point determining the NOAEL was directly related to possible carcinogenicity. " . The total uncertainty factor should not exceed 10000.

(2) Assesment of Carcinogenic Risks

On the basis of the available evidence of long-term animal studies, sometimes of exposure in humans, IARC(3) or EPA categorize chemical substances as regards to their potential carcinogenic risk (Table 4-6).

IARC	EPA	
Group 1	(Group A):	the agent is carcinogenic to humans
Group 2A	(Group B):	the agent is probably carcinogenic to humans
Group 2B	(Group C):	the agent is possibly carcinogenic to humans
Group 3	(Group D):	the agent is not classifiable as to its carcinogenicity to humans
Group 4	(Group E):	the agent is probably not carcinogenic to humans

If chemicals are classified as human (Group 1) or probable human (Group 2A) carcinogen, mathematical models are used to estimate upper bound excess lifetime cancer risk. Upper bound excess lifetime cancer risk estimates may be calculated with the models such as the one-hit, Weibull, logit, probit, or multistage models (4). The U.S. EPA generally uses the linearized multistage model, which uses dose-response data from the life time exposure carcinogenic study. In the case of drinking water, for example, the values are determined the concentration in drinking-water associated with a theoretical upper bound excess life-time cancer risk of 10^{-4} (concentration predicted to contribute one additional cancer case per 100,000 of the population for 70 years), 10^{-5} and 10^{-6}.

Syanide

For calculation of standard value, the effects of acute toxicity were mainly considered. There were not so many of toxicological studies which are suitable to consider effects on humans. The lethal dose of cyanide in oral is 150mg-300mg KCN/body, namely 60-120mg CN/body, based on an incident of human absorption or several results in animals. From these data, the LOAEL could be described about 2mg/body. People would be drink 500ml once so that the permissible value of drinking water was calculated as 1mg/l. For human health, cyanide should not be detected in public water and groundwater. The lowest detectable concentration of cyanide by recomended method in law is 0.1mg/l. In the Water Quality Standards for Drinking Water and the Standard of Fisheries Water, the standard value was 0.01mg/l. It was pointed that its concentration, 0.1mg/l, was not enough to protect human health and aquatic lives. However, syanide of Complex forms with metal, which are less farmful, are also detected by the method recomended in the Environmental Quality Standards for Water Pollution. If the concentration in the environment was 0.1mg/l, it would not occur trouble actually. Cyanide would be destroyed in short time in the river or sea. From these, the standard value was determined as "not detectable", which means "less than 0.1mg/l" in total of cyanide ion and complex forms with metal.

Total Mercury and Alkyl Mercury

For calculation of standard value, the effects of chronic toxicity were considered. Long-term exposure of alkyl mercury compounds causes the onset of neurological damage. So, alkyl mercury, especially methyl mercury, would be expected not to detect. It is difficult to remove it and to destroy in process for drinking water. From these, the standardvalue was determined as "not detectable", which means "less than 0.0005mg/l".
This concentration means the quantitative limit by recomended method in the law.

Cadmium

For calculation of standard value, the effects of chronic toxicity were considered. Cadmium co-moves with zinc at the ratio of about 1:100 in surface water and ground water, so that drinking water usually contains cadmium less than 0.01mg/l in according to the level of zinc. The absorbed cadmium was almost excreted, but accumulated cadmium has a long biological half-life in human about 10 ~ 30 years. Assuming that an absorpting ratio of dietary cadmium was 5% and a daily excretive ratio was 95% of body burden, a total intake of cadmium should not exceed 0.05mg/body. From the allocation of the TDI to drinking water, the concentration in drinking water should be less than 0.01mg/l. Although there are a few data about an accumulation of cadmium to the lives of environment, this standard value would not be trouble for human health and lives in the environment.

5. The Environmental Quality Standards for Protecting the Living Environment

25 items listed in the Environmental Quality Standards for Protecting the Living Environment had a lot of effect on human health, but these were detected at low level in public water. However, it was important that we should continue to collect the data about health effects and to monitor the concentration in public water. For these items, the target values were recomended to keep the concentration (Table 4-2). Chloroform, for instance, was used a lot. And chloroform is a disinfection by-product and it is one of the standard items in the Water Quality Standards for Drinking Water. Fluoride originates from natural sourse in the high proportion of the environmental content. The concentration of nitate and nitrite might be depended on the quantity of pesticide used. These items are difficult to consider how to lower the concentration in public water. For these reasons, these items are listed in the Environmental Quality Standards for Protecting the Living Environment.

6. Application of the Environmental Quality Standards for Protecting Human Health

The protection of human health should be given top priority to all. The effects on human health would be understood on the basis of the total influence of drinking water, ingestion of fish and shellfishes, and the circulation of water between hydrosphere and atmosphere and so on. From these idea, the Environmental Quality Standards for Protecting Human Health should be applied uniformly to all public waters.
The concentration of these items in public waters should be always maintained below the level of standard values regardless of the conditions of utilization, the site of pollution source, and the quantity of water. Waterer from rivers and lakes is used for a source of drinking water, there is the risk to absorb these compounds through tap-water contaminated without removing or degradation in process of drinking water. In the other area, there is risk also to ingest these items through fish and shellfishes. According to the application of the Environmental Quality Standards for Protecting Human Health with these idea, it is expected to decrease the risk for aquatic organism and to protect the environmental water pollution with harmful compounds.

7. The Evaluation of Achievement of the Environmental Quality Standards for Protecting Human Health

The standard methods are shown in Table 4-1. The quantitative limit will become lower according to a development of analytical methods and to an improvement of instrument. The quantitative limits of the items, excetp total syanide, total mercury, alkyl mercury and polychlorobiphenyl, are decided to detect the concentration of one-tenth of the standard values.

The standard values mean the average through a year. The standard values are determined with regard to consider the health effects during a long-term ingestion. If the detected values exceed a little the standard values transitionally, it might be not so serious condition. Because the counterplane would be performed to keep the level below the standardvalues on basis of the safety program. Namely, the Environmental Quality Standards for Protecting Human Health is based on the idea that the quality of water for long term should be continued to keep safety at the standard values on an average.

But the quantitative limit of total syanide is decided to have to be evaluated with the maxmal value in according to considering the effects of acute toxicity. The detected value should be less than 0.1mg・l^{-1} every time through a year. The standard values of total mercury, alkyl mercury and polychlorobiphenyl are determined as "not detectable". So, the quantitative limit of the detectable values of total mercury, alkyl mercury and polychlorobiphenyl should be less than 0.0005mg・l^{-1} every time through a year.

The standard values do not mean that the condition polluted at this concentration is permitted. It is important that the good quality of water is kept on the good condition below the level of the Environmental Quality Standards for Protecting Human Health and that the quality of water should be improved as clean as possible. When the detected values exceed the standard values transitionally, it is necessary that the cause should be investigated and that the monitoring of the subsequent level should be continued. Additionally, if necessary, we should consider and perform a suitable counterplane.

8. Achievement Frequency

Recently, the quality of public water and goundwater tends to become better and better. Especially, parameters about health items in the Environmental Quality Standards for Protecting Human Health are almost less than the levels of the standard values in most aera.

In 1995, 294,491 samples at 5,471 points (3,973 points at rivers, 260 points at lakes and 1,238 points at sea) were monitored. The ratio of the samples exceeded the standard values was 0.79% (Table 4-3, Table 4-4, Table 4-5). The ratio was 0.85% in 1994, 0.58% in 1993. The number of points, where arsenic was exceeded the standard value, resulted in increasing of the frequency of exceeded points. Cadmium, total syanide, lead, arsenic, dichloromethane, 1,2-dichloroethane, tetrachloroethylene and serenium are also items exceeded the standard values.

References

1. Hayamizu, T. (1993) J. Japan Society on Water Environment, 16, 2-8.
2. Guidelines for drinking-water quality (1996) 2nd Ed. World Health Organization.
3. International Agency for Research on Cancer (1992) Lyon, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol.54.
4. U.S. EPA (1986) Guidelines for Carcinogen Risk Assesment. Fed. Regis. 51 (185): 33992-34003.

Table 4－1 Environmental Quality Standards for Water-Items Related to the Protection of Human Health

Items	Standard Value	Method
Cadmium	less than 0.01mg・l^{-1}	Frame Atomic Absorption Spectrometric Method
		Electrothermal Atomic Absorption Method
		Inductively Coupled Plasma Method
		Inductively Coupled Plasma/Mass Spectrometric (MS) Method
Total Cyanide	not detectable(*1)	Pyridine-Pyrazolone Colorimetric Method
		Pyrrolidine-4-Carbonic acid/Pyrazolone Colorimetric Method
Lead	less than 0.01mg・l^{-1}	Frame Atomic Absorption Spectrometric Method
		Electrothermal Atomic Absorption Method
		Inductively Coupled Plasma Method
		Inductively Coupled Plasma/Mass Spectrometric (MS) Method
Hexavalent Chromium	less than 0.05mg・l^{-1}	Diphenylcarbazide Colorimetric Method
		Frame Atomic Absorption Spectrometric Method
		Electrothermal Atomic Absorption Method
		Inductively Coupled Plasma Method
		Inductively Coupled Plasma/Mass Spectrometric (MS) Method
Arsenic	less than 0.01mg・l^{-1}	Hydride Generation/Atomic Absorption Spectrometric Method
		Hydride Generation/Inductively Coupled Plasma Method
Total Mercury	less than 0.0005mg・l^{-1}	Cold-Vapor Atomic Absorption Spectrometric Method
Alkyl Mercury	not detectable(*2)	Liquid-Liquid Extraction/Gas Chromatographic Method (Electron Capture Detector)
Polychlorobiphenyl	not detectable(*2)	Liquid-Liquid Extraction/Gas Chromatographic Method (Electron Capture Detector)
Dichloromethane	less than 0.02mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method
		Purge and Trap Gas Chromatographic Method (Flame Ionization Detector)
		Head-space Gas Chromatographic/Mass Spectromeric Method
Tetrachloroethane	less than 0.002mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method
		Purge and Trap Gas Chromatographic Method (Electron Capture Detector)
		Head-space Gas Chromatographic/Mass Spectromeric Method
		Head-space Gas Chromatographic/Mass Spectromeric Method(Electron Capture Detector)

Table 4－1 Environmental Quality Standards for Water-Items Related to the Protection of Human Health (continued)

1,2-Dichloroethane	less than 0.004mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method Purge and Trap Gas Chromatographic Method (Electron Capture Detector) Purge and Trap Gas Chromatographic Method (Flame Ionization Detector) Head-space Gas Chromatographic/Mass Spectromeric Method
1,1-Dichloroethylene	less than 0.02mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method Purge and Trap Gas Chromatographic Method (Flame Ionization Detector) Head-space Gas Chromatographic/Mass Spectromeric Method
cis-1,2-Dichloroethylene	less than 0.04mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method Purge and Trap Gas Chromatographic Method (Flame Ionization Detector) Head-space Gas Chromatographic/Mass Spectromeric Method
1,1,1-Trichloroethane	less than 1mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method Purge and Trap Gas Chromatographic Method (Electron Capture Detector) Head-space Gas Chromatographic/Mass Spectromeric Method Head-space Gas Chromatographic/Mass Spectromeric Method(Electron Capture Detector) Liquid-Liquid Extraction/Gas Chromatographic Method (Electron Capture Detector)
1,1,2-Trichloroethane	less than 0.006mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method Purge and Trap Gas Chromatographic Method (Electron Capture Detector) Head-space Gas Chromatographic/Mass Spectromeric Method Head-space Gas Chromatographic/Mass Spectromeric Method(Electron Capture Detector) Liquid-Liquid Extraction/Gas Chromatographic Method (Electron Capture Detector)
Trichloroethylene	less than 0.03mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method Purge and Trap Gas Chromatographic Method (Electron Capture Detector) Head-space Gas Chromatographic/Mass Spectromeric Method Head-space Gas Chromatographic/Mass Spectromeric Method(Electron Capture Detector) Liquid-Liquid Extraction/Gas Chromatographic Method (Electron Capture Detector)
Tetrachloroethylene	less than 0.01mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method Purge and Trap Gas Chromatographic Method (Electron Capture Detector) Head-space Gas Chromatographic/Mass Spectromeric Method Head-space Gas Chromatographic/Mass Spectromeric Method(Electron Capture Detector) Liquid-Liquid Extraction/Gas Chromatographic Method (Electron Capture Detector)

Table 4－1 Environmental Quality Standards for Water-Items Related to the Protection of Human Health (continued)

1,3-Dichloropropene	less than 0.002mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method Purge and Trap Gas Chromatographic Method (Electron Capture Detector) Head-space Gas Chromatographic/Mass Spectromeric Method
Thiram	less than 0.006mg・l^{-1}	Liquid-Liquid Extraction/High-Performance Liquid Chromatographic Method Solid Phase Extracton/High-Performance Liquid Chromatographic Method
Simazine	less than 0.003mg・l^{-1}	Liquid-Liquid Extraction/Gas Chromatographic/Mass Spectromeric Method Liquid-Liquid Extraction/Gas Chromatographic/Mass Spectromeric Method (Flame Thermionic Detector) Solid Phase Extracton/Gas Chromatographic/Mass Spectromeric Method Solid Phase Extracton/Gas Chromatographic/Mass Spectromeric Method (Flame Thermionic Detector)
Thiobencarb	less than 0.02mg・l^{-1}	Liquid-Liquid Extraction/Gas Chromatographic/Mass Spectromeric Method Liquid-Liquid Extraction/Gas Chromatographic/Mass Spectromeric Method (Flame Thermionic Detector) Liquid-Liquid Extraction/Gas Chromatographic/Mass Spectromeric Method(Electron Capture Detector) Solid Phase Extracton/Gas Chromatographic/Mass Spectromeric Method Solid Phase Extracton/Gas Chromatographic/Mass Spectromeric Method (Flame Thermionic Detector) Solid Phase Extracton/Gas Chromatographic/Mass Spectromeric Method(Electron Capture Detector)
Benzene	less than 0.01mg・l^{-1}	Purge and Trap Gas Chromatographic/Mass Spectromeric Method Purge and Trap Gas Chromatographic Method (Flame Ionization Detector) Head-space Gas Chromatographic/Mass Spectromeric Method
Selenium	less than 0.01mg・l^{-1}	Hydride Generation/Atomic Absorption Spectrometric Method Hydride Generation/Inductively Coupled Plasma Method

The standard values indicate the average concentratin in the year. But the standard value of the total cyanide means the maximum concentration. " not detectable " means that the concentration is below the quantitative limit measured by standard method in this table.
not detectable(*1):the quantitative limit is 0.1mg・l^{-1}.
not detectable(*2):the quantitative limit is 0.0005mg・l^{-1}.

Table4-2 Monitaring Items and Their Guideline Values

Items	Guideline Value	Water Quality Standards Value for Drinking Water	WHO Drinking Water Guideline Value
Chloroform	less than 0.06mg・l^{-1}	less than 0.06mg・l^{-1}(a)	0.2mg・l^{-1}
trans-1,2-Dichloroethylene	less than 0.04mg・l^{-1}	less than 0.04mg・l^{-1}(a)	0.05mg・l^{-1}
1,2-Dichloropropane	less than 0.06mg・l^{-1}	less than 0.06mg・l^{-1}(b)	0.02mg・l^{-1}
p-Dichlorobenzen	less than 0.3mg・l^{-1}	less than 0.3mg・l^{-1}(b)	0.3mg・l^{-1}(P)
Isoxathion	less than 0.008mg・l^{-1}	less than 0.008mg・l^{-1}(b)	
Diazinon	less than 0.005mg・l^{-1}	less than 0.005mg・l^{-1}(b)	
Fenitrothion(MEP)	less than 0.003mg・l^{-1}	less than 0.003mg・l^{-1}(b)	
Isoprothiolane	less than 0.04mg・l^{-1}	less than 0.04mg・l^{-1}(b)	
Oxine-copper	less than 0.04mg・l^{-1}		
Chlorothalonil(TPN)	less than 0.04mg・l^{-1}	less than 0.04mg・l^{-1}(b)	
Propyzamide	less than 0.008mg・l^{-1}	less than 0.008mg・l^{-1}(b)	
EPN	less than 0.006mg・l^{-1}	less than 0.006mg・l^{-1}(b)	
Dichlorvos(DDVP)	less than 0.01mg・l^{-1}	less than 0.01mg・l^{-1}(b)	
Fenobucarb(BPMC)	less than 0.02mg・l^{-1}	less than 0.02mg・l^{-1}(b)	
Iprobenfos(IBP)	less than 0.008mg・l^{-1}	less than 0.008mg・l^{-1}(b)	
Chlornitrofen(CNP)	–	–	
Toluene	less than 0.6mg・l^{-1}	less than 0.6mg・l^{-1}(b)	0.7mg・l^{-1}
Xylene	less than 0.4mg・l^{-1}	less than 0.4mg・l^{-1}(b)	0.5mg・l^{-1}
Di-2-ethylhexyl phthalate	less than 0.06mg・l^{-1}	less than 0.06mg・l^{-1}(b)	
Boron	less than 0.2mg・l^{-1}	less than 0.2mg・l^{-1}(b)	0.3mg・l^{-1}
Fluoride	less than 0.8mg・l^{-1}	less than 0.8mg・l^{-1}(a)	1.5mg・l^{-1}
Nickel	less than 0.01mg・l^{-1}	less than 0.01mg・l^{-1}(b)	0.02mg・l^{-1}
Molybdenum	less than 0.07mg・l^{-1}	less than 0.07mg・l^{-1}(b)	0.07mg・l^{-1}
Antimony	less than 0.002mg・l^{-1}	less than 0.002mg・l^{-1}(b)	0.005mg・l^{-1}(P)
Nitrate and Nitrite	less than 10mg・l^{-1}	less than 10mg・l^{-1}(b)	50mg・l^{-1}(Nitrate)(*) 3mg・l^{-1}(Nitrite)(P)(*)

Water Quality Standard Value for Drinking Water (a):Standard Items Standard Value
Water Quality Standard Value for Drinking Water (b):Monitoring Items Guigeline Value
WHO Drinking Water Guideline Value (P) : Provisional Value
(*)

$$\frac{\text{Nitrate}}{50} + \frac{\text{Nitrite}}{3} \leqq 1$$

Table 4-3 Number of Points Exceeding Environmental Quality Standards for Water-Items Related to the Protection of Human Health in 1995

Items	Rivers			Lakes and Ponds			Sea Areas		
	a:Number of Points Exceeding ESV*	b:Number of Sampling Points	a/b: Ratio (%)	a:Number of Points Exceeding ESV*	b:Number of Sampling Points	a/b: Ratio (%)	a:Number of Points Exceeding ESV*	b:Number of Sampling Points	a/b: Ratio (%)
Cadmium	1	3,463	0.03	0	253	0	0	1,172	0
Total Cyanide	1	3,170	0.03	0	231	0	0	945	0
Lead	9	3,567	0.25	0	253	0	0	1,182	0
Hexavalent Chromium	0	3,206	0	0	229	0	0	1,073	0
Arsenic	26	3,492	0.74	1	252	0.40	0	1,153	0
Total Mercury	0	3,332	0	0	235	0	0	1,153	0
Alkyl Mercury	0	1,368	0	0	129	0	0	562	0
Polychlorobiphenyl	0	1,798	0	0	116	0	0	616	0
Dichloromethane	3	2,742	0.11	0	150	0	0	739	0
Tetrachloroethane	0	2,815	0	0	161	0	0	736	0
1,2-Dichloroethane	0	2,739	0	0	150	0	1	728	0.14
1,1-Dichloroethylene	0	2,730	0	0	150	0	0	726	0
cis-1,2-Dichloroethylene	0	2,739	0	0	150	0	0	726	0
1,1,1-Trichloroethane	0	2,843	0	0	161	0	0	743	0
1,1,2-Trichloroethane	0	2,738	0	0	150	0	0	727	0
Trichloroethylene	0	3,043	0	0	172	0	0	761	0
Tetrachloroethylene	1	3,047	0.03	0	172	0	0	766	0
1,3-Dichloropropene	0	2,825	0	0	154	0	0	711	0
Thiram	0	2,793	0	0	153	0	0	709	0
Simazine	0	2,817	0	0	153	0	0	702	0
Thiobencarb	0	2,812	0	0	153	0	0	697	0
Benzene	0	2,716	0	0	150	0	0	731	0
Selenium	1	2,696	0.04	0	147	0	0	774	0
Total	41	3,973	1.03	1	260	0.38	1	1,238	0.08

* Environmental Quality Standards Value

Table 4-4 Transition of Number of Points Exceeding Environmental Quality Standards for Water-Items Related to the Protection of Human Health (Assesment in Cnformity to New Environmental Quality Standard Value)

Items	1995			1994			1993		
	a:Number of Points Exceeding ESV*	b:Number of Sampling Points	a/b: Ratio (%)	a:Number of Points Exceeding ESV*	b:Number of Sampling Points	a/b: Ratio (%)	a:Number of Points Exceeding ESV*	b:Number of Sampling Points	a/b: Ratio (%)
Cadmium	1	4,888	0.02	1	4,910	0.02	1	5,171	0.02
Total Cyanide	1	4,346	0.02	1	4,340	0.02	1	4,517	0.02
Lead	9	5,002	0.18	10	5,017	0.20	7	5,174	0.14
Hexavalent Chromium	0	4,508	0	0	4,520	0	0	4,758	0
Arsenic	27	4,897	0.55	28	4,874	0.57	16	5,004	0.32
Total Mercury	0	4,720	0	0	4,722	0	0	4,918	0
Alkyl Mercury	0	2,059	0	0	2,179	0	0	2,267	0
Polychlorobiphenyl	0	2,530	0	0	2,451	0	0	2,463	0
Dichloromethane	3	3,631	0.08	4	3,510	0.11	2	2,496	0.08
Tetrachloroethane	0	3,712	0	1	3,598	0.03	1	2,695	0.04
1,2-Dichloroethane	1	3,617	0.03	4	3,506	0.11	4	2,497	0.16
1,1-Dichloroethylene	0	3,606	0	0	3,496	0	0	2,496	0
cis-1,2-Dichloroethylene	0	3,615	0	0	3,502	0	0	2,497	0
1,1,1-Trichloroethane	0	3,747	0	0	3,639	0	0	2,936	0
1,1,2-Trichloroethane	0	3,615	0	0	3,501	0	0	2,601	0
Trichloroethylene	0	3,976	0	0	3,942	0	0	3,389	0
Tetrachloroethylene	1	3,985	0.03	1	3,942	0.03	1	3,396	0.03
1,3-Dichloropropene	0	3,690	0	0	3,622	0	0	2,608	0
Thiram	0	3,655	0	0	3,593	0	0	2,681	0
Simazine	0	3,672	0	0	3,621	0	0	2,686	0
Thiobencarb	0	3,662	0	0	3,617	0	0	2,691	0
Benzene	0	3,597	0	0	3,496	0	1	2,494	0.04
Selenium	1	3,617	0.03	1	3,583	0.03	1	2,508	0.04
Total	43	5,471	0.79	47	5,516	0.85	33	5,708	0.58

* Environmental Quality Standards Value

Table 4-5 Transition of Disqualified Ratio of Points Exceeding Environmental Quality Standards for Water-Items Related to the Protection of Human Health (Assesment in Cnformity to New Environmental Quality Standard Value)

Items	1995			1994			1993		
	a:Number of Points Exceeding ESV*	b:Number of Sampling Points	a/b: Ratio (%)	a:Number of Points Exceeding ESV*	b:Number of Sampling Points	a/b: Ratio (%)	a:Number of Points Exceeding ESV*	b:Number of Sampling Points	a/b: Ratio (%)
Cadmium	10	21,495	0.05	14	21,794	0.06	10	25,035	0.04
Total Cyanide	1	18,749	0.01	1	18,875	0.01	1	21,636	0
Lead	137	22,053	0.62	138	22,231	0.62	87	24,906	0.35
Hexavalent Chromium	0	18,894	0	0	19,104	0	0	22,061	0
Arsenic	193	20,846	0.93	190	20,861	0.91	143	22,961	0.62
Total Mercury	0(17§)	22,463	0	0(6§)	22,915	0	0(0§)	27,545	0
Alkyl Mercury	0	5,598	0	0	6,216	0	0	6,606	0
Polychlorobiphenyl	0	4,109	0	0	4,012	0	0	3,821	0
Dichloromethane	15	9,992	0.15	17	9,497	0.18	6	4,594	0.13
Tetrachloroethane	0	11,297	0	1	10,917	0.01	1	6,298	0.02
1,2-Dichloroethane	3	9,969	0.03	27	9,502	0.28	9	4,541	0.20
1,1-Dichloroethylene	0	9,954	0	0	9,479	0	0	4,538	0
cis-1,2-Dichloroethylene	0	9,964	0	0	9,487	0	0	4,553	0
1,1,1-Trichloroethane	0	11,647	0	0	11,264	0	0	7,473	0
1,1,2-Trichloroethane	1	9,964	0.01	1	9,487	0.01	0	4,760	0
Trichloroethylene	5	14,519	0.03	6	14,717	0.04	6	12,529	0.05
Tetrachloroethylene	8	14,528	0.06	5	14,716	0.03	1	12,535	0.01
1,3-Dichloropropene	0	9,958	0	0	9,602	0	0	4,361	0
Thiram	0	9,764	0	0	9,462	0	0	4,435	0
Simazine	1	9,800	0.01	3	9,570	0.03	0	4,449	0
Thiobencarb	1	9,804	0.01	0	9,592	0	0	4,541	0
Benzene	1	9,601	0.01	2	9,153	0.02	3	4,242	0.07
Selenium	13	9,526	0.14	11	9,295	0.12	1	4,245	0.02
Total	389	294,491	0.13	416	291,748	0.14	268	242,575	0.11

* Environmental Quality Standards Value
§ Number of sampling points exceeded Environmental Quality Standards Value at 0.0005mg・l^{-1}

Table 4-6 Classification According to Their Carcinogenic Potential

Items	IARC(*1)	U.S. EPA(*2)
Cadmium	2A	D
Lead(Inorganic Lead)	2B	B2
Lead(Organic Lead)	3	B2
Hexavalent Chromium	1	D
Arsenic	1	A
Mercury		D
Dichloromethane	2B	B2
Carbon Tetrachloride	2B	B2
1,2-Dichloroethane	2B	B2
1,1-Dichloroethylene	3	B2
cis-1,2-Dichloroethylene		D
1,1,1-Trichloroethane	3	D
1,1,2-Trichloroethane	3	C
Trichloroethylene	3	B2
Tetrachloroethylene	2B	B2
1,3-Dichloropropene	2B	B2
Simazine		C
Benzene	1	A
Selenium	3	
Chloroform	2B	B2
trans-1,2-Dichloroethylene		D
1,2-Dichloropropane	3	2
p-Dichlorobenzen	2B	D
Diazinon		E
Chlorothalonil (TNP)		B2
Dichlorvos(DDVP)	3	B2
Toluene		D
Xylene		D
Boron		D
Fluoride	3	
Nickel	3	D
Molybdenum		D
Antimony		D