VOL. 20

OUTLINE OF WATER QUALITY SURVEY METHODS AND WATER QUALITY MONITORING

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I. OUTLINE OF WATER QUALITY SURVEY METHODS

1. Introduction

With the Water Pollution Control Law (Law No. 138, 1970), the prefectural governor should always supervise the effect of the water pollution in the Public Use Water Area (Article 15). In addition, the water quality in the Public Use Water Area is investigated to classify the water body into some category with the standards relating the living environment (cf. Table 1), and the industrial effluent is also investigated to establish stricter standards of the effluent as well as to monitor the industrial waste water.

For these purposes, the national water quality survey methods were made and announced to the prefectural governor in 1971 by the director of the Water Quality Bureau, Environment Agency. Therefore, the methods presented here are guidelines available for the surveillance and the investigation of the water quality in the Public Use Water Area, the industrial effluent and so on.

When the yearly measurement program concerned with the Water Quality Survey is made up by the prefectural governor* the methods are to be principally used. (*Article 16)

WATER POLLUTION CONTROL LAW

CHAPTER III SUPERVISING THE EFFECT OF WATER POLLUTION, ETC.

(Regular Supervision)
Article 15

The prefectural governor shall always supervise the effect of water pollution in the Public-Use Water Area.

(Program for measurement)
Article 16

1. The prefectural governor shall establish, after consulting with the chief of the State's local administrative organs, the program for the measurement of water quality in the Public-Use Water Area which belongs to the prefecture (hereinafter to be referred as "Measurement Program").

2. The Measurement Program shall provide, with regards to the measurements conducted by the State or by a local public body as to the water quality in the Public-Use Water Area, the matters to be measured, the location and method of measurement and other necessary items.

3. The State or local public body shall perform the measurement of water quality in the Public-Use Water Area in compliance with the Measurement Program, and notify the results of the measurement to the prefectural governor.

(Publication)
Article 17

The prefectural governor shall publicly announce the state of water quality in the Public Water Area within the prefecture.

Table 1 Environmental Water Quality Standards Items

1. Standards relating to Human Health

Item
Cyanide
Alkyl mercury
Organic phosphorus[2]
Cadmium
Lead
Chromium (sexivalent)
Arsenic
Total mercury
PCB

2. Standards relating to Living Environment

(1) Rivers

Item	pH	Biochemical Oxygen Demand (BOD)	Suspended Solids (SS)	Dissolved Oxygen (DO)	Number of Coliform Groups

(2) Lakes (natural lakes, reservoirs, marshes and artificial lakes with more than 10 million cubic meters of water)

Item	pH	Chemical Oxygen Demand (COD)	Suspended Solids[1] (SS)	Dissolved Oxygen (DO)	Number of Coliform Groups

(3) Coastat Waters

Item	pH	Chemical Oxygen Demand (COD)	Dissolved Oxygen (DO)	Number of Coliform Groups[1]	N-hexane Extracts

Table 2 Effluent Standards (June 21, 1971)

1. Substances related to the Protection of Human Health

Toxic Substances	Permissible Limits
Cadmium and its compounds	0.1 mg/l
Cyanide compounds	1 mg/l
Organic phosphorus compounds (parathion, methyl parathion, methyl demeton and EPN only)	1 mg/l
Lead and its compounds	1 mg/l
Sexivalent chrome compounds	0.5 mg/l
Arsenic and its compounds	0.5 mg/l
Total mercury	0.005
Alkyl mercury compounds	Not detectable
PCB	0.003

[1] By the term "not detectable" is meant that the substance is below the level detectable by the method designated by the Director General of the Environment Agency.

2. Items related to the Protection of the Living Environment

Item	Permissible Limits
pH	5.8 ∿ 8.6 for effluent discharged into public water bodies other than coastal waters 5.0 ∿ 9.0 for effluent discharged into coastal waters
BOD, COD	160 mg/l (daily average 120 mg/l)
SS	200 mg/l (daily average 150 mg/l)
N-hexane extracts	5 mg/l (mineral oil) 30 mg/l (animal and vegetable fats)
Phenols	5 mg/l
Copper	3 mg/l
Zinc	5 mg/l
Dissolved iron	10 mg/l
Dissolved manganese	10 mg/l
Chrome	2 mg/l
Fluorine	15 mg/l
Number of coliform groups (per cc)	3,000 (daily average)

1. The discharge standards in this table are applied to the effluents from industrial plants and other places of business whose volume of effluents per day is not less than 50 m^3.

2. The discharge standards for pH and the content of dissolved iron are not applied to the effluents from industrial plants and other places of business engaged in sulphur mining or processing including mining for iron sulphide ore coexistent with sulphur.

3. The discharge standards for BOD are applied to public waters other than coastal waters and lakes, while the discharge standards for COD are applied only to effluents discharged into coastal waters and lakes.

2. Kinds of Investigations

(1) Surveillance: (a) monitoring the public water bodies in compliance with the environmental quality standards (cf. Table 1), (b) monitoring the industrial waste water in compliance with the effluent standards (cf. Table 2 and/or the local stricter effluent standards established in the prefectural ordinance.

(2) Investigations as to the standards: (a) the investigation for classifying the water body into some category with the living environmental standards (cf. Table 1) (b) the investigation for establishing stricter standards of the effluent by the prefectural governor.

(3) Research on the bottom sedimentation quality

3. Research Items and Times

(1) Surveillance of the water quality in the public use water area and research for classifying the water body.

a) Measurements as to the Environmental Standards.
(i) Nine items of the standards relating to human health (cf. Table 1); four times/day or more once a month,

(ii) Five items with regard to standards relating to Living Environment (cf. Table 1); yearly research (four times/day or more once a month), daily research (thirteen times/day with two hours interval and two days or more/year), supplement research (four days/year at some stations other than those mentioned above.

b) Some other items; items cited in the Table 2 and those available for identifying the water conditions.

(2) Surveillance of the water quality of the industrial effluent and research for establishing stricter standards of the effluent.

a) Measurements as to the effluent standards
(i) substances related to the protection of human health (cf. Table 2) and items related to the protection of the living environment; whenever necessary.

b) Items required for establishing stricter standards of the effluent; four days/year or more.

4. Field Sampling Methods

(1) Stream

a) times; it is necessary to select the sampling times on such conditions that gentle weather continues relatively long in consideration of the low level flow of water volume or water utilization (irrigation).

b) sites; it is desirable to select the sampling point with such characteristics as follows; (i) irrigation point, (ii) a point where the major polluted water intruded into the river is well mixed with the river water and one just before its intrusion, (iii) before and after the junction of two rivers, (iv) the diverstion point of the flow and (v) a supplement point.

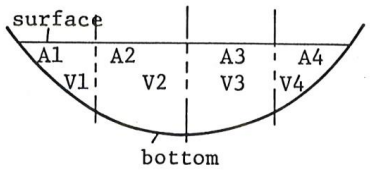
c) Sampling layer: the center of the flow (the layer that is located approximately 20% of the way from the surface to the river bottom.

d) volume: four to five liters for the harmful substances and 500 ml to one liter for the living environmental standards.

e) others: as a routine work, it is desirable to observe the width of the flow, location of the sampling station, the volume and the direction of the flow, the precipitation, the condition of the irrigation and morphology in the neighbourhood investigated and some major pollution point sources located.

f) measurement of the flow volume: in order to estimate the loadings of pollutants, the volume of the flow must be measured as exactly as possible.

(example) $Q = \sum_{n=1}^{n} AnVn = A_1V_1 + A_2V_2 + \text{-----}AnVn.$



where, Q = Flow Volume in m^3/sec, A_n + cross section in m^3 and V_n = mean velocity of the flow in m/sec.

(2) Lake, Reservoirs and sea (bay, coastal water)

a) sampling time and method: it is important to choose the sampling time, stations and layers in consideration of hydrographical and biological conditions such as layering, stagnation period, mixing zone, depth of the thermocline, current, transparency, water temperature and so on.

(3) Industrial Effluent

It is necessary to monitor the water quality of the effluent in consideration of the conditions of operation and seasonal and diurnal variations. The investigation for establishing stricter standards of the effluent is principally carried out together with that for classifying the water body.

5. Analytical Methods

(1) Parameters of environmental standards; examinations method cited in the Environmental Water Quality Standards.

(2) Parameters of effluent standards; examinations cited in Notification No. 21 of the Economic Planning Agency June 21, 1971.

(3) Items other than those mentioned above; examinations authorized scientifically (Japanese Industrial Standard, Tap water examination method, etc.).

II. WATER QUALITY MONITORING

1. Water Quality Survey on Public-Use Water Area

1-1 Program for measurement

In accordance with the provision of the Water Pollution Control Law (article 15), the prefectural governor shall supervise the state of water pollution in the public-use water area.

So he has to establish at the beginning of every year, after consulting with the chief of the State's local administrative organs, t he annual program for the measurement of water quality.

This program provides the matters to be measured, the location and method of measurement and other items, as previously described, then the measurement is performed in compriance with the program by the State or local public body. And the result shall be publicly announced by the prefectural governor.

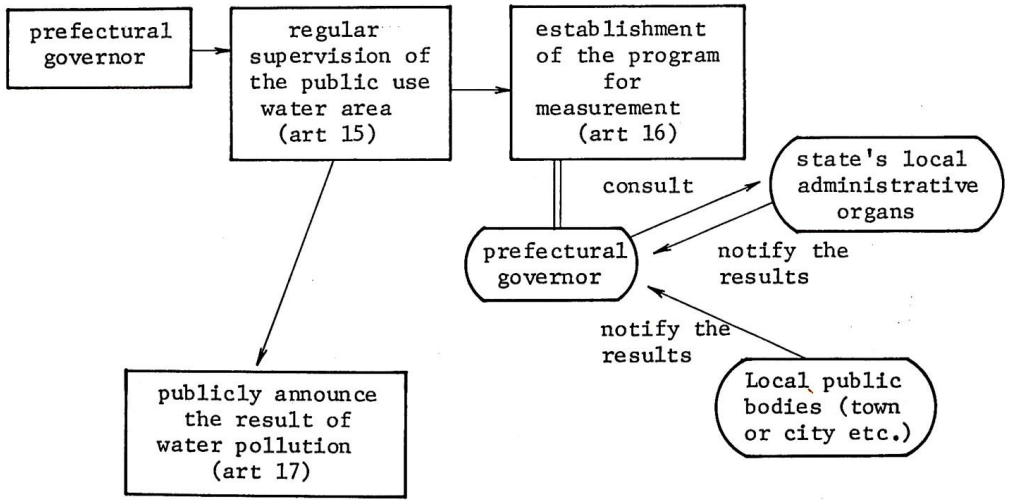


Fig. 1 Program for measurement

The Environment Agency has been subsidizing prefectural governors to perform the measurement of water quality since 1971. (Table-3)

Table-3 Subsidy for Monitoring

Unit: milion yen

Fiscal year	1971	1972	1973	1974	1975	1976	1977
1) Monitoring of the public use water area	110	139	193	231	326	377	415
2) Monitoring of the industrial waste water	8	11	13	15	19	29	39
3) Installation of the automatic water quality monitoring devices	35	53	134	167	156	89	86
4) Installation of the analytical devices in local institute for environmental pollution research	-	-	120	126	117	112	107

Note: subsidy rate 1), 2), → 1/3 3), 4)→ $\frac{1}{3}$ or $\frac{1}{2}$

1-2 Surveyed Spots and Method

Measuring points are 5,079 points 3,471 rivers, 236 lakes and marshes, and 1,372 sea zones) for toxic substances and 5,478 points (3,297 rivers, 264 lakes and marshes, and 1,917 sea zones) for items concerning the living environment in fiscal 1975.

The methods stipulated in an Environment Agency notification were used for analysis. The methods covering mercury were changed on Sept. 30, 1975 with the atomic absorption method (measurable to 0.0005) parts per million -- ppm) introduced to deal with total mercury in place of the dithzone absorption method (effective to 0.02 ppm) making it possible to enforce a limit of 0.0005 ppm in terms of annual average value. Before then, total mercury was simply "not to be detected" under the environmental quality standards.

The combined use of gaschromatography and the thin layer chromatography separation-dithizone absorption method (measurable to 0.001 ppm) to cover alkyl mercury (not to be detected under the standards) was replaced by the combined application of gas chromatography and the thin layer chromatography separation-atomic absorption method (effective to 0.0005 ppm).

1-3 Outline of the result

(1) Health Items

Of the 170,534 samples examined, 291 or 0.17 percent were found to exceed standard values, compared with 0.20 percent in the year before and a proportion which can be rated as signifying general improvement. Alkyl mercury and organic phosphorus were not detected as in the previous year (see table-4)

(2) Living Environment Items

Fulfilment rates regarding the environmental quality standards in water bodies to which zonal classifications for enforcement of the standards are applied -- 1,850 river, 70 lakes and marshes, and 474 sea zones -- in terms of biochemical oxygen demand (BOD) or chemical oxygen demand (COD) are given in Table 5. Figures were 57.1 percent for Rivers, 38.6 percent for lakes and marshes, and 72.4 percent for sea zones. Other than BOD or COD, PH, DO, SS, number of coliform groups and N-hexan extracts were also monitored.

Number of sampling stations for each water management area are given in Table - 5.

Table 4. Number of Samples Exceeding on Health Item

	Fiscal 1974			Fiscal 1975		
	E	F	F/E Ratio (%)	E	F	F/E Ratio (%)
Cyanogen	25,060	16	0.06	26,037	4	0.02
Alkyl Mercury	12,246	0	0	11,695	0	0
Organic Phosphorus	12,304	0	0	10,713	0	0
Cadmium	31,915	119	0.37	32,851	103	0.31
Lead	31,813	118	0.37	31,039	101	0.32
Hexavalent Chromium	25,438	8	0.03	25,722	4	0.02
Arsenic	26,005	71	0.27	28,447	67	0.24
Total Mercury						
Total	164,786	332	0.20	170,534	291	0.17

E: Samples Examined

F: Samples Topping Standard Values

Total Mercury

	Samples Examined (E)	Samples Topping 0.0005 ppm	Exceeding Tolerance Values(P)	P/E Ratio (%)
Fiscal 1974	25,901	50	0	0
Fiscal 1975	29,879	74	0	0

* In case where more than 37 % of tested samples not exceeds 0.0005 ppm, (detection limit) it is deemed that standard for T-Hg is satisfied

Table 5 Environmental Standards Fulfillment Rates (in terms of BOD or COD)

		Rivers (BOD)			Lakes & Marches (COD)			Sea Zones (COD)		
Grades	Period	No.of WBC	No.of WBSS	Rate (%)	No.of WBC	No.of WBSS	Rate (%)	No.of WBC	No.of WBSS	Rate (%)
AA	(1)	194	119	61.3	15	8	53.3			
	(2) (3)	16	1	6.3	3	0	0			
A	(1)	608	450	74.0	17	11	64.7	149	90	65.1
	(2) (3)	227	85	37.4	21	5	23.8	44	18	40.9
B	(1)	178	129	72.5	6	2	33.3	98	77	78.6
	(2) (3)	237	102	43.0	6	0	0	65	38	58.5
C	(1)	45	33	73.3	1	1	10.0	79	78	98.7
	(2) (3)	147	53	36.1	1	0	0	39	35	89.7
D	(1)	10	9	90.0						
	(2) (3)	57	23	40.4						
E	(1)	12	9	75.0						
	(2) (3)	119	37	31.1						
Total		1,850	1,056	57.1	70	27	38.6	474	343	72.4

Notes 1: WBC--Water Bodies in Category
WBSS--Water Bodies Satisfying Standards

2: (1)--achievement immediately, (2)--achievement as soon as possible within five years, (3)--achievement as soon as possible after five years

3: Judgements on whether the environmental quality standards are satisfied or not were made in the following strict ways. (A) In cases where measurements on a water body were taken at plural spots, passing marks were given only when all surveyed places satisfied the standards. (B) It was additionally required that 75 percent or more of average values obtained at respective spots of measurement (normally once a month and 12 times a year) fulfilled the standards.

Table - 6 Monitoring and Surveillance

(1) Percentage of health items not meeting the environmental water quality standards

Monitored Item	1970	1971	1972	1973	1974	1975	Standard	Remark
CN	1.5%	1.2%	0.5%	0.20%	0.06%	0.02%	not detectable	subject water
Cr^{6+}	0.8	0.1	0.07	0.08	0.03	0.02	0.05 mg/1	surveyed
As	1.0	0.4	0.29	0.31	0.27	0.24	0.05 mg/1	1970 - 16,164
Cd	2.8	0.7	0.34	0.32	0.37	0.31	0.01 mg/1	1971 - 89,074
Pb	2.7	1.4	0.70	0.55	0.37	0.32	0.1 mg/1	1972 - 167,368
Total-Hg	1.0	0.3	0.04	0.01	-	-	0.0005 mg/1	1973 - 181,072
Alkyl-Hg	0.0	0.0	0	0	0	0	not detectable	1974 - 164,788
Organic P	0.2	0.2	0	0	0	0	not detectable	1975 - 170,534
Total	1.4	0.4	0.3	0.23	0.20	0.17		

(2) Percentage of living environmental items not meeting the environmental water quality standards
(*anyone of items not meeting environmental quality standards)

Water area	Year	AA type	A	B	C	D	E	*Total	Remark
River	1971	21.4	22.2	22.0	16.9	18.0	35.2	23.0	
	1972	23.1	24.3	23.8	20.8	15.5	32.0	23.8	subject
	1973	23.4	24.9	24.2	21.5	16.9	32.9	24.5	water
	1974	24.2	23.0	23.3	18.7	13.4	27.1	22.4	surveyed
	1975	22.2	22.6	21.3	17.4	12.5	24.1	21.3	in 1975
Lake	1971	16.7	45.2	49.7	-			43.9	
	1972	36.2	47.2	50.7	4.0			45.3	R:212.211
	1973	34.6	39.6	42.8	56.3			38.5	L: 11.607
	1974	33.4	34.7	48.1	25.3			35.1	S: 78,337
	1975	32.5	39.1	46.2	30.3			38.4	
Sea	1971		23.8	19.6	10.6			17.8	
	1972		20.0	16.4	8.3			15.8	
	1973		20.5	16.2	8.0			16.2	
	1974		18.8	14.0	7.1			16.0	
	1975		18.1	14.2	8.4			16.1	

2. Industrial waste water surveillance

Under the Water Pollution Control Law, the prefectural governor may have his officials enter the specified establishment (or factories) and inspect the specified facility or other related matters. He has also carrying out industrial waste water surveillance.

Frequency of inspection is usually from one to three times per year per establishment.

When officials enter the establishment, they collect waste water and analyze.

The method of measuring waste water is designated by the Prime Minister's Office Order.

After inspection, when quality of the waste water doesn't meet the effluent standards, usually order for improvement of specified facilities may be issued.

Any person who violates the order shall be liable to a fine not exceeding 200,000 yen or penal survitude not exceeding a year.

In 1975, 928 cases of orders for improvement of waste water treatment were issued.

Inspection carried out during the day and during the night was 66,738 and 1,912 individually in 1975.

Table - 7. National subsidy for furnishing analytical equipments of the local institute for environmental pollution research.

Name of equipments	Basic unit price	Subsidy rate
Atomic absorption spectrophoto meter	2,800,000 yen	$\frac{1}{2}$ or $\frac{1}{3}$
Gas chromatograph	2,600,000	
Spectrophotometer	2,000,000	$\frac{1}{2}$ is applied to special area for Pollution Control designated by Article 19 of the Basic Law for Environmental Pollution Control.
Polarograph	2,100,000	
High rate liquid chromatograph	5,400,000	
Total Organic Carbon Analyzer	3,400,000	
Auto analyzer	11,600,000	
Draft	1,100,000	
Mas spectrograph	15,100,000	
Fluorescence X-ray spectrometer	14,500,000	
Non-dispersive infrared spectrometer	2,500,000	
Emission spectroscopic apparatus	12,600,000	
Plasma Asher	2,200,000	
Thermostatic extra shaker, reciprocating type	1,300,000	

3. Automatic Water Quality Monitoring System

3-1 Present status of automatic water quality monitoring system

Water quality monitoring in public-use water bodies with automatic equipment was first started in Sumida and Tama Rivers in 1969. Since then, various types of monitoring and surveillance have been carried out at various points in water areas.

In 1970, National Water Quality Standards were set under the Basic Law for Environmental Pollution Control, subsequently local authorities are obliged to monitor quality of public water to judge wheather the standards are maintained or not. In order to cope with these situation, the Environment Agency has been subsidizing prefectural governors to install automatic water quality monitoring devices since 1971. Until now 77 devices have been installed to monitor water quality in rivers and lakes by the aid of governmental subsidy.

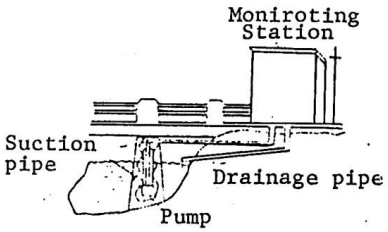
By the way, as it is necessary to measure water quality of river over a long period in order to maintain the normal water flow, the Ministry of Construction has also carried out water quality survey for major 108 river systems.

Water quality monitoring sites with automatic devices which installed by the Ministry of Construction are about 100 sites as of the end of fiscal 1974.

Some local communities such as Kobe city, Fukuoka city, Shiga prefecture, and Tokyo Metropolis etc. and several major rivers have already set up telemetry equipment to facilitate intensive surveillance.

3-2 Outline of monitoring system

The automatic water quality monitoring system which has usually been carried out is shown by figure 1.



Sample water is collected through pipes by a water pump, and automatically measured at the monitoring station which are equipped with sensors and recorders. Some of Monitoring items are Temperature, pH, Conductivity, ORP, DO, Turbidity, Cyanide, COD, Sexivalent Chromium, Oils, Phenol, Chloride and Ammonical Nitrogen. Some of their measuring range and measuring methods using a sensor are listed in Table-8.

Table 8. Specifications of monitoring items using electrode method

Measuring Objective	Measuring Method	Measuring Range	Reproducibility
pH	Glass Electrode	2 - 12 pH	± 0.1 pH
ORP	Metallic Electrode	0 - 1,000 mV & 0 - 1,000 mv	± 20 mV
Conductivity	AC Dipole	0 - 1,000μ/cm or 110 - 10,000 μ/cm	± 2% of full
DO	Galvanic Cell	0 - 10 ppm or 0 - 20 ppm	±2% of full scale
Temperature	Thermister	0 - 50°C	±0.5°C
Turbidity	Light scattering method	0 - 100 ppm 0 - 1,000 ppm	±5% of full scale
Cyanide	Ion electrode	0.03 - 30 ppm	±2 - 5% of full scale

For measuring Cr(VI), Phenol and COD, wet analysis using Chemical agents is used, while for other items, ion electrode method is used.

The Environment Agency started the experimental installation of automatic water quality monitoring system (buoy system) in sea in order to develop monitoring system of marine water quality in 1973. The location is in the Seto Inland Sea and it has telemetry system. Its monitoring items are DO, pH, turbidity, temperature, Chloride etc. The cost of installing such a buoy system is nearly 30 million yen in 1973 which is nearly 2 times expensive as that for monitoring system set in rivers and lakes.

3-3 Problems in automatic water quality monitoring
Following problems are to be solved to promote automatic monitoring,

1) establishment of measuring methods for organic substances especially in coastal water area

2) development of automatic measuring method for total nitrogen and total phosphorus for surveillance of entrophication.

3) development of devices which measure pollutants in terms of total pollutant load.

4) development of sensors which can measure heavy metals

5) establishment of more economical system and more practical system easy to handle and manage.

Year	Month	day	time	temp	pH	Turbidity	Conductivity	COD	CN
73	02	22	0000	17.9	06.5	146	00.5	069	0.03
73	02	22	0030	18.2	06.5	145	00.5	070	0.03
73	02	22	0100	17.8	06.5	153	00.5	070	0.03
73	02	22	0130	17.7	06.6	162	00.5	059	0.03
73	02	22	0200	17.6	06.6	168	00.5	059	0.03
73	02	22	0230	17.6	06.6	155	00.5	078	0.03
73	02	22	0300	18.0	06.6	169	00.5	065	0.03
73	02	22	0330	18.2	06.5	140	00.5	065	0.03
73	02	22	0400	19.2	06.5	131	00.5	076	0.03
73	02	22	0430	18.3	06.5	146	00.5	076	0.03
73	02	22	0500	18.8	06.4	146	00.6	071	0.03
73	02	22	0530	18.1	06.4	141	00.6	071	0.03
73	02	22	0600	18.6	06.4	144	00.6	072	0.03
73	02	22	0630	18.0	06.4	169	00.6	072	0.03
73	02	22	0700	18.5	16.5	460	00.6	069	0.03
73	02	22	0730	18.0	06.5	427	00.6	069	0.03
73	02	22	0800	18.3	06.4	235	00.6	074	0.03
73	02	22	0830	17.8	06.4	153	00.6	074	0.03
73	02	22	0900	17.8	06.6	125	00.6	079	0.03
73	02	22	0930	17.9	06.6	128	00.6	079	0.03
73	02	22	1000	17.7	06.6	108	00.6	080	0.03
73	02	22	1030	17.4	06.6	173	00.6	080	0.03
73	02	22	1100	17.4	06.5	104	00.6	080	0.03
73	02	22	1130	17.7	06.5	108	00.6	080	0.03
73	02	22	1200	17.8	06.5	104	00.6	077	0.03
73	02	22	1230	17.9	06.5	109	00.5	077	0.03
73	02	22	1300	17.9	06.6	100	00.5	076	0.03
73	02	22	1330	18.1	06.6	013	00.5	075	0.03
73	02	22	1400	18.8	06.6	025	00.5	080	0.03
73	02	22	1430	18.9	06.6	027	00.5	080	0.03
73	02	22	1500	19.1	06.5	026	00.5	070	0.03
73	02	22	1530	19.4	06.6	029	00.5	070	0.03
73	02	22	1559	19.0	06.6	034	00.5	083	0.03
73	02	22	1600	19.0	06.6	034	00.5	083	0.03
73	02	22	1630	19.1	08.6	133	00.5	083	0.03
73	02	22	1700	18.9	06.5	136	00.5	098	0.03
73	02	22	1730	19.7	06.5	118	00.5	098	0.03
73	02	22	1800	19.0	06.6	157	00.5	113	0.03
73	02	22	1830	18.8	06.7	110	00.5	113	0.03
73	02	22	1900	19.4	06.8	079	00.6	134	0.03
73	02	22	1930	19.4	06.8	129	00.6	134	0.03
73	02	22	2000	18.9	06.8	116	00.6	135	0.03
73	02	22	2030	19.4	06.9	142	00.6	135	0.03
73	02	22	2100	18.9	06.8	173	00.6	135	0.03
73	02	22	2130	18.8	06.8	184	00.6	135	0.03
73	02	22	2130	18.4	06.7	161	00.6	129	0.03

73	02	22	2200	18.4	06.7	161	00.6	129	0.03
73	02	22	2230	18.4	06.7	175	00.6	129	0.03
73	02	22	2300	18.4	06.7	174	00.6	132	0.03
73	02	22	2330	18.4	06.5	150	00.6	141	0.03
73	02	22	0000	18.6	06.6	184	00.6	141	0.03
73	02	23	0030	18.5	08.6	185	00.6	138	0.03
73	02	23	0100	18.5	06.5	167	00.6	138	0.03
73	02	23	0130	18.4	06.5	320	00.6	148	0.03
73	02	23	0200	18.4	06.5	174	00.6	148	0.03
73	02	23	0230	18.4	06.5	163	00.6	132	0.03
73	02	23	0300	18.6	06.5	157	00.6	132	0.03
73	02	23	0330	19.3	06.6	154	00.6	140	0.03
73	02	23	0400	19.3	06.6	227	00.6	140	0.03
73	02	23	0430	19.5	06.7	223	00.6	136	0.03
73	02	23	0500	19.2	06.7	253	00.6	136	0.03
73	02	23	0530	19.8	06.5	243	00.6	132	0.03
73	02	23	0600	19.2	06.6	241	00.6	132	0.03
73	02	23	0630	19.1	06.5	203	00.6	123	0.03
73	02	23	0700	20.0	06.5	214	00.6	123	0.03
73	02	23	0730	19.1	06.6	211	00.6	118	0.03
73	02	23	0800	19.6	06.6	463	00.6	118	0.03
73	02	23	0830	19.3	06.6	213	00.6	110	0.03
73	02	23	0900	19.2	06.6	180	00.6	110	0.03

Table-9 Example of the result obtained by automatic system in Gakunan channel.

This table shows the fact that COD value is increasing from 18:00 to 9:00 and reminds us that some industries discharge poorly treated waste in the night time.