NOWPAP POMRAC

UNEP

Northwest Pacific Action Plan
Pollution Monitoring Regional Activity Center

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National Reports on River and Direct Inputs of Contaminants into the Marine and Coastal Environment in NOWPAP Region

POMRAC, Vladivostok, Russian Federation
2006

POMRAC Technical Report No. 2

Pollution Monitoring Regional Activity Center of UNEP Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region (POMRAC NOWPAP)

Региональный Центр по мониторингу загрязнения окружающей среды Плана действия ЮНЕП по охране, управлению и развитию морской и прибрежной среды в регионе северо-западной Пацифики (POMRAC NOWPAP)

National Reports on River and Direct Inputs of Contaminants into the Marine and Coastal Environment in NOWPAP Region

POMRAC, Vladivostok, Russian Federation

Национальные доклады о речном и прямом поступлении загрязняющих веществ в морскую и прибрежную среду региона Северо-Западной Пацифики (NOWPAP)

POMRAC, Владивосток, Россия

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Prefase

1. The Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP) and three Resolutions were adopted at the First Intergovernmental Meeting (Seoul, Republic of Korea, 14 September 1994: UNEP(OCA)/NOWPAP/IG.1/5). Resolution 1 identified five areas of priority for implementation of the Action Plan, one of which was NOWPAP/3: Establishment of a collaborative, regional monitoring programme.

2. Following the decision of the 3rd NOWPAP Intergovernmental Meeting, the responsibility for NOWPAP/3 (Regional Monitoring Programme) was jointly shared by the Special Monitoring and Coastal Environmental Assessment Regional Activity Center (CEARAC) and the Pollution Monitoring Regional Activity Center (POMRAC) to carry out regional activities.

3. Pollution Monitoring Regional Activity Center (POMRAC) of UNEP Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region was established by Ministry of Natural Resources and Russian Academy of Sciences in compliance with decision of the 4th Intergovernmental Meeting of NOWPAP Countries (Beijing, People's Republic of China, 6-7 April 1999).

4. The functions of the Pollution Monitoring Regional Activity Center (POMRAC), as set forth by the decision of the 4th Intergovernmental Meeting of NOWPAP Countries, are performed by Pacific Geographical Institute of Far Eastern Branch of Russian Academy of Sciences, directed by Center for International Projects of Ministry of Natural Resources of Russia.

5. Following the results of discussions at the First NOWPAP/3 Meeting (Beijing, China, 21-22 May 2001), the 7th NOWPAP Intergovernmental Meeting (Vladivostok, Russia, 20-22 March 2002) approved the resolution 3.6, "the demarcation of the responsibilities and activities between CEARAC and POMRAC as presented by the secretariat in document UNEP/NOWPAP IG.7/8". Subsequently POMRAC was allocated with the responsibility to implement activities related to Working Group (WG) 1 "Atmospheric Deposition of Contaminants" and WG 2 – "River and Direct Inputs of Contaminants".

6. The 1st Focal Points Meeting of POMRAC (Vladivostok, Russia, 9-11 April 2003) decided that the main task of WG 2 should be to establish regional assessment programs to evaluate river and direct inputs of contaminants into the marine and coastal environment in NOWPAP Region.

7. The First Meeting of NOWPAP Working Groups WG 1 and WG 2 agreed on the structure and content of the National Reports (UNEP/NOWPAP/POMRAC/WG 1 WG2 1/6).

8. The 2nd Focal Points Meeting of POMRAC (Vladivostok, Russia, 26-27 May 2004) adopted the structure and content of the National Reports (see below) and the procedure for the compilation and preparation of National Reports for WG 2.

9. The 2nd 'back-to-back' Meetings of NOWPAP Working Group 1 and Working Group 2 (Vladivostok, Russia, 10-11 October, 2005) have reviewed the National Reports, prepared by NOWPAP Members, provided recommendations on

their harmonization and publishing.

Structure and Content of National Reports on River and Direct Inputs of Contaminants into the Marine and Coastal Environment in NOWPAP Region

1. **Executive Summary**
2. **Introduction**
   - Goals and objectives of this report
   - General background information on NOWPAP (set the report in the context of NOWPAP, short history, decisions)
   - General information/introduction on river and direct inputs of contaminants (what is it, why is it important, relevance to the region etc.)
   - Geographical scope of relevant region of NOWPAP area (geographical coverage of the report, major rivers, coasts, mountains, cities, climatic systems, physical geography etc.)
   - Institutional arrangements for developing this report (who prepared this report)
3. **Social and economic situation in 2001-2002 (**including the historical review for the last decade; short overview of relevant social and economic aspects related to river and direct inputs of contaminants, e.g. population, distribution of communities, anthropogenic activities which cause river and direct inputs of contaminants, transport, energy, industry)
4. **National monitoring and assessment activities** (related to river and direct inputs of contaminants)
   4.1 Overviews of national policies and laws
   4.2 National program(s) (major scientific or administrative programs, actors/organizations etc., institutional framework, regular or irregular activities/projects, and management program including standards)
   4.3 Methodologies and procedures (including equipment used, detection limits and accuracy, QA/QC procedures, characteristics of network)
   4.4 Research activities
   4.5 Training activities and programs
5. **Present situation** of river and direct inputs of contaminants (based on 2002 data) and long term trends, if available
6. **Proposals for future regional activities and priorities in NOWPAP Region**
7. **Conclusion**
8. **Data availability (publications, websites and other information sources**)

10. After harmonization by NOWPAP Countries, final versions of the National Reports (River and Direct Inputs of Contaminants) are published in the mentioned book.

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National Report of Japan
on River and Direct Inputs of Contaminants
into the Marine and Coastal Environment in NOWPAP Region

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National Report of Japan on River and Direct Inputs of Contaminants into the Marine and Coastal Environment in NOWPAP Region

1. Executive Summary

This document is a National report of Japan for Working Group 2 (WG2) based on the decisions of the POMRAC Focal Point Meetings (Vladivostok, Russia, 1st meeting on 9-11, April 2002, the 2nd meeting, 26-27, May 2003). Specifically, this document summarizes the current conditions with regard to pollution loads being discharged into rivers or directly into the marine and the coastal environments in the NOWPAP region.

In this report, the natural environmental factors and the socioeconomic factors are analyzed as an index of human activities that contribute to pollutant loads in the NOWPAP region. Particular emphasis is given to the legal and regulatory remedies in place internationally and in Japan for addressing water pollution issues in rivers systems draining into the NOWPAP region, as well as pollutants discharged directly into the marine environment.

This report also describes the water quality monitoring systems in place within the region, including research activities aimed at improving the interpretation and predictive analysis of monitoring data. There are a total of 16 prefectures facing the NOWPAP region in Japan, though the descriptions in this report cover over 21 prefectures.

The total land surface area of the basin and the total length of the coastline is about 180,000 km^2 and 11,000 km, respectively. The regional coastline and land area accounts for 47% and 32% of the entire coastline and land area of Japan, respectively. The number of major rivers in these basins is 35, and the amount of a total discharge was about 124.7 billion tons/year in fiscal year 2002.

The population of the subject region is 32,170,000 in fiscal year 2002, which accounts for about 25% of the total population of Japan. In the entire subject region, the population growth rate is 1% for the decade of 1990. The domestic wastewater from about 65% of the population of the region has been treated by some form of public sewage treatment system prior to being discharged.

The output of manufactured goods from the related prefectures is up to 30% of the nationwide total for Japan, but industrial output decreased during the 5 years from 1998 to 2002.

In Japan, environmental quality standards are defined by the Basic Environment Law for each type of water body, including rivers, lakes and coastal areas. Effluent standards are defined by the Water Pollution Control Law and the Sewage Law.

Under the nationwide monitoring programs in Japan, each prefecture is responsible for monitoring water quality by measuring various parameters, including heavy metals; chlorinated hydrocarbons; and organic pollution indices, such as COD, BOD, and DO. The prefectures are responsible for conducting these measurements at a frequency of about once a month at the environmental quality standard points in the rivers and coastal areas. The flow rates of the major rivers are also measured; therefore, the pollutant load that flows in the NOWPAP region can be estimated from the water quality concentration and the flow rate data.

In fiscal year 2002, the estimated pollutant load from rivers and direct marine discharge to the NOWPAP region was 126,000 tons/year for BOD. The interannual change of the estimated load of BOD is almost constant or slightly decreasing in the recent years. These pollutant loads are estimated by multiplying the concentrations of each pollutant of interest by the flow rate of the rivers measured near their mouths.

2. Introduction

2.1 Purpose of the Report

The Regional Seas Programme of the United Nations Environment Programme (UNEP) has been promoted as an action-oriented program for management of marine and coastal environments in collaboration with regional countries. As a part of the program, the Northwest Pacific Action Plan (NOWPAP) was adopted at the First Intergovernmental Meeting (IGM) in Seoul, Korea, on September 1994, attended by China, Japan, Korea, and Russia.

The Pollution Monitoring Regional Activity Centre (POMRAC) was established as one of four Regional Activity Centres of NOWPAP. POMRAC Working Group 1 (WG1) focuses on the area of atmospheric deposition, while Working Group 2 (WG2) focuses on water pollution discharged to rivers or directly into the marine environment.

This report introduces the national programs for evaluation of river and direct inputs of contaminants into the marine and coastal environment of the NOWPAP region, which should be useful for assessment by WG2.

2.2 Background (General Briefing on NOWPAP)

For nearly three decades, UNEP has fostered regional cooperation on behalf of the marine and coastal environment. It has accomplished the cooperation by stimulating the creation of “Action Plans”- prescriptions for sound environmental management- for each region. Now, more than 140 coastal countries are participating in 13 Regional Seas Programmes established under

UNEP auspices. Five partner programs are also fully operational.

NOWPAP or, in full, Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region is one of the 'Action Plans' which covers the Northwest Pacific region. The area surrounding the Northwest Pacific is one of the most highly populated parts of the world and is receiving enormous pressures on the environment. The countries of the region, the People’s Republic of China, Japan, the Republic Korea and the Russian Federation participate in NOWPAP by joining forces.

NOWPAP was adopted at the First Intergovernmental Meeting (IGM) in 1994, following a series of meetings of experts and National Focal Point Meetings that started as early as 1991.

The overall goal of the NOWPAP is "the wise use, development and management of the coastal and marine environment so as to obtain the utmost long-term benefits for the human populations of the region, while protecting human health, ecological integrity and the region's sustainability for future generations".

The IGM, made up of senior representatives of the NOWPAP members, provides policy guidance and decision-making for NOWPAP. The plan incorporates seven priority projects to be implemented through a network of Regional Activity Centres (RACs) - CEARAC, DINRAC, MERRAC and POMRAC. The RACs play a central role in coordinating regional activities in specific fields of priority projects. NOWPAP’s Regional Coordinating Unit (RCU), co-hosted by Japan and the Republic of Korea, serves as nerve center and command post of the Action Plan’s activities (Figure 2-1).

The settlement of two RCU office in Toyama City, Japan, and Busan city, Korea was agreed at the 6^{th} IGM in December 2000, and these two offices were established in November 2004.

The activities agreed upon as part of the implementation of NOWPAP are financed principally by contributions from the Members, international organizations and non-governmental organizations to the NOWPAP Trust Fund.

Priority Projects of NOWPAP

NOWPAP 1: Establishment of a comprehensive database and information management system;

NOWPAP 2: Formation of a survey of national environmental legislation, objectives, strategies and policies;

NOWPAP 3: Establishment of a collaborative regional monitoring program;

NOWPAP 4: Development of effective measures for regional cooperation in marine pollution preparedness and response;

NOWPAP 5: Establishment of Regional Activity Centre (RAC) and the network among these centers;

NOWPAP 6: Promotion of public awareness of the marine, coastal, and associated freshwater environments;

NOWPAP 7: Assessment and management of land-based activities.

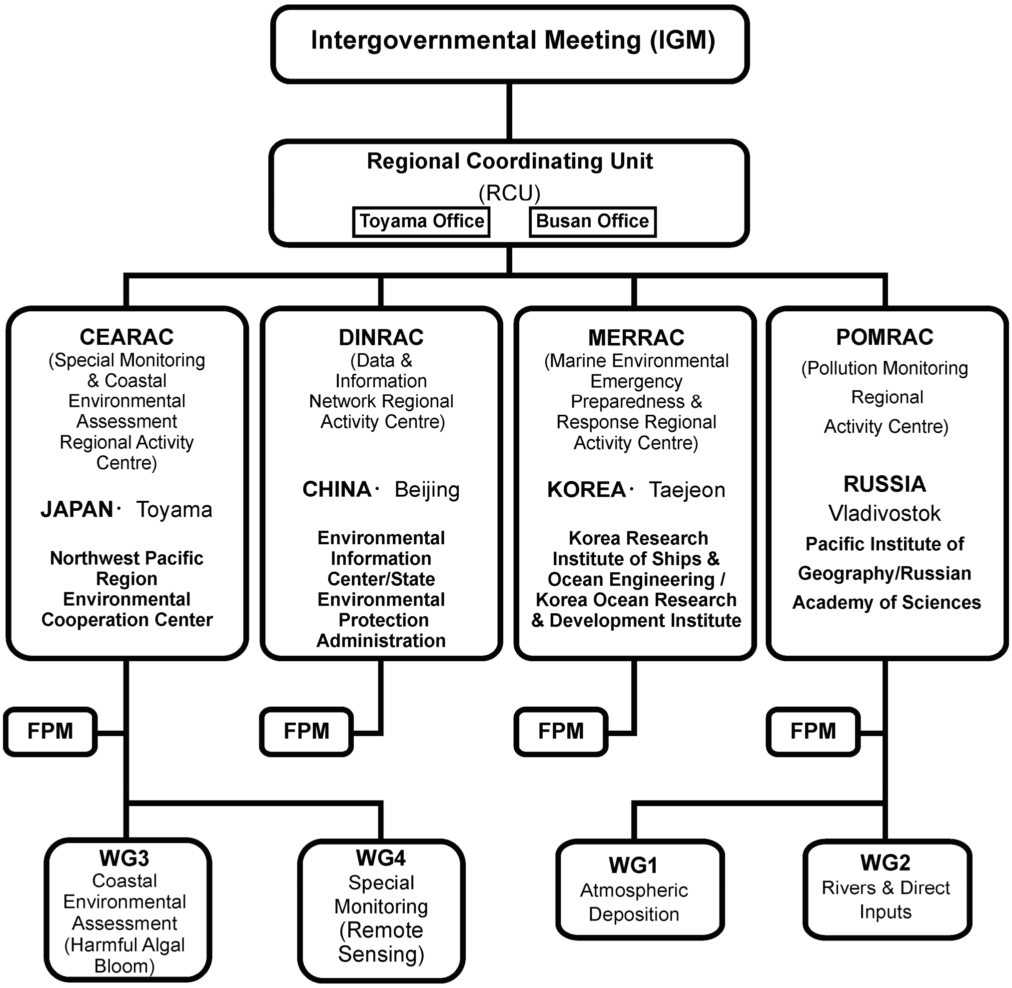


Figure 2-1 NOWPAP Organization

* Focal Points Meeting (FPM) is established for each RAC in order to review and advise the RAC on its activities.

2.3 General Information of River and Direct Pollution Load

Generally, the sources of river and marine water pollution are classified as domestic wastewater, industrial wastewater, and natural loads. The pollutant loads from these sources flow into the sea via the rivers running through urban and rural residential areas, industrial areas, and agricultural regions (the river input). Moreover, a part of the domestic and industrial wastewater, as well as natural loads enters directly into the sea (the direct input). The current situation with regard to river and marine water pollution sources is outlined in the following sections of this report.

2.3.1 Domestic Wastewater

Domestic wastewater is classified into two categories, human sewage (sometimes called night soil) and gray water, wastewater from kitchens, laundries, and bathrooms, excluding human sewage. The human sewage or night soil is treated at a rate of 100%. However, the entire nation rate of treatment of the gray water discharges is only 77.7%, as the ratio of population at the end of 2003, meaning that some percentage of the gray water sources is discharged untreated. The domestic wastewater load has been decreasing because sewage systems are becoming more wide spread and the conversion to the combined processing johkasou[1] (septic tank) from the single processing johkasou. However, pollution due to untreated discharges of domestic wastewater still exists in various areas, though measures like the maintenance of sewage facilities are being developed.

[1] Johkasou - a kind of equipment that consists of some storage tanks for domestic wastewater treatment which are set up on site of a house, a building or small communities, where Municipal sewage systems are not available.

2.3.2 Industrial Wastewater

The Water Pollution Control Law is the basis of the national effluent standards and authorizes prefectures to establish stringent standards in order to regulate wastewater discharged from factories and business establishments into public water bodies. The standards are applied to the factories and business establishments with the "Specified Facilities" defined by cabinet order.

The term "Specified Facilities" in this Law means those facilities that discharge polluted water or wastewater meeting certain condition to be specified by Cabinet Order.

2.3.3 Natural Load

The concept of natural load includes the load of naturally occurring substances flushed intorivers or the seas from the forests, agricultural areas, urban areas, and the atmosphere as a result of rainwater or snowmelt runoff. The control of natural loads from non-point sources is difficult. Therefore, the government is executing an investigation of potentially effective control measures. To reduce the pollution load from non-point sources, a new type of drainage support system and creation of management plans for the aquatic environment have been developed by the government.

2.3.4 Discharge to Sea

Discharge to the sea is controlled according to the *Agreement Concerning the Prevention of Seawater Pollution by the Dumping of Waste and Other Things* (London Convention 1972). Under the domestic legal system, waste discharge to the sea is only permitted to occur in designated areas of the sea and only when one has met the article and the standard prescribed by Waste Management and Public Cleansing Law and Law Concerning the Prevention of Seawater Pollution and Maritime Disasters.

The protocol concerning the amendment of the London Convention of 1972 was adopted in 1996 (the 1996 Protocol). In the protocol, the list (Reverse List), of wastes that will be allowed to be discharged to the sea was adopted in place of the present list of prohibited substances. Also, a Framework on the Assessment of Wastes was introduced that established procedures for managing and assessing the impacts of wastes. The enforcement of the protocol requires that it be ratified or joined by 26 or more countries, including the 15 countries adopting the London Convention. The Japanese government is preparing for the ratification of the protocol, expecting that the bill will become effective within several years.

2.4 Geographical Outline of the NOWPAP Region

2.4.1 Outline of the Subject Area

The subject area of this report consists of the basin areas of the rivers that flow into the NOWPAP region and the adjacent seas (Tsushima, Tsugaru, and Soya straits are excluded). The subject area is shown in Figure 2-2.

The NOWPAP region is a marginal sea surrounded by the Japanese Islands and the Asian continent. The surface area of the NOWPAP region is about 1,000,000 km^2, and average depth of the seas is 1,350 m. The depth of deepest part of the seas is 3,700 m. The straits that connect the NOWPAP region with other seas are shallow, and the depth of both of Tsushima and Tsugaru Straits are shallower than 140 m. The deepest part is about 60 m in the Soya straits and 10 m in the Tatar straits. From these facts, the NOWPAP region is isolated from the Pacific Ocean. Therefore, the NOWPAP region is characterized by the semi-closed basin.

In Japan, there are 21 prefectures within the basin areas that flow into the NOWPAP region.

These prefectures include the following:

(1) Hokkaido;

(2) Aomori Prefecture;

(3) Akita Prefecture;

(4) Yamagata Prefecture;

(5) Fukushima Prefecture;

(6) Niigata Prefecture;

(7) Toyama Prefecture;

(8) Ishikawa Prefecture;

(9) Fukui Prefecture;

(10) Nagano Prefecture;

(11) Gifu Prefecture;

(12) Kyoto-Fu;

(13) Hyogo Prefecture;

(14) Tottori Prefecture;

(15) Shimane Prefecture;

(16) Okayama Prefecture;

(17) Hiroshima Prefecture;

(18) Yamaguchi Prefecture;

(19) Fukuoka Prefecture;

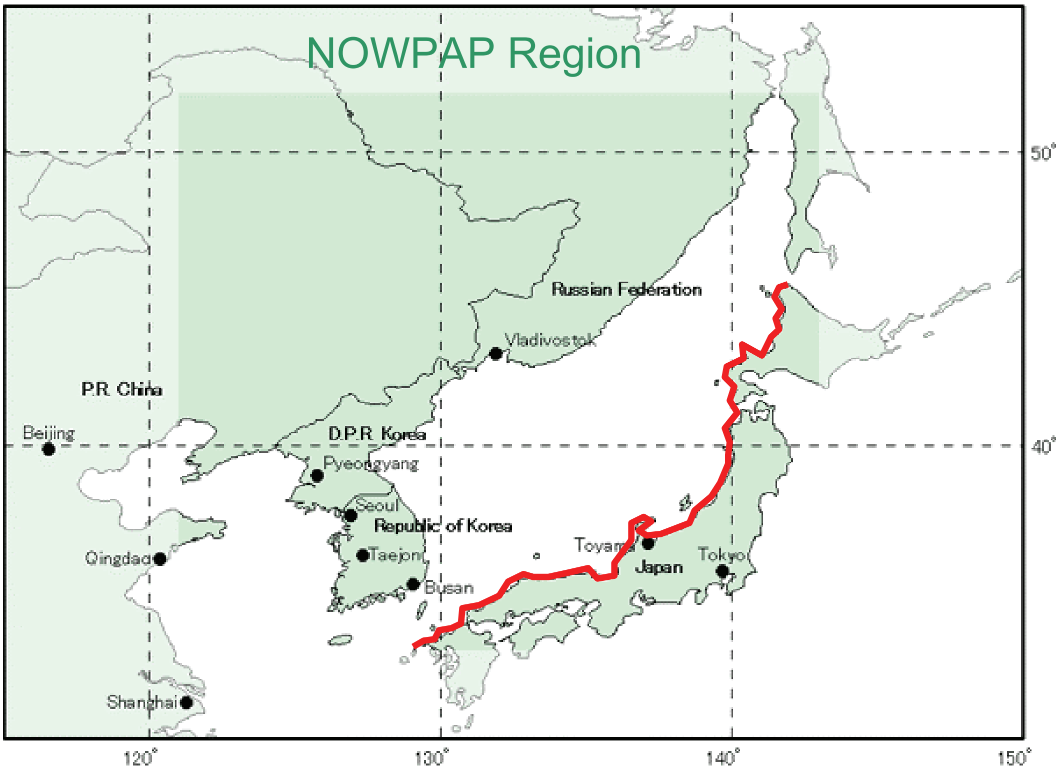
(20) Saga Prefecture;

(21) Nagasaki Prefecture.

In addition, parts of the areas of Fukushima, Gifu, Okayama, Hiroshima, and Nagasaki prefectures are located in mountainous regions at the headwaters of the some of the rivers that flow into the subject region; but these prefectures contribute no pollution loads to the rivers of seas within the subject region. Most of the land areas of these prefectures are drained by rivers that flow into seas that are not part of the NOWPAP region. For example, these prefectures include river basins that flow into the Pacific Ocean, Seto Inland Sea, East China Sea, and others. Therefore, these prefectures were excluded from the subject region.

Figure 2-2 Map of the NOWPAP Region

Note: The black line shows the coastal zone of Japan.



2.4.2 Outline of Regional Area

Table 2-1 summarizes the land area and the lengths of the coastlines of each prefecture with river basins that flow into the NOWPAP region.

The total land area of the prefectures within the basin is about 180,000 km^2, and the coastline is about 11,000 km. These land areas and coastlines account for 47% and 32% of Japan's nationwide totals, respectively. The total land area of Japan is about 380,000 km^2, and the total length of the Japanese coastline is about 34,000 km.

Table 2-1 Area and coastline of each prefecture

Prefecture	Total area (km^2)	Total coastline (km)
Hokkaido	83,454	4,377
Aomori	9,235	744
Akita	11,434	304
Yamagata	7,394	110
Niigata	10,939	585
Toyama	2,802	117
Ishikawa	4,185	581
Fukui	4,189	397
Nagano	12,598	0
Kyoto	4,613	310
Hyogo	8,393	783
Tottori	3,507	144
Shimane	6,707	814
Yamaguchi	6,111	1,398
Fukuoka	4,841	589
Saga	2,439	357
Total	182,841	11,610

(Source: Data of Area: 2002 fiscal year data (Environmental Statistic Data in 2004 fiscal year) Data of Coastline: Annual Report of Maritime Safety (Maritime Safety Agency, September, 1987))

2.4.3 Summary of the Major Rivers

1) Summary of the Discharge Rates of the Major Rivers in the Subject Region.

Table 2-2 summarizes the discharge rates of the major rivers (first class rivers[2] that flow into the NOWPAP region. The rivers with the largest flow rate are

[2] "The first class rivers" means that the Minister of Land, Infrastructure and Transport has given these rivers a special designation because of their economic importance and their importance to land conservation.

observed are located in the eastern and northern parts of Japan. The Shinano River, Ishikari River, Mogami River and Agano River are particularly large rivers and exhibit the largest flow rates.

2) Outline of the Main River Basin

Table 2-3 summarizes the vital information about the main river basins within the object region.

The 35 first class rivers that flow into the NOWPAP region correspond to about 32% of all domestic first class rivers in Japan. The Ishikari River and the Shinano River are noted for being especially large rivers that drain land areas in excess of 10,000 km^2. Most of the rivers that drain into the NOWPAP region are characterized by small watersheds comprising less than 5,000 km^2 and are swift-flowing streams. The main industry in the each basin area is primary industry, i.e. agriculture and forestry. There are few rivers with large-scale industrial zones within the subject region.

Table 2-2 Outline of major river discharge rate (1998)

(m^3/s)

Prefecture	River name	Monitoring point	High water flow	Long-run average water flow	Low water	Average *
Hokkaido	Teshio River	Maruyama	220.61	104.52	74.23	187.59
	Rumoi River	Owada	9.85	3.16	1.60	10.13
	Ishikari River	Ishikari Ohashi	538.32	325.05	226.53	457.87
	Shiribetsu River	Nakoma	62.31	43.56	35.21	58.79
	Shiribeshitoshibetsu	Imakane	26.96	14.35	10.63	21.86
Aomori	Iwaki River	Goshogawara	79.27	61.80	30.67	92.25
Akita	Yoneshiro River	Futatsui	233.17	127.54	86.76	223.59
	Omono River	Tsubakigawa	309.91	167.88	107.84	314.90
	Koyoshi River	Todorokibashi	69.38	44.27	33.84	81.27
Yamagata	Mogami River	Sagoshi	542.18	308.20	181.07	407.67
	Aka River	Hamanaka	114.67	70.05	39.71	98.23
Niigata	Ara River	Tsuzurayama	179.58	89.37	45.95	144.83
	Agano River	Maoroshi	504.52	346.43	169.84	474.56
	Shinano river	Ojiya	555.98	379.00	271.91	404.14
	Seki River	Takada	81.06	41.28	24.59	54.87
	Hime River *	Yamamoto	11.41	3.69	1.76	43.80
Toyama	Kurobe River	Unazuki	33.40	12.44	4.89	84.92
	Joganji River	Kameiwa	19.94	10.84	4.73	14.75
	Jintsu River	Jintsu Ohashi	197.27	136.05	101.75	160.95
	Sho River	Daimon	36.81	20.90	11.05	37.05
	Oyabe River	Nagae	62.06	48.91	38.03	70.50
Ishikawa	Tedori River	Nakajima	112.34	63.30	44.22	80.79
	Kakehashi River	Haneda	20.45	14.04	7.10	19.25
Fukui	Kuzuryuu River	Fukaya	62.82	28.37	16.76	46.92
	Kita River	Takatsuka	12.26	8.15	4.02	4.78
Kyoto	Yura River	Fukuchiyama	62.04	39.65	26.62	46.92
Hyogo	Maruyama River	Fuichiba	38.59	23.65	16.09	34.55
Tottori	Chiyo River	Gyotoku	61.59	39.55	28.80	37.00
	Tenjin River	Koda	22.05	15.51	12.09	13.28
Shimane	Hino River	Kuzumo	24.86	15.52	9.58	22.46
	Hii River	Otsu	42.87	28.56	13.69	39.27
	Gono River	Kawahira	112.53	74.97	56.76	119.18
	Takatsu River	Takatsuno	42.72	28.67	18.25	30.84
Fukuoka	Onga River	Hinodebashi	15.76	9.68	7.00	8.58
Saga	Matsuura river	Mutabe	6.12	3.70	2.38	4.72

Notes: 1 The discharge data of Hime River is from 1994 because the data in 1995 and 1996 were missing.

2) The discharge data of Joganji river, Kuzuryuu river and Hii river are from 1995 because of the data from 1996 were missing.

3) Only average * showed the data in fiscal year 2002.

4) Nagano Prefecture is included in the Shinano river basin. Yamaguchi Prefecture is not in the table because there are no first class rivers that flow from this prefecture into the NOWPAP region.

(Source: Flowing Quantity Chronology, Ministry of Land, Infrastructure and Transport, 1998, Japanese river water quality yearbook, Japan River Society, 2002)

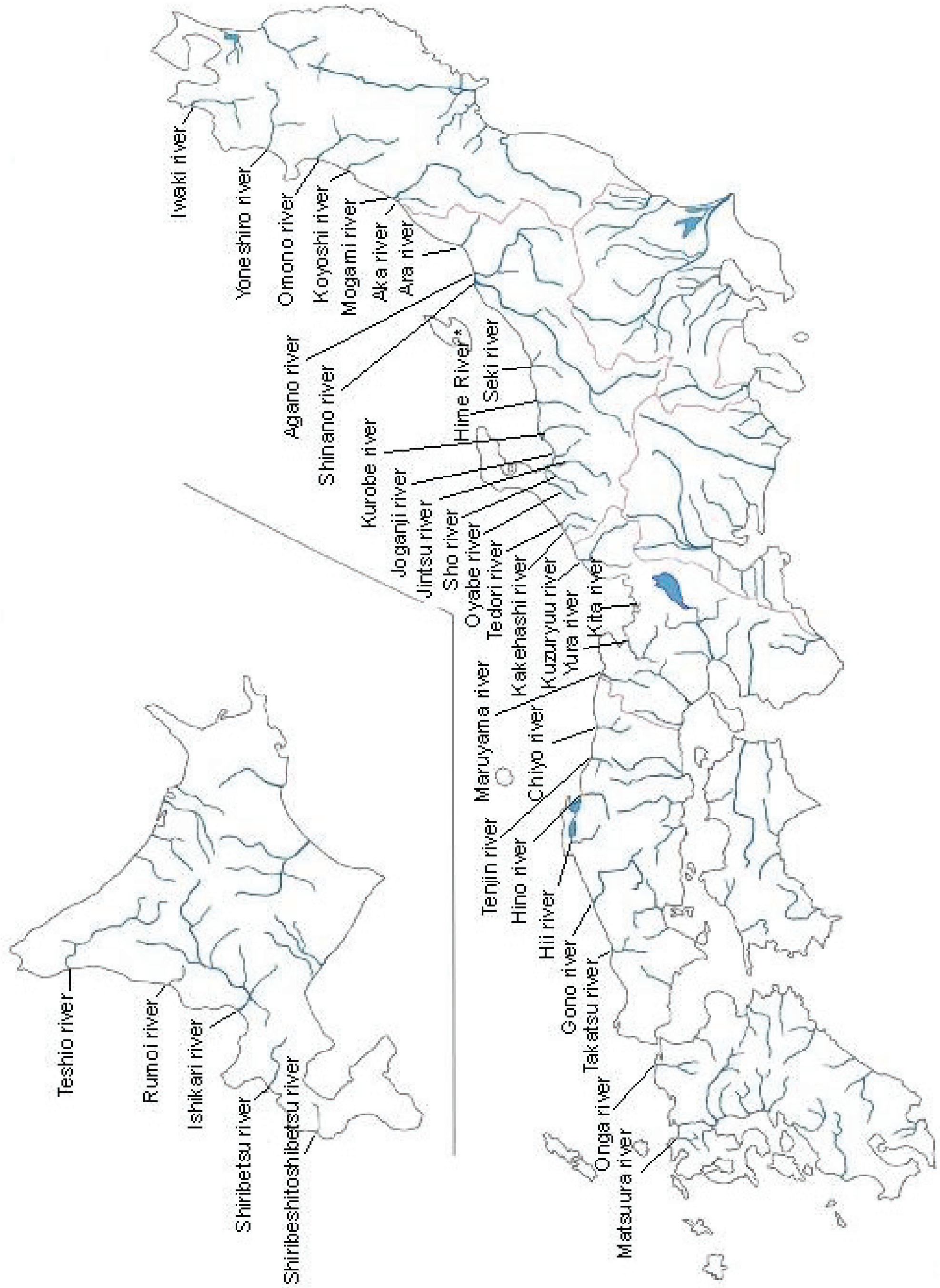


Figure 2-3 Location of the rivers of the NOWPAP region showed in Table 2-2

Table 2-3 Summary of river basin characteristics

River name	Length of trunk river route (km)	Basin area (km^2)	Included number of municipalities	Population (1,000)	Major industry	Amount of industrial shipment (hundred million yen)
Teshio River	256	5,590	2 cities, 10 towns, 1 village	100	Agriculture, forestry and fisheries thing processing industry and dairying	627
Ishikari River	268	14,330	18 cities, 28 towns, 2 villages	3,040	Food, publication, print, and metal manufacture	21,511
Rumoi River	44	270	1 city	30	Agriculture and marine product processing industry	939
Shiribetsu River	126	1,640	6 towns, 3 villages	40	Agriculture	164
Shiribeshitoshibetsu River	80	720	3 towns	10	Agriculture	220
Iwaki River	102	2,540	3 cities, 11 towns	480	Agriculture, metal, and machinery	3,632
Yonesiro River	136	4,100	3 cities, 10 towns, 1 village	2,700	Wood product manufacturing	2,737
Omono River	133	4,710	4 cities, 20 towns, 7 villages	6,700	Chemistry, metallic industry, and wood and food	8,343
Koyoshi River	61	1,190	1 cities, 10 towns	1,000	Agriculture, forestry, and wood and Food Industries	2,878
Mogami River	229	7,040	12 cities, 24 town and village	10,800	Agriculture, electromechanical apparatus, food, and wood	26,214
Aka River	70	857	2 cities, 4 towns, 1 village	110	Agriculture and forestry	4,957
Ara River	73	1,150	1 town	50	Agriculture and forestry livestock industry	770

Table 2-3 (continue)

Agano River	210	7,710	41 cities, towns and villages	420	Agriculture, brewing interest, wood working industry, and electric power industry	19,346
Shinano River	367	11,900	21 cities, 44 towns, 55 villages	3,000	Heavy and chemical industry	75,834
Seki River	64	1,140	2 cities, 3 towns, 8 villages	220	Chemical industry	4,558
Hime River	60	722	1 city, 2 villages	20	Agriculture, forestry, and cement industry	1,205
Kurobe River	85	682	1 city, 3 towns	100	Agriculture, brewing interest, and dynamic engineering	2,712
Joganji River	56	368	1 city, 2 towns, 1 village	30	Metal industry	1,308
Jintu River	135	2,720	2 cities, 7 towns, 9 villages	370	Mine, chemistry, and drug industry	9,812
Sho River	115	1,189	3 cities, 5 towns, 8 villages	30	Machine metallic industry	535
Oyabe River	68	667	4 cities, 6 towns, 1 village	310	Metal and chemical industry	12,468
Tedori River	72	809	1 city, 7 towns, 5 villages	40	Agriculture	1,150
Kakehashi River	42	271	1 city, 3 towns, 1 village	130	Electricity and machinery	2,700
Kuzuryu River	116	2,930	5 cities, 17 towns, 3 villages	650	Textile and agriculture	16,019
Kita River	30	224	1 city, 1 town	20	Agriculture	805
Yura River	146	1,880	4 cities, 12 towns	180	Agriculture and textile industry	6,725
Maruyama River	68	1,300	1 city, 12 towns	160	Sightseeing, agriculture, and leather product	2,177

Table 2-3 (continue)

Chiyo	52	1,190	1 city,	210	Forestry, agriculture,	4,238

River			8 towns, 1 village		and machinery	
Tenjin River	32	500	1 county, 1 city, 4 towns	60	Agriculture and sightseeing	1,034
Hino River	77	860	1 city, 2 counties	60	Agriculture and forestry industry and electromechanical	3,624
Hii River	153	2,070	6 cities, 6 counties	360	Agriculture and electromechanical	6,071
Gono River	194	3,870	3 cities, 25 towns, 4 villages	210	Pulp and food industry	544
Takatsu River	81	1,080	1 city, 6 towns and village	30	Wood working industry, pottery industry, earth and stone, and textile industry, etc.	521
Onga River	61	1,026	6 cities, 25 towns, 1 village	700	The third industry	5,775
Matsuura River	47	446	2 cities, 3 towns and village	100	Agriculture, forestry, pottery industry, and food industry	732

(Source: Japanese River Water Quality Yearbook, Japan River Society, 1998 and Each prefectural statistic data)

2.4.4 Climate Summary

The average values of weather parameters from 1971 through 2000 are summarized in Table 2-4. The climate data presented in this table were referred from the Japanese climate table (Meteorological Agency, 2001). The climate of the NOWPAP region coast in the Japan is characterized by heavy snowfall brought by the humid northwest monsoon in winter.

2.4.5 Current Status of Land Use

Table 2-5 summarizes the current status of land use within the region according to various land-use categories. The largest land use category in each of the prefectures is forestry.

Table 2-4 The average value of climate parameters in the NOWPAP

Region Coast (averaged from 1971 through 2000)

The location of weather station	Average temperature (ºC)	Relative humidity (%)	Annual precipitation (mm)	Maximum snow cover (cm)
Otaru	8.4	72	1218	118
Akita	15.2	73	1713	41
Niigata	13.5	73	1776	39
Toyama	13.7	77	2245	69
Maizuru	19.1	77	1786	37
Matsue	14.6	77	1799	24
Saigo (Oki)	14.0	76	1750	28
Fukuoka	16.6	69	1632	3
Izuhara (Tsushima)	15.5	71	2133	0

(Source: Japanese Climate Table, the Meteorological Agency, 2001)

Table 2-5 Current status of land use according to land categories

Prefectures	Private land area[1] (km^2)	Residential Area	Rice field	Farm land	Forest	Others	Wildlife Park area[2] (km^2)
Hokkaido	27,742	979	2,431	8,611	11,111	4,611	8,629
Aomori	3,940	274	885	730	1,514	537	1,145
Akita	4,279	238	1,314	243	1,858	626	1,232
Yamagata	3,550	241	1,020	352	1,625	313	1,548
Niigata	4,920	434	1,614	369	2,150	353	3,170
Toyama	1,379	225	621	62	378	93	1,198
Ishikawa	1,631	177	423	150	781	100	525
Nagano	4,754	437	680	739	2,259	639	2,785
Fukui	1,557	154	402	53	879	69	614
Kyoto	1,555	208	279	97	877	94	87
Hyogo	3,976	537	744	127	2,297	270	1,660
Tottori	1,341	101	264	160	653	163	491
Shimane	3,234	128	399	169	2,401	136	405
Yamaguchi	3,342	258	501	174	2,227	181	427
Fukuoka	2,839	593	744	294	931	277	881
Saga	1,540	143	458	227	598	114	270
Total	71,580	5,126	12,781	12,558	32,539	8,576	25,066

(Source: Japan Statistic Yearbook 2002, Ministry of Internal Affairs and Communications [1] As of January 1, 2002; [2] As of the end on March, 2002)

2.5 Institutional Arrangement for Developing this Report

This report was prepared by the Northwest Pacific Region Environmental Cooperation Center in cooperation with the Global Environmental Issues Division, the Global Environment Bureau of the Ministry of the Environment.

3. Social and Economic Situation in Recent Years

This section summarizes the current social and economic conditions within the region as they relate to water pollution discharges to the river basins or directly to the marine environment. The general condition of a social economic situation that relate to the river and direct input of pollution in the object region is arranged and shown in the following.

3.1 Population Distribution

The population and the population density of each prefecture for the year 2002 and the population change for the ten-year period from 1990 to 2000 in the subject region are summarized in Table 3-1.

The population of the subject region is 32,166,000, which corresponds to 25.2% of total population of Japan. The average population density in the subject region is 303 people per km^2, which is less than the average density of 340 people per km^2 for the whole country.

The population density in the subject region exhibited an overall growth rate of 1.0% over the ten-year period from 1990 to 2000. Hyogo and Fukuoka Prefectures exhibited an especially large rate of growth of 2 ~ 4%. In contrast, Akita, Shimane, and Yamaguchi Prefecture exhibited a decrease in population density of -2.4 ~ -3.1%.

Table 3-1 Outline of population in object region

(Unit: 1000 people)

Prefecture	Population in 1990	Population in 1995	Year 2000			Population in 2002	Ratio to the whole country (%)
			Population	Population change rate compared to 1990	Population density (per km^2)		
The whole country	123,611	125,570	126,926	2.7%	340	127,435	100.00
Hokkaido	5,644	5,692	5,683	0.7%	73	5,670	4.45
Aomori	1,483	1,482	1,476	-0.5%	154	1,469	1.15
Akita	1,227	1,214	1,189	-3.1%	102	1,176	0.92
Yamagata	1,258	1,257	1,244	-1.1%	133	1,235	0.97
Niigata	2,475	2,488	2,476	0.0%	197	2,465	1.93
Toyama	1,120	1,123	1,121	0.1%	264	1,119	0.88
Ishikawa	1,165	1,180	1,181	1.4%	282	1,180	0.93
Fukui	824	827	829	0.6%	198	828	0.65
Nagano	2,157	2,194	2,215	1.0%	163	2,217	1.74
Kyoto	2,602	2,630	2,644	1.6%	573	2,642	2.07
Hyogo	5,405	5,402	5,551	2.7%	661	5,578	4.38
Tottori	616	615	613	-0.5%	175	612	0.48
Shimane	781	771	762	-2.4%	114	757	0.59
Yamaguchi	1,573	1,556	1,528	-2.9%	250	1,518	1.19
Fukuoka	4,811	4,933	5,016	4.3%	1,009	5,043	3.96
Saga	878	884	877	-0.1%	359	874	0.69
Subtotal	34,019	34,248	34,405	1.0%	303 average	34,383	26.98

(Source: "Census report 2002", "Population estimate annual report 2002", Ministry of Internal Affairs and Communications, Posts and Telecommunications Statistics Bureau Statistics and Survey Department, Statistics Division)

3.2 Population of Major Cities

Table 3-2 summarizes the cities with populations larger than 50,000 in the basin facing the NOWPAP region.

The cities with populations larger than one million are Sapporo City (1,823,000 people), Fukuoka (1,302,500 people), and Kitakyushu (999,800 people). The cities with populations ranging between 300,000 to 500,000 people include

Niigata City, Kanazawa City, Asahikawa City, Nagano City, Toyama City, Akita City, Yamagata City, Fukui City, and Shimonoseki City, in order from largest to smallest.

Table 3-2 Population of major cities in object region

Prefecture and Cities	Population	Prefecture and Cities	Population
Hokkaido		Fukui	
Asahikawa	361,372	Fukui	249,656
Otaru	148,667	Tsuruga	67,888
Sapporo	1,822,992	Takefu	71,183
Ishikari	55,526	Sabae	65,761
Aomori		Nagano	
Hirosaki	176,252	Nagano	359,045
Goshogawara	50,367	Ueda	121,958
Akita		Kyoto	
Noshiro	53,762	Fukuchiyama	67,777
Odate	66,594	Maizuru	93,503
Akita	312,926	Hyogo	
Yamagata		Toyooka	47,802
Sakata	100,534	Tottori	
Tsuruoka	100,000	Tottori	148,357
Tendo	63,032	Yonago	139,333
Yamagata	250,316	Shimane	
Yonezawa	92,330	Matsue	147,909
Niigata		Izumo	86,610
Niigata	514,678	Masuda	50,342
Nagaoka	190,718	Yamaguchi	
Sanjo	85,768	Shimonoseki	246,924
Kashiwazaki	86,085	Fukuoka	
Shibata	81,271	Kitakyushu	999,806
Niitsu	67,624	Fukuoka	1,302,454
Toyosaka	50,288	Nogata	60,434
Joetsu	132,925	Iizuka	80,339
Toyama		Kasuga	106,490
Toyama	321,049	Onojo	90,550
Takaoka	172,257	Munakata	81,887
Himi	57,626	Dazaifu	65,129
Ishikawa		Maebaru	66,260
Kanazawa	439,892	Saga	
Komatsu	109,307	Karatsu	79,795
Kaga	68,134	Imari	59,819
Matto	67,027		

(Source: Basic Resident Register Population Handbook, March 31, 2002, Ministry of Internal Affairs and Communications, Posts and Telecommunications autonomy Local Administration Bureau Section)

3.3 General Industrial Conditions

Table 3-3 summarizes the number of employees working in various industrial categories nationwide in Japan compared with the number of employees in the subject region in the same industrial categories. On a nationwide basis in 2001, the number of employees working in the primary industries is 0.5%, the number of employed people of the secondary industries is about 30%, and the number of employees in the tertiary industries is about 70%. These figures clearly indicate that most employees are concentrated in the tertiary industries.

An especially large percentage of employees work in the service industries and the wholesale business of foods and beverages, each of which industries accounts for 29.3% of all employment, and both industries together account for about 60% of the overall employment. Moreover, it is understood that the number of employees in the primary and the secondary industries has been decreasing over the decade from 1991, whereas the number of employees in the tertiary industries has tended to increase.

The trends observed in the number of employees in the subject region are similar to the employment trends nationwide, i.e. the number of employees has been concentrated in the tertiary industries.

Table 3-4 summarizes value of manufactured goods produced and shipped the individual prefectures within the subject region according to various industrial categories. In the subject region, the amount of manufactured goods produced and shipped from Hyogo prefecture is the largest, followed by Fukuoka Prefecture, in that order. Shimane Prefecture has the smallest industrial output within the region.[3]

Table 3-3 Number of employed people according to industrial category

(Unit: 1000 people)

		Total	Agriculture and forestry fishery	Mining	Construction industry	Manufacturing	Electric gas water service	Transportation/ Communication	Wholesale retail eating and drinking	Finance/ Insurance	Real estate	Service	Official duties
The whole country	1991	60,019	259	78	5,282	14,096	314	3,680	16,913	2,084	923	14,613	1,777
	1996	62,781	260	64	5,775	12,930	341	3,896	18,248	1,976	934	16,508	1,850
	2001	60,158	248 (0.41)	47 (0.08)	4,944 (8.22)	11,134 (18.51)	324 (0.54)	3,756 (6.24)	17,608 (29.27)	1,657 (2.75)	922 (1.53)	17,640 (29.32)	1,877 (3.12)
Hokkaido		2,585	37	5	286	249	15	183	757	71	41	811	131
Aomori		633	8	1	76	78	3	37	183	16	6	190	36
Akita		523	5	1	64	93	3	27	140	12	3	151	22
Yamagata		570	3	1	64	132	3	26	148	16	5	151	22
Niigata		1,178	10	3	145	251	7	62	311	25	9	321	36
Toyama		579	4	1	60	146	5	30	146	14	4	154	15
Ishikawa		601	3	0	58	118	3	34	169	16	6	174	20
Fukui		422	1	0	45	100	5	21	110	10	3	114	13
Nagano		1,078	8	1	107	259	6	51	279	24	13	299	30
Kyoto		1,202	2	1	71	233	6	65	379	30	21	354	40
Hyogo		2,330	4	1	167	475	12	151	699	53	40	662	65
Tottori		280	3	0	30	49	1	15	76	7	2	85	12
Shimane		352	4	1	44	56	2	17	91	9	3	109	16
Yamaguchi		687	3	1	71	121	5	47	190	16	6	199	27
Fukuoka		2,255	5	1	195	286	12	155	739	65	34	692	71
Saga		388	3	0	38	68	3	22	107	9	3	119	16
Object region Total		16,623	109 (0.7)	19 (0.1)	1,626 (9.8)	2,931 (17.6)	98 (0.6)	993 (6.0)	4,772 (28.7)	415 (2.5)	207 (1.3)	4,849 (29.2)	603 (3.6)

(Source: "Office and Corporate, Statistical Investigation" (As of October 1, 2001), Ministry of Internal Affairs and Communications. The values enclosed in parentheses indicate the percentage to compared to the nationwide total or to the total for subject region)

[3] Strictly speaking, the statistic of Hokkaido, Aomori, Kyoto and Hyogo includes the number in the basins that are not faced to the NOWPAP region.

Table 3-5 Number of the specified facilities according to prefecture

Prefecture	Number of the specified facilities in 2002 fiscal year
Hokkaido	7,127
Aomori	5,353
Akita	4,380
Yamagata	4,235
Niigata	10,857
Toyama	3,386
Ishikawa	4,180
Fukui	2,788
Nagano	13,073
Kyoto	4,920
Hyogo	10,700
Tottori	2,465
Shimane	3,875
Yamaguchi	4,781
Fukuoka	6,757
Saga	2,891
Total of the watershed facing the NOWPAP region	91,768
Japan total	296,157

Table 3-4 Amount of manufactured goods produced and shipped from each prefecture (2002 fiscal year)

(Unit: Hundred million yen)

Prefecture	Total	Food	Beverage, cigarette, and fodder	Textile industry product	Clothes and other textile goods	Wood and wood manufacture	Furniture and equipment goods	Pulp, paper, and paper finished goods	Print and Goods concerned	Chemical industrial product	Petroleum product and coal product	Plastic Product
Hokkaido	51,569	17,534	3,964	46	171	1,813	602	4,184	1,618	1,382	4,974	922
Aomori	10,700	2,884	736	3	113	201	54	1,087	218	296	74	128
Akita	12,063	955	415	0	221	746	118	375	165	336	74	198
Yamagata	25,635	2,570	513	153	470	242	326	266	348	1,286	71	563
Niigata	39,309	5,804	766	405	746	432	504	1,654	854	3,122	237	1,281
Toyama	30,761	1,296	500	377	270	738	356	1,374	385	4,228	726	1,599
Ishikawa	21,470	1,449	1,912	812	199	247	418	224	789	1,144	71	525
Fukui	14,930	643	65	903	649	315	188	520	244	1,675	39	1,064
Nagano	50,489	4,697	2,118	72	172	483	385	674	856	1,135	83	1,320
Kyoto	43,729	3,905	5,311	743	385	461	316	927	2,322	1,784	51	1,034
Hyogo	119,079	12,564	5,728	656	767	549	701	3,546	2,058	11,970	2,908	3,213
Tottori	9,751	1,118	1,143	7	243	177	51	846	123	21	40	141
Shimane	9,379	722	181	153	99	346	103	210	183	208	34	188
Yamaguchi	48,354	2,410	443	61	119	484	85	970	388	13,136	7,304	810
Fukuoka	67,386	7,900	4,779	120	359	719	1,292	800	2,376	4,005	438	1,487
Saga	13,403	2,587	486	68	123	178	172	565	226	1,041	33	408
Total	568,007	69,037	29,060	4,579	5,106	8,129	5,672	18,222	13,154	46,768	17,159	14,879

Table 3-4 (continue)

Prefecture	Rubber commodity	Tanned hide, this product, and fur	Pottery industry and earth and stone product	Steel	Nonferrous metals	Metal manufacture	General machine apparatus	Electromechanical apparatus	Telecommunication machine apparatus	Electronic parts and devices	Machine apparatus for transportation	Precision machine apparatus	Other products
Hokkaido	136	67	2,493	1,871	86	2,705	1,311	713	1,214	1,250	2,107	68	337
Aomori	24	10	548	505	74	335	622	684	786	1,007	94	155	64
Akita	87	21	504	178	163	496	570	301	257	4,888	271	588	137
Yamagata	33	210	1,025	191	380	639	2,049	1,711	6,158	4,369	985	364	713
Niigata	143	28	1,338	1,433	544	4,220	4,366	2,238	1,436	4,978	1,195	1,072	512
Toyama	109	15	886	839	2,353	4,592	3,187	544	146	3,977	1,152	95	1,017
Ishikawa	34	3	665	222	264	877	4,426	816	2,583	2,883	571	31	305
Fukui	11	4	730	68	1,032	575	757	1,136	232	2,521	598	773	187
Nagano	152	109	1,138	326	666	1,756	6,744	5,408	7,548	7,999	3,022	3,139	488
Kyoto	106	90	1,898	395	712	1,319	3,567	4,676	853	3,238	4,734	1,644	3,259
Hyogo	1,372	913	2,946	9,379	2,000	6,778	17,243	12,383	5,904	4,378	8,392	544	2,185
Tottori	17	45	205	74	16	233	352	1,033	931	2,764	116	17	40
Shimane	63	10	548	989	105	264	947	257	2,305	979	353	95	34
Yamaguchi	866	3	1,911	4,136	802	1,319	2,107	589	2	1,765	8,267	214	165
Fukuoka	1,461	48	3,330	5,015	594	3,628	3,942	2,345	531	4,314	17,272	120	512
Saga	595	76	582	159	330	925	1,176	1,312	132	433	1,214	17	567
Total	5,206	1,652	20,748	25,780	10,123	30,663	53,364	36,146	31,016	51,744	50,342	8,935	10,521

Figure 3-1 illustrates the change over the ten-year period between fiscal years 1998-2002 in the amount of the manufactured goods produced and shipped from the regional prefectures and the nationwide total of industrial output. As indicated in this figure, the amount of the manufactured goods produced and shipped from prefectures within the subject region accounts for about 30% of the nationwide total. The figure also indicates that the valued of manufactured goods has tended to decrease in recent years, both with the subject region and nationwide.

Figure 3-2 illustrates the interannual change in the number of employees. The number of employees in prefectures within the subject region accounts for about 35% of nationwide employment. As with the value of manufactured goods, the number of employees has tended to decrease in recent years, both regionally and nationwide.

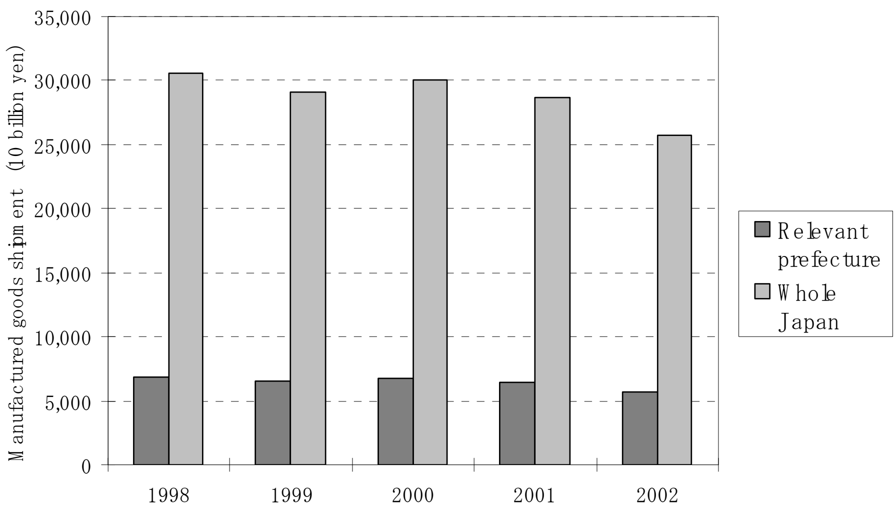


Figure 3-1 Interannual change of the amount of manufactured goods produced and shipped

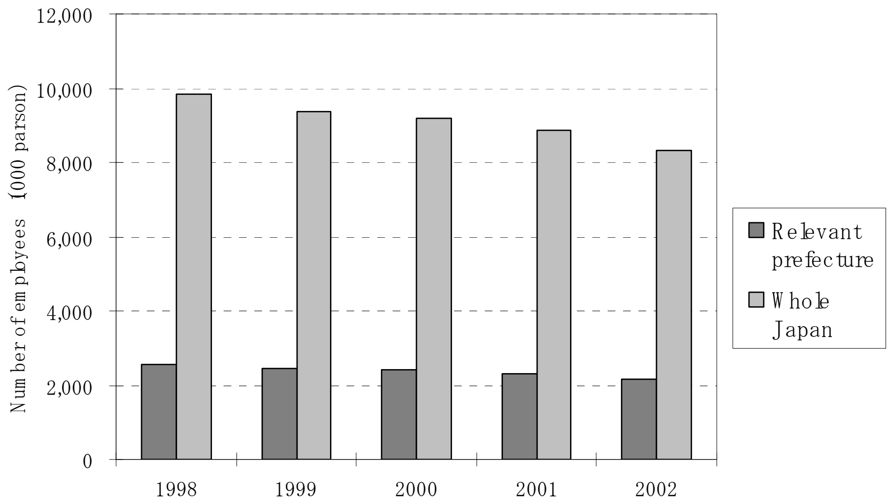


Figure 3-2 Interannual change of the number of employees of manufacturing industry

Figure 3-3 illustrates the per capita value of industrial output in each prefecture in the subject region compared with the nationwide per capita value. The per capita value of manufactured goods is largest in Yamaguchi Prefecture, followed by Toyama Prefecture and Nagano Prefecture, in that order. The smallest per capita value of manufactured good is observed in Aomori Prefecture. Table 3-6 lists the three largest categories of industrial products manufactured in each of the three highest-producing prefectures within the subject region.

Table 3-6 The three largest categories of industrial products manufactured in the three highest producing prefectures within the subject region

Order	Yamaguchi Prefecture	Toyama Prefecture	Nagano Prefecture
1	Chemical industrial product	Metal manufacture	Electronic parts and devices
2	Machine apparatus for transportation	Chemical industrial product	Telecommunication machine apparatus
3	Coal and petroleum product	Electronic parts and devices	General machine apparatus

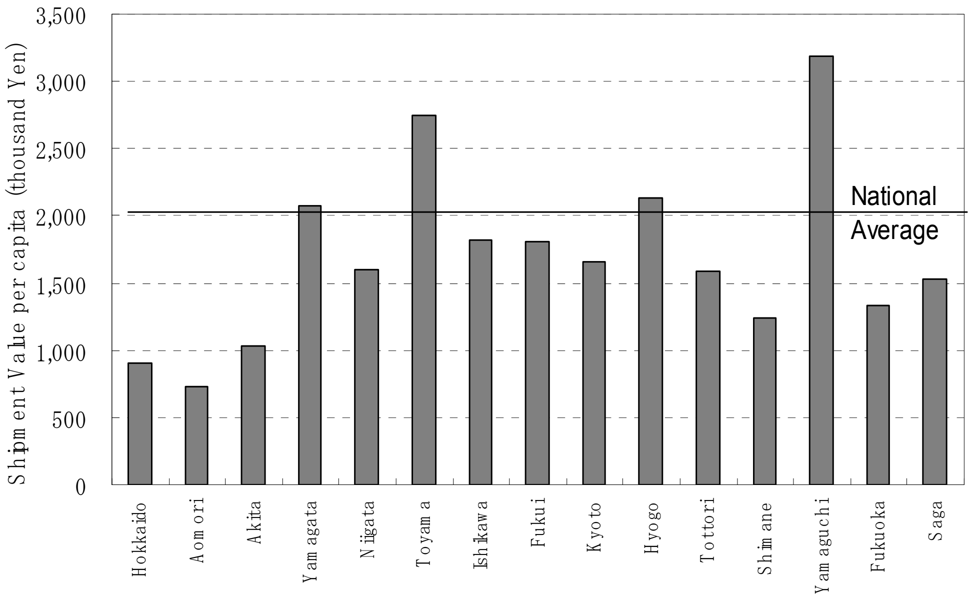


Figure 3-3 Value of manufactured goods per capita (2002 fiscal year)

3.4 Percentage of the Population Supplied with Public Sewage Systems

Table 3-7 summarizes the increase in public sewage systems nationwide in Japan since 1980 and the current extent of sewage systems within the subject region.

The percentage of the population supplied with public sewage treatment systems in Japan increased to 60.3% in 2000, which is double the percentage of 31.2% in 1980. In 2001, approximately 81,262,000 people in Japan were served by public sewage systems. Currently, the total land area of communities or districts served by sewage systems is about 1,250,000, or about 62% of the planned district areas in Japan. However, the land area of districts served by sewage systems is planned to increase to about 2,000,000 ha nationwide. The total number of sewage treatment plants in Japan in 2001 was 1,569. The population provided with sewage treatment in the subject region was 22,530,000 in 2001, which represents about 28% of the total population of

Japan. The developed land area served by public sewage systems in the subject region amounts to about 65% of all developed land, compared with 62% nationwide. There are 763 sewage treatment plants in the subject region, which accounts for 49% of all the treatment plants in Japan.

Table 3-7 The spread of Public Sewage Systems according to prefecture

Prefecture		Public Sewage Systems				
		Present population in districts with sewage system (unit: 1,000)	Planned area of districts with sewage system (ha)	Present area of districts with sewage treatment (ha)	Enforcement rate vs. planned area (%)	Number of sewage treatment terminals
The entire Japan	1980	32,724	909,399	283,646	31.2	439
	1985	41,178	1,048,626	426,627	40.7	568
	1990	53,996	1,326,252	644,957	48.6	744
	1995	66,838	1,668,300	896,561	53.7	997
	2000	78,852	1,965,446	1,186,123	60.3	1,476
	2001	81,262	2,010,290	1,246,640	62.0	1,569
Hokkaido		4,752	135,952	103,702	76.3	166
Aomori		616	26,319	13,178	50.1	19
Akita		466	20,881	13,018	62.3	24
Yamagata		672	24,158	12,386	51.3	29
Niigata		1,164	48,056	26,354	54.8	75
Toyama		708	27,042	17,550	64.9	30
Ishikawa		712	24,921	15,387	61.7	43
Fukui		468	20,182	12,167	60.3	26
Nagano		1,341	66,121	40,583	61.4	90
Kyoto		2,157	36,678	27,217	74.2	32
Hyogo		4,707	105,496	71,713	68.0	104
Tottori		285	11,698	6,812	58.2	29
Shimane		205	11,987	5,925	49.4	20
Yamaguchi		734	31,690	16,778	52.9	32
Fukuoka		3,295	73,746	49,103	66.6	31
Saga		251	13,595	5,628	41.4	13
Object region total		22,533	676,744	433,050	64.6	763
Contribution to entire Japan (%)		27.7%	33.7%	34.7%		48.6%

(Sources: Ministry of Internal Affairs and Communications, Posts and Telecommunications Autonomy; Local Finance Bureau, Financial Intelligence Section, Public Facilities Situation Research)

4. National Monitoring and Assessment Activities

4.1 Overview of National Policies and Laws

The system of relevant statutes governing the discharge of pollutants to rivers or directly to the marine environment is summarized in Table 4-1.

Table 4-1 Relevant statutes concerning the discharge of pollutants to rivers or directly to the marine environment

<table>
<tr><th></th><th>Source</th><th>Category</th><th>Relevant Statute</th><th>Load amount estimation data</th></tr>
<tr><td colspan="5">Environment Basic Law</td></tr>
<tr><td rowspan="4">Municipal wastewater</td><td colspan="2">Public sewage</td><td>Water Pollution Control Law [1]
Sewage Law</td><td rowspan="2">Administrative monitoring</td></tr>
<tr><td colspan="2">The night soil treatment plant</td><td>Water Pollution Control Law [1]
Wastes Management and Public Cleansing Law [3]</td></tr>
<tr><td rowspan="2">Johkasou (Septic tank)</td><td>More than 501 person Johkasou</td><td rowspan="2">Water Pollution Control Law [1]
Johkasou (Septic Tank) Law</td><td>Reported parameter data (monitoring)</td></tr>
<tr><td>Less than 501 person Johkasou</td><td>Basic unit data</td></tr>
<tr><td rowspan="2">Industrial wastewater</td><td colspan="2">Specified facilities [2]</td><td>Water Pollution Control Law [1]</td><td>Written report parameter data
Monitoring (record obligation)</td></tr>
<tr><td colspan="2">Non-specific facilities</td><td></td><td>None data</td></tr>
</table>

Notes: [1] The Water Pollution Control Law.

[2] Place where specified facilities exist.

[3] Waste Management and Public Cleansing Law It includes the regulations of the night soil treatment facilities. The dumping of sewage sludge and night soil to the sea will be prohibited according to the 2003 revision. All of the continuing part of dumping will be prohibited by 2007.

[4] The 1996 Protocol of London Convention. (Principle of the prohibition of discharge to the sea and incineration on the sea), which will come into effect in 2005, and the amended Marine Pollution Prevention Law will be enforced till May 2007.

[5] The Law Concerning the Prevention of Seawater Pollution and Sea Disaster (effluent control of oil, hazardous substance, and waste from ship, marine facility, and aircraft).

Table 4-1 (continue)

	Source	Category	Relevant Statute	Load amount estimation data
Environment Basic Law				
Non-point source wastewater	Natural load	Agriculture	Environment Basic Law (monitoring of public water area)	Basic unit data
		Livestock industry		Land use data
		Natural originating		Industrial, statistical data
	Urban load	Urban area		Land use data according to land category
		City activity		Basic unit according to land category
Ocean Dumping	Municipal waste		London Convention [4] Wastes Management and Public Cleansing Law [3] Marine Pollution Prevention Law [5] Public Water Body Reclamation Law	Water quality monitoring of dumping site
	Industrial waste			
	Dredged soil			
	Vessel waste	Oil, hazardous substance, and waste	Marine Pollution Prevention Law [5]	

Hereafter, the outline of each relevant statute shown in the table 4-1 is described.

1) Environment Basic Law

The "Environment Basic Law", which supplants "The Basic Law for Environmental Pollution Control (1967)", was promulgated as a law that determines the basic principles of environmental conservation policies. This law became effective on 19 November 1993.

The purpose of this law is to comprehensively and systematically promote policies for environmental conservation to ensure healthy and cultured living for both the present and future generations of the nation, as well as to contribute to the welfare of mankind through articulating the basic principles; clarifying the responsibilities of the State, local governments, corporations and citizens; and prescribing the basic policy considerations for environmental conservation.

Under the Environment Basic Law, the Government shall establish a basic plan with regard to environmental conservation (the "Basic Environment Plan") in order to comprehensively and systematically promote the policies for environmental conservation.

Also, under this law, Environmental Quality Standards (EQS) for water pollutants are established as target levels for water quality to be achieved and maintained in the public waters.

A. Environmental Quality Standards (EQS) for the water pollution

Environmental quality standards for water pollution are established to achieve two major goals: protection of human health and conservation of the living environment.

a) Environmental quality standards (EQS) for protecting the human health

The EQS for protecting human health from exposure to various chemical substances are summarized in Table 4-2a. These standards protect human health by setting uniform national standards applicable to all public waters.

In addition, 27 substances relating to the human health are selected for precautionary monitoring in aquatic environments. These substances are described as “Monitoring Substances” and guideline values for each substance are defined. The regulatory status of these monitoring substances is that more data on their health effects needs to be accumulated before EQS are established for them, but their concentrations in the environment should be monitored. The monitoring substances and their guideline values are presented in Table 4-2,b.

Table 4-2,a Environmental Quality Standards for protecting the human health

	Item	Standard value
1	Cadmium	0.01 mg/l or less
2	Total cyanide	not detectable
3	Lead	0.01 mg/l or less
4	Chromium (VI)	0.05 mg/l or less
5	Arsenic	0.01 mg/l or less
6	Total mercury	0.0005 mg/l or less
7	Alkyl mercury	not detectable
8	PCBs	not detectable
9	Dichloromethane	0.02 mg/l or less
10	Carbon tetrachloride	0.002 mg/l or less
11	1, 2-dichloroethane	0.004 mg/l or less
12	1, 1-dichloroethylene	0.02 mg/l or less
13	cis-1, 2-dichloroethylene	0.04 mg/l or less
14	1, 1, 1-trichloroethane	1.0 mg/l or less
15	1, 1, 2-trichloroethane	0.006 mg/l or less
16	Trichloroethylene	0.03 mg/l or less
17	Tetrachloroethylene	0.01 mg/l or less
18	1, 3-dichloropropene	0.002 mg/l or less
19	Thiuram	0.006 mg/l or less
20	Simazine	0.003 mg/l or less
21	Thiobencarb	0.02 mg/l or less
22	Benzene	0.01 mg/l or less
23	Selenium	0.01 mg/l or less
24	Nitrate nitrogen and Nitrite nitrogen	10 mg/l or less
25	Fluorine	0.8 mg/l or less
26	Boron	1 mg/l or less

Note: Standard values are defined as the annual mean value of the each substance that should be achieved. However, the standard value for total cyanide is defined as the one that the maximum value should be achieved.
(Source: Environment Agency)

Table 4-2,b Monitoring substances and guideline values

	Categories	Guideline value
1	Chloroform	0.06 mg/l or less
2	trans-1, 2-dichloroethylene	0.04 mg/l or less
3	1, 2-dichlorpropane	0.06 mg/l or less
4	p-dichlorobenzene	0.2 mg/l or less
5	Isoxathion	0.008 mg/l or less
6	Diazinon	0.005 mg/l or less
7	Fenitrothion (MEP)	0.003 mg/l or less
8	Isoprothiolane	0.04 mg/l or less
9	Oxine copper	0.04 mg/l or less
10	Chlorothalonil (TPN)	0.05 mg/l or less
11	Propyzamide	0.008 mg/l or less
12	EPN	0.006 mg/l or less
13	Dichlorvos (DDVP)	0.008 mg/l or less
14	Fenobucarb (BPMC)	0.03 mg/l or less
15	Iprobenphos (IBP)	0.008mg/l or less
16	Chlornitrofen (CNP)	—
17	Toluene	0.6mg/l or less
18	Xylene	0.4mg/l or less
19	di (2-etylhexyl) phatalate	0.06mg/l or less
20	Nickel	—
21	Molybdenum	0.07mg/l or less
22	Antimony	0.02mg/l or less
23	Vinyl chloride monomer	0.002mg/l or less
24	Epichlorohydrin	0.0004mg/l or less
25	1,4-dioxane	0.05mg/l or less
26	Total manganeses	0.2mg/l or less

Note: CNP and Nickle are monitored but the guideline value of these are pending problem.

b) Environmental quality standards (EQS) for conservation of the living organisms

All public water bodies in the Nation of Japan, including rivers, lakes, reservoirs, and coastal areas are classified based on water usage. EQS values and a schedule of EQS achievement are established for the conservation of living organisms in specific water bodies based on their water use classification.

The EQS standard values for various water quality parameters in different classifications of rivers, lakes, and reservoirs are presented in Table 4-3a,b, and c, respectively. In Japan, the index of organic pollution of river is BOD, and the index of organic pollution of coastal water is COD. The reason of this difference of parameter is as follows. The residence time of river water in Japan is too short and rich in the undecomposed organics, so BOD is thought to be a good index for river water. On the other hand, the lake and coastal water is poor in the undecompsed organics, COD is thought to be a good index for these water rather than BOD.

In addition, water quality parameters related to the conservation of living environment other than those listed in Table 4-3 are also selected for precautionary monitoring in aquatic organisms.

The substances identified for precautionary monitoring are designated as "monitoring substances" for which guideline values are provided as indicators of adaptability of living condition for aquatic life for various types of water bodies, i.e. rivers, lakes and coastal areas. The regulatory status of these monitoring substances is that more data on their environmental effects needs to be accumulated before EQS are established for them; therefore their concentrations in the environment should be monitored. The monitoring substances and their guideline values in rivers, lakes and coastal areas are presented in Table 4-4.

Table 4-3,a Environmental Quality Standards for conservation of the living environment rivers

Class	Item	Standard value				
	Water use	pH	BOD	SS	DO	Total Coliform
AA	Water supply class 1, conservation of natural environment, and uses listed in A-E	6.5-8.5	1 mg/l or less	25 mg/l or less	7.5 mg/l or more	50 MPN/100 ml or less
A	Water supply class 2, fishery class 1, bathing and uses listed in B-E	6.5-8.5	2 mg/l or less	25 mg/l or less	7.5 mg/l or more	1000 MPN/100 ml or less
B	Water supply class 3, fishery class 2, and uses listed in C-E	6.5-8.5	3 mg/l or less	25 mg/l or less	5 mg/l or more	5000 MPN/100 ml or less
C	Fishery class 3, industrial water class 1, and uses listed in D-E	6.5-8.5	5 mg/l or less	50 mg/l or less	5 mg/l or more	-
D	Industrial water class 2, agricultural water, and uses listed in E	6.0-8.5	8 mg/l or less	100 mg/l or less	2 mg/l or more	-
E	Industry water class 3 and conservation of environment	6.0-8.5	10 mg/l or less	Floating Matter such as garbage should not be observed	2 mg/l or more	-

Notes: 1. BOD: Biochemical Oxygen Demand, SS: Suspended Solids, DO: Dissolved Oxygen, MPN: Most Probable Number.
2. Standard values are imposed based on daily averages. Similar criteria are applied to the standard values of the lakes and coastal areas.
3. At intake for agriculture, pH should be between 6.0 and 7.5 and DO shall be higher than 5mg/l. The same criteria are applied to lakes.
3. Standard values are applied to unfiltered sample.

Class	Adaptability of living condition of aquatic organisms	Standard value Total Zinc
Aquatic Organisms A	The water bodies where aquatic organisms, such as char and salmon, (those that prefer comparatively cold water) live as well as their prey.	0.03 mg/l or less
Aquatic Organisms Special A	The water bodies that require special protection, as these are suitable for spawning (breeding areas), and/or nursery places for immature aquatic life that are specified in the column "Aquatic Organisms A".	0.03 mg/l or less
Aquatic Organisms B	The water bodies where aquatic life such as carp and crustaceans that prefer comparatively warm water live as well as their prey.	0.03 mg/l or less
Aquatic Organisms Special B	The water bodies that require special protection, as these are suitable for spawning (breeding areas), and/or nursery places for immature aquatic life that are specified in the column "Aquatic Organisms B".	0.03 mg/l or less

Notes: 1. Standard values are imposed on the annual mean. Same criteria are applied to the lakes and coastal areas.
2. Standard values are applied to unfiltered sample.

Table 4-3,b Environmental Quality Standards for conservation of the living environment lakes (natural lakes and reservoirs with volumes exceed $10x10^6$ m^3)

Class	Item	Standard value				
	Water use	pH	COD	SS	DO	Total Coliform
AA	Water supply class 1, fishery class 1, conservation of natural environment, and uses listed in A-C	6.5-8.5	1 mg/l or less	1 mg/l or less	7.5 mg/l or more	50 MPN/100 ml or less
A	Water supply classes 2 and 3, fishery class 2, bathing, and uses listed in B-C	6.5-8.5	3 mg/l or less	5 mg/l or less	7.5 mg/l or more	1000 MPN/100 ml or less
B	Fishery class 3, industrial water class 1, agricultural water, and uses listed in C	6.5-8.5	5 mg/l or less	15 mg/l or less	5 mg/l or more	-
C	Industrial water class 2 and conservation of the environment	6.5-8.5	8 mg/l or less	Floating matter such as garbage should not be observed	2 mg/l or more	-

Notes: 1. COD: Chemical Oxygen Demand, SS: Suspended Solids, DO: Dissolved Oxygen.
2. Standard values are applied to unfiltered sample.
3. The analysis method of COD is $KMnO_4$ method.

Table 4-3,b (continue)

Class	Item	Standard value	
	Water use	Total Nitrogen	Total Phosphorus
I	Conservation of natural environment and uses listed in II-V	0.1 mg/l or less	0.005 mg/l or less
II	Water supply classes 1, 2, and 3 (except special types), fishery class 1, bathing, and uses listed in III-V	0.2 mg/l or less	0.01 mg/l or less
III	Water supply class 3 (special types) and uses listed in IV-V	0.4 mg/l or less	0.03 mg/l or less
IV	Fishery class 2 and uses listed in V	0.6 mg/l or less	0.05 mg/l or less
V	Fishery class 3, industrial water, agricultural water, and conservation of the environment	1 mg/l or less	0.1 mg/l or less

Notes: 1.Standard values are the annual mean. 2. Standard values are applicable only to the lakes and reservoirs where phytoplankton bloom may occur and standard values for total nitrogen are applicable to lakes and reservoirs where nitrogen limits phytoplankton growth.
3. Standard values for total phosphorus are not applicable to agricultural irrigation water.
4. Standard values are applied to unfiltered sample.

Table 4-3,b (continue)

Class	Adaptability of living condition of aquatic organisms	Standard value
		Total Zinc
Aquatic Organisms A	The water bodies where aquatic life such as char and salmon that prefer comparatively cool water live as well as their prey.	0.03 mg/l or less
Aquatic Organisms Special A	The water bodies that require special protection, as these are suitable for spawning (breeding areas) and/or nursery places for immature aquatic life that are specified in the column “Aquatic Organisms A”.	0.03 mg/l or less
Aquatic Organisms B	The water bodies where aquatic life, such as carp and crustaceans that prefer comparatively warm water live as well as their prey.	0.03 mg/l or less
Aquatic Organisms Special B	The water bodies that require special protection, as these are suitable for spawning (breeding areas) and/or nursery places for immature aquatic life that are specified in the column “Aquatic Organisms B”.	0.03 mg/l or less

Notes: 1. Standard values are imposed on the annual mean. (Same criteria are applied to the lakes and coastal areas.)
2. Standard values are applied to unfiltered sample.

Table 4-3,c Environmental Quality Standards for conservation of the living environment coastal areas

Class	Item	Standard value				
	Water use	**pH**	**COD**	**DO**	**Total Coliform**	**N-hexan extracts (oil content, etc)**
A	Fishery class 1, bathing, conservation of the natural environment, and uses listed in B-C	7.8-8.3	2 mg/l or less	7.5 mg/l or more	1000 MPN/100ml or less	Not detectable
B	Fishery class 2, industrial water and the uses listed in C	7.8-8.3	3 mg/l or less	5 mg/l or more	-	Not detectable
C	Conservation of the environment	7.8-8.3	8 mg/l or less	2 mg/l or more	-	-

Notes: 1. COD: Chemical Oxygen Demand, DO: Dissolved Oxygen, MPN: Most Probable Number
2. Total coliform should be less than 70MPN/100ml for the fishery of class 1 to the cultivations of oyster for eating raw.
3. The analysis method of COD is $KMnO_4$ method
4. Standard values are applied to unfiltered sample

Class	Item	Standard value	
	Water use	**Total Nitrogen**	**Total Phosphorus**
I	Conservation of the natural environment and uses listed in II-IV (except fishery classes 2 and 3)	0.2 mg/l or less	0.02 mg/l or less
II	Fishery class 1, bathing, and the uses listed in III-IV (except fishery classes 2 and 3)	0.3 mg/l or less	0.03 mg/l or less
III	Fishery class 2 and the uses listed in IV (except fishery class 3)	0.6 mg/l or less	0.05 mg/l or less
IV	Fishery class 3, industrial water, and conservation of habitable environments for marine biota	1 mg/l or less	0.09 mg/l or less

Notes :1. Standard values are the annual mean.
2. Standard values are applicable only to marine areas where marine phytoplankton blooms may occur.
3. Standard values are applied to unfiltered sample.

Table 4-3,c (continue)

Class	Adaptability of living condition of aquatic organisms	Standard value
		Total Zincs
Aquatic Organisms A	The water bodies where aquatic organisms.	0.02 mg/l or less
Aquatic Organisms Special A	The water bodies that require special protection, as these are suitable for spawning (breeding areas) and/or nursery places for immature aquatic life.	0.01 mg/l or less

Note: Standard values are applied to unfiltered sample.

Table 4-4 Parameters to be monitored, waters classifications, and guideline values for the conservation of aquatic organisms

Categories	Water area	Class	Guideline value
Chloroform	Rivers and lakes	Aquatic Organisms A	0.7 mg/l or less
		Aquatic Organisms special A	0.006 mg/l or less
		Aquatic Organisms B	3 mg/l or less
		Aquatic Organisms special B	3 mg/l or less
	Coastal areas	Aquatic Organisms A	0.8 mg/l or less
		Aquatic Organisms special A	0.8 mg/l or less
Phenol	Rivers and lakes	Aquatic Organisms A	0.05 mg/l or less
		Aquatic Organisms special A	0.01 mg/l or less
		Aquatic Organisms B	0.08 mg/l or less
		Aquatic Organisms special B	0.01 mg/l or less
	Coastal areas	Aquatic Organisms A	2 mg/l or less
		Aquatic Organisms special A	0.2 mg/l or less
Formaldehyde	Rivers and lakes	Aquatic Organisms A	1 mg/l or less
		Aquatic Organisms special A	1 mg/l or less
		Aquatic Organisms B	1 mg/l or less
		Aquatic Organisms special B	1 mg/l or less
	Coastal areas	Aquatic Organisms A	0.3 mg/l or less
		Aquatic Organisms special A	0.03 mg/l or less

Note: Standard values are applied to unfiltered sample.

2) Water Pollution Control Law

The purpose of the Water Pollution Control Law is to prevent the pollution of water in public water bodies by regulating effluent discharged by factories or other industrial establishments into surface waters or groundwater, thereby protecting human health and preserving living organisms. For this purpose, the law establishes monitoring procedures to observe the quality of effluent water discharged from factories and other industrial establishments into public water bodies, as well as monitoring water quality conditions within those public water bodies.

A. National Effluent Standards

The national effluent standards are uniformly applied in Japan and consist of two categories, i.e., those for protecting the human health (24 substances including heavy metals, etc) and those for protecting living organisms (16 items).

National effluent standards represent the maximum permissible levels of specific substances that are allowed in the discharge water from the factories and businesses establishments where specified facilities are set up. The regulated substances and permissible limit values established under the effluent standard are presented in Table 4-5a-b.

Where it is judged that the national effluent standard is insufficient to attain the EQS in a certain water body, the governor of the prefecture is authorized to introduce a more stringent standard through a prefectural ordinate.

The legal system limiting total allowable pollutant loads into the designated water bodies was established to improve organic marine pollution in Tokyo Bay, Ise Bay; and the Seto Inland Sea, these are typical semi-closed sea of Japan. This system has been applied to control COD, TN and TP of industrial effluent.

Table 4-5, a Uniform National Effluent Standards

(Items related to the protection of the human health)

	Substance	Permissible limits
1	Cadmium and its compounds	0.1 mg/l
2	Cyanide compounds	1 mg/l
3	Organic phosphorus compounds (parathion, methyl parathion, methyl demeton and EPN only)	1 mg/l
4	Lead and its compounds	0.1 mg/l
5	Chromium compounds	0.5 mg/l
6	Arsenic and its compounds	0.1 mg/l
7	Total mercury	0.005 mg/l
8	Alkyl mercury compounds	Not detectable
9	PCBs	0.003 mg/l
10	Trichloroethylene	0.3 mg/l
11	Tetrachloroethylene	0.1 mg/l
12	Dichloromethane	0.2 mg/l
13	Carbon tetrachloride	0.02 mg/l
14	1,2-dichloro ethane	0.04 mg/l
15	1,1-dichloro ethylene	0.2 mg/l
16	cis-1,2-dichloro ethylene	0.4 mg/l
17	1,1,1-trichloro ethane	3 mg/l
18	1,1,2-trichloro ethane	0.06 mg/l
19	1,3-dichloropropene	0.02 mg/l
20	Thiram	0.06 mg/l
21	Simazine	0.03 mg/l
22	Thiobencarb	0.2 mg/l
23	Benzene	0.1 mg/l
24	Selenium and its compounds	0.1 mg/l
25	Boron and its compounds	Excluding the sea area: 10 mg/l. Sea area: 230 mg/l
26	Fluorine and its compounds	Excluding the sea area: 8 mg/l. Sea area: 15 mg/l
27	Ammonia, Ammonium compound, Nitrite compounds, and Nitrate compounds	100 mg/l*

Note: * Amount of total of nitrite nitrogen, nitrate nitrogen and that multiplies 0.4 by ammonium nitrogen.

These limits are applied to unfiltered sample in principle.

Table 4-5, b Uniform National Effluent Standards
(Items related to the conservation of the living environment)

	Aquatic life parameters	Permissible limits
1	Hydrogen ion activity (pH)	Excluding the sea area: 5.8-8.610 mg/l. Sea area: 5.0-9.0
2	Biochemical Oxygen Demand (BOD)	160 mg/l (Daily Average 120 mg/l)
3	Chemical Oxygen Demand (COD)	160 mg/l (Daily Average 120 mg/l)
4	Suspended solids (SS)	200 mg/l (Daily Average 150 mg/l)
5	N-hexane extracts (mineral oil)	5 mg/l
6	N-hexane extracts (animal and vegetable fats)	30 mg/l
7	Phenols	5 mg/l
8	Copper	3 mg/l
9	Zinc	5 mg/l
10	Dissolved iron	10 mg/l
11	Dissolved manganese	10 mg/l
12	Chromium	2 mg/l
13	Number of coliform groups	3,000/cm^3 (Daily Average)
14	Nitrogen	120 mg/l (Daily Average 60 mg/l)
15	Phosphorus	16 mg/l (Daily Average 8 mg/l)

Note: These limits are applied to unfiltered sample in principle.

B. Water Quality Monitoring

The prefectural governors and mayors of designated cities conduct continuous monitoring of water quality of public water bodies as mandated by the Water Pollution Control Law. The public waters covered by this monitoring include those to which the category types of EQS are applied, and for which the Ministry of the Environment is promoting the necessary expenditure.

Moreover, the governor of a prefecture can request a report from any factories and business establishments or conduct on-site inspections, if necessary to check their compliance with the effluent standards. When necessary to obtain compliance, the prefecture may issue administrative orders requiring improvements to the factory or establishment designed to bring them into compliance.

C. Promotion of Measures for Domestic Wastewater

Effluents from domestic activities, such as cooking, washing, and bathing are a major cause of pollution of public waters. The Ministry of the Environment specifies the provisions in the Water Pollution Control Law for promoting comprehensive countermeasures against domestic effluents, 1) the clarification of administrative and the general public's responsibilities, 2) systematic promotion of countermeasures against domestic effluents, 3) extension of control to certain effluent generating facilities in areas subject to Areawide Total Pollutant Load Control.

3) Sewage Law

The purpose of the Sewage Law is to promote the construction and use of sewage systems to improve public health contribute to the healthy development of cities, and maintain the quality of water in public water bodies. The main provisions of the Sewage Law are discussed in the following sections of this report.

A. Comprehensive Sewage Development Plan According to the Basin Area

According to the law, the prefectural government should develop a basic and comprehensive plan for the development of sewage systems on each public water body that is subject to environmental standards for protecting the environment specified under the Environment Basic Law. The purpose of such a plan is to meet the water quality standards established for each water body.

B. Public Sewage Systems

a) Installation and Management of the Public Sewage Treatment Facilities

According to the Sewage Law, the installation, rebuilding, repairing, maintenance and other management of the public sewage systems is under the jurisdiction of municipal governments, such as towns, cities or villages.

However, if the prefectural government determines that it would be too difficult for one municipality to build or maintain its own sewage system or if two or more communities would profit from combining their sewage systems, the law authorizes the prefectural government to install, rebuild, repair, maintain, or manage such sewage systems jointly with the municipalities.

b) Standards for Public Sewage Systems

The structure of the public sewage system should satisfy the technical standards provided by the cabinet order. The cabinet order provides the technical regulations, e.g. the installation of deodorization technology, the prevention measures for wastewater dispersion, and wastewater treatment performance criteria for satisfying effluent quality standards, etc.

c) Effluent Quality Standards for Sewage Treatment Facilities

The quality of water discharged from the public sewage system to public water bodies or coastal areas should meet or exceed the technological standards for effluent quality provided by the cabinet order. The technological standards for effluent quality apply to four basic water quality parameters, including BOD, T-N, T-P, SS, coliform bacteria count, and pH.

4) Johkasou Law (Septic Tank Law)

The purpose of the Johkasou (Septic Tank) Law is to achieve the proper treatment of human sewage and domestic wastewaters with the Johkasou. The law ensures proper treatment by regulating the installation, maintenance, cleaning, and manufacturing of septic tanks. The Septic Tank Law also contains provisions for registering or licensing those involved in johkasou manufacture and sales businesses and establishing a permit system for septic tank sales and installations. This law prohibits the manufacturing of johkasou that do not meet structural standards based on the enforcement order of the

Building Standard Law, and prohibits the manufacture, sale or installation of unregistered septic systems.

5) Regulation System Concerning Prevention of Marine Pollution

Concerning the prevention of the marine pollution, two major international agreements were adopted to regulate ocean dumping of land-based wastes and restrict the discharge of the oil and hazardous substances from ocean-going vessels. These two major international agreements include The Convention on the Prevention and of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) and The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).

In Japan, enforcement of these international agreements has been conducted by adjusting the domestic statutes to be consistent with the agreements. For example, two Japanese laws, The Law Relating to the Prevention of Marine Pollution and Maritime Disasters and The Waste Disposal and Public Cleansing Law have been revised for consistency with the international agreements.

A. London Convention

International agreement restricts the incineration of wastes at sea and tightly regulates the dumping of land-based wastes from ships, marine facilities, and aircraft. The London Convention was adopted in 1972 and came into effect in 1975. Japan ratified this convention in 1980. This agreement consists of three parts, including the purview that provides the content of the restrictions that each country should take, a list of substances that are prohibited from being discharged (Annex II), and the matters to be considered in developing criteria for the issuance of general or special ocean dumping permits (Annex III).

The protocol concerning the amendment of the London Convention of 1972 was adopted in 1996 (the 1996 Protocol). In the amendment bill, the so-called "Reverse list" of waste that will be able to be discharged to sea was adopted in place of the present prohibition list. In addition, “the Framework on the Assessment of Waste” was introduced as a standard procedure for assessing the impacts of specific wastes and tightly managing them. Formal adoption of the amendment bill requires that the bill be ratified or joined by at least 26 countries, including at least 15 of the original member countries that were signatory to the London Convention. The amendment bill has been ratified by 21 countries as of November 2004, including 15 member countries.

a) MARPOL 73/78 (The International Convention for the Prevention of Pollution from Ships)

This convention is aimed at preventing marine pollution due to the normal operation of ships, as well as to accidents involving ships. The convention was adopted in 1973 by the International Maritime Organization (IMO). It is formally called The International Convention for the Prevention of Pollution from Ships, 1973 as Modified by the Protocol of 1978 Relating Thereto. MARPOL was adopted in February 1978 and it came into effect internationally in 1983. Japan joined the convention in June 1983. MARPOL restricts or regulates all oils, noxious liquid substances in bulk, harmful substances carried in packaged form, the sewage fin order to prevent marine pollution.

The Protocol of 1997 on Amendment of the International Convention for the Prevention of Pollution from Ships is aimed at preventing air pollution from sulphur oxide (SOx) and nitrogen oxide (NOx) emissions from ship exhausts. This protocol is expected to come into effect formally on May 19, 2005.

MARPOL’s central provisions are presented, as follows:

Annex I Prevention of pollution by oil;

Annex II Control of pollution by noxious liquid substances in bulk;

Annex III Prevention of pollution by harmful substances carried by sea in packaged form;

Annex IV Prevention of pollution by sewage from ships;

Annex V Prevention of pollution by garbage from ships;

Annex VI Prevention of air pollution from ships.

B. Law Relating to the Prevention of Marine Pollution and Maritime Disaster (Marine Pollution Prevention Law)

The purpose of this Japanese law is to prevent marine pollution and maritime disasters, as well as to implement the international agreements concerning the prevention of marine pollution, such as MARPOL. "The Marine Pollution Prevention Law" attempts to restrict of the discharge of oil and waste from ships and other marine facilities to the oceans, including dredged sediments and the wastes generated by normal operation of ships. This law also requires the appropriate treatment of waste oil from ships and contains provisions aimed at preventing sea fire and their expansion, and preventing hazardous sea traffic conditions.

a) Prevention of Marine Pollution and Maritime Disaster

The Marine Pollution Prevention Law provides that all marine vessels should participate in efforts to prevent marine pollution by avoiding the ocean discharge of oil, noxious liquid substances, and waste. Also, the Law requires that ship captains and those in charge of other types of marine facilities should be held responsible for preventing marine pollution and sea disasters by taking appropriate measures to prevent, extinguish and otherwise control the spread of fires at sea as a means of preventing marine pollution from maritime disasters.

b) Restriction of Discharge of Oil from Ships

For the prevention of marine pollution by oil, the Marine Pollution Prevention Law provides some regulations, such as restrictions against the discharge of oil, the installation of equipment for bilge control, identification of responsible persons, development of rules for oil pollution control, and establishment of the waste oil record list.

c) Restriction of Discharge of Waste from Ships

The Law provides for the prohibition of the discharge of certain types of wastes from ships and the registration of wastes discharged from ships.

d) Exceptionally Admitted Discharges of Oil and Wastes

- Discharge of oil to secure the safety of a ship or to rescue of human life;
- Discharge due to unavoidable reasons, such a shipwreck;
- Discharge of oil to secure the safety of marine facilities or aircraft and rescue of human life;
- Discharge due to unavoidable reasons, such as a marine facilities or aircraft accident ;
- Discharge under a permitted condition.

Ocean dumping of certain wastes is permitted by The Marine Pollution Prevention Law. Such permitted wastes are classified and controlled by The Wastes Disposal and Public Cleansing Law (Wastes Law). In addition, the ocean dumping of the dredged sediment that is generated by dredging of navigation channels is managed by The Marine Pollution Prevention Law.

In Japan, The Marine Pollution Prevention Law and Waste Law institutionalize the London Convention by managing and regulating the ocean dumping of waste. The wastes permitted by the London Convention and the ocean disposal permitted under the existing laws of Japan are classified into three categories, including (1) municipal waste and industrial waste specified by The Waste Law, (2) dredged soils, (3) ships out of service.

Wastes permitted under The Waste Law and dredged soil can be dumped in the ocean only when fulfilling the following conditions under the existing law:

(1) The wastes are specifically permitted for ocean dumping under the applicable statutes (Table 4-6);

(2) Dumping meets the regulatory criteria of the each substances (Table 4-6);

(3) Dumping occurs in discharge areas specified under the applicable laws and regulations;

(4) Dumping is performed according to the permitted discharge methods;

(5) The generator or processor who obtains a permit to discharge wastes must use only the ship that was registered to perform the discharge under the permit.

e) The amendment of the Japanese Law Relating to the Prevention of Marine Pollution and Maritime Disaster

In order to set a strict control on ocean dumping of waste which causes marine pollution, the amendment of the Law Relating to the Prevention of Marine Pollution and Maritime Disaster passed the 159th Diet session on May 12th, 2004. In response to an international demand for more effective waste management at sea, this is a preparatory step to enter into the 1996 Protocol of the Convention of the Prevention of Marine Pollution by Dumping of Waste and Other Matter, 1972 (referred to as "London Convention") which is expected to be effective in the near future.

The summary of the amendment is as follows:

[1] A new system shall be established in which the Minister of the Environment gives permission to each waste discharging enterprises after examining the following points:

- Efforts made for waste reduction,
- Characteristics of waste,
- Result of environmental assessment on the proposed disposal area.

[2] Actual disposal of waste based on the permission shall be confirmed by the Commandant of Japan Coast Guard.

[3] Incineration at sea of waste deriving from inland, which is currently permitted partially, shall be prohibited.

[4] Other provisions such as punishment necessary for the new permission system shall be provided.

Table 4-6 Criteria for Ocean Dumping

Division of Waste	Organic sludge	Waste acid/ alkali	Insoluble inorganic sludge	Sewage sludge	[reference] Designated sewage sludge	Residue of animal and plant	Animal anure	[reference] municipal waste
Name of waste materials	Fermentation waste fluid Abolition carbohydrate solution Linters steam waste fluid	Fermentation waste fluid Abolition carbohydrate solution Linters steam waste fluid	Bauxite residue Construction sludge	Sewage sludge excluding designated sewage sludge	The ocean dumping is not acceptable because of special management industrial waste.	Food processing residue	Livestock excreta	Abolition explosive Nonflammable waste Johkasou sludge and night soil
pH	-	5.0-9.0	-	-	-	-	-	-
Oil	The oil slick is not detected by 15 mg or less of oil per test liquid 1l.	The oil slick is not detected by 15 mg or less of oil per test liquid 1l.	The oil slick is not detected by 15 mg or less of oil per test liquid 1l.	The oil slick is not detected by 50 mg or less of oil per test liquid 1l.	-	The oil slick is not detected	-	-
Hazardous Substances	Content (mg/kg)	Content (mg/kg)	Leaching (mg/l)	-	Leaching (mg/l)	-	-	-
Alkyl mercury compounds	N.D	N.D	N.D	No standards	N.D	No standards	No standards	No standards
Mercury and its compounds	0.025	0.025	0.0005		0.005			
Cadmium and its compounds	0.1	0.1	0.01		0.3			
Lead and its compounds	1	1	0.01		0.3			
Organic phosphorus compounds	1	1	N.D		1			
Chromium compounds	0.5	0.5	0.05		1.5			
Arsenic and its compounds	0.15	0.15	0.01		0.3			
Cyanide compounds	1	1	N.D		1			

PCB	0.003	0.003	N.D		0.003			
Trichloroethylene	0.3	0.3	0.03		0.3			
Tetrachloroethylene	0.1	0.1	0.01		0.1			
Dichloromethane	0.2	0.2	0.02		0.2			
Carbon tetrachloride	0.02	0.02	0.002		0.02			
1,2-dichloro ethane	0.04	0.04	0.004		0.04			
1,1-dichloro ethylene	0.2	0.2	0.02		0.2			
cis-1,2-dichloro ethylene	0.4	0.4	0.04		0.4			
1,1,1-trichloro ethane	3	3	1		3			
1,1,2-trichloro ethane	0.06	0.06	0.006		0.06			
1,3-dichloropropene	0.02	0.02	0.002		0.02			
Thiram	0.06	0.06	0.006		0.06			
Simazine	0.03	0.03	0.003		0.03			
Thiobencarb	0.2	0.2	0.02		0.2			
Benzene	0.1	0.1	0.01		0.1			
Selenium and its compounds	0.1	0.1	0.01		0.3			
Chlorinated hydrocarbons	4	4	1		-			
Copper and its compounds	10	10	0.14		-			
Zinc and its compounds	20	20	0.8		-			
Fluoride	15	15	3		-			
Beryllium and its compounds	2.5	2.5	0.25		-			
Chromium and its compounds	2	2	0.2		-			
Nickel and its compounds	1.2	1.2	0.12		-			
Vanadium and its compounds	1.5	1.5	0.15		-			
Phenols	20	20	0.2		-			

6) Law Concerning Special Measures Against Dioxins

The Law Concerning Special Measures Against Dioxins was enacted in Japan in 1999. The purpose of this law is to protect the health of citizens by establishing standards necessary to form the basis of policies on dioxins, to establish the necessary regulations, and to establish measures relating to soil contamination in order to carry out the prevention and removal of environmental pollution caused by dioxins.

Table 4-7 summarizes the environmental standards for dioxins with regard to water quality.

Table 4-7 Environmental standards for dioxins concerning water quality

Medium	Standard value	Measuring method
Water quality (The bottom sediment is excluded.)	1 pg-TEQ/l or less	Method of providing in Japan Industrial Standards K0312.
Bottom sediment quality	150 pg-TEQ/g or less	Method to extract dioxins included in bottom sediment by Soxhlet extractor, and to measure by high-resolution gas chromatography / high-resolution mass spectrometry.

Notes: 1. The standard value is converted into the toxicity of 2,3,7,8-tetrachlorinated dibenzo-para- dioxin.
2. Standard values of water quality (the bottom sediment is excluded) are set in terms of annual averages.

7) Law Concerning Reporting of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (Chemical Substance Release, Reporting and Management Promotion Law)

The Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (Chemical Substance Release, Reporting and Management Promotion Law, shortly PRTR Law) was enacted in 1999 to promote voluntary improvements in the management of specific chemical substances by business and industry.

This law obligates to the businesses that adopt its specific criteria to submit a report of the amounts of 354 potentially harmful or hazardous chemicals released to the environment. The government will review the collected data, environmental monitoring, and investigation of the impact to the human health and the ecosystem.

8) Other Statutes Relating to Water Quality

In addition to the seven other laws discussed in the previous sections of this report, there are various others laws that have water quality provisions, such as The River Law, Coast Law, Harbors Law, and Fishing Port Law. These other laws authorized those in charge of managing rivers, coastal areas, and harbors to regulate or restrict human activities for the purpose of protecting water quality.

4.2 National Program

4.2.1 Outline of Water Quality Monitoring Plan

Under the Water Pollution Control Law, the monitoring of water quality in the public water bodies and the groundwater should be conducted for observing the level of compliance with the applicable environmental quality standards and effluent standard for factories and businesses (refer 4.1 (2)).

The outline of the water quality monitoring plan is presented in Table 4-8, and the outline of the water quality monitoring in Japan is described in the following sections of this report.

Table 4-8 The outline of water quality monitoring under the Water Pollution Control Law

Water Type	Person responsible for observation	Number of survey points	Content of observations	Frequency
Public water area (river, lakes and coastal area)	Prefectural governor and government ordinance mayor	Environmental standards monitoring point (4,614 points as of 2002)	Environmental quality standard item concerning protection of human health (Table 4-2,a, and b)	More than once a month
			Environmental quality standard item concerning conservation of living environment (Table 4-3,a,b,c and Table 4-4)	More than once a month
Industrial waste water	Operating company	Specified facilities under the water pollution control law	Effluent standard item (Table 4-5,a, and b)	Measuring according to the situation of the impact of effluent quality.

1) Water Quality Monitoring and its Execution System

Under the Water Pollution Control Law, the governor of a prefecture shall, after consulting with the chiefs of the local offices of national administrative agencies and city governments, establish – an annual program for the measurement of water quality in the public water bodies that belong to the prefecture (hereinafter referred to as the annual "Measurement Program"). The governor of a prefecture and government ordinance mayor shall measure the water quality in the public water bodies and groundwater in compliance with the Measurement Program, and report the findings of the measurements that shall be published by governor of the prefecture.

Moreover, an operating company who discharges effluents from specified factories shall measure the pollutant levels in their effluents and keep records of the measured findings according to this law. The governor of the prefecture and government ordinance mayor can request the report from the factories and business establishments or conduct on-site inspection, if necessary to verify compliance with the effluent standards, and may issue whatever administrative orders are necessary to improve conditions in factories and establishments to achieve compliance.

2) Monitoring Parameters

The monitoring parameters for public water bodies consist of the environmental quality standards for protection of human health (Table 4-2,a and 4-2,b), the conservation of living organisms (Table 4-3a, b, c and Table 4-4), and effluent standard parameters (Table 4-5,a and 4-5,b).

3) Monitoring Points

The total number of the monitoring points in public water bodies is about 8,600 points (results in 2002) in all of Japan. The monitoring points that represent the water quality of the NOWPAP region to for evaluating achievement of the EQS are defined as the "environmental standard points". The environmental standard points are provided so that at least one exists in each water region where the water classification is applied. In addition, supplementary points can be defined.

The total number of the environmental standard points and the supplementary points on the first class rivers (35 rivers NOWPAP) is 247 in the NOWPAP region.

4.2.2 Outline of Monitoring Plan for Seawater Pollution

The Ministry of the Environment, the Meteorological Agency, and the Japan Coast Guard are each executing the monitoring of coastal waters for the purposes specified under the Water Pollution Control Law, as outlined below.

1) Oceanic Monitoring by the Ministry of the Environment

The Ministry of the Environment executes comprehensive and systematic marine environmental monitoring for the evaluation and observation of the status of the marine environment, including the conservation of the ecosystem in territorial waters and the exclusive economic zone. This monitoring is conducted for the purposes outlined in the United Nations Convention on The Law of the Sea, as well as to characterize the current status of the marine environment in seas around Japan. An annual survey has been conducted to measure the concentration of oil, PCB, and heavy metals, as well as general water quality parameters, such as water temperature, salinity, etc. In this survey, the sampling points are established along observation lines from the coast toward offshore for surveying the effect of land-based pollution. Sampling points are also established in the waste dumping area designated by The Marine Pollution Prevention Law.

2) Marine Monitoring by the Meteorological Agency

The Meteorological Agency began the oceanic background pollution survey of heavy metals (cadmium and mercury) in seawater to contribute to the pollution prevention and the marine conservation provisions of the Marine Pollution Prevention Law in 1972. Subsequently, the survey related to oil pollution began in 1976.

The survey related to oil pollution includes the following three items:

i) Observation of floating substances i.e. plastics etc. and surface oil slicks - observations are made from the bridge of the observation ship between sunrise to the sunset.

ii) Observation of floating tar balls (oil lumps) - Involves the collection of tar balls by towing a newston net and then drying and weighing the collected tar balls;.

iii) Measuring dissolved and dispersed petroleum hydrocarbon (oil)

Sampling seawater from the prow shipboard of the observation ship with 1000 ml sample bottles. The oil extracted from seawater with chloroform and n-hexane is measured by the fluorescent brightness method.

3) Marine Monitoring by the Japan Coast Guard

The Japan Coast Guard, Hydrographic and Oceanographic Department has been conducting the survey of seawater and marine debris and analyzing the concentrations of oil, PCB, and heavy metals (cadmium and mercury) in the sea around Japan, the principal bays continuously since 1972. The Coast Guard's monitoring is conducted as a scientific research on the prevention of marine pollution and conservation of the marine environment based on the Marine Pollution Prevention Law. The Coast Guard data is gathered in addition to the physical observation that they are responsible for collecting, such as currents, water temperature, and salinity, etc.

4) Method of Analysis of Water Quality and Frequency of Monitoring

The principal methods for water quality analysis are described in the publication *Water Quality Analysis Methods* (issued by Ministry of the Environment, 1971). The water quality monitoring that will be conducted by prefectures and factories shall be according to the methods described in this publication.

The basic frequency of the sampling and analysis for parameters related to human health shall be more than one per month, and more than four times per day in the public water bodies. Also, the basic frequency of the sampling and analysis for the parameters related to conservation of living organisms shall be more than one per month, and more than four per day at the environmental standard point or other important point. However, the monitoring frequency may be changed if monitoring results indicate a deviation from normal conditions has occurred. The frequency of the measurement of the effluent water from the factories and other business establishments is not provided. However, it is the responsibility of the factories or businesses to monitor frequently enough to document compliance with the effluent standards and EQS. Moreover, the measurement should be done according to the method established by the Prime Minister.

4.3 Methodologies and Procedures

1) Analysis Method

The analytical methods required for various water quality monitoring parameters are summarized in Table 4-9. This table includes the parameters to be monitored for evaluating compliance with the environmental standards for both the protection of human health and conservation of living environment.

2) Accuracy Management

Accuracy management or quality control is becoming more important in water quality monitoring because of the increasing of the number of analytical parameters and the upgrading the analysis techniques. The Ministry of the Environment (Environmental Agency at that time) has been implementing a program to unify accuracy management of environmental measurement analysis since 1975. Since that time the ministry has been evaluating the data reported by each analytical institution, and reporting on the measurement accuracy of the analytical institutions.

Moreover, each analytical institution is required to meet standards for accuracy through the licensing system provided in Measurement Law, and is executing an accuracy management system in accordance with ISO/IEC17025 (JIS Q

17025) that is an international standard of the accuracy management and analysis skill examination based on ISO/IEC guide 43-1 (the Japan Chemical Analysis Academy), etc. in each organization.

In addition, the Ministry of the Environment established an accuracy management program concerned with the measurement of dioxins in the environment in 2000. "Order qualification examination system for contract investigations of the dioxin that the Ministry of the Environment executed" was enacted in 2001. Also, the Ministry of Economy, Trade and Industry introduces the specific measurement proof entrepreneur register system by enforcing "Law that revises a part of the measurement law" in April 2002, therefore public mechanism concerning to QA/QC of the analysis has been maintained.

Table 4-9 Monitoring parameters and their analytical methods

Item	Preservation method	Major analytical method	Measurement range and accuracy (minimum limit of detection: mg/l)
pH	Dark and cool, 0~5 ºC	Glass electrode method	-
BOD (Biological Oxygen Demand)	Dark and cool, 0~5 ºC	Membrane electrode method	0.5
COD (Chemical Oxygen Demand)	Dark and cool, 0~5 ºC	$KMnO_4$ method with sulfuric acid	0.5
SS (Suspended Solid)	Dark and cool, 0~5 ºC	Filter and weigh method	1.0
DO (Dissolved Oxygen)	Dark and cool, 0~5 ºC	Membrane electrode method	0.5
Total Coliforms	Dark and cool, 0~5 ºC	MPN method	-
Cadmium	Add HCl and pH<1	Atomic absorption method	0.001
Total cyanide	Add NaOH and pH>11	Absorptiometric method	0.1
Lead	Add HCl and pH<1	Atomic absorption method	0.005
Chromium (VI)	Add HCl and pH<1	Atomic absorption method	0.004

Arsenic	Add HCl and pH<1	Absorptiometric method	0.005
Total mercury	Add HCl and pH<1	Atomic absorption method	0.0005
Alkyl mercury	Add HCl and pH<1	Gas chromatograph	0.0005
PCBs	Dark and cool, 0~5 ºC	Gas chromatograph	0.0005
Dichloromethane	Dark and cool, 0~5 ºC	Gas chromatograph	0.002
Carbon tetrachloride	Dark and cool, 0~5 ºC	Gas chromatograph	0.0002
1, 2-dichloroethane	Dark and cool, 0~5 ºC	Gas chromatograph	0.0004
1, 1-dichloroethylene	Dark and cool, 0~5 ºC	Gas chromatograph	0.002
cis-1, 2-dichloroethylene	Dark and cool, 0~5 ºC	Gas chromatograph	0.004
1, 1, 1-trichloroethane	Dark and cool, 0~5 ºC	Gas chromatograph	0.0005
1, 1, 2-trichloroethane	Dark and cool, 0~5 ºC	Gas chromatograph	0.0006
Trichloroethylene	Dark and cool, 0~5 ºC	Gas chromatograph	0.002
Tetrachloroethylene	Dark and cool, 0~5 ºC	Gas chromatograph	0.0005
1, 3-dichloropropene	Dark and cool, 0~5 ºC	Gas chromatograph	0.0002
Thiuram	Dark and cool, 0~5 ºC	High-performance liquid chromatograph	0.0006
Simazine	Dark and cool, 0~5 ºC	Gas chromatograph	0.0003
Thiobencarb	Dark and cool, 0~5 ºC	Gas chromatograph	0.002
Benzene	Dark and cool, 0~5 ºC	Gas chromatograph	0.001
Selenium	Add HCl and pH<1	Absorptiometric method	0.002
Ammonium nitrogen	Dark and cool, 0~5 ºC	- // -	0.7
Nitrate nitrogen	Dark and cool, 0~5 ºC	- // -	0.2
Nitrite nitrogen	Dark and cool, 0~5 ºC	- // -	0.2
Fluorine	Dark and cool, 0~5 ºC	- // -	0.2
Boron	Dark and cool, 0~5 ºC	- // -	0.2

Note: The environment standards of each parameters are shown in Table 4-2,3. These method are applied to unfiltered sample in priciple.

4.4 Research Activities

There are a number of past and current research works being on conducted on the river environment. Among this research, we refer mainly to the activities that will contribute to developing and establishing the future cooperative monitoring programs of NOWPAP/3. The load of a particular substance carried by rivers as input into the seas is basically calculated by the products of its concentration (a) and the rate of water discharge (b) at a given points, taking into account any diversions from the given watershed (c). The existing data collected under the National Monitoring Programs are not fully sufficient for providing these three quantities.

Furthermore, the load assessment could not be completed based solely on the monitoring data but needs certain models to estimate the unknown variables from known variables. In this regard, research activities working with the construction of the models are equally important to the monitoring activities.

A group of researchers from the field of civil engineering has systematically assessed environmental changes in rivers based on the data of the River Water Quality Monitoring being performed by the Ministry of Land, Infrastructure and Transport (MLIT). These researchers proposed the addition of the inorganic nutrients, such as nitrate, nitrite, ammonia, phosphate and silicate to the monitoring parameters, although the main indicators of the river environment have primarily been BOD, total-N and total-P [13]. Their proposal will contribute to the reinforcement in terms of the point (a).

There has been a worldwide agreement that we should establish a methodology for the comprehensive and accurate understanding of the water system, including the river discharges, to manage the increasing demand of water for life. For this purpose, the Japanese Government started the Global Water Cycle

Research Initiative (GWCRI) in 2003 encompassing the global observation, development of the model, and assessment of the effect of the hydrological changes to human society. A research program called The R & D of Hydrological Modeling and Water Resources Systems started in 2001 targeting the construction of a water cycle model considering the man-made effects. Data products from these projects will contribute to improving the accuracy and precision of (b).

On the other hand, UNESCO-GRAPHIC (Groundwater Resources Assessment under the Pressures of Humanity and Climatic Change) started in 2004. One of the purposes is to understand the flux of the ground water. This flux is thought to amount to 10% of the global water flux from land to the sea. Therefore, inputs of dissolved substances, such as nitrate, may be updated by considering the contribution of the flux of ground water [14]. Particularly, concentration of some pollutants is sometimes higher in the ground water than in the river water due to the pollution of the soil. Measurement of ground water flux has been tried in the seabed off the Kurobe river alluvial fan [15], which faces the NOWPAP Region.

The exports of substances via rivers from watersheds have been recognized as an important component of LOICZ (Land-Ocean Interactions in the Coastal Zone under IGBP (International Geosphere-Biosphere Program). Recently, a group of researchers proposed "Global NEWS (Global Nutrient Export from Watersheds)" as a program of LOICZ. Their main target is to construct a spatially explicit, multi-element (N, P, Si and C) model to understand the human and natural processes. They also intend to make linkage with the UNEP-Mediterranean Action Plan and UNESCO/IOC [16].

It has been pointed out some land-originated substances crucial to the maintenance of the marine ecosystem may be lost by man-made effects, such as the hydraulic alterations combined with eutrophication.

An example of such process is shown as the "silica deficiency hypothesis". This hypothesis holds the following sequence of phenomena. Stagnant water bodies generated by dams let freshwater diatoms take up DSi (dissolved silicate) fuelled by loaded N and P and sink to the sediment. Consequently, the flow of DSi to the seas decreases and non-diatom algal species (non-siliceous and potentially harmful) increase in place of diatoms (siliceous and forming the basis of the health of the marine ecosystem) in the coastal seas downstream, because diatoms need Si in addition to N and P, nominally in the ratio of N: P: Si = 16: 1: 16 [17], [18]. To verify this hypothesis, a study on the deterioration of marine environment due to the N and P excesses and Si decline is currently being carried out as a project supported by the Global Environment Research Fund of the Ministry of the Environment.

One part of this project is to retrospectively analyze the historical data on the river water quality before and after the 1960s (period of the rapid economic growth [19] and assess the effect of the economic growth. Also, the dissolved inorganic nutrients are measured monthly in the Sai River (with dams) and the Chikuma River (with less number of dams), which merge to form the Shinano River flowing into the NOWPAP Region. Also, the nutrients are measured in the system of Lake Biwa (assumed large dam reservoir) - Yodo River- Seto Inland Sea. From these results, it was shown that the latter system is silica-sensitive, whereas the former system is less sensitive to the silica process possibly because the still water effect depends on the average residence time of the reservoir.

4.5 Training Activities

4.5.1 The Ministry of the Environment: National Environmental Research and Training Institute

National Environmental Research and Training Institute started in March 1973, as an organization that trains the administrative staff of the Ministry of the Environment. In addition, the institute conducts training concerning various fields of environmental administration for the national and local government staff with responsibility for protecting the environment.

As for the content of training, in fiscal year 2004, it is classified into 1) administration training, 2) international training, 3) analysis training, 4) training for environmental officials, and 5) an environmental administrative business. The content of the analysis training is the analysis of water quality, endocrine disrupters, and dioxins, etc. as shown in Table 4-10.

Table 4-10 Analysis training of National Environmental Research and Training Institute

Content of analysis training	
Analysis equipment training and specific analysis equipment training	
Analysis training	Atmospheric analysis, odor substances analysis, and water analyses
	Waste analysis and VOCs analysis
Theme analysis	I (marine plankton)
	II (plankton)
	III (benthos)
Endocrine disrupters analysis	
Dioxins environmental monitoring (exhaust gas and wastewater)	
The latest analysis technology (LC/MS analysis) and special analysis	

4.5.2 Training Program of the Japan Sewage Works Agency

The Japan Sewage Works Agency conducts practical training for government sanitary engineers, including field practice and exercises.

As for the content of training, it is divided into 1) planning and the design of sewage systems and treatment works, 2) management, 3) execution design, 4) construction supervisor management, and 5) control of maintenance. In the maintenance management course, the training consists of water quality, wastewater treatment, and management of the sewage plants, as shown in Table 4-11.

Table 4-11 Content of the Training of Japan Sewage Works Agency

	Content of training of maintenance management course
1	Drainage system management
2	Consignment of administrative work
3	Treatment plan management
4	Treatment plant administration
5	Rebuilding and updating of treatment plant equipment
6	Water quality control
7	Control the processed effluent
8	Equipment and facilities management
9	Start and preparation of service
10	Promotion of water closet and information disclosure

4.5.3 Training Program of the Research Laboratory for Public Health by Local Government

The Research Laboratory for Public Health set up in the prefecture or the designated city is an integrated organization to protect human health and promote safety from infectious diseases, toxic chemicals (dioxin etc.), and food and drinking water pollutants . The Research Laboratory is responsible for collecting, analyzing, and publishing surveillance data, as well as conducting examinations and collecting public health information in cooperation with related public health administration agencies. The laboratory also conducts training and provides guidance health and safety and environmental protection.

5. Present Situation of Rivers and Direct Discharge of Pollution to the Marine Environment

5.1 Pollution Loads Attributable to Rivers

5.1.1 Current Status of the Major River Water Quality

The results of monitoring the water quality of the major rivers (the first class rivers) that flow in the NOWPAP region in fiscal year 2002 are summarized as Table 5-1(a) and (b). The mean value of BOD is in the range of 0.5-2.1 mg/l, and COD is 1.7-5.5 mg/l. COD and BOD are indices of organic pollution in rivers that flow in the NOWPAP region. The concentration of heavy metals, chloronated hydrocabons etc. are under the detection limit which are registered in the government monitoring manual in Japan.

The POPs data of the Ishikari river that is the greatest river in the NOWPAP region in Japan are shown in Table 5-1(c) for reference. These POPs data were measured on November 19, 2002, and it could not show the annual average because the data is scarce.

Other water quality monitoring data are summarized in Table 5-2.

Table 5-1(a) Water quality of the rivers that flow into the NOWPAP Region in fiscal year 2002

(Unit: mg/l)

	Rivers	SS	BOD_5	COD	DO	T-N	T-P	NO_2-N	NO_3-N	Pb	Cd
1	Teshio River	5	0.6	3.6	11	0.51	0.032	-	-	<0.005	-
2	Rumoi River	15	2.1	5.5	11	1.27	0.065	0.043	0.117	0.008	<0.001
3	Ishikari River	35	1.0	4.9	10	1.12	0.074	-	-	-	-
4	Shiribetsu River	4	0.5	2.4	12	-	-	-	-	-	-
5	Shiribeshitoshi-betsu River	4	0.6	2.6	11	0.33	0.031	-	-	<0.005	<0.001
6	Iwaki River	15	1.7	3.8	9.9	1.4	0.075	0.044	-	0.002	<0.001
7	Yoneshiro	5	1.2	-	11	0.68	0.023	-	-	<0.005	<0.001

	River									
8	Omono River	9	1.2	-	10	0.84	0.033	-	-	<0.005	<0.001
9	Koyoshi River	9	1.2	-	10	0.74	0.049	-	-	<0.005	<0.001
10	Mogami River	17	0.9	2.5	11	0.73	0.03	-	-	<0.005	<0.005
11	Aka River	11	0.8	2.1	11	0.61	0.029	0.01	0.2	<0.005	<0.005
12	Ara River	4	0.6	2.2	11	0.33	0.016	<0.01	0.22	<0.005	<0.001
13	Agano River	8	0.8	2.5	11	0.59	0.056	-	-	-	-
14	Shinano River	13	1.2	3.2	9.3	0.92	0.085	-	-	-	-
15	Seki River	25	1.2	3.9	10	1.13	0.073	0.02	0.41	<0.005	<0.001
16	Hime River	95	0.9	3.5	11	0.64	0.288	-	-	-	-
17	Kurobe River	7	0.6	1.7	12	0.28	0.018	<0.05	0.16	<0.005	<0.001
18	Joganji River	9	0.8	2.1	11	0.58	0.022	<0.05	0.24	<0.005	<0.001
19	Jintu River	7	1.3	2.4	11	1.53	0.039	<0.05	0.62	<0.005	<0.001
20	Sho River	10	0.9	2.4	11	-	-	-	-	-	-
21	Oyabe River	8	2.1	4.4	9.2	1.4	0.105	<0.05	0.77	<0.005	<0.001
22	Tedori River	34	1.1	-	11	0.52	0.044	0.01	0.34	<0.005	<0.001
23	Kakehashi River	11	0.8	-	10	0.69	0.039	0.01	0.4	0.005	<0.001
24	Kuzuryu River	9	1.4	3.7	10	-	-	-	-	<0.002	<0.001
25	Kita River	9	0.6	2.3	9.4	-	-	-	-	<0.002	<0.001
26	Yura River	4	0.7	2.5	9	0.78	0.049	0.01	0.61	<0.005	<0.005
27	Maruyama River	5	2.0	-	9.7	0.48	0.054	-	-	0.002	<0.001
28	Chiyo River	3	1.4	1.9	9.1	-	-	-	-	<0.005	<0.002
29	Tenjin River	2	0.8	1.8	11	-	-	-	-	<0.005	<0.002
30	Hino River	16	1.3	3.5	9.6	-	-	-	-	<0.005	<0.002
31	Hii River	7	1.3	-	10	0.71	0.03	0.003	0.317	<0.005	<0.005
32	Gono River	2	0.5	-	9.8	-	-	-	-	<0.005	<0.005
33	Takatsu River	2	0.5	-	9.1	-	-	-	-	<0.005	<0.005
34	Onga River	7	1.7	3.3	8.5	1.31	0.105	-	-	<0.005	<0.001
35	Matsuura River	14	0.9	3.2	8.3	0.64	0.047	-	-	<0.005	<0.001

Notes: 1. Unfiltered samples are measured for all monitoring items without NO_2-N and NO_3-N.
2. The symbol "-" means no data.
3. Symbol "<" means that the values are under the detection limits which are registered in the government manual published in 1974.

Table 5-1 (b) Other water quality of the rivers that flow into the NOWPAP Region in fiscal year 2002

(Unit: mg/l)

Rivers	Flows (m^3/s)	NO_2		NO_2+ NO_3	NO_3	Cr^{6+}		CN		As		T-Hg		PCB		Dichloro-methanne		Carbon tetrachloride		1,2-dichloroenthane		1,2-dichloroentyeine	
Teshio River	187.59		0.021	0.78	0.759	<	0.02	<	0.1		0.007	<	0.0005	N	0.0005	<	0.002	<	0.0002	<	0.0004	<	0.002
Rumoi River	10.13	E				E		E		<	0.005	E		E		E		E		E		E	
Ishikari River	457.87	E				E		E		E		E		E		E		E		E		E	
Shiribetsu River	58.79	<	0.005	0.1	0.095	<	0.02	<	0.1	<	0.005	<	0.0005	N	0.0005	<	0.002	<	0.0002	<	0.0004	<	0.002
Shiribeshitoshibetsu River	21.86		0.025	0.51	0.485	<	0.02	<	0.1	<	0.005	<	0.0005	N	0.0005	<	0.002	<	0.0002	<	0.0004	<	0.002
Iwaki River	92.25		0.044			<	0.02	<	0.1		0.001	<	0.0005	N	0.0005	E	0.001	E	0.0001	E	0.0001	E	0.001
Yoneshiro River	223.59	E		0.43		<	0.005	E		<	0.001	<	0.0005	E		E	0.002	E	0.0002	E	0.0004	E	0.002
Omono River	314.90	E				<	0.005	E		<	0.001	<	0.0005	E		<		<		<		<	
Koyoshi River	81.27	E		0.19		<	0.005	E		<	0.001	<	0.0005	E		E	0.002	E	0.0002	E	0.0004	E	0.002
Mogami River	433.57		0.01	0.52	0.51	E		E		E		E		E		E	0.002	E	0.0002	E	0.0004	E	0.002
Aka River	92.32		0.01	0.21	0.2	<	0.02	<	0.1	<	0.005	<	0.0005	N	0.0005	E	0.002	E	0.0002	E	0.0004	E	0.002
Ara River	144.84		0.01	0.71	0.7	<	0.01	<	0.1	<	0.005	<	0.0005	N	0.0005	E	0.002	E	0.0002	E	0.0004	E	0.002
Agano River	434.07		0.02	0.43	0.41	<	0.01	<	0.1	<	0.005	<	0.0005	N	0.0005	E	0.002	E	0.0002	E	0.0004	E	0.002
Shinano River	400.06	E				E		E		E		<	0.0005	E		<		<		<		<	
Seki River	50.68	<	0.01	0.22	0.21	<	0.01	<	0.1	<	0.005	<	0.0005	E		E	0.002	E	0.0002	E	0.0004	E	0.002
Hime River	44.42	<	0.01	0.26	0.25	<	0.01	<	0.1		0.006	<	0.0005	E		E	0.002	E	0.0002	E	0. 0004	E	0.002
Kurobe River	83.21	<	0.05	0.77	0.72	<	0.04	<	0.1	<	0.005	<	0.0005	N	0.0005	E	0.002	E	0.0002	E	0. 0004	E	0.002
Joganji River	16.85	<	0.05	0.49	0.44	<	0.04	<	0.1	<	0.005	<	0.0005	E		E	0.002	E	0.0002	E	0. 0004	E	0.002
Jintu River	151.26	<	0.05	0.21	0.16	<	0.04	<	0.1	<	0.005	<	0.0005	N	0.0005	E	0.002	E	0.0002	E	0. 0004	E	0.002
Sho River	39.23	<	0.05	0.24	0.19	<	0.04	<	0.1	<	0.005	<	0.0005	N	0.0005	E	0.002	E	0.0002	E	0. 0004	E	0.002

Note: 1. Symbol "<" means that the values are under the detection limits which are registered in the government manual published in 1974.
2. Unfiltered samples are measured for all monitoring items without NO_2-N and NO_3-N.

Table 5-1 (b) (continue)

Rivers	Flows (m^3/s)	NO_2		NO_2+ NO_3	NO_3	Cr^{6+}		CN		As		T-Hg		PCB		Dichloro-methanne		Carbon tetrachloride		1,2-dichloroent hane		1,2-dichloroent yeine	
Oyabe River	68.90	<	0.05	0.16	0.11	<	0.04	<	0.1	<	0.005	<	0.0005	N	0.0005	<	0.002	<	0.0002	<	0.0004	<	0.002
Tedori River	83.22	E				E		E		<	0.005	<	0.0005	E		E		E		E		E	
Kakehashi River	18.56		0.01	0.35	0.34	<	0.04	E		<	0.005	<	0.0005	E		<	0.002	<	0.0002	<	0.0004	<	0.002
Kuzuryu River	46.92	E				<	0.02	<	0.1	<	0.005	<	0.0005	E		E		E		E		E	
Kita River	4.78		0.01	0.61	0.6	<	0.002	<	0.1	<	0.005	<	0.0005	N	0.0005	<	0.002	<	0.0002	<	0.0004	<	0.002
Yura River	39.20		0.01	0.62	0.61	<	0.002	<	0.1	<	0.005	<	0.0005	N	0.0005	<	0.002	<	0.0002	<	0.0004	<	0.002
Maruyama River	34.55	E				<	0.01	E			0.001	<	0.0005	E		E		E		E		E	
Chiyo River	43.30	<	0.05	0.4	0.35	<	0.005	<	0.1	<	0.005	<	0.0005	N	0.0005	<	0.002	<	0.0002	<	0.0004	<	0.002
Tenjin River	13.28	E		0.5		<	0.005	<	0.1	<	0.005	<	0.0005	N	0.0005	<	0.002	<	0.0002	<	0.0004	<	0.002
Hino River	22.46	E		0.4		<	0.005	<	0.1	<	0.005	<	0.0005	N	0.0005	<	0.002	<	0.0002	<	0.0004	<	0.002
Hii River	39.27	<	0.01	0.53	0.52	<	0.02	E		<	0.005	<	0.0005	E		E		<	0.0002	E		E	
Gono River	119.18		0.003	0.32	0.317	<	0.02	E		<	0.005	<	0.0005	E		<	0.002	<	0.0002	<	0.0004	<	0.002
Takatsu River	30.84	<	0.01	0.43	0.42	<	0.02	E			0.005	<	0.0005	E		E		<	0.0002	E		E	
Onga River	16.99	E				<	0.02	<	0.1	<	0.005	<	0.0005	E		E		E		E		E	
Matsuura River	9.68		0.015	0.79	0.775	<	0.02	<	0.1	<	0.005	<	0.0005	E		<	0.002	<	0.0002	<	0.0004	<	0.002

Table 5-1 (b) (continue)

Rivers	Cis-1,2-Dichloroent-yeine		1,1,1-trichloroent-hane		1,1,2-trichloroent-hane		Ttrichloroent hane		Tetrachloroent hane		1,3-dichchlorop-ropene		Thiuram		Thioben-carb		Benzene		Selenlum		Fluorine		Boron		Dioxins (pgTEQ/l)
Teshio River	<	0.004	<	0.001	<	0.0006	<	0.002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002		0.07	<	0.1	0.098
Rumoi River	E		E		E		E		E		E		E		E		E		E		E		<	0.1	
Ishikari River	E		E		E		E		E		E		E		E		E		E		E		<	0.1	
Shiribetsu River	<	0. 004		0.001	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002		0.03	<	0.1	0.071
Shiribeshitoshibetsu River	<	0. 004	<	0.001	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002		0.04	<	0.1	0.079
Iwaki River	<	0.001	<	0.0005	<	0.0001	<	0.001	<	0.0005	<	0.0001	<	0.0005	<	0.001	<	0.001	<	0.002		0.07		0.15	0.56
Yoneshiro River	<	0.004	<	0.001	<	0.0006	<	0.002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.001	<	0.1		0.09	0.076
Omono River	E		E		E		E		E		E		E		E		E		E		E		E		0.18
Koyoshi River	<	0. 004	<	0.001	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.001	<	0.1		0.09	0.11
Mogami River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.02	<	0.1	0.14
Aka River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.02	<	0.1	0.085
Ara River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.1		0.1	0.44
Agano River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002		0.2		0.1	0.35
Shinano River	E		E		E		E		E		E		E		E		E		E		E		E		
Seki River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.1	<	0.1	0.085
Hime River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.1	<	0. 1	0.084
Kurobe River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002		0.3		0. 11	0.77
Joganji River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.1		0. 08	0.1
Jintu River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.1		0. 09	0.084
Sho River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.1		0. 09	0.084

Table 5-1 (b)   (continue)

Rivers	Cis-1,2-Dichloroent-yeine		1,1,1-trichloroent-hane		1,1,2-trichloroent-hane		Ttrichloroent hane		Tetrachloroent hane		1,3-dichchlorop-ropene		Thiuram		Thioben-carb		Benzene		Selenlum		Fluorine		Boron		Dioxins (pgTEQ/l)
Oyabe River	<	0.004	<	0.0005	<	0.0006	<	0.002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.1		0.16	0.073
Tedori River	E		E		E		E		E		E		E		E		E		E		E		E		
Kakehashi River		0.004		0.0005		0.0006		0.002		0.0005		0.0002		0.0006		0.002		0.001		0.002	<	0.1		0.09	0.52
Kuzuryu River	E		E		E		E		E		E		E		E		E		<	0.002	E		E		
Kita River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.02		0.1	0.23
Yura River	<	0.004	<	0.1	<	0.0006	<	0.003	<	0.001	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002		0.3		0.1	
Maruyama River	E		E		E		E		E		E		E		E		E		<	0.001	E			0.1	0.089
Chiyo River		0.004		0.0005		0.0006		0.002		0.0005		0.0002		0.0006		0.002		0.001		0.002		0.1		0.1	0.089
Tenjin River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.1	<	0.08	0.083
Hino River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.1	<	0.08	
Hii River	<	0. 004	<	0.0005	E		<	0. 002	<	0.0005	E		E		E		E		E			0.03		0.1	0.15
Gono River	<	0. 004	<	0.0005	<	0.0006	<	0. 002	<	0.0005	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002	<	0.02	<	0.08	
Takatsu River	E		<	0.0005	E		<	0.002	<	0.0005	E		E		E		E		E			0.07		0.11	
Onga River	E		E		E		E		E		E		E		E		E		E		E		E		
Matsuura River	<	0. 004	<	0.1	<	0.0006	<	0. 003	<	0.001	<	0.0002	<	0.0006	<	0.002	<	0.001	<	0.002		0.02	<	0.1	

Table 5-1 (c) Concentration of POPs in the Ishkari River that flow into the NOWPAP Region

(Unit: pg/l)

POPs	Sample No. 1	Sample No. 2	Sample No. 3	Determination limit	Number of detected sample	Number of sample	Minimum value	Maximum value
PCB	180	420	370		3	3	180	420
Mono-CBs	0.84	1.1	0.89	0.18	3	3	0.84	1.1
Di-CBs	14	13	19	0.6	3	3	13	19
Tri-CBs	22	42	70	0.9	3	3	22	70
Tetra-CBs	45	99	120	0.9	3	3	45	120
Penta-CBs	56	140	94	0.6	3	3	56	140
Hexa-CBs	31	90	44	0.9	3	3	31	90
Hepta-CBs	10	26	14	0.6	3	3	10	26
Octa-CBs	1.7	4.1	2.3	0.9	3	3	1.7	4.1
Nona-CBs	tr(0.5)	tr(0.8)	tr(0.40)	0.9	3	3	tr(0.4)	tr(0.8)
Deca-CB	tr(0.70)	tr(0.70)	tr(0.80)	0.9	3	3	tr(0.70)	tr(0.80)
Aldrin	1.3	1.1	1.3	0.6	3	3	1.1	1.3
Dieldrin	71	76	82	1.8	3	3	71	82
Endrin	8	8	8	6	3	3	8	8
p,p'-DDT	220	200	420	0.6	3	3	200	420
p,p'-DDE	110	86	150	0.6	3	3	86	150
p,p'-DDD	50	47	87	0.24	3	3	47	87
o,p'-DDT	52	46	77	1.2	3	3	46	77
o,p'-DDE	3.5	2.8	3.9	0.9	3	3	2.8	3.9
o,p'-DDD	18	16	22	0.6	3	3	16	22
trans-Chlordane	23	24	39	1.5	3	3	23	39
cis-Chlordane	18	18	29	0.9	3	3	18	29
trans-Nonachlor	11	13	19	1.2	3	3	11	19
cis-Nonachlor	2.1	2.3	4	1.8	3	3	2.1	4
Oxychlorden	3.6	4.6	5.6	1.2	3	3	3.6	5.6
Heptachlor	tr(1.0)	tr(1.1)	2	1.5	3	3	tr(1.0)	2
alpha-HCH	150	180	250	0.9	3	3	150	250
beta-HCH	1100	1100	1100	0.9	3	3	1100	1100

Note: 1. These data were measured on just only a day, November 19, 2002.
2. "tr" is abbreviation of "trace amount" which means that the data is under the detection limit shown between parentheses.

Table 5-2 Water quality of the rivers that flow into the NOWPAP Region from other data source including other parameters

(Unit: mg/l)

Rivers	Alkalinity	DO	SS	SiO_2	BOD	CDO_{Mn}	TOC	T-N	NH_4-N	NO_3-N	NO_2-N	O-N	T-P
Ishikari River[1]	0.69	10.2	42	18.0	3.2	4.7	3.3	0.98	0.10	0.66	0.02	0.28	0.068
Mogami River[1]	0.37	10.5	6	15.0	1.9	2.7	2.0	0.62	0.01	0.46	0.01	0.30	0.032
Shinano River[1]	0.61	10.0	10.5	15.5	3.8	2.9	2.5	1.15	0.04	0.80	0.02	0.24	0.071
Jintu River[1]	0.70	9.0	6	12.5	1.8	2.0	1.5	2.46	1.43	0.99	0.11	0.47	0.039
Tedori River	<0.5	13.0	4	8.7	0.7	1.2	1.1	0.43	0.01	0.31	0.00	0.11	0.010
Kuzuryu River	<0.5	9.9	2	10.0	1.1	1.5	1.4	0.76	0.13	0.46	0.01	0.22	0.029
Gono River[1]	0.65	9.8	1.5	12.0	3.9	2.5	2.2	0.51	0.01	0.40	0.00	0.11	0.022
Takatsu River	<0.5	11.0	12	10.0	3.7	2.9	1.1	0.69	0.12	0.23	0.03	0.36	0.058
Onga River	1.70	9.0	8	2.4	2.2	4.1	2.3	0.97	0.15	0.36	0.01	0.40	0.071

Note: 1 Data in FY 2000

(Source: The NOWPAP Promoting Project Report, 2003, NPEC)

5.1.2 Pollution Loads from Rivers

Estimation of the pollutant loads (in fiscal year 2002) of each river (first class rivers) that flow in the NOWPAP region is indicated in Table 5-3(a) and (b).

The pollution loads to the NOWPAP region were estimated by multiplying the volumetric flow rates of the various rivers by the concentrations of various pollutants in each river. BOD, COD, and SS are the general water quality parameters considered to be the best indexes for assessing water pollution. The concentration of other pollutants like heavy metals and pesticides are under the limit of analytical detection, so there loads flow into NOWPAP region will be negligible. The pollution loads of the Ishikari, Omono, Mogami, Agano, and Shinano Rivers, located in the Hokkaido and Hokuriku regions, indicate that these rivers carry large pollution loads especially.

Table 5-3(a) Annual pollution loads of rivers that flow into the NOWPAP Region

(Unit: ton/year)

	Rivers	Flows (m^3/s)	BOD	COD	SS	T-N	T-P	NO_2-N	NO_3-N
1	Teshio River	187.6	3,550	21,297	29,579	3,017	189		
2	Rumoi River	10.1	671	1,757	4,792	406	21	14	37
3	Ishikari River	457.9	14,439	70,753	505,379	16,172	1,069		
4	Shiribetsu River	58.8	927	4,450	7,416				
5	Shiribeshitoshibetsu River	21.9	414	1,792	2,758	227	21		
6	Iwaki River	92.3	4,946	11,055	43,638	4,073	218	128	
7	Yonesiro River	223.6	8,461		35,256	4,795	162		
8	Omono River	314.9	11,917		89,376	8,342	328		
9	Koyoshi River	81.3	3,076		23,066	1,897	126		
10	Mogami River	433.6	11,571	32,141	218,557	9,981	410		
11	Aka River	92.3	2,478	6,505	34,076	1,776	84	31	620

Table 5-3(a) (continue)

12	Ara River	144.8	2,740	10,048	18,269	1,507	73	0	1,005
13	Agano River	434.1	11,973	37,414	119,726	8,076	767		
14	Shinano River	400.1	15,294	40,784	165,684	11,607	1,072		
15	Seki River	50.7	2,076	6,748	43,260	1,806	117	35	709
16	Hime River	44.4	1,243	4,834	131,221	897	403		
17	Kurobe River	83.2	1,607	4,553	18,746	735	47	0	428
18	Joganji River	16.9	372	977	4,186	308	12	0	112
19	Jintu River	151.3	6,598	12,182	35,530	7,298	186	0	3,147
20	Sho River	39.2	1,052	2,804	11,684				
21	Oyabe River	68.9	4,669	9,782	17,786	3,042	228	0	1,712
22	Tedori River	83.2	2,803		86,625	1,365	115	25	866
23	Kakehashi River	18.6	486		6,678	404	23	6	243
24	Kuzuryu River	46.9	2,072	5,475	13,317				
25	Kita River	4.8	90	347	1,357				
26	Yura River	39.2	1,036	3,699	5,919	964	61	15	903
27	Maruyama River	34.6	2,179		5,448	523	59		
28	Chiyo River	43.3	1,634	2,217	3,500				
29	Tenjin River	13.3	335	754	838				
30	Hino River	22.5	921	2,479	11,333				
31	Hii River	39.3	1,610		8,669	879	37	4	393
32	Gono River	119.2	1,879		7,517				
33	Takatsu River	30.8	486		1,945				
34	Onga River	17.0	460	893	1,894	702	56		
35	Matsuura River	9.7	134	476	2,084	195	14		
Nominally Total		3,930	126,197	(296,217)	1,717,108	(90,995)	(5,899)		—

Note: "0" means that the average annual concentration was below the minimum limit of detection. The blank cells means no data. The number in the blankets shows provisional total value.

Table 5-3 (b) Annual pollution loads that flow into the NOWPAP Region from other data source including other parameters

(Unit: ton/year)

Rivers	Flows (m^3/s)	SS	SiO_2	BOD	COD_{Mn}	TOC	T-N	NH_4-N	NO_3-N	NO_2-N	O-N	T-P	PO_4^{3-}
Ishikari River[1)]	579	767,065	328,742	58,443	84,925	60,269	17,898	1,835	12,054	393	5,114	1,242	1,653
Mogami River[1]	395	74,814	187,035	23,691	33,043	24,315	7,731	156	5,736	106	3,741	393	237
Shinano River[1]	368	121,812	179,818	44,084	33,643	28,423	13,341	458	9,223	244	2,784	824	887
Jintu River[1)]	164	30,960	64,499	9,288	10,062	7,482	12,693	7,379	5,108	550	2,399	199	279
Tedori River	83	10,498	22,833	1,837	3,149	2,887	1,129	18	814	3	289	26	45
Kuzuryu River	47	2,959	14,797	1,628	2,220	2,072	1,125	192	681	13	326	43	111
Gono River[1)]	125	5,927	47,414	15,409	9,878	8,693	2,015	36	1,580	18	415	87	124
Takatsu River	31	11,671	9,726	3,599	2,820	1,070	671	117	224	26	350	56	21
Onga River	17	4,286	1,286	1,179	2,197	1,232	520	80	193	6	214	38	15
Total	1,809	1,029,991	856,149	159,158	181,937	136,442	57,123	10,272	35,612	1,358	15,632	2,908	3,372

Note: 1) Data in FY 2000

(Source: The NOWPAP Promoting Project Report, 2003, NPEC)

Figure 5-1 shows the annual change of the amount of the BOD load from 1995 to 2002 from the first class rivers that flow into the NOWPAP region. In general, the data presented in this figure indicate pollutant loads are almost stable or tending to decrease, although some of the rivers do not follow the general pattern.

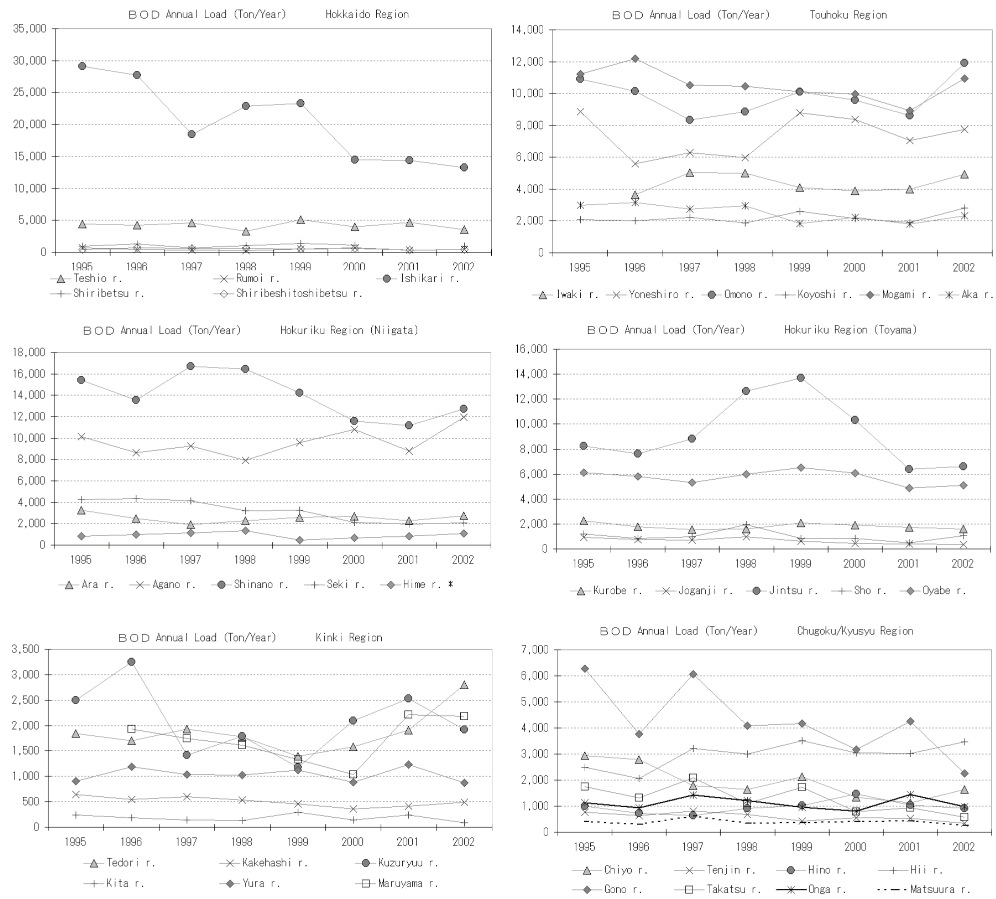


Figure 5-1 Interannual change of amount of inflow BOD load in the NOWPAP Region

5.2 Direct Pollution Loads

In this section, the pollution loads from sewage treatment plants and the main industrial plants that discharge treated wastewater directly into the NOWPAP region and the pollution load from ocean dumping are estimated and discussed.

5.2.1 Sewage Treatment Plants

The number of sewage treatment plants from which the treated wastewater is discharged directly to the NOWPAP region and the pollution loads from them are summarized in Table 5-4.

Table 5-4 Number of sewage treatment plants and pollution loads discharged directly to the NOWPAP Region

Prefecture	Number of public sewage treatment plant	Amount of BOD discharge (kg/day)	Amount of COD discharge (kg/day)
Hokkaido	4	67.4	191.4
Aomori	0	-	-
Akita	1	315.0	1,035.0
Yamagata	1	6.0	19.5
Niigata	4	85.3	133.3
Toyama	5	1,371.3	1,814.5
Ishikawa	9	79.5	218.2
Fukui	5	120.2	301.8
Nagano	5	202.3	686.9
Kyoto	1	2.7	2.7
Hyogo	5	366.5	728.7
Tottori	3	8.4	14.6
Shimane	5	684.9	1,467.1
Yamaguchi	7	4,832.6	8,462.6
Fukuoka	2	141.7	418.3
Nominal Total	57	8,283.8	15,494.7

(Source: The data was processed from Japan Sewage Statistics (FY 2002). Values of the total amounts of discharges should be regarded nominal because the scale of each sewage treatment plant varies over a wide range.)

A total of 57 sewage treatment plants were identified that discharge directly to the NOWPAP region. The total BOD and COD loads entering the region from direct discharges are about 8 tons per day and about 15 tons per day, respectively.

The number of plants and the BOD, COD loads are the largest in Fukuoka Prefecture.

5.2.2 Major Industrial and Business Facilities

The number of offices which discharged directly to the NOWPAP region in each prefecture was 28 offices (5 in Aomori Prefecture, 5 in Akita Prefecture, 3 in Yamagata Prefecture, 2 in Tottori Prefecture, 10 in Shimane Prefecture, and 3 in Yamaguchi Prefecture) in total in the report of fiscal year 2004.

5.2.3 Waste Discharge to the Sea

Table 5-5 shows the total amount of waste discharged into the sea surrounding the whole of Japan.

The total amount of ocean waste dumping is up to 10,400,000 tons in 2003, and about 60% of it is dredged sediment, about 30% is bauxite residue and construction sludge. The amount of ocean dumping in Japan has decreased gradually since 1997.

Table 5-5 Amount of waste discharged to sea nationwide in Japan

(Unit: 1000 tons)

Type Waste		1997	1998	1999	2000	2001	2002	2003
Abolition explosive		0.7	0.3	0.2	0.5	0.4	1.0	0.6
Sewage sludge	Human Sewage Johkasou sludge	2,396	2,181	1,886	1,702	1,481	1,249	996
	Sewage sludge and Nonflammable waste	5	7	2	4	20	22	10

Organic sludge	Sludge and residue of food processing industry	538	519	323	267	192	161	148
	Others	-	-	-	-	-	-	-
Insoluble inorganic sludge	Mining sludge	-	-	-	-	-	-	-
	Bauxite residue and constructi on sludge	2,789	2,683	2,595	2,869	2,643	2,457	2,685
	Constructi on sludge	-	(965)	(1,028)	(1,077)	(963)	(806)	(948)
	Bauxite residue	-	(1,718)	(1,567)	(1,792)	(1,680)	(1,651)	(1,736)
	Others	-	-	-	-	-	-	-
Dredged sediment		6,466	7,045	6,628	5,426	6,274	5,586	6,576
Total		12,195	12,435	11,434	10,269	10,610	9,476	10,416

6. Proposals for Future Regional Activities

At present, the Japanese government is promoting the following management approaches for the aquatic environment in Asia.

The Water Environmental Partnership in Asia (WEPA) proposal is aimed at enhancing governance in conservation of aquatic environments and capacity building in Asia. Also, the Network of Asian River Basin Management Organizations (NARBO) was established in February 2004, which aims at sharing technology and information among the Asian countries, and Japan will support the cooperation among the member countries. In addition, the Ministry of the Environment is starting its survey on marine litters in the Japanese waters in the fiscal year 2005.

In the future regional activities of POMRAC, it should be important to share the monitoring data through these activities.

7. Conclusions

In this report, the natural environmental factors and the socioeconomic factors are analyzed as an index of human activities that contribute to pollutant loads in the NOWPAP region. Particular emphasis is given to the legal and regulatory remedies in place internationally and in Japan for addressing water pollution issues in river systems draining into the NOWPAP region, as well as pollutants discharged directly into the marine environment.

In Japanese regulatory system, environmental quality standards are defined by the Basic Environment Law for each type of water body, including rivers, lakes and coastal areas, and effluent standards are defined by the Water Pollution Control Law and the Sewage Law.

This report also describes the water quality monitoring systems in place within the region, including research activities aimed at improving the interpretation and predictive analysis of monitoring data. There is a total of 16 prefectures facing the NOWPAP region in Japan, though the descriptions in this report cover over 21 prefectures.

Under the nationwide monitoring programs in Japan, each prefecture is responsible for monitoring water quality by measuring various parameters, including heavy metals; chlorinated hydrocarbons; and organic pollution indexes, such as COD, BOD, and DO. The prefectures are responsible for conducting these measurements at a frequency of about once a month at the environmental quality standard points in the rivers and coastal areas. The flow rates of the major rivers are also measured; therefore, the pollutant load that flows in the NOWPAP region can be estimated from the water quality concentration and the flow rate data.

The theme of the "River and Direct Inputs to the Sea" corresponds to the action to deal with the watershed, the river and the sea as an aquatic continuum. To this end, we need to organize certain environmental indices that are common to each of the three parts of the continuum. We could not say that the present situation, for example BOD for the river environment and COD for the marine environment, is ideal. Also the difference among the dimension of the sea is far larger than those of the watersheds and rivers. As a result, the change in the marine environment is seemingly very subtle compared to those in the watersheds and rivers. The situation can be past cure once the adverse change become visible in the NOWPAP region, which is basically a semi-closed sea and the inputs can be accumulated. Therefore precautionary approaches are particularly needed in terms of the assessment and counter measures based on the soundly designed monitoring programs.

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National Report of China
on River and Direct Inputs of Contaminants
into the Marine and Coastal Environment in NOWPAP Region

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National Report of China on River and Direct Inputs of Contaminants into the Marine and Coastal Environment in NOWPAP Region

1. Executive Summary

The document, National Report of China on River and Direct Inputs of Contaminants into the Marine and Coastal Environment in the NOWPAP Region, is prepared for Working Group 2 (WG2) that based on the decisions of the POMRAC Focal Point Meetings (Vladivostok, Russia, 1st Meeting on 9-11, April 2003, the 2nd Meeting, 26-27, May 2004 and the 3rd Meeting, 10-11, October 2005). This is the Final National Report of China to the secretariat of POMRAC of NOWPAP and approved by with responsible sector in China.

To meet the requirements of the decisions and prepare the regional report of the whole NOWPAP Region, the report is focused on the description for the status of contaminants in China, including general information, national monitoring and assessment activities, present situation, and proposals for future regional activities and recommendation of priorities in NOWPAP Region.

There are parts of 6 major river basins and part of Yellow Sea districts involved into NOWPAP Region, whose being located at northern and eastern of China, belonging to 5 provinces and taking 10.8% of whole country in terrestrial area.

The other information is reported in the document according to the requirement by the POMRAC Meetings.

2. Introduction

2.1 Goals and Objectives

The Regional Seas Programme of the United Nations Environment Programme (UNEP) has been promoted as an action-oriented program for management of marine and coastal environments in collaboration with regional countries. As a part of the program, the Northwest Pacific Action Plan (NOWPAP) was adopted at the First Intergovernmental Meeting (IGM) in Seoul, Korea, on September 1994, attended by China, Japan, Korea, and Russia.

The Pollution Monitoring Regional Activity Centre (POMRAC) was established as one of four Regional Activity Centres of NOWPAP. Working Group 2 (WG2) of POMRAC focuses on water pollution discharged to rivers or directly into the marine environment.

The report will be contributed to the Working Group 2 (WG2). The goals and objectives are identification of the status and background for preparing whole regional pollution monitoring activities at next stage.

2.2 General Background Information on NOWPAP

For nearly three decades, UNEP has fostered regional cooperation on behalf of the marine and coastal environment. It has accomplished the cooperation by stimulating the creation of “Action Plans”- prescriptions for sound environmental management- for each region. Now, more than 140 coastal countries are participating in 13 Regional Seas Programmes established under UNEP auspices. Five partner programs are also fully operational.

NOWPAP or, in full, Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region is one of the 'Action Plans' which covers the Northwest Pacific Region.

The area surrounding the Northwest Pacific is one of the most highly populated parts of the world and is receiving enormous pressures on the environment. The countries of the region, the People's Republic of China, Japan, the Republic Korea and the Russian Federation participate in NOWPAP by joining forces.

NOWPAP was adopted at the First Intergovernmental Meeting (IGM) in 1994, following a series of meetings of experts and National Focal Point Meetings that started as early as 1991.

The overall goal of the NOWPAP is "the wise use, development and management of the coastal and marine environment so as to obtain the utmost long-term benefits for the human beings of the region, while protecting human health, ecological integrity and the region's sustainability for future generations".

The IGM, made up of senior representatives of the NOWPAP members, provides policy guidance and decision-making for NOWPAP. The plan incorporates seven priority projects to be implemented through a network of Regional Activity Centres (RACs) - CEARAC, DINRAC, MERRAC and POMRAC. The RACs play a central role in coordinating regional activities in specific fields of priority projects. NOWPAP's Regional Coordinating Unit (RCU), co-hosted by Japan and the Republic of Korea, serves as nerve center and command post of the Action Plan's activities.

The activities agreed upon as part of the implementation of NOWPAP are financed principally by contributions from the Members, international organizations and non-governmental organizations to the NOWPAP Trust Fund.

So far, the priority projects of NOWPAP are set as following:

NOWPAP 1: Establishment of a comprehensive database and information management system;

NOWPAP 2: Formation of a survey of national environmental legislation, objectives, strategies and policies;

NOWPAP 3: Establishment of a collaborative regional monitoring program;

NOWPAP 4: Development of effective measures for regional cooperation in marine pollution preparedness and response;

NOWPAP 5: Establishment of Regional Activity Centre (RAC) and the network among these centers;

NOWPAP 6: Promotion of public awareness of the marine, coastal, and associated freshwater environments;

NOWPAP 7: Assessment and management of land-based activities.

2.3 General Information

China is a big coastal country in Asia. The total sea area, totally 4,730,000 km^2, is divided into four sea areas from the north to the south, including the Bohai Sea, the Yellow Sea, the East Sea and the South China Sea. The length of the mainland coastline is more than 18,000 km and that of the island coastline is about 14,000 km.

With the developing activities at land-based basins, many rivers input drainages with contaminants into the marine and coast environments. Most wastewater sources have been treated well before discharge, but some not yet. To manage and control the pollution, therefore, many laws and legislations, from national and local, are set to discharging sources. There two kinds standards, environmental quality and effluent quality, are important and basic requirements to protect environments and reduce pollutants loads, although many different between those standards and being revised. Besides, the standards of environments are divided for surface waters, underground waters, marine waters, and for special usage waters as well. Generally speaking, the main controlled contaminations are chemical oxygen demand (COD) and ammonia nitrogen (NH_3-N) in fresh water, and COD, biochemical oxygen demand (BOD), inorganic nitrogen (IN), and active phosphate (P) in marine water.

2.4 Geographical Scope

According to the United Nation's principal (1997), the NOWPAP Region includes marine, near-shore coasts and offshore basins at 33°-52°N and 121°-143°E (Figure 2-1).

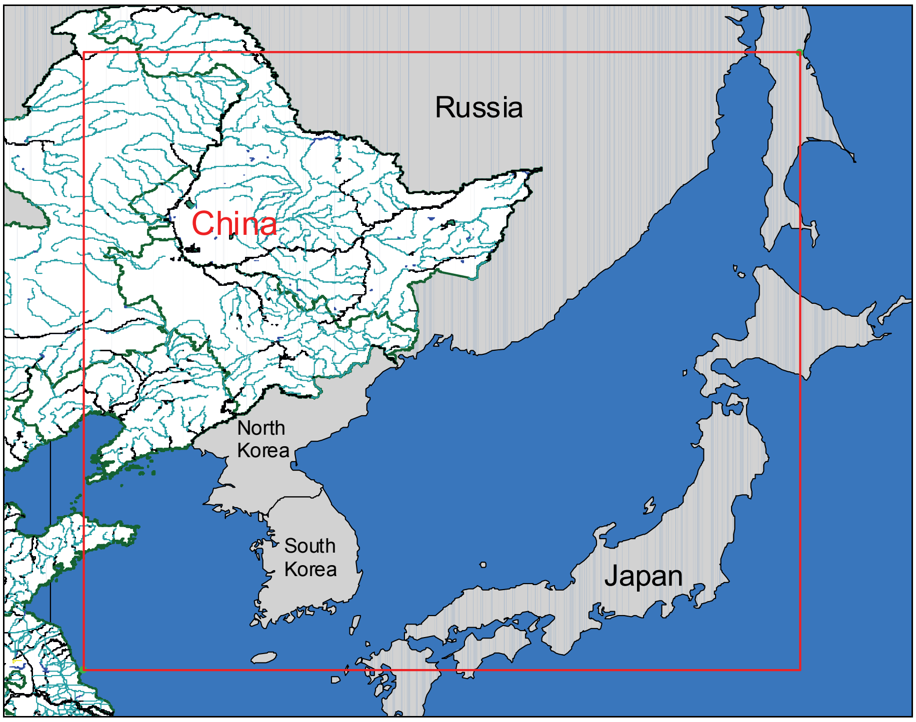

Figure 2-1 NOWPAP Region

The Chinese marine parts in NOWPAP mainly refer to the Yellow Sea, belonging to Liaoning, Shandong and Jiangsu three provinces. The terrestrial parts include Heilongjiang, Jilin, Liaoning, Jiangsu, and Shandong five provinces or municipality. The total land surface area of the basin and the total length of the coastline is about 1,004,000 km^2 and 6054 km, respectively. The regional area accounts for 10.8% of the entire area of China. The number of major rivers in these basins is 6, and the amount of a total discharge was about 1193.1 billion tons/year in fiscal year 2002.There are 3 parts of basins in National Water Resources' First Zones, Songhua River, Liaohe River and Haihe River basins, are covered in NOWPAP Region, with thousands rivers, lakes and reservoirs (Figure 2-2).

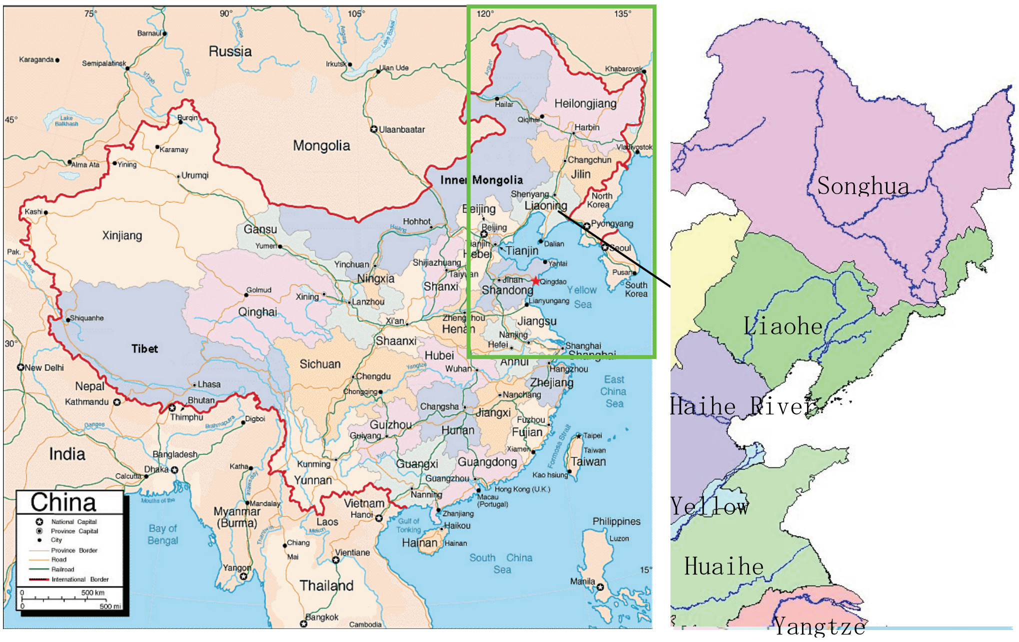

Figure 2-2 Northeast China Rivers in NOWPAP Region

Major cities, rivers and coastline

The major cities in NOWPAP Region include Harbin, Changchun, Shenyang, Dalian, Yantai, Qingdao, and Lianyungang, whose locations have been noted in Figure 2-2. The GDP from the related provinces is up to 3784 billion RMB, which 36.5% of the nationwide total, and industrial output keeps increasing up to now.

The major rivers' basins of the region include Songhua River, Liaohe River, Haihe River, Yellow River, Huaihe River and Yangtze River, directly or indirectly.

The other two provinces or city, Hebei and Tianjin, belongs to Haihe River basin that input indirectly to the NOWPAP region through the Bohai Sea that connects to Yellow Sea from western. The part of Shandong in Huaihe River basin also inputs to the Yellow Sea indirectly through the marine out of the Region. The part of Jiangsu, in Yangtze River Basin, inputs indirectly to the Region through Yellow Sea (Table 2-1).

Table 2-1 Geographical characteristics of the main territorial objects

Basin/Marine	Name of province				
	Heilongjiang	**Jilin**	**Liaoning**	**Shandong**	**Jiangsu**
Songhua River	√	√	√		
Liaohe River		√	√		
Haihe River			(√)	(√)	
Yellow River				√	
Huaihe River				(√)	√
Yangtze River					(√)
Yellow Sea			√	√	(√)

Note: (√) indicates the indirectly input to NOWPAP Region.

Table 2-2 lists annual discharges statue of the six main rivers. Only limited of the fluxes of the discharges, however, can be input into the NOWPAP region through the outside marine waters.

Table 2-2 Annual discharge of major rivers

Items	Songhua River	Liaohe River	Haihe River	Yellow River	Huaihe River	Yangtze River
Area ($10^4 m^2$)	55.7	22.9	26.4	75.2	26.9	180.9
Length (km)	2308	1390	1090	5456	1000	6300
Annual precipitation (mm)	527	473	559	475	889	1070
Average discharge (billion m^3)	76.2	14.8	22.8	65.8	62.2	951.3

Climate systems

Climate of Jiangsu province and Shandong province belong to warm temperate zone half moist continent monsoon climate, four seasons distinct. South wind is popular in Summer of Shandong province and Jiangsu province is often attacked by typhoon. The average value of annual temperature of the two provinces is above 5. The annual precipitation value of Jiangsu province is about 1000 mm, while 550~950 mm of Shandong province.

The other three provinces belong to temperate continental monsoon climate, with more drought and cloudy days in spring and hot and rainy days in summer. The winter days last longer than other provinces of China. Of the three provinces, annual precipitation of Liaoning province is most abundant with 600~1100 mm.

Physical geography

The major relief of Jiangsu province, Shandong province and Liaoning province are hilly and plain regions, while mountainous regions cover a big proportion in the other two provinces. Besides, water area of Jiangsu province is quite large with 17% of the whole province.

The vegetation rate of Liaoning province, Heilongjiang province and Jilin province is separately 28.7%, 41.9% and 42.4%. Contrast with the three provinces, the vegetation rate of the other two provinces is much lower with 21.5% of Shandong province and 10.56% of Jiangsu province.

Of the five provinces, Heilongjiang and Liaoning province is abundant in protected natural areas with a total number 84 and 81 separately, covering 2.3 million hectares occupying 5.05% area of whole province and 2.848 million hectares occupying 9.7% area of the whole province separately. Secondly, there are 66 protected natural areas in Shandong province covering about 6% area of whole province. At last, number of Jiangsu and Jilin provinces is relatively fewer with 26 and 27 separately covering 0.738 million hectares and 1.846 million hectares.

3. Social and Economic Situation in 2001-2002

This part includes the historical review for the last decade; Short overview of relevant social and economic aspects related to river and direct inputs of contaminants. e.g. population, distribution of communities, anthropogenic activities which cause river and direct inputs of contaminants, transport, energy, industry.

3.1 Population, Distribution of Communities in the Country

The social and economic information of the related main territorial objects in the year of 2002 is listed in Table 3-1. It should be noticed that only the parts of the provinces are covered in the NOWPAP Region. The exact data divided within the Region are not available unless carrying on more investigations and works in further.

Table 3-1 Geographical characteristics and economic situation of the main provinces in 2002

Province	Square, km^2	GDP per capita, USD/person	Population (million)
Jiangsu	100,000	2102	74.058
Shandong	150,000	1703	91.25
Liaoning	150,000	1782	42.10
Jilin	180,000	1166	27.037
Heilongjiang	460,000	1453	38.15

3.2 Industrial Condition of Major Provinces (2002)

The total added industrial value of Heilongjiang Province is 193.5 billion RMB, which had increased by 11.0% than last year. Heilongjiang Province is abundant in green food, which is the major industry in this region.

The total weath of society of Jilin Province by the end of 2002 is 1445.5 billion, among which the wealth from enterprises accounts for 70.1%. The preponderant industry of Jilin Province is resources exploitation and manufacturing industry, including petrol and natrual gas exploitation, tabacco manufacturing, black metal smelt, and transportation devices manufacturing, etc.

The total industrial value of Liaoning Province of 2002 is 490.48 billion RMB, which had increased by 15.3% than the last year. The major industries of Liaoning Province are metallurgy industry, oil and petrifaction industry and electronics manufacturing industry, etc.

The total added industry value in Shandong Province of 2002 is 350.2 billion RMB, which had increased by 17.3% than the last year. The added production value of heavy industry and light industry are 213.64 billion and 136.6 billion RMB separately. The branch industry includes petroleum and natural gas exploitation industry, food manufacturing industry, textile industry, chemical materials manufacturing industry, non-metal mineral manufacturing industry, and wiring manufacturing industry, whose production value account for the 54.8% of the whole.

The added value of total industry production of Jiangsu Province in 2002 is 482.01 billion, which had increased by 14.0% by the last year. The added production value of heavy industry is beyond that of light industry, focused on textile industry, electronics industry, chemicals manufacturing industry, etc.

3.3 Energy

The total energy consumption in 2002 is about 1.5 billion tons of coal, which has added 0.5 billion tons than that of 1990 with an average annual rate of 3.6%. Of which, coal occupies 66.3%, petrol occupies 23.5%, natural gas occupies 2.6% and water-electricity and nucleus energy occupies 7.6%.

Nearly 70% coals are not completely burned, which caused SO_2 and dust emission and led to acid rain finally. High grade energy such as petrol and natural gas occupied 33.7% of the whold energy consumpition in 2002, which has incresed by 9.9% than 1990. While, the energy consumption level is still lower than developped countries with the energy consumption each person is 156 KWh, which is only 7.7 % of Japan and 4% of USA.

4. National Monitoring and Assessment Activities

4.1 Overviews of National Policies and Laws

The national monitoring tasks are, based on the types of the water bodies, taken by different ministries following the functions in their duties:

- State Environmental Protection Administration

  Responsible for the whole surface waters (i.e. lakes, reservoirs, and rivers), underground waters, coasts and near shores seawaters, and the waste water discharge sources as well. The monitoring items are water qualities, biology, sediments and discharge volumes. This duty is designated by the National laws and regulations, such as Environmental Protection Law and Water Pollution Prevention Law.

The monitoring stations, at every administrative level, have carried the routine monitory tasks, and additional jobs those to meet the supervisory requirements by any kinds uses.

- Ministry of Water Resources

  Responsible for the water resources, through the whole water moving process, from the generation, the influx, the flowing to the allocation for using. The main monitoring items are the water quantities and hydrological characters. The duty is based on the National Water Law.

  The measurement stations, divided into each grade of drainage or river basins, take the regulation surveys, and any additional tasks.

- National Marine Administration

  Responsible for the surveys of far shore water qualities at four marine areas. The job is defined in the State Law of Marine Environmental Protections. Major items in the surveys include hydraulics, physics, chemicals, biologics and sediments. The duty is accorded with the Law of Marine Environmental Protection mainly.

  The marine surveys and investigating jobs are taken by local teams at the same marine area.

The national and international laws and regulations, which related to the subject of China, are listed in Table 4-1.

Table 4-1 Main laws and regulations related to the contaminants inputs on environment

Type	Name and published year of document	Approved by
Law	Law of Fishery (1986)	People's representative Committee of China
	Law of Reservation for Wild Animals (1988)	
	Law of Environmental Protection (1989)	
	Law of Water and Soil Conservation (1991)	
	Law of Prevention on Environmental Pollution by Solid Wastes (1995)	
	Law of Water Pollution Prevention (1996)	
	Law of Mines Resources (1996)	
	Law of Marine Environmental Protection (1999)	
	Law of Water (2002)	
	Law of Promotion on Clean Production (2002)	
	Law of Environmental Influences Assessment (2003)	
Legislation	Managing Guidelines to Protecting on Propagation of Aquaculture Resources (1979)	State Council of China
	Managing Guidelines to Prevention Marine from Shipping (1983)	
	Managing Guidelines to Keep Contamination and Damage from Coastal Construction and Engineering (1990)	
	Managing Guidelines to Keep Contamination and Damage from Pollutants in Terrestrial Sources (1990)	
	Rules on Implementation of the Law of Prevention of Terrestrial Wild Animals (1992)	
	Technical Guidelines on Environmental Impacts Assessment (1993)	
	Rules on Implementation of the Law of Prevention of Water and Soil (1993)	
	Rules on Implementation of the Law of Prevention of Aquicolous Wild Animals (1993)	
	Guidelines on Natural Preservation Zones (1994)	
	Guidelines on Preservation of wild Plants (1996)	
	Management Ordinance of Environmental Protection on Projects (1998)	
	Detailed Rules on Implementation of the Law of Prevention of Water Pollution (2000)	
	Implementation Guidelines on Law of Forests (2000)	

Type	Name and published year of document	Approved by
Standard	Sanitary Standard for Drinking Water (1985)	National or Ministries
	Water Quality Standard for Fisheries (1989)	
	Quality Standard for Agricultural Irrigation (1992)	
	Wastewater and Sludge Disposal Standard for Municipal WTP (1993)	
	Integrated Wastewater Discharge Standard (1996)	
	Sea Water Quality Standard (1997)	
	Discharge Standard for Municipal Wastewater (1999)	
	Environment Quality Standard for Surface Water (2002)	
	Standard for Pollution Control of Sewage Marine Disposal Engineering (2000)	

According to **"Law of Environmental Protection",** Chaper I, Article 7, the envrionmental protection should be carried out by serval departments & ministries:

"The competent department of environmental protection administration under the State Council shall conduct unified supervision and management of the environmental protection work throughout the country. The competent departments of environmental protection administration of the local people's governments at or above the county level shall conduct unified supervision and management of the environmental protection work within areas under their jurisdiction."

"The state administrative department of marine affairs, the harbour superintendency administration, the fisheries administration and fishing harbour superintendency agencies, the environmental protection department of the armed forces and the administrative departments of public security, transportation, railways and civil aviation at various levels shall, in accordance with the provisions of relevant laws, conduct supervision and management of the prevention and control of environmental pollution. The competent administrative departments of land, minerals, forestry, agriculture and water conservancy of the people's governments at or above the county level shall, in accordance with the provisions of relevant laws, conduct supervision and management of the protection of natural resources."

According to **"Law of the People's Republic of China on the Prevention and Control of Water Pollution**"(Amended on 5/15/1996).

Article 3 Competent departments under the State Council and local people's governments at various levels shall incorporate the protection of the water environment into their plans and adopt ways and measures to prevent and control water pollution. Article 4 The environmental protection departments of the people's governments at all levels shall be the organs exercising unified supervision and management of the prevention and control of water pollution.

Navigation administrative offices of transportation departments at various levels shall be the organs exercising supervision and management of pollution from ships.

Water conservancy administration departments, public health administration departments, geological and mining departments, municipal administration departments and water sources protection agencies on major rivers of people's governments at various levels shall, through performing their respective functions and in conjunction with environmental protection departments, implement supervision and management of the prevention and control of water pollution.

Article 19 Urban sewage shall be disposed of in a centralized way.Competent departments under the State Council and local people's governments at various levels must incorporate into their plans of municipal construction the protection of urban water sources and the prevention and control of urban water pollution, construct and perfect municipal drainage systems, and construct urban sewage treatment facilities in a planned way, in order to strengthen the comprehensive improvement of urban water environment.

Urban sewage treatment facilities shall, according to the state provisions, be used to provide paid service of sewage treatment for pollutant dischargers, and the fee for sewage treatment shall be collected to ensure the normal operation of sewage treatment facilities. Where sewage is discharged into urban sewage treatment facilities and the fee for sewage treatment has been paid therefor, the discharge fee shall not be levied. The income derived from the fee for sewage treatment so collected must be used for the construction and operation of urban sewage treatment facilities and may not be appropriated for other purposes. The State Council shall formulate specific measures for the collection of the sewage treatment fee, and for the management and utilization of urban sewage treatment facilities.

The China National Monitoring Center is the top level in the environmental monitoring network according the **"regulation of environmental monitoring of the People's Repulic of China".**

Article II: the task of environmental monitoring is regular monitoring on the environment factors, and evaluate the environmental quality status and changing tendency; surveillant monitoring on the pollutant emission of relative plant & organization; provide accurate and reliable data & information for the govenment to perform the environmental protection activities according to the environmental laws & regulations and standards; promote environmental monitoring technique with researches.

Article III: the work of environmental monitoring should be fulfilled under the plan, arrangement and organizing of the environmental protection administration. The environmental monitoring organization belongs to the different departments enterprises should take part in the different levels of the environmental monitoring network which organized by the environmental protection administration.

Article V: there's 4 levels of environmental monitoring center in China.

First level: China National Environmental Monitoring Center.

Second level: the environmental monitoring center in different provinces or municipalities govener by the central government.

Third level: the environmental monitoring center in municipalities govener by the provincial government.

Forth level: the environmental monitoring center in the counties and the district of municipalities.

4.2 National Programs

4.2.1 Marine Monitoring

The offshore environmental monitoring network of the State Environmental Protection Administration conducts regular monitoring for two or three times every year in the offshore areas in the entire country except Taiwan Province, Hong Kong and Macao Special Administration Regions, mainly including over 30 key areas and over 300 stationary seawater quality monitoring sites in the offshore areas near cities, estuaries of rivers, key harbors, fishery areas and the marine areas with frequent human activities. In certain areas, monitoring on the sediments and the ambient biological quality is also conducted.

In 2002, two-phase seawater quality monitoring was carried out in 381 monitoring sites in 37 key offshore areas in the country, with 76 sites in Bohai Sea, 124 ones in the Yellow Sea, 122 ones in the East china Sea and 59 ones in the South China Sea. The monitoring items include water temperature, salinity, suspended solid, pH, DO, COD (alkali manganese method), oil, activate phosphate, inorganic nitrogen (nitrite nitrogen, nitrogen nitrate and ammonia nitrogen), non-ion ammonia, mercury, copper, lead and cadmium, altogether 14 ones.

The assessment of the marine water quality follows “Sea water quality standard ”(GB3097-1997). In it, there are four classifications: The Grade One seawater is suitable for marine fishery areas, marine nature reserves and reserves for endangered and rare marine species. The Grade Two seawater is suitable for aquaculture areas, swimming, marine sports or entertainment areas with direct exposure of human bodies to the seawater as well as industrial water sources areas directly related to human foods. The Grade Three seawater is suitable for normal industrial water sources, coastal tourist areas. The Grade Four seawater is suitable for coastal harbours and operational areas of the marine development.

The assessment methodologies of the seawater is single element index method, namely once any the assessment indicator in one certain monitoring site exceeds the standards for the Grade One Seawater, the water quality at that site is at Grade Two; if it exceeds the standards for Grade Two Seawater, the water is at Grade Three and so on. 11 of the 14 monitoring items are used to decide the water quality classification.

The part of standard values of seawater (GB3097-1997) are listed in Table 4-2:

Table 4-2 Part of standard values of seawater items

	Item	Unit	Grade I	Grade II	Grade III	Grade IV
1	pH	-	7.8~8.5			6.8~8.8
2	DO >	mg/l	6	5	4	3

3	COD ≤	mg/l	2	3	4	5
4	BOD_5 ≤	mg/l	1	3	4	5
5	Oil ≤	mg/l	0.05		0.30	0.50
6	active phosphate ≤	mg/l	0.015	0.030		0.045
7	inorganic nitrogen ≤	mg/l	0.20	0.30	0.40	0.50
8	non-ion ammonia ≤	mg/l	0.020			
9	Hg ≤	mg/l	0.00005	0.0002		0.0005
10	Copper ≤	mg/l	0.005	0.010	0.050	
11	Lead ≤	mg/l	0.001	0.005	0.010	0.050
12	Cadmium ≤	mg/l	0.001	0.005	0.010	
13	Cr(VI) ≤	mg/l	0.005	0.010	0.020	0.050
14	Total Cr≤	mg/l	0.05	0.10	0.20	0.50
15	As≤	mg/l	0.020	0.030	0.050	
16	Zn≤	mg/l	0.020	0.050	0.10	0.50
17	Se≤	mg/l	0.010	0.020		0.050
18	Ni≤	mg/l	0.005	0.010	0.020	0.050
19	CN^-≤	mg/l	0.005		0.10	0.20
20	S^-≤	mg/l	0.02	0.05	0.10	0.25
21	v-phen≤	mg/l	0.005		0.010	0.050
22	Fcg[1]	Entrise/l	2000			-
23	Colform group	Entrise/l	10000			-
24	$C_6H_6CI_6$≤	mg/l	0.001	0.002	0.003	0.005
25	DDT≤	mg/l	0.00005	0.0001		
26	malathion≤	mg/l	0.0005	0.001		
27	Methyl parathion≤	mg/l	0.0005	0.001		
28	LAS[2]	mg/l	0.03	0.10		
29	$C_{20}H_{12}$≤	ug/l	0.0025			

Notes: [1]Fcg – fecal coliform group;
[2]LAS – linear alculate sulfonate

4.2.2 Surface Water Monitoring

1) Monthly report of surface water monitoring

The scope of the 7 key drainage areas' monthly report includes 571 surface water national monitoring stations, while 6 of them are involved in NOWPAP regions, that is Haihe River, Huaihe River, Liaohe River, Yangtze River, Yellow River, Songhua River, and 479 stations are included.

Monitoring items: water temperature, pH, electrical conductivity, dissolved oxygen, index of permanganate, BOD_5, ammoniac nitrogen, oil, volatile hydroxybenzene, hydrargyrum, plumbum and flux (mainly analyzing the tendency of water quality variation).

Monitoring frequency: The above items are monitored once every month. The else items are analyzed according to "The environmental quality criterion of the surface water (GB3838-2002)" except the above analyzed items, monitored 3 times once a year, and each time in dry season, normal season and flood season.

Monitoring time: from 1st to 10th every month; the date in May and in Octobor can be postponed until 15th.

Monitoring report: The monitoring centre of drainage area monitoring network should compile drainage area water quality monthly report, and deliver it to China National Environmental Monitoring Center (CNEMC). The evaluation standard unifiedly adopts "surface water environmental quality standard (GB3838-2002)". CNEMC issues drainage area water quality monthly report in public through various media before 5th next month. The center publishes the range of the monthly report and the distribution of the monitoring spots. The range of the monthly report covers Songhua River, Liaohe River, Haihe River, Yellow River, Huaihe River and Yangtze River, those related indirectly input to the NOWPAP region.

The data transprotation: The substations transport data to province(autonomous region,municipality directly under the Central Government) stations before 20th every month. The province(autonomous region,municipality directly under the Central Government) stations transport data to National Environmental Monitoring Center of China (CNEMC)and the central stations of the valley monitoring web before 25^{th} every month.

Transporting content and method: The name ,the transporting format and method of the monthly report are ruled by CNEMC.

2) Weekly report of surface water automatic monitoring

From 1999 to 2002, 43 automatic stations has been set up in the important basins.The distribution about automatic monitoring stations:Songhua River 4, Liaohe River 5, Haihe River 7, Yellow River 10, Yangtze River 17.

Monitoring items: There are eight items analyzed by the automatic monitoring stations, including water temperature (T), pH, dissolved oxygen (DO), electric conductivity (EC), turbidity (TB), chemical oxygen demand (COD_{Mn}), total organic carbon (TOC) and ammonium nitrogen (NH_3-N).

Monitoring frequency: The person managing the automatic system just can adjust the frequency. It could determine continuously and interrupted. Now, most stations analysis the water once per hour. So, we can obtain 24 data every day for each pollutant.

Data transportaion: The control center at CNEMC connected with substations through dialing modem and satellite. Data could get to CNEMC and to SEPA from local station through these two ways.

3) Environmental quality standards for surface water

The assessment of the surface water quality follows Environmental quality standard of surface water (GB3838-2002).

Single factor assessment method is used for the surface water quality classification system, namely once any the assessment indicator in one certain monitoring site exceeds the standards for the Grade One surface water, the water quality at that site is at Grade II; if it exceeds the standards for Grade Two surface water, the water quality is at Grade III and so on. The over standard rate, over standard multiple and integrated pollution index are calculated depending on the 3rd grade of "Environmental quality standard of surface water" (GB3838-2002).

The surface water are divided into 5 grades according to the standard:

Grade I: the source water of river, lake, etc; nature reserve.

Grade II: first level reserve area of source of drinking water, habitat of rare aquatic animals and plants, spawn area of fish and shrimps, food source area of cubhood fish.

Grade III: second level reserve area of source of drinking water, living area through the winter of fish and shrimps, migration routes, fishery area and swimming area.

Grade IV: source water for industry use and water for amusement that unosculant with body.

Grade V: source water for agriculture use and water for sight seeing.

The standard values of surface water (GB3838-2002) are listed in Table 4-3. While 7 items NH_3-N, COD_{Mn}, BOD_5, Hg, Pb, V-phen, Oils are used to decide the water quality classification of monthly report of surface water, and 4 items pH, DO, COD_{Mn}, NH_3-N used for weekly report.

Table 4-3 Standard values of surface water (GB3838-2002)

	Item	Unit	Grade I	Grade II	Grade III	Grade IV	Grade V
1	pH	-	6~9				
2	Temp.	C	Weekly Max raised temp≤1, weekly Min decline temp. ≤2				

3	DO ≥	mg/l	7.5	6	5	3	2
4	COD_{Mn}≤	mg/l	2	4	6	10	15
5	COD≤	mg/l	15	15	20	30	40
6	BOD_5 ≤	mg/l	3	3	4	6	10
7	NH_3-N ≤	mg/l	0.15	0.5	1.0	1.5	2.0
8	T P ≤	mg/l	0.02	0.1	0.2	0.3	0.4
9	T N ≤	mg/l	0.2	0.5	1.0	1.5	2.0
10	Cu ≤	mg/l	0.01	1.0	1.0	1.0	1.0
11	Zn ≤	mg/l	0.05	1.0	1.0	2.0	2.0
12	F^- ≤	mg/l	1.0	1.0	1.0	1.5	1.5
13	Se ≤	mg/l	0.01	0.01	0.01	0.02	0.02
14	As ≤	mg/l	0.05	0.05	0.05	0.1	0.1
15	Hg ≤	mg/l	0.00005	0.00005	0.0001	0.001	0.001
16	Cd ≤	mg/l	0.001	0.005	0.005	0.005	0.01
17	Pb ≤	mg/l	0.01	0.01	0.05	0.05	0.1
18	Cr(VI)≤	mg/l	0.01	0.05	0.05	0.05	0.1
19	CN^-≤	mg/l	0.005	0.005	0.2	0.2	0.2
20	V-phen≤	mg/l	0.002	0.002	0.005	0.01	0.1
21	oils≤	mg/l	0.05	0.05	0.05	0.5	1.0
22	LAS≤	mg/l	0.2	0.2	0.2	0.3	0.3
23	S^-≤	mg/l	0.05	0.1	0.2	0.5	1.0
24	Fcg≤	entrise/l	200	2000	10000	20000	40000

4.3 Methodologies and Procedures

The methodologies and produres for the monitoring activities are listed as following tables, including equipment used, detection limits and accuracy, QA/QC procedures. characteristics of network, and others.

Table 4-4 Structure of monitoring network, content and monitoring frequency, 2002

Water Type	Quantity of stations	Monitoring items	Frequency
Surface water (river)	479	water temperature, pH, electrical conductivity, dissolved oxygen, index of permanganate, BOD_5, ammoniac nitrogen, oil, volatile hydroxybenzene, hydrargyrum, plumbum and flux	monthly
	43	water temperature, pH, dissolved oxygen, electric conductivity, turbidity, chemical oxygen demand (COD_{Mn}), total organic carbon (TOC) and ammonium nitrogen (NH_3-N)	once per hour
Seawater	124 Yellow Sea	water temperature, salinity, suspended solid, pH, DO, COD (alkali manganese method), oil, activate phosphate, inorganic nitrogen (nitrite nitrogen, nitrogen nitrate and ammonia nitrogen), non-ion ammonia, mercury, copper, lead and cadmium	two or three times every year

4.3.1 Surface Water

The analyzed method of the part items in the environmental quality standard of the surface water is listed in Table 4-5.

Table 4-5 The analyzed method of the part items in the environmental quality standard of the surface water (GB3838-2002)

Serial number	Items	The analyzed method	Detective limit (mg/l)
1	Temperature	Thermometor method	
2	pH	Glass electrode probe method	
3	The dissolved oxygen	Iodometric method	0.2
		Electric chemistry method	
4	COD_{Mn}		0.5
5	BOD_5	Dilution and seeding method	2
6	NH_3-N	Nessler's reagent colorimetric method	0.05
		Spectrophotometric method with salicylic acid	0.01
7	The total P	Spectrophotometric method with molybdenum acid ammonium	0.01
8	The total N	Alkali Potassium persalfate decomposed ultraviolet spectrophotometry method	0.05
9	Hg	Cold atomic absorption spectrophotometry	0.00005
		Cold atomic fluorescence method	0.00005
10	Pb	Atomic absorption spectrophotometry	0.01
11	The volatilized hydroxybenzene	After distillation by means of 4-AAP spectrophotometric method	0.002
12	Oils	Infrared spectrophotometric method	0.01
13	Cd	Atomic absorption spectrophotometry	0.001
14	As	Spectrophotometric method	0.007
		Cold atomic absorption spectrophotometry	0.00006
15	Cr(IV)	Spectrophotometric method	0.004

4.3.2 Marine Water

The seawater quality monitoring items and analytical method are listed in Table 4-6:

Table 4-6 Seawater quality monitoring items and analytical method

	Item	**Unit**	**Standard, regulation and code name (Including publishing year)**	**Uncertainty degree, accuracy and limit**
1	water temperature	°C	thermometry GB17378.4-1998(26.1)	(-5 ~ 40) °C
2	salinity	‰	salinometry GB17378.4-1998(30.1)	n.l.
3	suspended dolid	mg/l	gravimetry GB17378.4-1998(28.1)	2 mg/l
4	dissolved oxygen	mg/l	iodimetry GB17378.4-1998(32.1)	0.32 mg/l
5	pH		glass-electrode method GB17378.4-1998(27.1)	0.02 pH
6	active phosphate	mg/l	phosphomolybdic blue spectrophotometry GB17378.4-1998(40.1)	0.001 mg/l
7	nitrogen nitrite	mg/l	1-amino-2-(α-naphthylamine)ethane spectrophotometry GB17378.4-1998(38.1)	0.001 mg/l
8	nitrogen nitrate	mg/l	cadmium column reduction method GB17378.4-1998(39.1)	0.003 mg/l
9	ammoniac nitrogen	mg/l	indigotic hydroxybenzene blue spectrophotometry GB17378.4-1998(37.1)	0.005 mg/l
			hypobromite oxidation method GB17378.4-1998(37.2)	n.l.
10	inorganic nitrogen	mg/l	GB17378.4-1998 (36)	n.l.
11	COD	mg/l	basic potassium periodate method GB17378.4-1998(33.1)	0.15 mg/l
12	oils	mg/l	fluorescene spectrophotometry GB17378.4-1998(14.1)	4.5 μg/l
			ultra-violet spectrophotometry GB17378.4-1998(14.4)	50 μg/l
13	hydrargyrum	μg/l	cold atomic fluorometry “water and waster water monitoring and analytical	0.002 μg/l

			method”	
14	copper	μg/l	non-flame atomic absorption spectrometry GB17378.4-1998(7.1)	0.2 μg/l
15	plumbum	μg/l	non-flame atomic absorption spectrometry GB17378.4-1998(8.1)	0.03 μg/l
16	cadmium	μg/l	non-flame atomic absorption spectrometry GB17378.4-1998(9.1)	0.01μg/l

Note: n.l. – no limit.

4.4 Research Activities and International Cooperation

An international project, cooperated by China and R.O.K, had been carried on Yellow Sea Environmental Cooperative Research during 1996-2004.

The other cooperative project, the technology on environmental protection and management of Olympic sailing boat venue and adjacent sea area, had been performed In 2002, with the cooperation among the Qingdao Environmental Monitoring Center, the First Institute Oceanography of State Oceanic administration and Ocean University of China. The project is ongoing successfully.

The special item on environmental research report, Clean Blue Sea Plan of Shandong Province, has been compiled.

4.5 Training Activities

Technical training & forum on automatic monitoring of surface water: Three times of training have been put up in 2002. The participator came from 42 automatic station and relative provincial monitoring center.

Technical training on the assessment of surface water: held in XinJiang province on Sep. 23~25, 2004. The participator came from 31 provincial monitoring center and the monitoring center of 47 key cities.

Technical training on monitoring of red tide: held in Zhoushan city in June, 2004.The participators learned the technique and theory about red tide monitoring. The relative monitoring center improved the level of red tide monitoring.

QA/QC procedure: the first proceeding on verification between laboratories of sea water monitoring had been fulfilled by CNEMC and the off-shore environmental monitoring center in Oct. ~ Dec, 2004. The components are NO_3-N, NO_2-N, NH_3-N and active phosphate.

5. Present Situation

5.1 River Input

Current status on chemical composition and concentration of contaminants in the river water presented in this report is based on the data obtained by China National Environmental Monitoirng Center (CNEMC) in 2002, The data used in the report come from the closed section to the coast of the surface water monitoring network. There are 24 parameters in Chinese Environmental quality standards for surface water (GB 3838-2002). 7 of them are used to assessed the water quality: BOD_5, COD_{Mn}, Oil, NH_4-N, Pb, Hg and v-phen, but some of the other parameters are also monitored by the local monitoring center.

There's only one section into the coast of Yellow River and Yangze River, but there're more than one section into the coast in other rivers among the 6 key drainage areas involved in NOWPAP regions.

The chemical composition of rivers flowing into the sea in 2002 listed in Table 5-1.

Table 5-1 Chemical composition of rivers flowing into the sea (average for 2002)

Rivers	Water discharge (m^3/s)	SS (mg/l)	BOD_5 (mg/l)	COD_{Mn} (mg/l)	Si (mg/l)	NH_4 (mg/l)
Songhua River	2416	70.6	2.9	6.62	nd	0.003
Wusuli River		46.6	1.81	5.53	nd	0.002
Tumen River		126.3	2.18	20.06	nd	0.539
Yalu River		76.5	1.63	3.33	nd	0.086
Daliaohe River	469	383.4	2.57	12.9	nd	1.801
Dalinghe River		nd	7.34	8.68	nd	1.920
Luanhe River		6.3	2.09	3.20	nd	0.177
Yongdingxinhe River		nd	6.14	6.46	nd	0.978
Chaobaixinhe River		nd	12.4	15.7	nd	9.0
Haihe River	723	nd	8.68	7.13	nd	16.4
Duliujianhe River		nd	18.5	26.8	nd	1.60
Yellow River	2087	nd	2.83	4.09	nd	0.35
Yihe River		81	1.4	3.71	nd	0.145
Huaihe River	1972	34.4	1.0	3.49	nd	0.687
Yangze River	30166	nd	2.31	2.51	nd	0.075

Table 5-1 (continue)

Rivers	NO_2 (mg/l)	NO_3 (mg/l)	PO_4 (mg/l)	oils (mg/l)	∑DDT (μg/l)	∑HCH (μg/l)
Songhua River	0.015	0.19	nd	0.002	nd	nd
Wusuli River	0.01	0.22	nd	nd	nd	nd
Tumen River	0.011	0.22	nd	nd	nd	nd
Yalujiang River	nd	nd	nd	0.024	nd	nd
Daliaohe River	0.355	0.38	nd	0.114	nd	nd
Dalinghe River	nd	nd	nd	0.384	nd	nd
Luanhe River	0.042	2.20	nd	0.01	nd	nd
Yongdingxinhe	nd	nd	nd	0.41	nd	nd
Chaobaixinhe	nd	nd	nd	0.81	nd	nd
Haihe River	nd	nd	nd	0.037	nd	nd
Duliujianhe R.	nd	nd	nd	1.14	nd	nd
Yellow River	0.024	3.15	nd	0.009	nd	nd
Yihe River	0.028	0.55	nd	0.02	nd	nd
Huaihe River	0.033	0.36	nd	0.052	nd	nd
Yangze River	nd	nd	nd	0.068	nd	nd

Rivers	Phenols (mg/l)	Pb (mg/l)	Cu diss (mg/l)	Mn diss (mg/l)	Fe diss (mg/l)	Fe_{tot} (mg/l)
SonghuaRiver	0.001	2.0	nd	nd	nd	nd
Wusuli River	0.001	nd	nd	nd	nd	nd
Tumen River	0.0028	1.0	nd	nd	nd	nd
YalujiangRiver	0.0017	1.0	nd	nd	nd	nd
Daliaohe River	0.0003	1.1	nd	nd	nd	nd
Dalinghe River	0.0073	2.0	nd	nd	nd	nd
Luanhe River	0.001	1.0	nd	nd	nd	nd
Yongdingxinhe River	0.009	4.0	nd	nd	nd	nd
Chaobaixinhe River	0.001	10.0	nd	nd	nd	nd
Haihe River	0.003	6.0	nd	nd	nd	nd
Duliujianhe River	0.003	2.0	nd	nd	nd	nd
Yellow River	0.001	8.0	nd	nd	nd	nd
Yihe River	0.001	1.0	nd	nd	nd	nd
Huaihe River	0.001	1.0	nd	nd	nd	nd
Yangze River	0.001	5.0	nd	nd	nd	nd

Table 5-1 (continue)

Rivers	Cd (mg/l)	Zn diss (mg/l)	DO (mg/l)	Hg (mg/l)	As (mg/l)
Songhua River	0.01	nd	8.39	0.01	1.0
Wusuli River	nd	nd	8.1	nd	4.0
Tumen River	0.01	nd	5.59	0.03	4.0
Yalujiang River	nd	nd	9.8	0.02	4.0
Daliaohe River	1.0	nd	4.1	0.01	1.0
Dalinghe River	nd	nd	7.3	0.05	4.0
Luanhe River	0.07	nd	10.54	0.01	4.0
Yongdingxinhe River	nd	nd	nd	0.41	nd
Chaobaixinhe River	nd	nd	nd	nd	nd
Haihe River	nd	nd	nd	0.24	nd
Duliujianhe River	nd	nd	nd	1.24	nd
Yellow River	0.2	nd	8.27	nd	nd
Yihe River	0.1	nd	7.33	0.02	4.0
Huaihe River	0.1	nd	7.68	0.11	4.0
Yangze River	nd	nd	nd	0.02	nd

Notes: SS - suspended solids; DO – dissolved oxygen; All nutrients and metal in unfiltered samples; Fe tot – concentration of all acid released Fe from unfiltered samples; ∑DDT - sum of DDT and its metabolites (DDD and DDE); ∑HCH - sum of HCH isomers (α, β and γ).

For the assessment of annual runoff of dissovled substances and metals we use the concentrations and water discharge presented in Table 5-1 for the calculation. Since most of the water of Huaihe River flows into Yangze River, the total amount of the substances should be sum of SonghuaRiver, Daliaohe River, Haihe River, Yellow River and Yangze River.

Since all components are carried out from unfiltered samples at the monitoring of surface water quality in China, and the constitution of the SS do not be analysised, the annual discharge of particulate metals with rivers into the sea isn't available up to now.

Annual discharge of SS, some nutrients, petroleum, and dissolved metals (tons) with rivers into the sea listed in Table 5-2.

Table 5-2 Annual discharge of SS, some nutrients, oils,and dissolved metals (tons) with rivers into the sea (average for 2002)

River	SS	BOD_5	COD_{Mn}	NH_4-N	Phenols	NO_2-N	NO_3-N	oils	As	Cd	Pb	Hg
SonghuaRiver	5379720	220980	504444	228.6	76.2	1143	14478	152.4	76.2	0.762	152.4	0.762
Daliaohe River	5672840	38036	190920	26654.8	4.44	5254	5653.6	1687.2	14.8	14.8	162.8	0.148
Haihe River	nd	197904	162564	373920	68.4	nd	nd	843.6	nd	nd	136.8	5.472
Yellow River	nd	186214	269122	23030	65.8	1579.2	207270	592.2	263.2	13.16	526.4	nd
Huaihe River	2139680	62200	217078	42731.4	62.2	2052.6	22392	3234.4	248.8	6.22	62.2	6.842
Yangze River	nd	2195914	2390141	70947.95	951.3	nd	nd	64212.75	nd	nd	4756.5	19.026

Note: nd - means no data

5.2 Direct Discharge Pollution Loads

Three province are involved the NOWPAP region in China for direct discharge pollution loads. The pollution loads include the wastewater from main industrial plants and sewage directly into the coast.

The total amount of direct discharge of industrial waste water is 65,930,000 tons, while the total amount of sewage is 321,630,000 tons. And the total amount of COD in sewage is 118,959 tons, while the total amount of NH_3-N is 14,780 tons.

The annual load of discharge of wastwater, sewage and typical pollutants to the coastal water is listed in Talble 5-3.

Table 5-3 The annual load of discharge of wastwater, sewage and typical pollutants to the coastal water (average for 2002)

Province	Number of industrial plants in 2002	Amount of direct discharge of industrial waste ater (10×10^4T)	Sewage treatment plants	Amount of direct discharge of sewage (10×10^4T)	Amount of direct discharge of COD in sewage (ton)	Amount of direct discharge of NH_3-N in sewage (ton)
Liaoning	139	311		1359	10225	1684
Jiangsu	958	1049	2	22642	82588	9616
Shandong	449	5233	8	8162	26146	3480
Total	1545	6593	10	32163	118959	14780

The annual load of pollutants in industrial wastewater to the coast is listed in Table 5-4. The total amount of COD in industrial waste water is 42924.3 tons, while the total amount of NH_3-N is 3164.6 tons.

Table 5-4 The annual load of pollutants in industrial wastewater (tons) to the coast (average for 2002)

Province	COD_{Mn}	NH_3-N	Phenols	oils	As	Cd	Pb	Cr(IV)	CN^-
Liaoning	1476.5	627.0		0.0	0.006		0.038	0.009	0.1
Jiangsu	25185.4	2199.7	3.391	16.5	0.645	0.003	0.012	0.745	0.6
Shandong	16262.4	338.0	1.008	14.8	0.039		0.001	0.110	0.2
Total	42924.3	3164.6	4.399	31.3	0.690	0.003	0.051	0.864	0.9

5.3 The Quality Status of Marine Water

In 2002, the key pollution elements affecting the water quality in the offshore areas remain the inorganic nitrogen and activate phosphate. In some marine areas, COD, lead and oil far exceed the standards. In specific marine areas, copper, mercury and cadmium exceed the standard.

Yellow Sea: Grade I and II sea water account for 78.2%, 20.1% over that of the previous year. Grade IV and worse than Grade IV seawater accounts for 9.7%, 21.7% lower than that of the previous year. Inorganic nitrogen and activate phosphate are the major pollution elements affecting the offshore water quality in the Yellow Sea. Lead exceeds the standard in general, and in certain marine areas, COD, oil and copper exceed the standards.

The water quality statistics in Yellow Sea are listed in Table 5-5.

The status of sea water quality in offshore area in Liaoning, Shandong and Jiangsu listed bvelow:

Liaoning province: Grade I and II seawater accounts for 60.2%; Grade III seawater accounts for 7.7%; and Grade IV and worse than Grade IV seawater accounts for 32.1%. Compared with the previous year, the percentage of Grade I and II seawater increases by 8.1% and that of Grade IV and worse than Grade

IV decreases by 9%.

Table 5-5 The water quality statistics in Yellow Sea

Item	Samples number	Mathe-matic average	Measure ments values	Over Grade I rate %	Over Grade II rate %	Over Grade III rate %	Over Grade IV rate %
DO	284	7.83	5.01~16.5	0	0	0	0
pH	289	8.09	7.34~8.80	5.2	5.2	0	0
COD	289	1.21	0.10~4.40	17.0	3.5	0.7	0
Oils	289	0.031	Δ~0.128	7.3	7.3	0	0
activate phosphate	284	0.014	Δ~0.312	25.7	2.5	2.5	1.4
NO_2-N	289	0.014	Δ~0.262	-	-	-	-
NO_3-N	289	0.077	Δ~0.684	-	-	-	-
NH_3-N	289	0.089	0.002~2.88	-	-	-	-
inorganic nitrogen	289	0.180	0.010~3.01	20.8	8.7	5.5	3.8
non-ion ammonia	181	0.0056	Δ~0.1347	4.4	4.4	4.4	4.4
Hg	168	0.006	Δ~0.020	0	0	0	0
Cu	224	2.61	Δ~24.0	12.5	2.7	0	0
Pb	235	1.38	Δ~6.80	53.6	0.4	0	0
Cd	174	0.087	Δ~1.70	0.6	0	0	0

Note: the unit of heavy metal is μg/l, others are mg/l (ex. PH), Δ means lower than detection limit.

Shandong province: the water quality in the offshore areas is fairly good, with Grade I and II seawater accounting for 78.2%, Grade III 12.0% and worse than Grade IV 9.8%. Compared with the previous year, the percentage of Grade I and II seawater increases by 13.2% and the percentage of the seawater worse than Grade IV decreases by 11.5%.

Jiangsu province: Grade I and II seawater accounts for 75.0%; Grade III seawater accounts for 6.2%; and Grade IV 18.8%. Compared with the previous year, the percentage of Grade I and II seawater increases significantly, with any seawater worse than Grade IV. Activate phosphate and inorganic nitrogen exceeds the standards on wide scale. In few key regions, lead, copper, COD, pH, cadmium and mercury exceed the standards.

5.4 The Quality Status of Surface Water

In 2002, the water quality monitoring covered 379 sections in the surface water monitoring network, and 117 sections located on mainstream among of them. The key components are NH_3-N, COD_{Mn}, BOD_5, Oils, volatile hydroxybenzene(V-phen), Hg and Pb in the water quality assessment of river. And single factor assessment method is used for the water quality classification system, namely once any the assessment indicator in one certain monitoring site exceeds the standards for the Grade One surface water, the water quality at that site is at Grade II; if it exceeds the standards for Grade Two surface water, the water quality is at Grade III and so on. The over standard rate, over standard multiple and integrated pollution index are calculated depending on the 3^{rd} grade of “Environmental quality standard of surface water” (GB3838-2002).

5.4.1 The Water Quality of Songhua River Valleys

In 2002, the water quality of of Songhua River Valleys is tolerable. In 36 monitoring sections on 14 rivers, 30.6% are with Grade III, while 5.6% reached Grade IIand 25.0% reached Grade III ; 50.0% are with Grade IV-V, while 44.4% reached Grade IV and 5.6% reached Grade V; 18.9% reached Grade V plus.

Distribution of the water quality grade is mainly with Grade III and IV, a little better than 2001. The water quality is fairly good in Ne River and the Seconde Songhua River, and Heilong River, Tumen River, and Songhua River follow according to the water quality. The water quality of branches is worse than other parts in the whole Valleys. Major pollutants are COD_{Mn} BOD_5.

The water quality statistics in Songhua River Valleys in 2002 is listed in Table 5-6:

Table 5-6 The water quality statistics in Songhua River Valleys in 2002

Component	Sections number	Sections number over standard	Annual average (mg/l)
NH_3-N	36	4	0.001 ~ 10.833
COD_{Mn}	35	23	2.43 ~ 35.52
BOD_5	36	9	0.75 ~ 136.82
Hg	29	2	0.00001 ~ 0.0002
Pb	29	0	0.001 ~ 0.009
V-phen	31	5	0.001 ~ 0.185
Oils	23	9	0.002 ~ 1.018

The section water quality classification of Songhua River Valleys is listed in Table 5-7:

Table 5-7 The section water quality classification of Songhua River Valleys

River	Administration	Section	NH_3-N	COD_{Mn}	BOD_5	Hg	Pb	V-phen	Oils	water quality
Songhua River	Zhaoyuan	Zhaoyuan	I	IV	III	I	I	I	IV	IV
	Haerbin	Zhushuntun	I	III	I	I	I	I	I	III
	Haerbin	Hulanhekou	I	IV	IV	I	I	I	I	IV
	Haerbin	Dadingzishan	I	IV	IV	I	I	I	I	IV
	Jiamusi	Jiamusi	I	IV	III	I	I	I	IV	IV
	Jiamusi	Jiangnatun	I	IV	III	I	I	IV	I	IV
	Tongjiang	Tongjiang	I	IV	I	I	I	I	I	IV
Ashih River	Haerbin	Ashihekou	II	V	Vplus	IV	I	Vplus	IV	Vplus
Hulan River	Haerbin	Hulanhekou	I	V	Vplus	I	I	III	IV	Vplus
Mudan	Haerbin	Chaiheqiao	I	IV	IV	I	I	III	I	IV

River	Yilan	Mudanjiangkou	I	IV	I	I	I	I	IV	IV
2nd Songhua River	Dehui	Songhuacun	II	III	I	I	I	III	I	III
	Jilin	Baiqi	III	III	I	I	I	III	I	III
	Jilin	Fengman	II	III	I	I	I	I	I	III
	Songyuan	Ganshuigang	III	III	I	I	I	III	IV	IV
Yitong River	Changchun	Yangjiaweizi	Vplus	I	Vplus	IV	I	V	Vplus	Vplus
Yinma River	Changchun	Kaoshannanlou	Vplus	IV	IV	III	I	V	IV	Vplus
Ne River	Qiqihaer	Liuyuan	I	III	I	I	I	I	I	III
	Qiqihaer	Jiangqiao	I	III	I	I	I	I	I	III
	Qiqihaer	Nenjiangkou	I	II	III	I	I	I	I	III
Yalu River	Zhalantun	Zhalantun	III	II	I	I	I	I	I	III
Heilong River	Heihe	Heihexia	I	IV	I	I	I	I	I	IV
	Heihe	Heiheshang	I	IV	I	I	I	I	I	IV
	Tongjiang	Jiangkoushang	I	IV	I	I	I	I	I	IV
	Tongjiang	Jiangkouxia	I	IV	I	I	I	I	I	IV
	Yichun	Jiayin	I	V	I	I	I	III	IV	V
Erguna River	Hulunbeier	Heishantou	II	IV	I	I	I	I	I	IV
Hailaer River	Yakeshi	Bahao	I	II	I	I	I	I	I	II
	Hailaer	Bahou	Vplus	Vplus	Vplus	I	I	Vplus	I	Vplus
	Hailaer	Jiegang	IV	Vplus	Vplus	I	I	I	I	Vplus
	Yakeshi	Yakeshi	I	II	I	I	I	I	I	II
Wusuli River	Hulin	Hutoushang	I	III	I	I	I	I	I	III
Tumen River	Tumen	Hedong	II	V	I	I	I	III	I	V
	Helong	Nanping	II	IV	I	I	I	I	I	IV
	Huichun	Juanhe	I	IV	I	I	I	III	I	IV
	Tumen	Tumen	III	Vplus	I	I	I	III	I	Vplus

5.4.2 The Water Quality of Liaohe River Valleys

In 2002, the water quality of Liaohe River is after a sort. In 35 monitoring sections on 10 rivers including Yalu River, 7 sections are with Grade II and III with 20.1%, while 17.1% reached Grade II and 3.0% reached Grade III; 12 sections are with Grade IV-V with 34.2%, while 17.1% reached Grade IV and Grade V respectively; 16 reached Grade V plus with 45.7%.

The water quality of Yalu River is preferable in the whole Valleys. The water quality of Dalinghe is tolerable and no sections meet Grade III. The water quality of Liaohe River and its branches is bad, while half of the sections are with Grade V plus, and Liaohe River is heavy polluted in Tieling and Shenyang. Daliaohe River and its branches are heavy polluted, 66.7% of the sections are with Grade V plus, Hun River in Fushun and Shenyang, Taizi River in Anshan, Daliaohe River in Yingkou are heavy polluted.

The water quality statistics in Liaohe River Valleys in 2002 is listed in Table 5-8:

Table 5-8 The water quality statistics in Liaohe River Valleys in 2002

Component	Sections number	Sections number over standard	Annual average (mg/l)
NH_3-N	35	19	0.083 ~ 20.82
COD_{Mn}	33	21	2.3 ~ 299
BOD_5	35	21	0.6 ~ 351
Hg	25	3	* ~ 0.27×10^{-3}
Pb	21	0	0.001 ~ 0.20
V-phen	26	9	* ~ 0.072
Oils	28	21	* ~ 1.393

Note: * means lower than detection limit. The section water quality classification of Liao River Valleys in 2002 is listed in Table 5-9:

Table 5-9 The section water quality classification of Liao River Valleys

River	Administration	Section	NH_3-N	COD_{Mn}	BOD_5	Hg	Pb	V-phen	Oils	water quality
Daliaohe river	Yingkou	heiyingtai	Vplus	V	I	I	I	I	IV	Vplus
Daliahe river	Yingkou	yongyuanjiao	V	V	I	I	III	I	IV	V
Hun River	Fushun	Ajipu	II	II	I	I	I	I	IV	IV
Hun River	Fushun	Hepingqiao	IV	IV	III	I	I	I	IV	IV
Hun River	Fushun	Qijianfang	Vplus	III	IV	I	I	I	IV	Vplus
Hun River	Shenyang	Donglinqiao	Vplus	IV	IV	I	III	III	IV	Vplus
Hun River	Shenyang	Yujiafang	Vplus	V	Vplus	I	III	IV	IV	Vplus
Taizi River	Anshan	Liujiatai	Vplus	IV	IV	I	I	I	IV	Vplus
Taizi River	Anshan	Tangmazhai	Vplus	IV	IV	I	I	I	IV	Vplus
Taizi River	Anshan	Xiaojiemiao	Vplus	IV	IV	I	I	I	IV	Vplus
Taizi River	Benxi	Xingan	Vplus	IV	IV	IV	III	V	IV	Vplus
Taizi River	Liaoyang	Xiawangjia	III	III	III	I	I	III	IV	IV
Liaohe River	Shenyang	Hongmiaozi	III	V	Vplus	I	III	V	IV	Vplus
Liaohe River	Shenyang	Mahushan	V	V	V	I	III	V	IV	V
Liaohe River	Tieling	Fudedian	V	Vplus	IV	I	I	I	Vplus	Vplus
Liaohe River	Tieling	Tongjiangkou	Vplus	Vplus	Vplus	I	I	V	IV	Vplus
Liaohe River	Tieling	Zhuershan	Vplus	Vplus	V	I	I	V	V	Vplus
Laoha River	Chifeng	Dianzi	I	II	IV	/	/	/	/	IV
Laoha River	Chifeng	Dongbajai	IV	IV	V	/	/	/	/	V
Laoha River	Chifeng	Dongshanwan	II	V	Vplus	/	/	/	/	Vplus
Laoha River	Chifeng	Xinglongpo	IV	IV	V	/	/	/	/	V
Xilamulun River	Chifeng	Hairisu	III	V	V	/	/	/	/	V
West liao River	Chifeng	Sujiapu	II	IV	I	/	/	/	/	IV
East liao River	Liaoyuan	Liaoheyuan	II	II	I	I	I	I	I	II
East liao River	Shuangliao	Sishuangdaqiao	IV	/	Vplus	I	I	I	/	Vplus
Tiaozi River	Siping	Huihekou	Vplus	/	Vplus	IV	I	V	Vplus	Vplus
Yalujiang	Dandong	Jiangqiao	I	II	I	I	I	I	I	II
Yalujiang	Dandong	Wenan	II	III	I	I	I	III	I	III
Yalujiang	Ji an	shuiwenzhan	I	II	I	I	I	I	I	II
Yalujiang	Ji an	Taipingjiangkou	I	II	I	I	I	I	I	II
Yalujiang	Ji an	Taiwang	I	II	I	I	I	I	I	II
Yalujiang	Ji an	Yunfeng	I	II	I	I	I	I	I	II
Daling River	Jinzhou	Wangjiagou	II	III	III	I	I	I	IV	IV
Daling River	Jinzhou	Xibaqian	III	Vplus	Vplus	IV	I	V	Vplus	Vplus
Daling River	Jinzhou	Zhangjiapu	V	IV	V	I	I	IV	IV	V

5.4.3 The Water Quality of Huaihe River Valleys

In 86 monitoring sections on 65 rivers, 19.8% sections are with Grade II and III, while 7.0% reached Grade II and 12.8% reached Grade III ; 36.0% sections are with Grade IV and V, while 18.6% reached Grade IV and 17.4% reached Grade V; 44.2% sections reached Grade V plus. According the proportion of different Grade of the water quality, the water quality in Jiangsu Province and Henan Province is better than An Hui Province and Shandong Province, no sections meets Grade III in Shandong Province. Major pollutants are NH_3-N, BOD_5, COD_{Mn} and oils.

The water quality statistics in Huaihe River Valleys in 2002 is listed in Table 5-10:

Table 5-10 The water quality statistics in Huaihe River Valleys in 2002

Component	Sections number	Sections number over standard	Annual average (mg/l)
NH_3-N	86	50	0.114 ~ 34.53
COD_{Mn}	86	49	2.8 ~ 67.6
BOD_5	86	53	1.0 ~ 118.4
Hg	45	5	0.01×10^{-3} ~ 5.0×10^{-3}
Pb	41	1	0.001 ~ 0.063
V-phen	83	15	0.001 ~ 0.167
Oils	73	42	* ~ 1.66

Note: * means lower than detection limit.

5.4.4 The Water Quality of Haihe River Valleys

In 2002, the water quality of Haihe River is after a sort. In 55 monitoring sections on 35 rivers, 14.5% are with Grade I ~ III, while 3.6% reached Grade I, 7.3% reached Grade II and 3.3% reached Grade III; 21.8% are with Grade IV and V, while 14.5% reached Grade IV and 7.3% reached Grade V, 63.7% are with Grade V plus.

The water quality statistics in Haihe River Valleys in 2002 is listed in Table 5-11:

Table 5-11 The water quality statistics in Haihe River Valleys in 2002

Component	Sections number	Sections number over standard	Annual average (mg/l)
NH_3-N	55	37	0.028 ~ 39.40
COD_{Mn}	55	34	1.2 ~ 201
BOD_5	55	37	0.1 ~ 589
Hg	51	13	0.01×10^{-3} ~ 6.69×10^{-3}
Pb	51	2	0.001 ~ 0.10
V-phen	53	18	0.001 ~ 0.714
Oils	55	39	0.01 ~ 1.14

5.4.5 The Water Quality of Yangtze River Valleys

In 2002, the water quality of Yangtze River is fairly good. In 82 monitoring sections, 3.7% are with Grade I, 47.6% are with Grade II, 24.4% are with grade III; 14.6% are with Grade IV and V, while 8.5% reached Grade IV and 6.1% reached Grade V, 9.8% are with Grade V plus. The water quality is better than 2001 of Yangtze River Valleys, especially the mainstream, while 94.7% sections meet Grade III, 12.6% upper than 2001. The water quality in of the branches is not as good as the mainstream.

The water quality statistics in Yangtze River Valleys in 2002 is listed in Table 5-12:

Table 5-12 The water quality statistics in Yangtze River Valleys in 2002

Component	Sections number	Sections number over standard	Annual average (mg/l)
NH_3-N	82	13	0.010 ~ 22.70
COD_{Mn}	82	5	1.3 ~ 8.7
BOD_5	82	5	0.4 ~ 7.3
Hg	76	4	* ~ 0.50×10^{-3}
Pb	77	1	0.001 ~ 0.051
V-phen	80	3	* ~ 0.020
Oils	78	17	* ~ 2.04

Note: * means lower than detection limit.

5.4.6 The Water Quality of Yellow River Valleys

In 2002, the water quality of Yellow River is after a sort. In 36 monitoring sections on 11 rivers, 8 sections are with Grade II and III with 22.2%, while 5.6% reached Grade IIand 16.6% reached Grade III; 10 sections are with Grade IV and V with 27.8%, while 22.2% reached Grade IV and 5.6% reached Grade V; 18 sections are with Grade V plus with 50.0%.

The water quality statistics in Yellow River Valleys in 2002 is listed in Table 5-13:

Table 5-13 The water quality statistics in Yellow River Valleys in 2002

Component	Sections number	Sections number over standard	Annual average (mg/l)
NH_3-N	36	18	0.055 ~ 19.15
COD_{Mn}	36	11	1.4 ~ 174
BOD_5	36	12	0.6 ~ 51.0
Hg	28	6	0.01×10^{-3}~ 0.39×10^{-3}
Pb	30	0	0.002 ~ 0.049
V-phen	30	8	0.001 ~ 0.087
Oils	32	24	0.01 ~ 6.85

6. Proposals for Future Regional Activities and Priorities in NOWPAP Regions

1. The capacity building of oceanic monitoring should be strengthened; some buoyage automatic station should be setup on the special sea area.

2. The relative country should use the uniform monitoring method and assessment standard, so the data from different country could be acceptable by all of the partners. The training on this kind of method & standard should also be held.

3. Some pilot project about the influence on seawater from the pollutants of the big river should be started.

7. Conclusion

Offshore Areas: Marine pollution in offshore areas has been mitigated. The main pollutants are inorganic nitrogen, active phosphate. The water quality is better in Yellow Sea and South China Sea than in the East China Sea and Bohai Sea.

Marine pollution in offshore areas is mitigated in 2002, 49.7% of sea water is grade with I and II, while an increase of 8.3% occurred in comparison with the previous year. 35.9% of the total is grade with IV and exceeded IV, while the decrease of 10.5% occurred.

The main pollutants are inorganic nitrogen and active phosphate of the offshore area water quality with upper over standard rate. Some of pollutants, such as oils, COD and lead, exceeded the standard in parts of the sea area. Heavy metals, such as copper, mercury and cadmium, also exceeded the standard in some individual sea area.

The surface water: There is organic pollution issue in most river valleys. Water quality in Hai River is contaminated seriously. Water quality in branches of Yellow River, Liaohe River and Huaihe River are bad. The conditions are passable in Songhuajiang River and satisfactory in Yangtze River.

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National Report of Republic of Korea
on River and Direct Inputs of Contaminants
into the Marine and Coastal Environment in NOWPAP Region

Table of Contents

National Report of Republic of Korea on River and Direct Inputs of Contaminants into the Marine and Coastal Environment in NOWPAP Region

1. Executive Summary

This document is a National report of Republic of Korea for Working Group 2 (WG2) based on the decisions of the POMRAC Focal Point Meetings (Vladivostok, Russia, 1st meeting on 9-11, April 2002 and the 2nd meeting, 26-27, May 2003). Specifically, this document summarizes the current conditions with regard to pollution loads being discharged into rivers or directly into the marine and the coastal environments in the NOWPAP region.

In this report, the natural environmental factors and the socioeconomic factors are considered as the index of human activities that contribute to pollutant loads in the NOWPAP region. Particular emphasis is given to the legal and regulatory remedies.

This report also describes the water quality monitoring systems within the region, including research activities aimed at improving the interpretation and predictive analysis of monitoring data. There´s a total of 8 provinces facing the NOWPAP region in Korea, and this report covers all the provinces.

The total land surface area of the basin and the total length of the coastline is about 99,913 km^2 and 12,051 km, respectively. The regional coastline and land area accounts for 100% of the entire coastline and land area of Korea. The number of major rivers in these basins is 10, and the amount of a total discharge was about 506 billion tons/year in fiscal year 2002.

The population of Korea is 47,640,000 in fiscal year 2002. In Korea, the average population growth rate is less than 1% in recent years. The domestic wastewater from about 65% of the population of the region has been treated by some form of public sewage treatment system prior to being discharged.

Under the nationwide monitoring programs in Korea, each city and province is responsible for monitoring water quality by measuring various parameters. The cities and provinces are responsible for conducting these measurements. The discharge quantity of the major rivers is also measured; therefore, the pollutant load that flows in the NOWPAP region can be estimated from the water quality concentration and discharge quantity data.

2. Introduction

2.1 Purpose of the Report

The Regional Seas Programme of the United Nations Environment Programme (UNEP) has been promoted as an action-oriented program for management of marine and coastal environments in collaboration with regional countries. As a part of the program, the Northwest Pacific Action Plan (NOWPAP) was adopted at the First Intergovernmental Meeting (IGM) in Seoul, Korea, on September 1994, attended by China, Japan, Korea, and Russia.

The Pollution Monitoring Regional Activity Centre (POMRAC) was established as one of four Regional Activity Centres of NOWPAP POMRAC Working Group 1 (WG1) focuses on the area of atmospheric deposition, while Working Group 2 (WG2) focuses on water pollution discharged to rivers or directly into the marine environment.

This report introduces the national programs for evaluation of river and direct inputs of contaminants into the marine and coastal environment of the NOWPAP region, which should be useful for assessment by WG2.

2.2 Background

For nearly three decades, UNEP has fostered regional cooperation for the marine and coastal environment. It has accomplished the cooperation by stimulating the creation of "Action Plans"- prescriptions for sound environmental management- for each region. Now, more than 140 coastal countries are participating in 13 Regional Seas Programmes established under UNEP auspices. Five partner programs are also fully operational.

NOWPAP or, in full, Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region is one of the 'Action Plans' which covers the Northwest Pacific region. The area surrounding the Northwest Pacific is one of the most highly populated parts of the world and is receiving enormous pressures on the environment. The countries of the region, the People's Republic of China, Japan, the Republic Korea and the Russian Federation participate in NOWPAP.

NOWPAP was adopted at the First Intergovernmental Meeting (IGM) in 1994, following a series of meetings of experts and National Focal Point Meetings that started as early as 1991.

The overall goal of the NOWPAP is "the wise use, development and management of the coastal and marine environment so as to obtain the utmost long-term benefits for the human populations of the region, while protecting human health, ecological integrity and the region's sustainability for future generations".

The IGM, made up of senior representatives of the NOWPAP members, provides policy guidance and decision-making for NOWPAP. The plan incorporates seven priority projects to be implemented through a network of Regional Activity Centres (RACs) - CEARAC, DINRAC, MERRAC and

POMRAC. The RACs play a central role in coordinating regional activities in specific fields of priority projects. NOWPAP's Regional Coordinating Unit (RCU), co-hosted by the Republic of Korea and Japan serves as nerve center and command post of the Action Plan's activities. (Figure 2-1)

The activities agreed upon as part of the implementation of NOWPAP are financed principally by contributions from the Member States, international organizations and non-governmental organizations to the NOWPAP Trust Fund.

Priority Projects of NOWPAP

NOWPAP 1: Establishment of a comprehensive database and information management system;

NOWPAP 2: Formation of a survey of national environmental legislation, objectives, strategies and policies;

NOWPAP 3: Establishment of a collaborative regional monitoring program;

NOWPAP 4: Development of effective measures for regional cooperation in marine pollution preparedness and response;

NOWPAP 5: Establishment of Regional Activity Centre (RAC) and the network among these centers;

NOWPAP 6: Promotion of public awareness of the marine, coastal, and associated freshwater environments;

NOWPAP 7: Assessment and management of land-based activities.

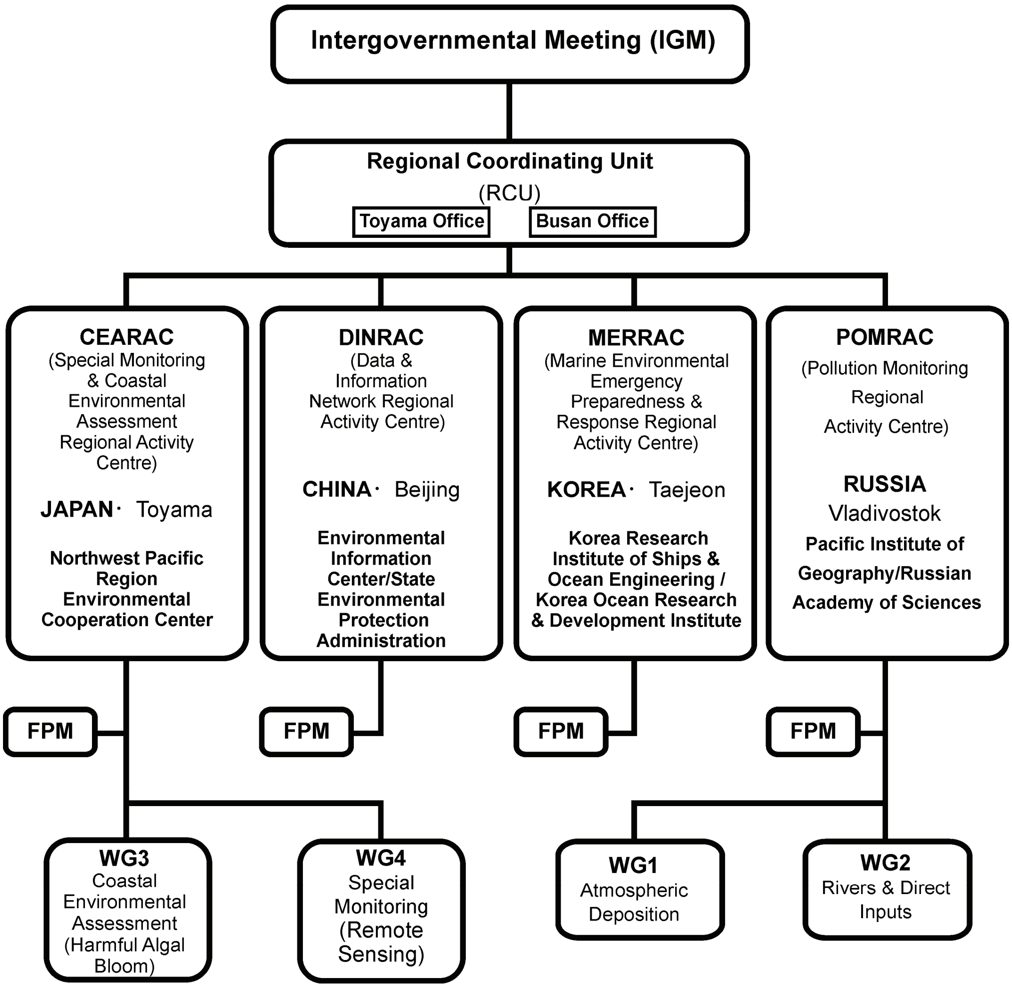

Figure 2-1 NOWPAP Organization

* Focal Points Meeting (FPM) is established for each RAC in order to review and advise the RAC on its activities.

2.3 General Information of River and Direct Pollution Load

Generally, the sources of river and marine water pollution are classified as domestic wastewater, industrial wastewater, livestock wastewater and natural loads. The pollutant loads from these sources flow into the sea via the rivers running through urban and rural residential areas, industrial areas, and agricultural regions (the river input). Moreover, a part of the domestic and industrial wastewater, as well as natural loads enters directly into the sea (the direct input).

2.4 Geographical Outline of the NOWPAP Region

2.4.1 Outline of the Subject Area

The subject area of this report consists of the basin areas of the rivers that flow into the NOWPAP region and the adjacent seas, which covers whole Korea.

In Korea, there are 7 big cities and 9 provinces within the basin areas that flow into the NOPAP region. These big cities and provinces cover whole Korea and they are as follows:

(1) Seoul
(2) Busan
(3) Daegu
(4) Incheon
(5) Gwangju
(6) Daejeon
(7) Ulsan
(8) Gyeonggi province
(9) Gangwon province
(10) Chungbuk province
(11) Chungnam province
(12) Jeonbuk province

(13) Jeonnam province

(14) Gyeongbuk province

(15) Gyeongnam province

(16) Jeju province

2.4.2 Outline of Regional Area

Table 2-1 summarizes the land area and the lengths of the coastlines of each province and each city with river basins that flow into the NOWPAP region.

The total land area of the cities and provinces within the basin is about 99,913 km^2, and the coastline is about 12,051 km witch includes islands. These land areas and coastlines account for 100% of Korea's nationwide totals, respectively.

Table 2-1 Area and coastline of each big city and province

Big cities and provinces	Total area (km^2)	Total coastline including islands (km)	Total coastline without islands (km)
Seoul	606	0	
Busan	763	314	224
Daegu	886	0	
Incheon	987	955	364
Gwangju	501	0	
Daejeon	540	0	
Ulsan	1,057	136	132
Gyeonggi P.	10,183	357	310
Gangwon P.	16,874	318	286
Chungbuk P.	7,432	0	
Chungnam P.	8,597	986	698
Jeonbuk P.	8,051	504	265
Jeonnam P.	12,046	5,540	2,103
Gyeongbuk P.	19,025	428	321
Gyeongnam P.	10,518	2,093	1,347
Jeju P.	1,848	420	308
Total	99,913	12,051	6,358

Note: Data of area: 2002 fiscal year data (Environmental Statistic Data in 2004 fiscal year)
Data of coastline: Coastal Information System, MOMAF (2005,http://www.coast.go.kr/cmis/)

2.4.3 Summary of the Major Rivers

1) Summary of the Discharge Rates of the Major Rivers in the Subject Region

Table 2-2 summarizes the discharge rates of the major rivers that flow into the NOWPAP region. The rivers with the largest flow rate are observed are located in the western and southern parts of Korea. The Han River and Nakdong River are particularly large rivers and exhibit the largest discharge quantities.

Table 2-2 Outline of major rivers (2002)

River	Basin area (km^2)	Length (km)	Annual discharge quantity (10^9 m^3)	Annual average precipitation (mm)
Han	25,954(35,770)[1]	494	189	1,301
Nakdong	23,384	510	138	1,186
Geum	9,912	398	66	1,272
Seomjin	4,960	224	39	1,412
Yeongsan	3,468	137	27	1,318
Ansungcheon	1,656	60	13	1,269
Sapgyeocheon	1,650	59	10	1,235
Mankyeng	1,504	81	10	1,254
Hyeongsan	1,133	63	6	1,138
Dongjin	1,124	51	8	1,278
Tamjin	505	55	0.33	1,438
Taehwa	626	42		1,271

Note: [1] including North Korea Ministry of Construction and Transport, 2003

2.4.4 Current Status of Land Use

Table 2-3 summarizes the current status of land use within the region according to various land-use categories. The largest land use category in each of the prefectures is forestry.

Table 2-3 Current status of land use according to land categories

	Crop	Forest	Orchard Pasture	Building Site	Factory site	School site	Road	River	Ditch	Marsh	Park & Recreation area	Religion & Historical site	Grave-yard	Total
Seoul	32	152	0.1	216	3	23	74	52	4	1	10	2.7	3	605
Busan	121	366	4.1	96	17	10	42	43	15	1	7	1.4	3	763
Daegu	148	485	3.5	76	18	9	46	45	15	6	7	0.9	5	886
Incheon	282	417	3.6	76	21	7	55	6	22	17	5	1.1	3	987
Gwangju	146	199	2.4	48	11	8	29	19	13	5	4	0.6	2	501
Daejeon	81	291	2.7	57	6	8	30	19	8	21	3	0.5	1	540
Ulsan	154	693	18.7	39	42	3	32	31	13	8	1	0.4	4	1,057
Gyeonggi P.	2,472	5,637	77.4	383	119	33	314	397	190	74	26	6.3	32	10,13
Gangwon P.	1,687	13,691	81.7	137	16	17	196	372	142	126	4	2.8	8	16,61
Chungbuk P.	1,398	5,050	69.3	133	42	17	170	209	123	134	4	3.0	19	7,432
Chungnam P.	2,658	4,490	98.7	219	67	21	230	234	228	179	3	7.0	29	8,598
Jeonbuk P.	2,273	4,583	39.4	185	32	20	238	279	192	105	4	2.8	21	8,051
Jeonnam P.	3,277	7,115	90.4	256	51	24	339	207	268	187	3	3.2	32	12,04
Gyeongbuk P.	3,160	13,747	183.3	269	68	28	315	575	353	155	4	4.4	57	19,02
Gyeongnam P.	2,020	7,116	69.5	224	62	20	269	285	188	104	6	3.8	43	10,51
Jeju P.	353	915	364.6	48	2	5	73	24	3	2	2	0.8	17	1,848

Source: Ministry of Administration & Home Affairs

2.5 Institutional Arrangement for Developing this Report

This report was prepared by Korea Ocean Research & Development Institute (KORDI) in cooperation with National Fisheries Research & Development Institute (NFRDI).

3. Social and Economic Situation in Recent Years

This section summarizes the current social and economic conditions of Korea as they relate to water pollution discharges to the river basins or directly to the marine environment. The general condition of social economic situation that relate to the river and direct input of pollution in the object region is arranged and shown in the following.

3.1 Population Distribution

The population of each city and province for the year 2000 and the population change for the fifteen-year period from 1985 to 2000 in Korea are summarized in Table 3-1. The population density of Korea for the period from 1994 to 2003 is summarized in Table 3-2.

The population of Korea in 2002 is 47,640 and the population density is 478 people per km^2.

Table 3-1 Outline of Population in Korea

(Unit: 1000 people)

Year	1985	1990	1995	2000
Seoul	9,639	10,613	10,231	9,895
Busan	3,515	3,798	3,814	3,663
Daegu	2,030	2,229	2,449	2,481
Incheon	1,387	1,818	2,308	2,475
Gwangju	-	1,139	1,258	1,353
Daejeon	-	1,050	1,272	1,368
Ulsan	-	-	-	1,014
Gyeonggi P.	4,794	6,156	7,650	8,984
Gangwon P.	1,725	1,580	1,466	1,487
Chungbuk P.	1,391	1,390	1,397	1,467
Chungnam P.	3,001	2,014	1,767	1,845
Jeonbuk P.	2,202	2,070	1,902	1,891
Jeonnam P.	3,748	2,507	2,067	1,996
Gyeongbuk P.	3,011	2,861	2,676	2,725
Gyeongnam P.	3,517	3,672	3,846	2,979
Jeju P.	489	515	505	513
Total	40,448	43,411	44,609	46,136

Source: Korea National Statistical Office

Table 3-2 Population Density (person/km^2)

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Population Density (person/km^2)	449.1	454.3	458.4	462.4	465.6	468.8	472.6	475.6	478.4	481.2
Urban Population (1,000 persons)	38,429	39,852	40,378	40,839	41,200	41,579	42,375	42,805	43,256	43,713
Urbanization Rate (%)	84.4	86.7	87.1	87.2	87.5	87.6	88.4	92.6	89.3	89.8
Total Population (1,000 persons)	45,512	45,981	46,434	46,885	47,174	47,543	47,977	48,289	48,518	48,824

(Source: Korea National Statistical Office)

3.2 General Industrial Conditions

General industrial conditions of Korea from 1994 to 2003 are summarized in Table 3-3. Industrial production index for Korea, as generated by the Korea National Statistical Office indicates that the overall economic growth of the country has been on the increase in the past decade. In important sectors like mining and manufacturing the production has doubled in 10 years. Pulp, paper and paper products industry that is considered as a principle source of anthropogenic contamination has been 86% growth in 9 years.

Table 3-3 Industrial Production Index

Year	All items	Mining and manufacturing	Mining	Manufacturing	Electricity and gas	Mining			Manufacturing		
						Coal, crude oil and uranium	Metal ores	Non-metallic minerals	Food products and beverages	Tobacco products	Textiles
Items	647	643	12	631	4	2	1	9	63	1	32
Weight	10,000.0	9339.1	36.2	9,362.9	600.9	4.7	0.8	30.7	658.8	53.4	472.7
1994	58.0	58.0	138.1	57.7	58.8	230.2	141.8	124.7	94.3	92.6	124.3
1995	64.9	64.8	129.1	64.6	66.7	173.3	141.6	124.6	94.7	89.5	120.6
1996	70.4	70.2	126.6	70.0	74.9	138.7	176.9	124.2	99.3	96.4	112.6
1997	73.7	73.3	121.3	73.1	82.2	115.9	187.8	120.1	98.1	98.5	104.2
1998	68.9	68.4	93.9	68.3	79.4	106.8	144.6	91.4	88.8	102.8	94.2
1999	85.6	85.4	101.4	85.4	89.3	98.8	122.0	101.2	97.2	97.7	100.1
2000	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2001	100.7	100.3	99.9	100.2	106.9	94.0	58.1	101.9	105.7	99.6	90.1
2002	108.8	108.5	103.8	108.5	115.0	83.4	96.7	107.2	108.7	99.9	84.6
2003	114.4	114.0	103.1	114.0	121.3	84.3	84.5	106.5	106.7	130.3	76.5

Source: Korea National Statistical Office

Table 3-3 (continue)

Year	Manufacturing										
	Sewn wearing apparel and fur articles	Tanning and dressing of leather	Wood and products of wood and cork	Pulp, paper and paper products	Publishing, printing and reproduction of record media	Coke and refined petrol, products and nuclear fuel	Chemicals and chemical products	Rubber and plastic products	Non-metallic mineral products	Manufac-ture of basic metals	Fabricated of other machinery
Items	9	9	6	18	6	16	74	21	28	46	28
Weight	210.3	97.6	62.2	193.2	226.8	309.9	856.9	429.9	331.5	566.2	414.8
1994	134.9	247.9	123.2	83.7	111.8	62.4	65.9	88.7	99.6	74.5	95.1
1995	139.2	210.9	121.1	89.5	129.1	70.6	70.3	93.1	105.5	81.8	106.8
1996	140.3	180.5	121.8	94.4	128.6	82.7	78.7	98.7	111.7	86.8	113
1997	110.9	152.8	122.4	98.3	121.1	100.8	88.5	100.6	113.6	91.8	115.7
1998	79	107.7	76.6	86.6	100.4	90.3	85.5	79.7	87.3	80.7	90.8
1999	87.1	108.4	96.7	96.3	98.2	98.4	94.3	93.7	93.8	92.2	95.4
2000	100	100	100	100	100	100	100	100	100	100	100
2001	91.6	94.4	107.2	99.4	102.8	96.3	102.7	102.5	102	101.3	92.6
2002	98	87.6	112.8	105.3	109.3	88.9	109.2	109.2	104.2	106.4	95.6
2003	82.5	75.5	113.9	105.4	101.2	91.1	113.4	112	110.1	111.9	97.4

Table 3-3 (continue)

Year	Manufacturing								Electricity and gas	
	Manufacture of other machinery	Computer and office machinery	Electrical machinery and apparatus n.e.c.	Radio, television and communication equipment	Medical, precision, optical instrument and watches	Motor vehicles and trailers mfg.	Other transport equipment	Electricity and gas	Electricity	Manufacture gas distribution of gaseous fuel through mains
Items	82	16	33	68	15	22	12	26	3	3
Weight	812.5	330.8	379.8	1,481.00	105	916.1	274.6	178.9	521.8	79.1
1994	77.1	14.7	70.8	18.9	95.6	66.3	45	113.6	62	32.6
1995	91	20.6	84.3	24.7	98.5	77.5	51.5	113.8	69.4	43.8
1996	95.5	25.7	89.1	30.4	94	87.3	61.4	108.6	77.1	56
1997	93.5	30.3	88.2	37.1	92	86.7	67	98.9	84.2	64.9
1998	66.2	30.7	64.4	50.4	83.1	57.3	100.3	88.7	80.8	67.3
1999	81.5	62.2	82.7	74	92.5	87.8	108.8	105.2	89.8	84.2
2000	100	100	100	100	100	100	100	100	100	100
2001	96.9	100.6	96.1	102.4	101.6	98.9	121.8	95.4	107.1	105.9
2002	104.5	111.4	104.2	131.6	100.9	107.3	119.4	94.6	114.9	116.1
2003	109	97.4	107.2	160.2	102.8	114.3	127.5	87.3	121.3	123.4

Percentage of the Population Supplied with Public Sewage Systems

Table 3-4 summarizes the population with sewage systems in cities and provinces in Korea. And the capacity of sewage treatment plants from which the treated wastewater is discharged directly to the NOWPAP region and the population served are summarized in Figure 3-1.

Table 3-4 Population with sewage treatment system

(Unit : 1,000 persons)

Cities and provinces	Total population (D)	Total population with sewage system (A+B+C)	Population with sewage treatment terminals (A)	Other population with sewage treatment system		
				Population with waste water treatment terminal (B)	Population with village sewage treatment system (C)	Sewage system supply rate (%) (A+B+C)/D X100
Seoul	10,277	10,164	10,164	-	-	98.9
Busan	3,711	2,926	2,922	-	3.9	78.8
Daegu	2,545	2,451	2,450	-	1.5	96.3
Incheon	2,601	2,273	2,273	-	-	87.4
Gwangju	1,401	1,366	1,366	-	0.2	97.5
Daejeon	1,439	1,350	1,350	-	-	93.8
Ulsan	1,079	716	713	-	3.2	66.4
Gyeonggi P.	10,362	8,251	8,241	-	10.3	79.6
Gangwon P.	1,533	867	804	-	63.0	56.5
Chungbuk P.	1,501	1,065	1,042	-	23.4	721.0
Chungnam P.	1,930	831	819	5.5	6.3	43.0
Jeonbuk P.	1,963	1,312	1,283	2.5	26.4	66.8
Jeonnam P.	2,024	830	774	17.2	38.5	41.0
Gyeongbuk P.	2,742	1,479	1,315	139	25.0	53.9
Gyeongnam P.	3,162	2,204	2,175	-	28.5	69.7
Jeju P.	554	363	358	-	4.7	65.6
Total	48,824	38,448	38,049	164	235	78.7

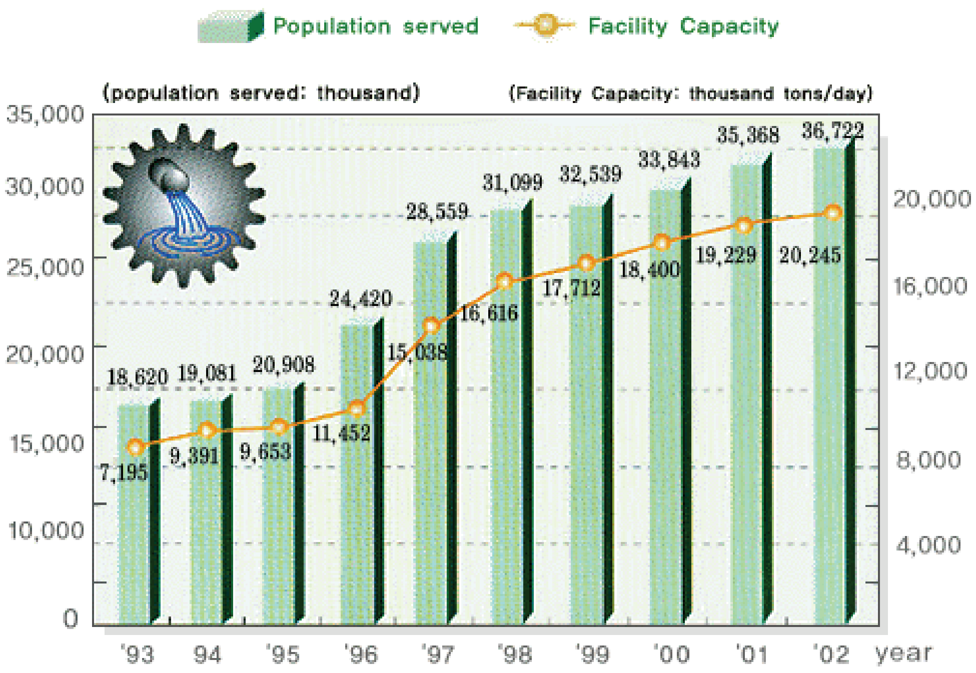

Figure 3-1 Supply of sewage treatment (Ministry of Environment)

4. National Monitoring and Assessment Activities

4.1 Overview of National Policies and Laws

The Environmental laws established since 1961 were summarized in Table 4-1.

Table 4-1 Environmental laws

Period	Law name	Enacted on
1960s (6 laws)	Waste Cleaning Act (Repealed on 12.31.1986)	12.30.1961
	Water Supply & Waterworks Installation Act (2003)	12.31.1961
	Environmental Pollution Prevention Act (Repealed on 12.31.1977)	11.05.1963
	Act Relating to Toxic & Hazardous Substances (Repealed on 08.02.1999)	12.13.1963
	Sewerage Act (2002)	08.03.1966
	Act Relating to the Protection of Birds, Mammals & Hunting (Repealed on 02.09.2004)	03.30.1967

1970s-1980s (6 laws)	Environmental Conservation Act (Repealed on 12.30.2002)	12.31.1977
	Compound Waste Treatment Corporation Act (Repealed on 12.30.2003)	12.28.1979
	Natural Park Act (2002)	01.04.1980
	Environmental Pollution Prevention Corporation Act (Repealed on 05.29.2003)	05.21.1983
	Environmental Management Corporation Act (2003)	05.21.1983
	Waste Control Act (2003)	12.31.1986
1990s-Present (33 laws)	Clean Air Conservation Act (2004)	08.01.1990
	Environmental Dispute Adjustment Act (2002)	08.01.1990
	Framework Act on Environmental Policy (2002)	08.01.1990
	Noise & Vibration Control Act (2004)	08.01.1990
	Toxic Chemicals Control Act (2000)	08.01.1990
	Water Quality Conservation Act (2004)	08.01.1990
	Act on the Disposal of Sewage, Excreta & Livestock Wastewater (2004)	03.08.1991
	Act on Special Measures for the Control of Environmental Offenses (2004)	05.31.1991
	Environmental Improvement Expenses Liability Act (2002)	12.31.1991
	Natural Environment Conservation Act (2004)	12.31.1991
	Act on the Control of Transboundary Movement of Hazardous Wastes & Their Disposal (2001)	12.08.1992
	Act on the Promotion of Saving and Recycling of Resources (2003)	12.08.1992
	Act Relating to Special Accounting for Environmental Improvement (2004)	01.05.1994
	Development of & Support for Environmental Technology Act (2004)	12.22.1994
	Management of Drinking Water Act (2003)	01.05.1995
	Promotion of Waste Disposal Facilities & Assistance, etc. to Adjacent Areas Act (2004)	01.05.1995
	Soil Environment Conservation Act (2003)	01.05.1995
	Special Act on the Ecosystem Conservation of Small Islands such as Dokdo Island (2004)	12.31.1997
	Act Relating to Han River Water Quality Improvement & Community Support (2003)	02.08.1999
	Wetland Conservation Act (2004)	02.08.1999
	Act on the Assessment of Impacts of Works on Environment, Traffic, Disasters, etc. (2004)	12.31.1999

	Sudokwon Landfill Site Management Corporation Act	01.21.2000
	Act on Geum River Watershed Management & Community Support (2003)	01.14.2002
	Act on Nakdong River Watershed Management & Community Support (2003)	01.14.2002
	Act on Yeongsan & Sumjin River Watershed Management & Community Support (2003)	01.14.2002
	Indoor Air Quality Management Act	05.29.2003
	Korea Environment & Resources Corporation Act	12.30.2003
	Act on the Protection of the Baekdu Daegan Mountain System	12.31.2003
	Act on the Promotion of Construction Waste Recycling	12.31.2003
	Special Act on Metropolitan Air Quality Improvement	12.31.2003
	Foul Odor Prevention Act	02.09.2004
	Wildlife Protection Act	02.09.2004
	Act on Antarctic Activities and Environmental Protection	03.22.2004

4.2 National Program

4.2.1 Outline of Water Quality Monitoring Plan

Ministry of Environment monitors regularly the quality of water in rivers, streams, lakes, ground water and drinking water to ensure public health. Health injuring substances (biotic and abiotic) enter these waters from domestic activities and from transboundary pollution. Hence it is important to derive a risk assessment based on regular monitoring. Ministry of Maritime Affairs & Fisheries is responsible for monitoring coastal and open ocean waters for overall health of the ecosystem and that of human health. In a similar way, coastal waters are polluted by sewage, shipping, industrial and other domestic activities. Transboundary pollution may be a minor cause as well. These toxic substances may affect local fishery and ecosystem and hence regular monitoring is mandatory.

4.2.2 Outline of Monitoring Plan for Seawater Pollution

Marine environmental monitoring in Korea started in 1972. Begun as a simple system with very limited parameters measured, the monitoring system has expanded over time to cover newly emerging pollution issues. Currently, monitoring of marine environment in Korea is largely composed of three monitoring systems: national marine environment monitoring system, oceanographic observation system, and red tide monitoring system with other occasional monitoring programs including TMS systems. The coastal monitoring system is the most comprehensive system that monitors coastal environmental qualities at a total of 296 stations in coastal area of Korean peninsula (Table 4-2). National Fisheries Research and Development Institute (NFRDI) and its three affiliated institutes (East Sea Fisheries Research Institute, South Sea Fisheries Research Institute, and West Sea Fisheries Research Institute) manage the system that monitors general water quality parameters such as temperature, pH, chemical oxygen demand (COD), nutrients, and others, four times per year. Concentrations of trace metals in surface water are monitored twice a year at a total of 66 stations, and those in surface sediment and organisms (mussels, oysters, fishes, etc) are measured once a year at 60 stations. The system monitors organic contaminants in surface water and sediment and organisms once a year at a total of 25 stations.

An oceanographic observation system that covers neighbouring sea of the Korean peninsula with a total of 175 stations is also managed by NFRDI and its affiliated institutes (Table 4-3). This system monitors temperature, salinity, dissolved oxygen, chlorophyll-a, suspended solids, and nutrients. NFRDI is also responsible for a red tide (commonly harmful algal blooms, HABs) monitoring system with a total of 77 monitoring stations. Korea Coast Guard (KCG) and National Oceanographic Research Institute (NORI) manage the remaining two monitoring systems that mainly monitor physical parameters in offshore waters.

Monitoring data from the coastal and offshore monitoring systems are published in annual reports and also posted on the web site of NFDRI (http://www.nfrdi.re.kr).

Table 4-2 Monitoring parameters of the coastal monitoring system of Korea

Classification		Frequency	No. of Stations	Parameters
Seawater	General items	4 times/yr	296	W.T, Sal. PH, DO, COD, TN, TP, DIN, DIP, Oil, SS, Transparency
	Trace metals	2 times/yr	66	Cu, Pb, Zn, Cd, Cr^{6+}, Total-Hg, As, CN
	Organic compounds	1 time/yr	25	PCBs, TBT
Sediment	General items	1 time/yr	60	Particle size, IL, AVS, COD
	Trace metals	1 time/yr	60	Cu, Pb, Zn, Cd, Cr^{6+}, Total-Hg, As, CN
	Organic compounds	1 time/yr	25	PCBs, TBT, Organochloride, PAHs, PCDDs/DFs
Organism	General items	4 times/yr	298	Chl.a
	Trace metals	1 time/yr	30	Cu, Pb, Zn, Cd, Cr^{6+}, Total-Hg, As, CN
	Organic compounds	1 time/yr	25	PCBs, TBT, Organochloride, PAHs, PCDDs/DFs
Seawater	General items	4 times/yr	296	W.T, Sal. PH, DO, COD, TN, TP, DIN, DIP, Oil, SS, Transparency
	Trace metals	2 times/yr	66	Cu, Pb, Zn, Cd, Cr^{6+}, Total-Hg, As, CN
	Organic compounds	1 time/yr	25	PCBs, TBT
Sediment	General items	1 time/yr	60	Particle size, IL, AVS, COD
	Trace metals	1 time/yr	60	Cu, Pb, Zn, Cd, Cr^{6+}, Total-Hg, As, CN
	Organic compounds	1 time/yr	25	PCBs, TBT, Organochloride, PAHs, PCDDs/DFs
Organism	General items	4 times/yr	298	Chl.a
	Trace metals	1 time/yr	30	Cu, Pb, Zn, Cd, Cr^{6+}, Total-Hg, As, CN
	Organic compounds	1 time/yr	25	PCBs, TBT, Organochloride, PAHs, PCDDs/DFs

The Korean government plans to expand the marine environmental monitoring systems, especially the coastal monitoring system, with more sampling stations and parameters measured to reflect the newly emerging marine environmental issues of river input and air deposition.

Table 4-3 Other marine environment monitoring systems of Korea

Classification	Frequency	No. of Stations	Parameters
Offshore Monitoring System	6 times/yr	175	W.T, Sal. DO, NO_2-N, NO_3-N, PO_4-P, SiO_2-Si, Chl.a, SS, Transparency
Red Tide Monitoring System	10 times/yr	77	Phytoplankton including the physico-chemical parameters

* KCG(Korea Coast Guard) and NORI (National Oceanographic Research Institute) also operate monitoring systems in offshore waters (mainly on ocean currents, tidal currents, water temperature, and salinity).

4.2.3 Outline of Monitoring Plan for Freshwater Pollution

Monitoring of freshwater qualities is under jurisdiction of the Ministry of Environment (MOE). Local Environmental Offices affiliated with MOE, local governments, Korea Water Resources Cooperation (KOWACO), and Korea Agricultural and Rural Infrastructure Corporation (KARICO) are responsible for the management and operation of the monitoring system; monitoring of rivers and lakes by local Environmental Offices, local governments, and KOWACO; that of drinking water supply sources by local governments and KOWACO; and that of agricultural waters by KARICO. National Institute of Environmental Research (NIER) of MOE provides necessary supports to MOE and other agencies involved in the monitoring.

The freshwater monitoring system monitors water qualities at a total of 1,837 stations throughout Korea (Table 4-4); 559 stations for rivers, 165 stations for lakes, 563 stations for drinking water supply sources, 417 stations for agricultural waters, and 133 stations for others including industrial wastewaters. The Local Regional Environmental Offices are responsible for 461 stations, local governments for 820 stations, KOWACO for 139 stations, and KARICO for 417 stations.

River water is monitored 12 times per year for 16 essential parameters, 4 times per year for 11 parameters including trace metals. Water quality parameters at major points (21 stations) of five rivers (Han River, Nakdong River, Keum River, Yeongsan River, and Seomjin River) and in Keumho River are measured 48 times per year for 16 essential parameters, 12 times per year for 11 parameters, and 1 time per year for 4 organic compounds. Lake water is monitored 12 times/year for 21 parameters including nutrients, 4 times/year for 7 parameters including trace metals, and 1 time/year for 4 organic compounds.

Drinking water supply sources, such as rivers and lakes, are monitored more than once per month for 5 parameters, and 4 times/year for 18 parameters including trace metals and organic compounds. Water quality of groundwater is measured more than 2 times per year for 19 parameters including trace metals and pesticides.

Agricultural waters are monitored two times/year for 13 parameters including nutrients and trace metals, while industrial wastewaters monitored 24 times/year for 7 essential parameters, 12 times/year for 19 parameters including trace metals and nutrients, and one time/year for 4 organic compounds.

MOE has installed and been operating 24-hour water quality telemetering systems to constantly monitor the water quality near water supply facilities in four major rivers in Korea (Han River, Nakdong River, Keum River, and Yeongsan River). They act as an early warning system for pollutants input into lakes and rivers by sending out a warning signal to managers and operators when it detects a sudden increase in pollutants input. This enables them to quickly respond to any contamination accident. Currently, there are 22 systems installed in 4 major river basins and MOE plans to install the system at 34 locations by the year 2005.

Table 4-4 Freshwater quality monitoring stations in Korea

Classification		Frequency	Stations	Parameters
River water		12 times/yr (five rivers: 48 times/yr)	559 (five rivers: 21)	Water level (flow rate), pH, DO, BOD, COD, SS, TN, NH_3-N, NO_3-N, TP, Water Temperature, phenol, Conductivity, MPN, Phytoplankton
		4 times/yr (12 times/yer)		DTN, DTP, PO_4-P, Chl.a, Cd, CN, Pb, Cr^{6+}, As, Hg, ABS
		One time/yr		PCB, Organochloride, TCE, PCE
Lake water		12 times/yr	165	Water level (flow rate), pH, DO, BOD, COD, SS, TN, DTN, NH_3-N, NO_3-N, TP, DTP, PO_4-P W.T., phenol, Cond., Chl.a, Transp., MPN, Phytoplankton
		4 times/yr		Cd, CN, Pb, Cr^{6+}, As, Hg, ABS
		One time/yr		PCB, Organochloride , TCE, PCE
Water Supply Source	Rivers	more than 1 time/month	563	BOD, pH SS, DO, MPN
		4 times/yr		Cd, CN, Pb, Cr^{6+}, As, Hg, F, Se, ABS, phenol, NH_3-N, NO_3-N , TCE, PCE, PCB, Cabaryl, 1,1,1-trichloroethane, Organochloride
	Lakes	more than 1 time/month		COD, pH, DO, SS, MPN
		4 times/yr		Cd, CN, Pb, Cr^{6+}, As, Hg, F, Se, ABS, phenol, NH_3-N, NO_3-N , TCE, PCE, PCB, Cabaryl, 1,1,1-trichloroethane, Organochloride .
	Under-ground	more than 2 times/yr		Cd, As, CN, Pb, Cr^{6+}, Hg, F, Se, ABS, phenol, NH_3-N, NO_3-N , TCE, PCE, Cabaryl, 1,1,1-trichloroethane, Organochloride, Insecticides.
Agricultural Water		2 times/yr	417	DO, pH, BOD, COD, SS, TN, TP, Cu, Pb, Cd, Cl^-, Conductivity, Phytoplankton
Industrial wastewater		24 times/yr	83	DO, pH, BOD, COD, SS, W.T., Cond.
		12 times/yr		Cd, CN, Pb, Cr^{6+}, As, Hg, Cu, Zn, Cr, F, ABS, TN, TP, phenol, N-hexan, dis.-Mn, dis.-Fe, MPN, Color
		One time/yr		Organochloride , PCB, TCE, PCE

MOE provides access to the monitoring data for freshwater bodies through annual reports and its web site (http://www.me.go.kr).

4.3 Methodologies and Procedures

1) Analysis Method

The analytical methods required for various water quality monitoring parameters are summarized in Table 4-5. This table includes the parameters to be monitored for evaluating compliance with the environmental standards for protection of human health and ecosystem. Unfiltered water is used for the determination of nutrients, metals and persistent organic pollutants at the monitoring of river water quality in Korea.

2) Water Quality Criteria

The freshwater and marine water quality criteria

Water Quality Standards are the foundation of the water quality-based pollution control program mandated by the Clean Water Act of Korea. Water Quality Standards define the goals for a waterbody by designating its uses (e.g., recreation, water supply, aquatic life, agriculture), setting criteria to protect those uses (numeric pollutant concentrations and narrative requirements), and establishing provisions to protect waterbodies from pollutants.

Table 4-5 Monitoring parameters and their analytical methods

Item	Preservation method	Major analytical method	Measurement range and accuracy (minimum limit of detection: mg/l)
pH	Measure immediately	Glass electrode method	-
BOD (Biological Oxygen Demand)	4°C	Membrane electrode method	0.5
COD (Chemical Oxygen Demand)	4℃, add sulphuric acid and pH<2	Dichromate reflux method Permanganate reflux method	
SS (Suspended Solid)	4°C	Filter and weigh method	5.0
DO (Dissolved Oxygen)	Winkler method reagents -	Winkler method Membrane electrode method	0.1 0.5
Total coliforms	4°C, dark	MPN method	-
Cadmium	Conc. HNO^3 2ml/l	Atomic absorption method Absorptiometric method ICP-AES	0.002 0.001 0.004
Total cyanide	4℃, add NaOH and pH>12	Absorptiometric method	0.1
Lead	Conc. HNO^3 2ml/l	Atomic absorption method Absorptiometric method ICP-AES	0.04 0.001 0.04
Chromium (VI)	4℃	Atomic absorption method Absorptiometric method ICP-AES	0.01 0.002 0.007
Arsenic	Conc. HNO^3 2ml/l	Atomic absorption method Absorptiometric method ICP-AES	0.005 0.002 0.05
Total mercury	Conc. HNO^3 2ml/l	Atomic absorption method Absorptiometric method	0.0005 0.001
PCBs	4°C, add HCl and pH 5-9	Gas chromatograph-ECD	0.0005

Organic P	4°C, add HCl and pH 5-9	Gas chromatograph-FPD	0.001ug
ABS	4°C	Absorptiometric method	0.02
Ammonium nitrogen	4°C	Absorptiometric method	0.7
Nitrate nitrogen	4°C	Absorptiometric method	0.2
Nitrite nitrogen	4°C	Absorptiometric method	0.2
TCE (tetrachloloethylene)	Add 10% phosphoric acid or add 20% sulphric acid	Gas chromatograph-ECD	0.01ng
PCE	Dark and cool, 0～5°C	Absorptiometric method	0.2

Water quality standards are important because they help to protect and restore the quality of Korean surface waters. Standards help to identify water quality problems caused by, for example, improperly treated wastewater discharges, runoff or discharges from active or abandoned mining sites, sediment, fertilizers, and chemicals from agricultural areas, and erosion of stream banks caused by improper grazing practices. Standards also support efforts to achieve and maintain protective water quality conditions as described subsequently in this report.

Table 4-6 The water quality standard for river water

<table>
<tr><th rowspan="2">Purpose</th><th rowspan="2">Grade</th><th rowspan="2">The Applicable Objects for the use</th><th colspan="5">Standard</th></tr>
<tr><th>pH</th><th>BOD (mg/l)</th><th>SS (mg/l)</th><th>DO (mg/l)</th><th>Coliform group (MPN/ 100ml)</th></tr>
<tr><td rowspan="5">Living Environment</td><td>I</td><td>- 1st grade source water for municipal use-
- Conservation of natural environment</td><td>6.5-8.5</td><td>≤1</td><td>≤25</td><td>≥7.5</td><td>≤50</td></tr>
<tr><td>II</td><td>- 2nd grade source water for municipal use
- 1st grade fishery water
- Swimming water</td><td>6.5-8.5</td><td>≤3</td><td>≤25</td><td>≥5</td><td>≤1,000</td></tr>
<tr><td>III</td><td>- 3rd grade source water for municipal use
- 2nd grade fishery water
- 1st grade water for industrial use</td><td>6.5-8.5</td><td>≤6</td><td>≤25</td><td>≥5</td><td>≤5,000</td></tr>
<tr><td>IV</td><td>- 2nd grade water for industrial use
- Irrigation water</td><td>6.0-8.5</td><td>≤8</td><td>≤100</td><td>≥2</td><td>-</td></tr>
<tr><td>V</td><td>- 3rd grade water for industrial Use
- Conservation of municipal living environment</td><td>6.0-8.5</td><td>≤10</td><td>No Suspended Solids like trashes</td><td>≥2</td><td>-</td></tr>
<tr><td>Protection of human health</td><td>Whole water area</td><td colspan="6">· No detection: CN, Hg, Organic Phosphorous, PCB
· ≤ 0.01mg/l : Cd
· ≤ 0.1mg/l : Pb
· ≤ 0.05mg/l: AS, Cr^{6+}
· ≤ 0.5mg/l : ABS</td></tr>
<tr><td>Remarks</td><td colspan="7">1. 1st grade fishery water : For aquatic creatures of clean water area
2. 2nd grade fishery water : For aquatic creatures of a little polluted water area
3. Conservation of natural environment : Environmental conservation like natural spectacles
4. 1st grade source water for municipal use : Usable after low level of treatment like filtration
5. 2nd grade source water for municipal use : Usable after general water treatment such as sedimentation and filtration
6. 3rd grade source water for municipal use : Usable after advanced water treatment including pre-treatment
7. 1st grade water for industrial use : Usable after usual treatment like</td></tr>
</table>

	sedimentation 8. 2nd grade water for industrial use : Usable after advanced water treatment like chemical application 9. 3rd grade water for industrial use : Usable after special treatment 10. Conservation of living environment : the degree not to give displeasure to daily lives of people

Reference: Fact sheets on Statistics of Water Management in 2000 (The Task Force Team for Water Quality Improvement in the Office of Prime Minister, 2000)

Table 4-7 The water quality standard for lake water

Purpose	Standard	The applicable objects for the use	Standard				
			pH	BOD (mg/l)	SS (mg/l)	DO (mg/l)	Coliform group (MPN/100ml)
Living Environment	I	- 1st grade source water for municipal use - Conservation of natural environment	6.5-8.5	≤1	≤1	≥7.5	≤50
	II	- 2nd grade source water for municipal use - 1st grade fishery water - Swimming water	6.5-8.5	≤3	≤5	≥5	≤1,000
	III	- 3rd grade source water for municipal use - 2nd grade fishery water - 1st grade water for industrial use	6.5-8.5	≤6	≤15	≥5	≤5,000

	IV	- 2nd grade water for industrial use - Irrigation water	6.0-8.5	≤8	≤15	≥2	-
	V	- 3rd grade water for industrial use - Conservation of municipal living environment	6.0-8.5	≤10	No Suspended Solids like trashes	≥2	-
Protection of human health	Whole water area	·No dectection: CN, Hg, Organic Phosphorous, PCB · ≤ 0.01mg/l : Cd · ≤ 0.1mg/l : Pb · ≤ 0.05mg/l : AS, Cr^{6+} · ≤ 0.5mg/l: ABS·					
Remarks	In the case of T-P and T-N, when the concentration ratio of T-N and T-P is less than 7, the standard of T-P is not applied, while the standard of T-N is not applied when it is above 16.						

* Reference: Fact sheets on Statistics of Water Management in 2000 (The Task Force Team for Water Quality Improvement in the Office of Prime Minister, 2000)

Table 4-8 The water quality standard for ground water

<table>
<tr><th colspan="2" rowspan="2">Items \ Purposes of use</th><th colspan="3">Standard</th></tr>
<tr><th>Municipal use</th><th>Agricultural use</th><th>Industrial use</th></tr>
<tr><td rowspan="5">General pollutants</td><td>pH</td><td>≤5.8-8.5</td><td>≤6.0-8.5</td><td>≤5.0-6.0</td></tr>
<tr><td>Chemical Oxygen Demand (mg/l)</td><td>≤6</td><td>≤8</td><td>≤10</td></tr>
<tr><td>A group of coliforms (MPN/100 ml)</td><td>≤5,000</td><td>-</td><td>-</td></tr>
<tr><td>Nitrate nitrogen (mg/l)</td><td>≤20</td><td>≤20</td><td>≤40</td></tr>
<tr><td>Chlorine (mg/l)</td><td>≤250</td><td>≤250</td><td>≤500</td></tr>
<tr><td rowspan="10">Specified hazardous substances</td><td>Cd (mg/l)</td><td>≤0.01</td><td>≤0.01</td><td>≤0.02</td></tr>
<tr><td>Asmg/l)</td><td>≤0.05</td><td>≤0.05</td><td>≤0.1</td></tr>
<tr><td>CN (mg/l)</td><td>No detection</td><td>No detection</td><td>≤0.2</td></tr>
<tr><td>Hg (mg/l)</td><td>No detection</td><td>No detection</td><td>No detection</td></tr>
<tr><td>Organic Phosphorous (mg/l)</td><td>No detection</td><td>No detection</td><td>≤0.2</td></tr>
<tr><td>Phenol (mg/l)</td><td>≤0.005</td><td>≤0.005</td><td>≤0.01</td></tr>
<tr><td>Pb (mg/l)</td><td>≤0.1</td><td>≤0.1</td><td>≤0.2</td></tr>
<tr><td>Cr6+ (mg/l)</td><td>≤0.05</td><td>≤0.05</td><td>≤0.1</td></tr>
<tr><td>Trichloroethylene (mg/l)</td><td>≤0.03</td><td>≤0.03</td><td>≤0.06</td></tr>
<tr><td>Tetrachloroetylene (mg/l)</td><td>≤0.01</td><td>≤0.01</td><td>≤0.02</td></tr>
<tr><td>Remarks</td><td colspan="4">- Municipal water: It includes every kind of household water use except drinking water, irrigation water, and industrial water
- Agricultural water: It is the water used for irrigation and farming
- Industrial water: It is the water used for business activity at workplace which installs wastewater discharge facility under the Water Quality Conservation Act, Item 5, Article 2.
- Common fact: If the irrigation water and industrial water are used for municipal purpose, the water quality standard for municipal water shall be applied.</td></tr>
</table>

* Reference: Fact sheets on Statistics of Water Management in 2000 (The Task Force Team for Water Quality Improvement in the Office of Prime Minister, 2000)

Table 4-9 The water quality standard for oceanic area

Classifica-tion	Grade	Standard						
		PH	BOD (mg/l)	SS (mg/l)	The number of coliforms (MPN/100 ml)	Solvent (mg/l)	T-N (mg/l)	T-P (mg/l)
Living Environ-ment	I	≤7.8-8.3	≤1	≤7.5	≤1,000	≤0.01	≤0.3	≤0.03
	II	≤6.5-8.5	≤2	≤5	≤1,000	≤0.01	≤0.6	≤0.05
	III	≤6.5-8.5	≤3	≤2	-	≤1,000	≤1.0	≤0.09
Protection of human health	whole water area	≤0.05 mg/l: Cr6+, As, Pb ≤0.01 mg/l: Cd, CN, benzine, tetrachloroethylene ≤0.1 mg/l: Zn, 1.1.1-trichloroethane ≤0.02 mg/l: diazinon, Copper, dichloromethane ≤0.0005 mg/l: Hg, polychlorynatedbiphenyl ≤0.06 mg/l: parathion ≤0.25 mg/l: malathion ≤0.03 mg/l: trichloroethylene ≤0.005 mg/l: phenol ≤0.5 mg/l: Ion-negative Surfactandt						
Remarks	- 1st grade: The water quality proper to living and raising for marine creatures such as red sea bream, yellowtail, brown seaweed, etc, and proper to swimming. - 2nd grade: The water quality proper to living and raising for laver and a gray mullet ,except aquatic creatures proper to the 1st grade marine area, and making use of leisure, and sightseeing on the sea - 3rd grade: The water quality which can be used for Industrial Cooling Water, anchoring of ships							

* Reference: Fact sheets on Statistics of Water Management in 2000 (The Task Force Team for Water Quality Improvement in the Office of Prime Minister, 2000)

4.4 National Laboratories

National Fisheries Research & Development Institute (NFRDI)

NFRDI was established in 1921 as the Fisheries Experiment Station. It was reorganized in 1949 as the Central Fisheries Experiment Station under the Ministry of Commerce and Industry. It was renamed in 1963 as the National Fisheries Research and Development Institute and was reorganized in 1966 under the National Fisheries Administration. Recently it was reorganized in 1996 under the Ministry of Maritime Affairs and Fisheries (MOMAF). NFRDI has been responsible for the national marine environment monitoring program. It also has been surveyed the outbreak of red tides in the coastal areas. NFRDI plans to revise the monitoring program to include trace metals and persistent organic pollutants in the sediment and biota (fish and bivalves). It needs to be equipped with high resolution GC-MS, HPLC-MS to study the persistent organic pollutants and endocrine disruptors in the marine environment.

Korea Ocean Research & Development Institute (KORDI)

KORDI is a government funded research institute. It was established at the Korea Institute of Science & Technology (KIST) in 1973. KORDI separated itself from KIST in 1990 and reorganized under the MOMAF in 1996. KORDI has been carrying out short-term (generally 3 years) research projects funded by MOMAF, MOENV, MOST, other related government agencies and private sectors. It has been carrying out monitoring projects not only surveying the pollutants level but also the effects of pollutants on marine organisms like biomarkers (eg. histopathology of bivalves) and imposex of marine snails. It needs to be equipped with high resolution GC-MS, HPLC-MS to study the persistent organic pollutants and endocrine disruptors in the marine environment.

National Institute of Environmental Research (NIER)

NIER is responsible for supporting the Ministry of Environment in the formulation of environmental policies through surveys and studies, research, tests and assessments related to environmental pollution prevention. The institute was separated from the National Health Research Institute in July 1978 as a specialized research institute on the environment. With the inauguration of the Environment Administration in 1980, the institute was transferred to the Environment Administration. The institute consists of four departments, two sections, one research center and four water quality inspection laboratories, with a total of 214 staff members employed. NIER is responsible for the monitoring of air and water quality of the environment. NIER stopped marine environmental monitoring since the establishment of Ministry of Maritime Affairs and Fisheries. Since the incidence of phenol pollution of the river water which was used for drinking water, Ministry of Environment invested enough budget to purchase modern equipments like high resolution GC-MS and ICP-MS.

4.5 Training Activities

1) Ministry of the Environment: Environmental Training Department of National Institute for Environmental Research (NIER)

Environmental Training Department of NIER started in 1980, as an organization that trains the government officer of the Environmental Agency. It expanded training concerning various fields of environmental administration for the national and local government staff with responsibility for protecting the environment.

As for the content of training, in fiscal year 2004, it is classified into 1) environmental administration, 2) environmental policy, 3) natural environment, 4) water management, 5) waste management, 6) environment management, and 7) environmental analysis. The content of the analysis training is the analysis of water quality, endocrine disrupters, and dioxins, etc. as shown in Table 4-10.

Table 4-10 Analysis Training of Environmental Training Department of NIER

Content of analysis training	
Instrumental Analysis	GC, UV, AAS, ICP
Analysis training	Atmospheric analysis, odor substances analysis, and water analysis
	Waste analysis and VOCs analysis
	Drinking water analysis
Endocrine disrupters analysis	
Dioxins environmental monitoring	
Toxic chemicals analysis	

2) Ministry of Maritime Affairs and Fisheries: National Fisheries Research & Development Institute (NFRDI)

Training Support Team of NFRDI carries out training of Government officers, Fishermen and Marine industry. Training fields are Basic and Professional Training Course, Fishermen Training Course, and Video Communicating Training Course.

3) Korea Institute of Maritime and Fisheries Technology (KIMFT)

KIMFT carries out education and training of personnel engaged in maritime and fisheries sectors, services promoting an international exchange of technology related to maritime affairs and fisheries, and services for the execution of the maritime license examination. KIMFT has devoted a lot of efforts to the improvement of seafarer's competency and proficiency together with developing various effective training course, publishing up-to-date training materials, dispatching the trainers on board for the practical study, and installing high-tech taining facilities.

4) KORDI

KORDI carries out international training for APEC and PEMSEA countries for twice a year (3 weeks). The training include analytical techniques of POPs, EDCs, Oil pollution, Nutrients and on board training. Financial supports are provided by APEC (main funding), MOMAF, and KOICA (Korea International Cooperation Agency)

5. Present Situation

5.1 Pollution Loads Attributable to Rivers

5.1.1 Current Status of the Major River Water Quality

The results of monitoring the water quality of the major rivers that flow in the NOWPAP region in fiscal year 2002 are summarized as Table 5-1. These values are average of the downstream of rivers. The mean value of COD is in the range of 2.0-8.8mg/l, and BOD is 0.8-6.7mg/l. COD and BOD are indexes of organic pollution in rivers that flow in the NOWPAP region. Historical water quality monitoring data is summarized in Table 5-2. Cd, Pb, Cr^{6+}, As, Hg and cyanide (CN) were also monitored, but all of them were under detection limits.

Water quality assessment has been done extensively by various agencies throughout the world. Similar criteria are available in Korea (Table 4-6 to 4-9) that can be applied to water quality in rivers and streams of Korea in year 2002 (Table 5-1), the following conclusions can be obtained:

1. River temperature is within natural range of variation for the sample period.

2. The watr quality standard of pH in river water ranges from 6.5 to 8.5 (Table 4-6) and pH values in Korean rivers & streams fall within this range.

3. Dissolved Oxygen (DO) is an important parameter for living quality of water for most aquatic organisms. DO should not fall below 2 mg/l which will be

fatal. A range in 5-6 mg/l is sufficient for most aquatic species. The DO in Korean rivers & streams is much higher than the level indicated.

4. The Chemical Oxygen Demand (COD) is an easy and quick measurement to complement Biological Oxygen Demand (BOD). Waters having a BOD of less than 1 mg/l can be considered clean and BOD standards at 2 and 3 mg/l are considered normal. Whereas, COD measures of the amount of oxygen required to chemically transform the organic matter in a sample to carbon dioxide. A low COD denotes little pollution. This number is typically slightly higher than the BOD number since more organic material is transformed chemically than biologically. Considering all these points, the COD and BOD values in Korean rivers & streams indicate 'satisfactory' condition. However, Anseongcheon, Sapghocheon and Hyeongsan River showed BOD values higher than 3 mg/l indicating attention is necessary.

5. Suspended Solid (SS) is ranging from 0-100 mg/l and most of the values in Table 5.1 are low and within satisfactory range.

6. High counts of fecal coliform bacteria in rivers, streams and lakes are caused by contamination from humans and other warm-blooded animals' feces. The Korean standard for drinking water is 0 col./50 ml of water. The standard for recreational water bathing should not exceed 2,000 col./100 ml of water; secondary body contact, such as in boating, should not exceed 5,000 col./100 ml of water. While most Korean rivers & streams fall within safe range, Nakdong and Dongjin and Sapgyocheon streams exceed the upper limit.

7. Total Nitrogen and Total Phosphorus. Used as an index of eutrophication in closed water areas such as lake and bays. Nitrogen and phosphorus exist in the water as ions, nitrides and phosphides, but these parameters measure the overall amount of nitrogen and phosphorus in the water. Nitrogen and phosphorus are essential to plant growth, but if large quantities flow into lakes

or bays, eutrophication takes place whereby phytoplankton starts proliferating abnormally. In lakes and wetlands, phenomena such as algal blooms and green tide can occur, while red tides occur in bays. The lesser the TN and TP the better is the water quality. The US EPA recommended values for TN is 6 mg/l in Korea, Sapghochen stream and Han River exceeded this limit. The US EPA recommended values for TP is 1 mg/l and fortunately, the value is far lower in all the sampled rivers and streams. .

8. The US EPA limit for NO_3 is 10 mg/l and the values in Table 5-1 are much lower.

9. A value of 0.2 mg/l was identified as a pollution threshold for ammonia. If we apply this to our data 50% of the sampled rivers and streams exceed this limit.

10. In a stream draining into a lake, the phosphates should not exceed 0.05 mg/l (US EPA). In a lake the phosphates should not exceed 0.025 mg/l (US EPA). A stream not flowing into a lake should not exceed 0.025 mg/l. Phosphates exceeding these levels can be harmful. If the phosphates exceed these levels algal growth can choke out other plants and completely take over the water. This is part of the eutrophication process.

11. Heavy metals such as arsenic, lead, cadmium etc. do not occur at any measurable concentration in Korean Rivers and Streams (Table 5-1)

5.1.2 Water Quality from a Historical Perspective

The fresh water systems studied show that Korean water is on the alkaline side rather than acidic side. Among all the studied systems, Nakdong River showed the highest alkalinity. However, even those levels fall within the natural range of 6.5 to 8.5 pH. There is no time trend observable in this monitoring.

DO in all the systems is sufficient enough to support aquatic life and no declining trend is noticed.

BOD over the years showed a positive trend towards reduced BOD values which is a sign of good quality water. COD measurements confirm this trend.

SS values are in a safe range and no time trend is noticeable.

The E-coli count shows no time trend. While the count in most of the rivers and streams is below the level recommended by USEPA, a couple of counts in Han River and Anseongcheon are above this limit. However, recent recordings shows a reduced count in those systems indicating better quality of water.

ABS (alkyl benzene sulfonate) and phenol concentrations in Korean waters are non detectable.

Table 5-1 Water quality of rivers and streams (2002)

River	Temp (℃)	pH	DO (mg/l)	COD (mg/l)	BOD (mg/l)	SS (mg/l)	E-Coli (MPN/100ml)	TN	TP	NO_3	NH_3	PO_4
Han River	15.0	7.4	7.1	6.2	3.4	13.2	1.3×10^4	7.9	0.3	2.2	2.0	0.2
Nakdong River	16.0	7.5	9.2	5.8	2.5	16.1	6.8×10^2	3.3	0.1	2.4	0.4	0.1
Geum River	15.0	7.7	9.0	7.4	3.3	22.1	1.7×10^3	4.4	0.1	2.6	0.9	0.1
Yeongsan River	17.0	7.8	9.9	5.7	1.9	12.7	2.8×10^2	5.2	0.1	3.1	0.3	0.1
Seomjin River	12.0	7.0	7.9	2.9	0.9	2.8	1.1×10^1	0.7	0.0	0.4	0.1	0.0
Anseongcheon	16.0	8.0	9.7	8.8	6.7	13.2	2.2×10^4	2.4	0.2	3.0	2.1	0.2
Sapgyocheon	16.0	7.6	8.9	8.0	4.7	27.5	8.9×10^3	6.5	0.1	3.5	1.1	0.0
Dongjin River	18.0	7.6	11.0	3.4	1.7	5.3	5.1×10^3	2.4	0.1	1.7	0.1	0.0
Tamjin River	16.0	7.5	10.4	2.0	0.8	7.4	1.8×10^2	2.5	0.0	1.0	0.1	0.0
Taehwa River	16.0	7.2	10.2	2.8	1.0	5.9	2.8×10^2	3.2	0.0	2.7	0.1	0.0
Hyeongsan River	15.0	8.3	11.6	6.6	4.0	12.5	2.3×10^3	4.2	0.2	2.7	0.6	0.1

Table 5-1 (continue)

River	Cd	CN	Pb	Cr^{6+}	As	Hg	ABS	Phenol
Han River	0	0	0	0	0	0	0.01	0
Nakdong River	0	0	0	0	0	0	0	0
Geum River	0	0	0	0	0	0	0	0
Yeongsan River	0	0	0	0	0	0	0	0
Seomjin River	0	0	0	0	0	0	0	0
Anseongcheon	0	0	0	0	0	0	0.075	0
Sapgyocheon	0	0	0	0	0	0	0	0
Dongjin River	0	0	0	0	0	0	0.025	0
Tamjin River	0	0	0	0	0	0	0	0
Taehwa River	0	0	0	0	0	0	0	0
Hyeongsan River	0	0	0	0	0	0	0	0

Table 5-2 Historical water quality monitoring data of rivers and streams

River	Year	Temp	pH	DO	COD	BOD	SS	E-Coli	ABS
		°C		mg/l	mg/l	mg/l	mg/l	MPN/100 ml	mg/l
Han River	1995	15.1	7.4	7.6	6.7	4.4	22.6	8.2×10^4	0.0
	1996	15.0	7.5	7.6	7.6	5.0	17.4	$1.2\times10^{\circ}$	0.1
	1997	16.0	7.9	8.2	8.3	5.5	20.0	$4.8\times10^{\circ}$	0.0
	1998	16.0	7.9	9.3	6.3	4.6	17.2	8.0×10^4	0.0
	1999	16.0	7.3	7.7	5.9	3.9	15.5	5.1×10^4	0.0
	2000	14.8	7.3	7.8	5.4	3.0	9.5	1.0×10^4	0.0
	2001	15.0	7.3	9.2	6.5	3.5	13.8	1.3×10^4	0.0
	2002	15.0	7.4	7.1	6.2	3.4	13.2	1.3×10^4	0.0
	2003	15.0	7.4	7.0	5.3	2.8	13.3	1.4×10^4	0.0
Nakdong River	1995	15.9	8.4	7.6	8.9	4.7	12.6	7.2×10^3	0.0
	1996	16.0	8.2	10.7	8.7	4.4	12.4	2.1×10^3	0.0
	1997	16.0	8.2	10.1	8.3	3.8	16.4	1.7×10^3	0.0
	1998	17.0	7.8	10.7	6.1	3.2	13.6	4.1×10^3	0.0
	1999	16.0	7.9	11.0	6.4	3.1	12.9	5.2×10^3	0.0
	2000	16.5	7.8	9.8	6.9	2.9	14.2	8.6×10^3	0.0
	2001	16.0	8.2	10.8	6.3	3.2	21.6	9.7×10^2	0.0
	2002	16.0	7.5	9.2	5.8	2.5	16.1	6.8×10^2	0.0
	2003	16.0	7.3	9.1	5.2	2.2	27.4	6.2×10^1	0.0
Geum River	1995	15.3	7.5	10.0	6.5	4.3	9.7	3.3×10^2	0.0
	1996	15.0	7.6	7.9	5.8	3.7	12.2	9.9×10^2	0.0
	1997	15.0	7.5	8.6	6.0	3.4	12.5	2.7×10^3	0.0
	1998	15.0	7.4	8.9	5.0	2.4	25.3	2.3×10^3	0.0
	1999	16.0	7.6	9.9	4.8	2.6	18.6	1.1×10^3	0.0
	2000	15.2	7.7	9.6	5.4	2.7	14.7	2.2×10^3	0.0
	2001	15.0	7.8	9.4	6.5	3.7	21.6	1.4×10^3	0.0
	2002	15.0	7.7	9.0	7.4	3.3	22.1	1.7×10^3	0.0
	2003	15.0	7.8	9.5	5.4	2.1	20.8	1.6×10^2	0.0

River	Year	Temp	pH	DO	COD	BOD	SS	E-Coli	ABS
		°C		mg/l	mg/l	mg/l	mg/l	MPN/100ml	mg/l
Yeongsan River	1995	17.0	7.9	10.5	5.7	2.6	12.5	5.6×10^1	0.0
	1996	17.0	7.5	9.3	4.0	2.0	12.0	3.1×10^2	0.0
	1997	17.0	7.7	10.3	6.1	2.2	11.7	3.6×10^2	0.0
	1998	18.0	7.7	9.9	5.8	2.0	15.8	2.3×10^2	0.0
	1999	17.0	7.6	10.0	5.9	2.1	12.3	$3.0\times10^{\circ}$	0.0
	2000	16.2	7.4	10.1	5.7	1.7	13.6	4.2×10^2	0.0
	2001	17.0	7.4	10.1	6.1	1.9	12.2	2.4×10^2	0.0
	2002	17.0	7.8	9.9	5.7	1.9	12.7	2.8×10^2	0.0
	2003	17.0	7.6	9.3	5.9	1.9	11.8	1.2×10^2	0.0
Seomjin River	1995	12.0	7.7	7.5	2.4	1.5	2.5	1.0×10^2	0.0

	1996	11.0	7.2	7.4	2.3	1.1	2.1	1.5×10^{2}	0.0
	1997	12.0	7.0	7.3	2.6	1.3	1.8	8.9×10^{1}	0.0
	1998	14.0	7.0	8.2	2.8	0.9	1.9	2.4×10^{1}	0.0
	1999	12.0	7.2	7.7	2.6	0.9	2.0	4.2×10^{0}	0.0
	2000	11.0	7.5	7.7	2.5	0.8	1.9	8.3×10^{0}	0.0
	2001	11.0	7.0	8.4	2.5	0.7	1.8	3.8×10^{0}	0.0
	2002	12.0	7.0	7.9	2.9	0.9	2.8	1.1×10^{1}	0.0
	2003	12.0	7.3	8.7	3.8	1.2	3.3	3.0×10^{0}	0.0
Anseongcheon	1995	16.6	7.3	8.5	10.0	10.9	14.5	8.5×10^{5}	0.2
	1996	14.0	7.7	9.2	11.0	9.7	19.3	3.9×10^{4}	0.1
	1997	14.0	7.4	9.2	11.2	8.8	35.0	2.8×10^{4}	0.3
	1998	16.0	7.4	8.7	9.0	8.3	27.4	9.5×10^{4}	0.2
	1999	16.0	7.5	9.3	7.3	6.1	21.6	1.7×10^{4}	0.0
	2000	16.3	7.7	10.4	9.8	9.3	16.7	3.2×10^{4}	0.0
	2001	16.0	7.5	8.9	9.5	9.8	17.1	3.0×10^{4}	0.1
	2002	16.0	8.0	9.7	8.8	6.7	13.2	2.2×10^{4}	0.1
	2003	16.0	7.9	10.7	7.3	5.3	14.9	3.8×10^{3}	0.0

River	Year	Temp	pH	DO	COD	BOD	SS	E-Coli	ABS
		°C		mg/l	mg/l	mg/l	mg/l	MPN/100ml	mg/l
Sapgyocheon	1995	16.0	7.4	9.8	7.1	4.5	17.3	5.9×10^{2}	0.0
	1996	15.0	7.6	8.4	5.6	4.5	16.9	1.3×10^{3}	0.0
	1997	17.0	7.6	7.9	7.7	4.1	15.8	7.1×10^{3}	0.0
	1998	17.0	7.3	9.1	6.2	3.7	23.1	1.6×10^{4}	0.0
	1999	16.0	7.5	8.4	6.5	3.3	33.9	6.2×10^{3}	0.0
	2000	14.7	7.3	8.8	6.6	3.2	31.5	4.0×10^{3}	0.0
	2001	15.0	7.5	8.6	6.0	3.3	34.5	3.7×10^{3}	0.0
	2002	16.0	7.6	8.9	8.0	4.7	27.5	8.9×10^{3}	0.0
	2003	16.0	7.9	8.7	7.4	3.6	38.4	2.1×10^{2}	0.0
Dongjin River	1995	16.2	7.5	12.3	2.3	1.1	6.3	5.5×10^{2}	0.0
	1996	13.0	7.7	11.3	3.0	1.4	6.2	3.4×10^{2}	0.0
	1997	13.0	8.1	10.7	3.2	1.1	13.4	1.2×10^{3}	0.0
	1998	15.0	7.9	11.1	3.0	1.1	3.5	8.7×10^{2}	0.0
	1999	13.0	7.6	11.1	3.3	1.2	4.9	1.1×10^{4}	0.0
	2000	16.3	7.7	10.1	2.6	1.1	5.6	3.4×10^{3}	0.0
	2001	15.0	7.4	9.7	3.7	1.5	7.5	6.4×10^{2}	0.0
	2002	18.0	7.6	11.0	3.4	1.7	5.3	5.1×10^{3}	0.0
	2003	17.0	7.4	10.8	3.1	1.0	6.4	1.6×10^{2}	0.0
Tamjin River	1995	16.8	7.6	11.9	1.5	1.0	2.8	1.1×10^{1}	0.0
	1996	16.0	7.6	10.8	1.9	1.2	2.6	9.0×10^{1}	0.0
	1997	18.0	7.5	11.0	2.9	1.1	3.7	2.6×10^{2}	0.0
	1998	16.0	7.4	10.9	2.3	1.1	2.2	2.4×10^{2}	0.0
	1999	17.0	7.1	10.5	2.8	0.9	4.6	7.0×10^{0}	0.0
	2000	15.3	7.2	10.6	2.7	1.1	6.0	5.9×10^{2}	0.0
	2001	17.0	7.2	10.3	2.4	0.6	3.7	1.1×10^{2}	0.0
	2002	16.0	7.5	10.4	2.0	0.8	7.4	1.8×10^{2}	0.0
	2003	17.0	7.4	9.7	1.9	0.7	9.6	3.8×10^{2}	0.0

River	Year	Temp	pH	DO	COD	BOD	SS	E-Coli	ABS
		C		mg/l	mg/l	mg/l	mg/l	MPN/100ml	mg/l
Taehwa River	1995	15.8	8.1	7.9	3.3	1.3	3.3	2.9×10^3	0.0
	1996	16.0	7.9	11.1	3.5	1.2	2.7	4.1×10^2	0.0
	1997	16.0	7.7	10.2	3.9	1.0	2.5	6.0×10^2	0.0
	1998	18.0	7.5	10.8	3.1	1.2	3.2	1.6×10^3	0.0
	1999	17.0	7.7	11.2	2.6	1.3	3.3	1.3×10^3	0.0
	2000	17.2	7.6	10.1	2.8	1.1	3.5	1.3×10^3	0.0
	2001	17.0	8.0	11.0	3.0	1.3	3.2	3.4×10^2	0.0
	2002	16.0	7.2	10.2	2.8	1.0	5.9	2.8×10^2	0.0
	2003	17.0	7.7	8.7	3.1	1.3	4.1	2.5×10^1	0.0
Hyeongsan River	1995	15.8	7.7	12.4	9.9	6.9	14.8	3.2×10^3	0.1
	1996	14.0	7.7	10.6	8.1	5.9	11.3	7.0×10^2	0.1
	1997	15.0	8.2	11.8	9.6	5.4	12.3	3.0×10^3	0.1
	1998	15.0	7.6	10.9	4.7	2.7	9.4	1.5×10^4	0.1
	1999	16.0	7.7	10.9	4.6	2.9	10.6	6.5×10^3	0.0
	2000	14.9	7.8	11.9	7.0	5.6	12.0	2.9×10^3	0.0
	2001	16.0	8.0	11.3	7.1	4.2	10.8	2.3×10^3	0.0
	2002	15.0	8.3	11.6	6.6	4.0	12.5	2.3×10^3	0.0
	2003	15.0	7.5	10.4	4.5	2.2	9.0	1.3×10^3	0.0

5.2 Direct Pollution Loads

In this section, the pollution loads from sewage treatment plants that discharge treated wastewater directly into the NOWPAP region and additional pollution load from ocean dumping are estimated and discussed.

5.2.1 Water Pollutant Discharge

From the overall waste generation nearly 30% of the waste is discharged in to the waters (Table 5.3). However, there is a clear-cut regional difference in this discharge. The south coast stations have the lowest dischargedumping, amounting to 12%, followed by the west coast with 20%. On the other hand, in the east coast more than 85% of the waste is discharged into rivers and sea. In general, BOD load to rivers are drastically reduced after treatment. For example after treatment only about 1.4% BOD enters rivers. If this does not happen, the waste load to rivers and seas will be much greater (Table 5.4).

Night soil generation over the years have been reduced, for example in 2003 it was only 30% of what was produced in 1995 (Table 5.5). However, livestock waste water generation has not seen such a reduction (Table 5.6). The levels in 2002 are still 83% of what was seen in 1995.

5.2.2 Generation of Wastes

The waste generated in Korea since 1996 has been accounted in three categories in Table 5.7. While this table gives an overall estimation from 1995 till 2002, it gives detailed account for major cities in 2003. Overall there was a 40% increase in the production of waste from 1996 to 2003. This increase is accounted by industrialization rather than domestic waste generation. The domestic wastes in Korea remained rather stable during the 8 year period of the survey. There is an increase of 34% in some specified wastes as well.

5.2.3 Waste Discharge to the Sea

Table 5-8 shows the total amount of waste discharged into the sea surrounding Korea.

The total amount of ocean waste dumping is up to 8,874,000 tons in 2003. The amount of ocean dumping in Korea has steadily increased upto 270% since 1994. There is a phenomenal growth in the Pohang region that caused tribling of waste generation in that region. Whereas it was more than doubled in the western sector and less than doubled in Busan region. But Ministry of Maritime Affairs & Fisheries plans to reduce dumping amount to less than 500MT till 2011.

Table 5-3 Generation & discharge of waste water by river basin

(Unit:1,000m^3/day)

	2001		2002		2003		2004	
	Generation	**Discharge**	**Generation**	**Discharge**	**Generation**	**Discharge**	**Generation**	**Discharge**
Total	7,907	2,555	7,966	2,442	7,972	2,363	7,991	2,350
Hangang	739	332	659	275	668	309	614	255
Nakdong-gang	758	591	835	601	761	516	767	527
Geumgang	345	188	362	171	319	198	244	156
Yeongsangang	28	22	39	27	42	24	40	22
Mankyeonggang	120	85	109	73	107	74	107	74
Seomjingang	8	6	9	6	9	7	8	6
Ansungcheon	188	108	55	35	34	25	36	27
Sapgyocheon	28	17	60	25	53	25	58	26
Dongjingang	19	10	19	10	20	10	20	9
Taewhagang	28	19	30	17	28	17	2	1
Hyeongsangang	140	71	188	48	168	35	170	37
Samcheok Osipcheon	-	-	1	-	1	-	1	-
Gangneung Namdaecheon	-	-	5	3	5	3	5	3
Tamjingang	-	-	-	-	-	-	-	-
Yeongdeok Osipcheon	2	1	1	1	1	1	1	1
Yangyang Namdaecheon	1	1	1	-	1	-	1	1
Hoeyagang	17	1	11	-	11	-	43	9
Suncheon Dongcheon	1	1	3	2	3	3	3	3
East Coast	477	449	494	455	570	449	132	117
West Coast	1,712	359	1,850	370	1,837	357	1,923	413
South Coast	3,296	294	3,235	320	3,334	308	3,816	663

(Source: Ministry of Environment, Water Quality Management Bureau)

Table 5-4 Pollutant load by river basin

(Unit: kg/day)

	BOD load	
	Before treatment	**After treatment**
Total	2,409,545	33,990
Hangang	278,685	3,066
Nakdonggang	447,631	6,817
Geumgang	210,277	5,267
Yeongsangang	16,253	354
Mankyenggang	144,422	1,560
Semjingang	4,090	109
Ansungcheon	15,592	340
Sapgyeocheon	100,910	792
Dongjingang	11,753	151
Taewhagang	1,767	152
Hyeongsangang	11,164	447
Samcheok Osipcheon	126	3
Gangnung Namdaecheon	-	-
Tamjingang	1	-
Yeongdeok Osipcheon	1,827	23
Yangyang Namdaecheon	131	21
Hoeyagang	18,973	178
Suncheon Dongcheon	2,970	96
Others	336	13
East Coast	306,959	3,531
West Coast	664,391	6,085
South Coast	171,289	4,985

(Source: Ministry of Environment, Water Quality Management Bureau)

Table 5-5 Night Soil Generation & Treatment

(Unit: m^3/day)

Classification	Generation			Treatment			Treatment specification: Night Soil Treatment Facilities		
	Total	Night Soil	Night Soil Treatment Sludge	Total	Collected Night Soil	Night Soil Treatment Sludge	Total	Collected Night Soil	Night Soil Treatment Sludge
1995	45,901	9,493	36,408	26,968	7,130	19,838	21,051	4,810	16,241
1996	45,954	8,411	37,543	26,362	7,683	18,679	25,325	6,878	18,447
1997	46,872	7,563	39,309	25,934	6,440	19,494	24,465	5,377	19,088
1998	47,162	6,589	40,573	26,447	5,584	20,864	25,380	4,927	20,375
1999	47,495	5,864	41,631	27,934	5,148	22,739	26,665	4,517	22,148
2000	47,388	5,202	42,186	25,798	4,501	21,297	24,945	3,889	21,056
2001	48,227	4,623	43,604	26,184	4,251	21,933	25,098	3,763	21,335
2002	48,494	3,984	44,511	32,420	3,676	28,744	30,961	3,090	27,872
2003	48,717	3,271	45,446	25,802	3,037	22,765	24,844	2,612	22,232
2004	49,053	3,005	46,048	24,526	2,272	22,255	24,526	2,272	22,255
Seoul	10,288	79	10,211	5,144	76	5,067	5,144	76	5,067
Busan	3,684	75	3,609	1,842	71	1,771	1,842	71	1,771
Daegue	2,540	75	2,465	1,270	75	1,195	1,270	75	1,195
Incheon	2,611	80	2,530	1,305	76	1,229	1,305	76	1,229
Gwangju	1,407	27	1,380	703	27	676	703	27	676
Daejeon	1,451	9	1,442	725	8	718	725	8	718
Ulsan	1,088	12	1,076	544	12	532	544	12	532
Gyunggi P.	10,629	544	10,074	5,314	464	4,850	5,314	464	4,850
Gwangwon P	1,529	247	1,282	764	212	552	764	212	552
Chungbuk P.	1,501	179	1,322	750	115	636	750	115	636
Chungnam P.	1,973	323	1,649	986	198	788	986	198	788
Jeonbuk P.	1,916	213	1,703	958	173	784	958	173	784
Jeonnam P.	1,994	349	1,645	997	166	831	997	166	831
Gyungbuk P.	2,719	540	2,179	1,359	395	965	1,359	395	965
Gyungnam P.	3,169	217	2,952	1,584	174	174	1,584	174	174
Jeju	557	29	529	279	29	250	279	29	250

(Source:Ministry of Environment, Water Supply & Sewerage Bureau)

Table 5-6 Livestock waste water generation

(Unit: m^3/day)

	Generation
1995	168,228
1996	197,017
1997	206,386
1998	202,260
1999	128,461
2000	125,100
2001	130,912
2002	138,989
2003	150,483
Seoul	17
Busan	181
Daegue	717
Incheon	998
Gwangju	199
Daejeon	107
Ulsan	772
Gyunggi P.	29,951
Gwangwon P.	7,201
Chungbuk P.	7,987
Chungnam P.	28,916
Jeonbuk P.	13,837
Jeonnam P.	15,010
Gyungbuk P.	17,881
Gyungnam P.	22,024
Jeju	4,658

(Source: Ministry of Environment, Water Quality Management Bureau)

Table 5-7 Generation of wastes

(Unit: Ton/day)

	General wastes			Specified wastes
	Total	**Domestic**	**Industrial**	
1996	175,334	49,925	125,409	5,239
1997	189,200	47,895	141,305	6,075
1998	184,989	44,583	140,406	5,266
1999	219,217	45,614	166,114	7,489
2000	226,668	46,438	180,230	7,614
2001	252,927	48,499	204,428	8,105
2002	269,548	49,902	219,646	7,985
2003	295,047	50,736	244,311	7,982
Seoul	48,189	12,058	36,131	177

Busan	13,879	3,980	9,899	534
Daegue	10,421	2,641	7,780	319
Incheon	13,271	2,444	10,827	833
Gwangju	3,964	1,487	2,477	59
Daejeon	6,548	1,688	4,860	85
Ulsan	8,831	1,330	7,501	720
Gyunggi P.	42,962	9,354	33,608	1,582
Gwangwon P.	16,816	1,993	14,823	60
Chungbuk P.	14,914	1,636	13,278	150
Chungnam P.	18,174	2,194	15,980	387
Jeonbuk P.	17,608	1,754	15,854	176
Jeonnam P.	24,111	2,194	21,917	378
Gyungbuk P.	30,132	2,340	27,792	1,877
Gyungnam P.	22,541	3,010	19,531	629
Jeju	2,679	628	2,051	13

(Source: Ministry of Environment, Waste Management & Recycling Bureau)

Table 5-8 Amount of waste discharged to sea nationwide in Korea

(Unit: 1000 tons)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
West	868	1,049	1,613	2,013	2,429	2,380	2,423	2,390	2,424	2,406
East-a	1,236	1,740	1,998	2,216	2,140	2,325	2,862	3,394	4,088	4,372
East-b	1,187	1,381	1,403	1,414	1,407	1,739	1,819	1,887	1,963	2,096
Total	3,291	4,170	5,014	5,643	5,976	6,444	7,104	7,671	8,475	8,874

Note: - West: 200 km west of Gunsan
- East-a: 125 km east of Pohang
- East-b: 90 km east of Busan

6. Proposals for Future Regional Activities

6.1 Environmental Cooperation in Northeast Asia

Northeast Asia, in which Korea, China, Japan, Mongolia and Russia are located, is a geo-graphically close region that falls under the same environmental influence. Due to rapid economic growth of the countries in the region, environmental problems became exacerbated and such transboundary threats like acid rain and marine contamination substantially increased. These problems have highlighted the need for joint countermeasures, and environmental cooperation in the region has expanded considerably since the 1990s. Many multilateral agreements were concluded and regional bodies like the Northeast Asia Conference on Environmental Cooperation (NEAC) and the Northeast Asian Subregional Programme of Environmental Cooperation (NEASPEC) were formed. In particular, based on the cooperative experience of the 1990s, Korea spearheaded the institution of the Tripartite Environment Ministers' Meeting Among Korea, China, and Japan (TEMM) for a regular discussion of major environmental issues in Northeast Asia. Korea would like to strengthen cooperation in the near future.

6.2 Tripartite Environment Ministers' Meeting (TEMM)

First held in January 1999 and annually thereafter, TEMM has been organized as the only ministerial environment meeting in Northeast Asia held on a regular basis, and identifies long-term visions for regional environmental cooperation and carries out concrete cooperative projects.The initial focus of TEMM projects was on strengthening the sense of environmental community among the three countries through joint education of environmental officials, tripartite networking of environmental educational organizations, and maintenance of the TEMM website (www.temm.org). In line with these activities, Korea, China and Japan organized environmental industry round-tables to boost environmental industry cooperation, launched a freshwater pollution prevention project, and executed the "co-logical Environment Restoration Project in Inner Mongolia" with emphasis on capacity-building. In the near future, TEMM should be expended to support water pollution projects in this region.

6.3 EAS Congress

The East Asian Seas (EAS) Congress is a pioneering region-wide platform for capacity-building, strategic action and cooperation for the sustainable management and development of the Seas of East Asia. The congress brings together government ministers and high-level officials; heads of regional, international and non-governmental organizations; experts; and private sector/civil society representatives for comprehensive forums, plenary sessions, workshops and seminars. The strategic aim of the Congress is to provide a dynamic format for meaningful knowledge exchange, dialogue and interaction between key players and stakeholders in sustainable coastal and ocean management. PEMSEA was set up in 1999 with financial help from the Global Environment Facility, an arm of the United Nations. And East Asian Seas (EAS) congress is held every three years.

7. Conclusions

Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region is one of the 'Action Plans' which covers the Northwest Pacific region. The area surrounding the Northwest Pacific is one of the most highly populated parts of the world and is receiving enormous pressures on the environment. The countries of the region, the People's Republic of China, Japan, the Republic Korea and the Russian Federation participate in NOWPAP by joining forces.

There are a total of 9 provinces and 7 big cities in Korea that are included in NOWPAP region. The total land surface area of the Korean basin and the total length of Korean coastline is about 99,913 km^2 and 12,051 km, respectively. There are 10 major rivers in these basins that drains an estimated 506 billion tons/year as per our calculation in the year 2002. The population of Korea for the same year is 47,640,000. The domestic wastewater from about 65% of the population of the region has been treated by some form of public sewage treatment system prior to being discharged. Each city and province in Korea, is responsible for monitoring water quality by measuring various parameters.

Monitoring for water quality has been conducted since 1980's with gradual increase of monitoring items and areas. In 2002, a total of 21 water quality items were monitored at 240 stations in coastal areas and at 40 stations in offshore areas were monitored by two government agencies,

National Fisheries Research & Development Institute (NFRDI) and Korea Coast Guard carried out monitoring programs independently. Ministry of Environment is responsible for monitoring water quality of rivers, streams, lakes, ground water and drinking water while Ministry of Maritime Affairs & Fisheries is responsible for monitoring coastal and open ocean waters. Apart from it, several national laboratories were involved in this task such as 1) National Fisheries Research & Development Institute (NFRDI), 2) Korea Ocean Research & Development Institute (KORDI), 3) National Institute of Environmental Research (NIER), 4) Korea Coast Guard (KCG, 5) National Oceanographic Research Institute (NORI). Korean agencies and institutes conduct regular training to public and technicians to empower them on national monitoring activities. For example, Environmental Training Department of National Institute for Environmental Research (NIER) of Ministry of Environment; National Fisheries Research & Development Institute (NFRDI) and Korea Institute of Maritime and Fisheries Technology (KIMFT) of Ministry of Maritime Affairs and Fisheries; KORDI carry out such trainings regularly.

This document summarizes the results of such monitoring surveys, reflecting on the pollution loads that are being discharged to rivers and/or to marine and the coastal environments in the NOWPAP region. The discharge quantity of the major rivers are calculated and hence the pollutant load to NOWPAP region can be estimated from these surveys. In addition, national monitoring and assessment activities were reviewed to summarize sample preservation methods and analytical methods of pollutants, and measurement range and accuracy of each analytical method. This information can be used to provide quality assurance and quality control procedures in this region. The current status and historical trend of chemical substances in river water were described as well. The natural environmental conditions and the current socio-economic situation were reviewed to understand their influence on the pollutants load to the sea.

Due to rapid economic growth of the countries in NOWPAP region, environmental problems became exacerbated. Transboundary threats like acid rain and marine contamination substantially increased. Hence, based on the cooperative experience of the 1990s, Korea spearheaded the institution of the Tripartite Environment Ministers' Meeting Among Korea, China, and Japan (TEMM) for a regular discussion of major environmental issues in Northeast Asia. Korea would like to strengthen cooperation in the near future.

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National Report of Russian Federation
on River and Direct Inputs of Contaminants
into the Marine and Coastal Environment in NOWPAP Region

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National Report of Russian Federation on River and Direct Inputs of Contaminants into the Marine and Coastal Environment in NOWPAP Region

1. Executive Summary

This document is a National report of Russian Federation for Working Group 2 (WG2) based on the decisions of the POMRAC Focal Point Meetings (Vladivostok, Russia, 9-11 April 2002 and 26-27 May 2003). Specifically, this document summarizes the current status on the concentration of chemical substances in river water and chemical substances run off with regard to pollution loads being discharged into rivers or directly into coastal environments in the NOWPAP region.

The brief description of natural environmental conditions and socio-economical factors is done for the analysis of natural and anthropogenic influence on the chemical substances input to the sea. The total area of river watersheds within Russian part of NOWPAP area is about 93,000 km^2 with coastline of about 3000 km. Averaged water runoff by 45 major rivers is about 43.25 km^3/year (43.25 billon tons). The population of the region studied is 1382000 with very uneven distribution from 1.7 to 292 persons/km^2. Unfortunately the main part of domestic wastewater has not been treated so far. The volume of industrial and agriculture production was about 864 USD per capita in fiscal year 2002.

The legislative base of water quality monitoring in Russian Federation is described in this report as well as existing monitoring network, responsible agencies, methods used, and water quality criteria. Under the existing legislative base the state authorized agency for Hydrometeorology and Environmental Monitoring is responsible for the monitoring of ambient waters,

and State Office for Supervision on the Protection of Consumer's Rights and Human Welfare of the Ministry of Health and Social Development jointly with local authorities is responsible for the quality of drinking water. The main criteria of water quality is a compliance with maximum permissible concentration (MPC).

The chemical characteristics of river waters in 2002 are presented as well as estimated runoff of chemical substances with rivers and wastewaters. The averaged annual runoff was 84,401 tons for BOD, 7617 tons for dissolved inorganic nitrogen, 469 tons for phosphate, and 2,287,300 tons for suspended solids. Runoff of metals is evaluated for dissolved and suspended forms separately. More than 80% of overall run-off of metals carried in solid phase. For such particulate bound elements as Fe and Pb, the role of particulate forms increase up to 98-99%.

For the whole Russian mainland coast within NOWPAP region the anthropogenic flux of phosphate reaches up 80% of total river plus direct input of phosphor to coastal water. For ammonia and petroleum hydrocarbons the anthropogenic flux reaches up 50%. BOD_5, oxidaizable organic matter and phenols fluxes from anthropogenic sources form at least about 20% of total fluxes.

2. Introduction

2.1 Goals and Objectives

The goal of this report is to give an overview of national activities of the Russian Federation related to river and direct inputs of contaminants in the NOWPAP region, including organizations involved, institutional framework, research and management programs, which should be useful for the assessment of environment quality.

Another goal of this report is to provide available information about concentration of some chemical substances in the river waters, to assess run off of contaminants by rivers, and to evaluate the direct input of contaminants to the coastal area due to sewages and storm water run off.

2.2 Background

The Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP) was adopted at the First Intergovernmental Meeting (Seoul, 14 September 1994) by representatives of four countries: Japan, People's Republic of China, Republic of Korea and Russian Federation. The geographical scope for this Action Plan is the marine environment and coastal zones from about 121^{o}E to 143^{o}E and from approximately 33^{o}N to 52^{o}N, without prejudice to the sovereign right of any State (UNEP, 1997).

One of five priority projects identified at the First Intergovernmental Meeting is NOWPAP/3, “Establishment of a collaborative, regional monitoring program”. To oversee the implementation of NOWPAP/3, two Regional Activity Centers (RACs) were established in Toyama, Japan, and Vladivostok, Russia. Under the Pollution Monitoring Regional activity Center (POMRAC) in Vladivostok, two Working Groups were established: WG1 “Atmospheric

Deposition of Contaminants" and WG2 "River and Direct Inputs of Contaminants". Members of both working groups are going to prepare the national reports and, later, regional overviews on these important environmental issues mentioned above.

2.3 General Information on River and Direct Inputs of Contaminants

Generally, the sources of river and marine water pollution are classified as domestic wastewater, industrial wastewater, and natural loads. The pollutant loads from these sources flow into the sea via the rivers running through urban and rural residential areas, industrial areas, and agricultural regions (the river input). Moreover, a part of the domestic and industrial wastewater, as well as natural loads enters directly into the sea (the direct input). The current situation with regard to river and marine water pollution sources is outlined in the following sections of this report.

Information on river input and chemical substances concentration in river waters will be done for the observation points situated much close to the river mouths without special attention to the processes obtained in the estuaries and mixing zone. Information on direct input of contaminants is based on official data about volume of municipal and industrial wastes and expert assessment of storm water runoff.

2.4 Geographical Scope of Russian Territory Within NOWPAP Region

The Russian territory within NOWPAP area includes Primorski Krai, southeast part of Khabarovski Krai, and southwest part of Sakhalin Is. (Fig. 1). First one is the main from the point of view coast line length, watershed square, population, and economic production. The main geographic and social-economic characteristics of the different districts (subarea) situated within this area are presented in Table 1. The total land area is about 93000 km^2 with coastline is about 3000 km.

About 80 per cent of the Primorski Krai and adjoining part of Khabarovski Krai is occupied by numerous mountain ridges belonging to the mountainous country of Sikhote Alin. The average height of mountains is 600 meters with highest up to 1855 meters. More than 2/3 of watersheds are covered by Ussury taiga in which coniferous and broad-leaved species are mixed up. Southwestern part of Sakhalin Is. is presented by low mountains and hills covered by forest.

Monsoon atmospheric circulation is a main climatic feature of the region. The pretty cold dry winter and moderate warm humid summer are typical for the Russian part of NOWPAP area. There is clear shift of air temperature decrease in winter and increase in summer in moving away from the coast to the west even for the distance 30-50 km. Annual number of days with precipitations at the western coast of Primorski Krai makes 100-115 days. Annual sums of precipitations increase southward: in Vladivostok average sum is 806 mm, maximal - 1276 mm. 80-95% annual precipitations fall out in the period from April to October, and 16-26% of annual precipitations fall out in the month of the maximum average monthly amount.

Region is characterized by developed hydrographical net which density is in average about 0.9-1.0 km/km^2. In the south part of the region prevails rainwater feeding (50-70%), though in the north part of the region melting snow waters is very important too. A role of the underground water feeding changes in the interval of 5-15% from north to south. 80-90% of annual discharge falls to a warm period. This considerable river discharge unevenness makes some problems for providing population with fresh water. The main rivers of region are Tumen River (average discharge 287 m^3/s), Razdolnaya (Suifun) River (average discharge 72 m^3/s), Samarga River (average discharge 84 m^3/s), Koppi River (average discharge 69 m^3/s) and Tumnin River (average discharge 252 m^3/s), which summary provide about 53% of all river input from the Russian coast to the NOWPAP sea area.

In this report Russian territory within NOWPAP area is divided on to the several sub-area (regions) (Table 3.1 and Figure 2-1) different by the level of their socio-economical development and by the some geographical characteristics. The largest river of the region – Tumen River is not included in this classification due to its transboundary nature. Region 1 includes Khasanski district of Primorski Krai with several small rather uncontaminated rivers and low level of economical development. Region 2 includes Nadezhdinski district with Razdolnaya River and Vladivostok area and has high river input and anthropogenic press. Region 3 includes districts of east part Peter The Great Bay with Nakhodka - second city of Primorski Krai by industrial production. Region 4 includes rather spacious districts with moderate level of economical development. Region 5 includes Dalnegorski district – the only district in Primorski Krai with developed mining and ore processing industry, numerous metal enriched industrial wastes and high anthropogenic load on the chemical composition of Rudnaya River draining this district. Region 6 consists of vast unpopulated area of the north of Primorski Krai and southeast of Khabarovski Krai. Region 7 includes districts of southwest part of Sakhalin Island with small population density but rather high economic development.

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Pacific Oceanological Institute (POI), Far East Branch of the Russian Academy of Sciences (FEBRAS), Vladivostok

Figure 2-1 The Russian coastal area within NOWPAP Region

1-7 – sub-regions (districts) different by socio-economical and/or natural conditions described in Table 3.1

3. Social and Economic Situation in 2001-2002

The generalized social-economic characteristics of the different regions within Russian part of NOWPAP area is presented in Table 3-1.

Table 3-1 Social-economical characteristics of the coastal regions of Russian sector of NOWPAP area

Regions	Square, $*10^3$ km^2	Shore line, km	Population $*10^3$ person	Population density, per/km^2	Volume of industrial production $*10^6$ USD	Volume of agriculture production $*10^6$ USD	Volume of all production USD per capita
1	4.13	376	36,8	8,9	15,5	3,8	526
2	2.66	113	764	287,2	650,7	33,0	895
3	7.51	295	307,5	40,9	190,1	22,2	690
4	15.32	404	57,7	3,8	75,5	5,8	1409
5	5.34	18	49,4	9,2	72,9	3,6	1548
6	42.7	1119	73,8	1,7	134,5	8,1	1932
7	26,2	767	151,2	5,8	364,1	31,3	2615
Total	103,9	3092	1440,4	13,9	1503,2	107,8	1118

Note: *The regions studied includes: 1 – Khasanski district; 2 – Nadezhdinski district plus Vladivostok and Artem cities, 3 – Shkotovski and Partizanski districts plus Nakhodka and Fokino cities, 4 – Lazovski, Olginski and Kavalerovski districts, 5 – Dalnegorski district, 6 - Terneiski and part of Sovgavanski districts, 7 – south-western districts of Sakhalin Island. (Source: State Statistics Data on Primorski Krai by 2002)

The population of areas studied is consisted of three parts: within Primorski Krai (regions 1 – 5 and part of 6 – 1229.6 $*10^3$ peoples), within Khabarovski Krai (part of region 6 – 110.7$*10^3$ peoples) and within Sakhalin Oblast (region 7 – 151.2$*10^3$ peoples). It corresponds to 60.4%, 7,8%, and 28,1% of total population of Primorski Krai, Khabarovski Krai and Sakhalin Oblast, respectively. It means that for the time being the territories of Primorski Krai play a main role in the economical situation within Russian part of NOWPAP area compare to other large administrative units – Khabarovski Krai and Sakhalin Oblast. In future situation could be changed due to fast economical development of Sakhalin Island.

The population of Primorski Krai exhibited the decrease over the last 5 years from 15,4 to 30.6 thousands peoples/year.

The major cities within Primorski Krai are following: Vladivostok City – 613.400, Artem City – 111.500, Nakhodka City – 174.600, Fokino City – 35400, Bolshoi Kamen City – 39300, Partizansk City – 51.500, Dalnegorsk City – 49400.

The amount of people working at the “goods producing” business (industrial enterprises, transport, construction, wholesale, agriculture, forestry) is about 58.5% of all employed, and only 3.7% of them work in agriculture and forestry. The amount of people working at the “service producing” business (service, medicine, education, science, officials) is about 41.5%. The percentage of employed in “goods producing” is decreased to 52.5% during last 5 years.

The main fields of industrial production in Primorski Krai include energy producing and delivery, coal and ore mining, mashinery, chemical industry, wood industry, textile industry, construction industry and food production. The ore mining industry is concentrated in the Dalnegorski (subregion 5) as well as chemical production. Artem-Vladivostok area (subregion 2) and Nakhodka (subregion 3) are the major food and mashinery producers. Terneisky district (subregion 6) is specialized on wood manufacturing (Table 3-2).

Table 3-2 Amount of goods (% of total industrial production) produced at the subregions of Primorski Krai

Subre-gions*	Energy	Coal/ Metal	Chemical	Mashinery	Wood	Construct	Textile	Food
1	15,9	-	-	63,5	1,6	-	1,4	17,6
2	30,3	7,6	0,6	12,7	1,9	3,4	1,6	48,4
3	5,2	1,8	0,3	16,6	3,8	2,0	1,7	69,3
4	7,0	-	-	0,6	7,1	0,5	-	84,7
5	20,8	16,1	44,6	0,1	9,3	0,1	-	2,9
6**	6,0	-	-	-	92,0	-	-	2,0

Note: *- subregions as presented in Table 3.1, ** - part within Primorski Krai

The volume of industrial production in the Russian part of NOWPAP area exceeds volume of agriculture production in 14 times, that is less then 10% of overall production in region is provided by agriculture land use.

The land use structure in the subregions of Primorski Krai within NOWPAP area is presented in Table 3-3

Table 3-3 Status of land use according to land categories (km^2)

Subregions*	Agriculture	Industry	Residental	Forest	Wildlife reserve
1	906,7	600,4	316,5	1116,6	179
2	852	348	432	964	2
3	619	476	472	5013	-
4	1160	345	303	12073	1200
5	88	29	78	4498	
6**	127	6	168	24386	3471
Total	3753	1804	1770	48051	4852
% of Total	6,2	3,0	2,9	79,8	8,1

Note:*- subregions as presented in Table 3.1, ** - part within Primorski Krai

4. National Monitoring and Assessment Activities

4.1 Overview of National Policies and Laws

The legislative basement of monitoring activities in Russian Federation is the FEDERAL LAW «ON ENVIRONMENTAL PROTECTION» (No. 7-FZ of January 10, 2002). The main goal of this Law is to promote formation and strengthening of the ecological law enforcement and maintenance of ecological safety in the territory of the Russian Federation and republics in structure of the Russian Federation.

In the Article 1 of this Law definition is given as follow:

"Environmental monitoring (state ecological monitoring) is a comprehensive system of observing the condition of the environment, assessing and forecasting of environmental changes resulted from natural and man-made factors… The state environmental monitoring (the state ecological monitoring) is the environmental monitoring performed by the governmental bodies of the

Russian Federation and the governmental bodies of the subjects of the Russian Federation".

Another legislative Act on this issue is The WATER CODE of the RUSSIAN FEDERATION (October 18, 1995). The Article 78 of this Law "The state monitoring of water objects" gives the follow definition:

"The state monitoring of water objects represents a system of regular observations for hydrological or hydro-geological and hydrochemical parameters of their condition, providing gathering, transfer and processing of obtained information aimed at up-date revealing of negative processes, forecasting of their development, prevention of harmful consequences and definition of efficiency degree of water protection measures.

The state monitoring of water objects is an integral part of a system of the state monitoring of the surrounding natural environment.

The state monitoring of water objects is governed by the special authorized state bodies for the use and protection of water resources together with the specially authorized state bodies dealing with protection of the surrounding natural environment, the state authorized body dealing with hydrometeorology and monitoring of environment (on surface water objects) and the state authorized body dealing with the use and protection of the interior of the earth (on underground water objects).

The procedure of the state monitoring of water objects is established by the Government of the Russian Federation".

Other legislative and normative documents regulating activity in the field of ecological monitoring include:

«THE AGREEMENT ON COOPERATION IN THE FIELD OF ECOLOGICAL MONITORING OF THE STATES - PARTICIPANTS OF

THE CIS» (it is approved by the GIS of January 13, 1999 and commissioned within the territory of the Russian Federation by the decision of the Government of the Russian Federation No.299 of April 04,2000);

The Decision of the Government of the Russian Federation No. 177 of March 30,2003 «ON ORGANIZATION AND REALIZATION OF THE STATE MONITORING OF ENVIRONMENT (THE STATE ECOLOGICAL MONITORING)»;

The Decisions of Heads of administrations of the subjects of the Russian Federation on creation of territorial subsystems of ecological monitoring (48 subjects of the Russian Federation);

The Decision of the Government of the Russian Federation No. 622 of August 23, 2000 «ON STATE SERVICE OF ENVIRONMENTAL MONITORING»;

Moreover a number of the articles of «The Federal law on wildlife» (No.52 - FZ of April 24,1995), «On a special economic zone» (Article 28), «On a continental shelf of the Russian Federation» (Article 33), «On special protected natural territories» (Article 7), «On protection of Lake Baikal» (Article 20) concern different issues of the organization and implementation of monitoring of water quality.

The water quality assessment in Russia is based on the compliance of the characteristics observed with so called maximum permissible concentrations (MPC). There are three sets of MPC in ambient water: (1) for the drinking water; (2) for the water of domestic, drinking and cultural uses – “public waters” (both according to former SanPIN 2.1.4.559-96, from the July 2003 – GN 2.1.2.1315-03); (3) for the water used for the fishery purposes. All substances are divided for four classes of danger (toxicity level - TL) according to their toxicity for people and/or fish, cumulative and prolonged effects, etc: 1st class – extremely dangerous, 2nd class – high dangerous, 3rd class –

dangerous, 4th – moderately dangerous.

The MPC of the most common potentially hazardous chemical substances in the waters for the different types of water use are presented in Table 4-1. This list covers only small part of substances with obtained and established MPC. Besides this list the maximum permissible concentrations are determined for the more than 600 organic chemical substances in drinking water, more than 1000 chemical substances in "public" waters, and more than 800 chemical substances in the waters used for fishery purposes.

Table 4-1 Maximum permissible concentration of chemical substances (mg/l) in waters used for the different purposes

Parameter	Drinking	"Public" waters	Fishery purpose	TL
pH	6-9	6-9	6.5-8.5	4
Mineralization	1000 mg/l	1000 mg/l	1000	4
BOD_5	nd	nd	2.0	4
COD	5.0 mg/l ($KMnO_4$)	5.0 mg/l ($K_2Cr_2O_7$)	15 ($K_2Cr_2O_7$)	4
PHC (petroleum hydrocarbons)	0.1 mg/l	0.1 mg/l	0.05	3
Detergents (Surfactants)	0.5 mg/l	0.5 mg/l	0.1	4
Phenols (summary)	0.25 mg/l	0.25 mg/l	0.001	3
Al^{3+}	0.5 mg/l	0.5	0.04	2/4
Be^{2+}	0.0002 mg/l	0.001	0.0003	1/2
B (summary)	0.5 mg/l	0.5	10*, 0.1	2/4
Fe (summary)	0.3 mg/l	0.3	0.05*, 0.1	3/4
Cd (summary)	0.001 mg/l	0.001	0.005	2
Mn(summary) , Ni(summary)	0.1 mg/l	0.1	0.05*, 0.01	3/4
Cu(summary)	1.0 mg/l	1.0	0.005*, 0.001	3
As(summary)	0.05 mg/l	0.05	0.01*, 0.05	2/3
Se(summary)	0.01 mg/l	0.01	0.0016	2
Hg(summary)	0.0005 mg/l	0.0005	0.0001*, $<10^{-5}$	1
Cr	0.05 Cr^{6+}, 0.5 Cr^{3+}		0.02Cr^{6+},0.07Cr^{3+}	3
Zn (summary)	5 mg/l	1.0	0.05*, 0.01	3
Pb(summary)	0.03 mg/l	0.03	0.01*, 0.1	2
$N\text{-}NO_3^-$	10 mg/l	10	9.1	3
$N\text{-}NO_2^-$	0.75	0.8	0.02	2
$N\text{-}NH_4^-$	nd	1.0	0.4	3/4
SO_4^{2-}	500 mg/l	500	100	2
F^-	1.2-1.5 mg/l	1.5	0.75	2/3
CN^-	0.035 mg/l	0.1	0.05	2/3
HCH	0.002 mg/l	0.02	<0.00001	1

DDT (summary)	0.002 mg/l	0.1	<0.00001	2/1
PCBs	0.001	0.001	0.0001	1-2

Note:* - for sea water only; nd – not determined; TL for drinking water/TL for fisheries

For the drinking water maximum permissible concentration is a hygienic norm obligatory without any exception. For some kind of "public" waters and waters used for fishery purpose maximum permissible concentration is an ecological norm, that is there is some possibility to exceed MPC with adequate deterioration of water quality.

Table 4-2 Water quality criteria based on concentration of chemical substances (mg/l)

Parameter	Type of water use	MPC	High pollution	Extremely high pollution
Mineralization	fisheries	1000	> 10000	> 50000
DO	-//-		< 3.0	< 2.0
BOD_5	-//-	2.0	> 10	> 40
$COD(K_2Cr_2O_7)$	-/-	15	> 150	> 750
$N\text{-}NH_4^+$	-//-	0.4	> 4.0	> 20
$N\text{-}NO_2^-$	-//-	0.02	> 0.2	> 1.0
$N\text{-}NO_3^-$	-//-	9.1	> 91	> 910
$P\text{-}PO_4$	-//-	0.05	> 0.5	> 2.5
SO_4^{2-}	-//-	100	> 1000	> 5000
Fe	hygienic	0.1	> 3.0	> 5.0
Al	fisheries	0.04	> 0.4	> 2.0
Zn	-//-	0.01	> 0.1	> 0.5
Mn	-//-	0.01	> 0.3	> 0.5
Ni	-//-	0.01	> 0.1	> 0.5
Cu	-//-	0.001	> 0.03	> 0.05
Cd	hygienic	0.005	> 0.015	> 0.025
Pb^{2+}	-//-	0.006	> 0.018	> 0.03
Cr^{6+}	fisheries	0.02	> 0.2	> 1.0
Cr^{3+}	-//-	0.07	> 0.7	> 3.5
PHC	-//-	0.05	> 1.5	> 2.5
Detergents	-//-	0.1	> 1.0	> 5.0
Phenols	-//-	0.001	> 0.030	> 0.050
HCH, DDTs	-//-	0.00001	> 0.00003	> 0.00005
F^-	-//-	0.75	> 7.5	> 37.5
B	hygienic	2.67	> 26.7	> 133.5
H_2S	fisheries	0.00001	> 0.00010	> 0.00050

The quantitative criteria based on the concentration observed are established for the classification of contamination events in ambient waters (Table 4-2). According to these criteria all events are divided on pollution (exceeding

MPC), high pollution and extremely high pollution. State Office for Supervision on the Protection of Consumer's Rights and Human Welfare – subdivision of Ministry of Health and Social Development is an executive authority responsible for the establishment of sanitary hygienic MPC, and State Fishery Service – subdivision of Ministry of Agriculture is responsible for establishment and affirmation of MPC for the waters used for fishery purposes.

4.2 National Programs

The Federal Service on Hydrometeorology and Environmental Monitoring (ROSHYDROMET) is responsible for routine monitoring in Russia. In Primorsky Kray, monitoring of contamination of air, river waters, soil and marine environment is implemented by Primorsky Office on Hydrometeorology and Environmental Monitoring according to State Monitoring Programs.

The amount and quality of all types of municipal and industrial wastewaters are controlled by the subdivisions of Federal Service for Environmental, Technological and Nuclear Supervision. Main related issue is a development of Maximum Permissible Discharge of wastes – MPD. The MPD are developed by scientific and engineering organizations for the different water users and affirmed by the Federal Service for Environmental, Technological and Nuclear Supervision, and Ministry of Natural Resources. The quality of underground water is a subject of responsibility of subdivisions of the Ministry of Natural Resources.

The quality of surface waters could be used as drinking water is controlled by the local authorities according to the standards (MPC) established by the State Office for Supervision on the Protection of Consumer's Rights and Human Welfare of the Ministry of Health and Social Development.

Research activities in the field of quality and chemistry of surface waters are carried out by Institutes of the Far East Branch of the Russian Academy of Sciences (FEBRAS), by the Far Eastern Regional Hydrometeorological Research Institute (FERHRI), and other scientific organizations.

State Monitoring Program on the ambient water quality is implemented on the State monitoring network. The main criterion of water quality assessment is a compliance with Water Quality Standards: Maximum Permissible Concentration – MPC, which development and affirmation is a concern of State Office for Supervision on the Protection of Consumer's Rights and Human Welfare of the Ministry of Health and Social Development and State Fishery Service.

The general objectives of State Monitoring Program in Russia are: 1) Observation on the water quality at the background (pristine) sites, and near the possible sources of contamination due to human activity as well; 2) Assessment and prediction (prognosis) of the water quality changes under the influence of the natural and human factors; 3) Provision the needs of state (governmental), business and human communities in the reliable information about ambient water quality and its changes for the subsequent use for the prevention/remediation of environmental damage.

The water quality monitoring plan at the different monitoring sites is established according to the several criteria including population of watershed and significance for the biological resources. The several classes of monitoring sites are established. The characteristics of monitoring plan are depend on site classes (Table 4-3).

Table 4-3 The criteria for site classification and corresponding monitoring plan

Site classes	The criteria of classes establishment	Periodicity	Program of observation
I	- The cities with population more than 1 billion people; - The sites of the repeated (reiterated) wreck waste discharge with 100 MPC by	Daily	Concise Program Type 1
		Decade	Concise Program Type 2

	at least one parameter and/or repeated mortality of water organisms - The water body of the spawning and wintering of the especially valuable biological species;	Monthly	Concise Program Type 3
		Main hydrological stages (quarterly)	Full Program
II	- The cites with population 0.5 – 1.0 billion people; - The sites of the repeated wreck discharge with 10-100 MPC by at least one parameter; - The water body of the spawning and wintering of the valuable species; - The sites upstream of dams and near the state border	Daily	Visual observation
		Decade	Concise Program Type 1
		Monthly	Concise Program Type 3
		Main hydrological stages	Full Program
III	- The cities with population less than 0.3 billion people; - The sites of the repeated wreck discharge with up to 10 MPC by at least one parameter; - The mouth sites of rivers and big tributaries	Monthly	Concise Program Type 3
		Main hydrological stages	Full Program
IV	The surface waters of State Reserves and pristine territories	Main hydrological stages	Full Program

The list of parameters should be measured at the different water quality monitoring plan is presented in Table 4-4. Additionally to the hydrological and chemical parameters, the hydrobiological features are studied. The hydrobiological works include description of phytoplankton, zooplankton, zoobenthos and periphiton communities, carried out three times per year (spring, summer and fall) at all Stations Class I and some Stations Class II and III.

Actual quantity of monitoring sites in Primorsky Krai is presented in Table 4-5, and their location is shown on Figure 4-1. Unfortunately, due to lack of government funding, number of monitoring stations decreased in recent decades from 46 in 1990 to 33 in 2003.

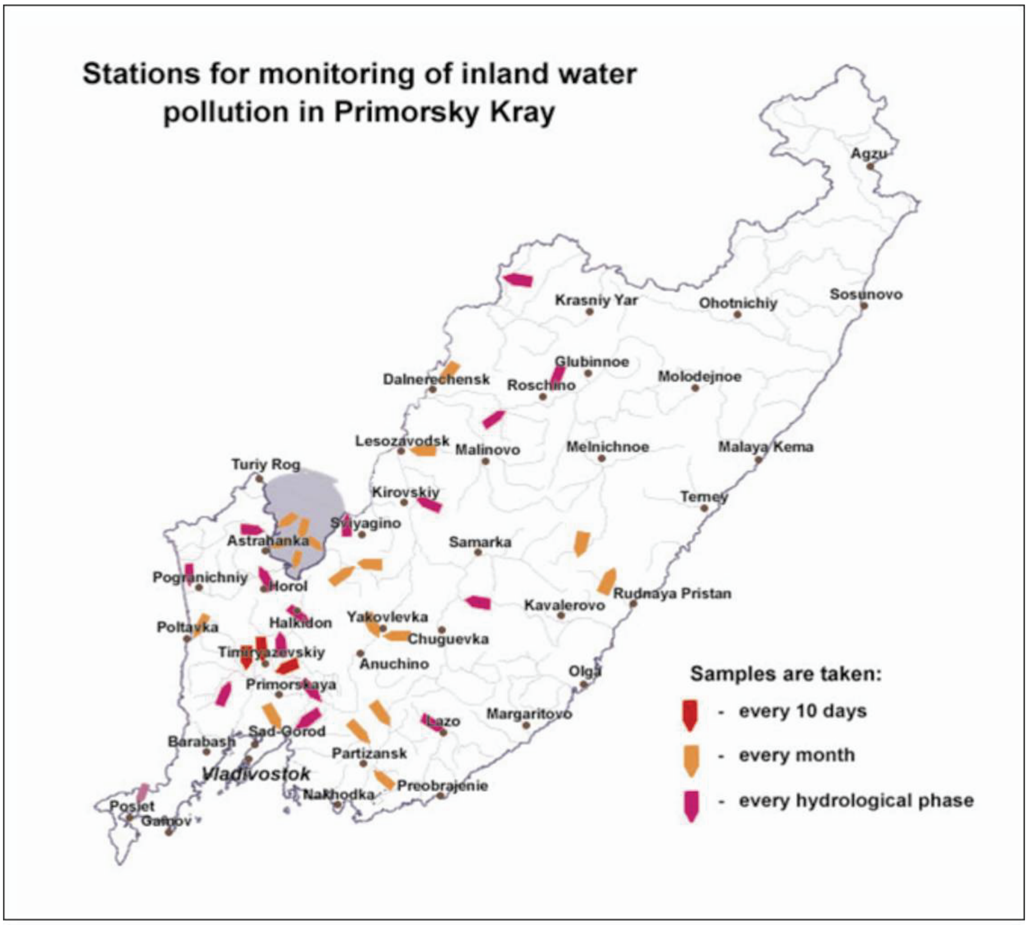


Figure 4-1 State network of water quality monitoring stations of rivers and lakes in Primorski Krai.

Table 4-4 Description of observation (parameters measured) on the monitoring stations of different classes in Primorski Krai

Class of Station	Type of observation	Parameters measured
II	Concise Program Type 2 (CPT-2)	Hydrological parameters, visual observation, temperature, conductivity, DO, pH, SS, BOD, COD, an 2-3 characteristic pollutants

III	Concise Program Type 3 (CPT-3)	CPT-2 plus all characteristic pollutants
IV	Full Program	CPT-3 plus Eh, macro-ions, N-NH_4, NO_3, NO_2, PO_4, Fe, Si, oil products (PHC), PAH, trace metals, POPs

Table 4-5 Number of monitoring stations of different class in Primorski Krai and frequency of observations

Number and class of stations	Frequency
1 station of class II	Every 10 days
19 stations of class III	Every month
13 stations of class IV	Every hydrological phase

4.3 Methodologies and Procedures

Information on analytical methods required for the various water quality monitoring parameters is given in Table 4-6. This table includes list of recommended methods and some metrological characteristics of them.

Table 4-6 Brief description of some analytical methods used in the monitoring of ambient water quality in Primorsky Kray

Parameters	Methods	Measurement range	Precision
Suspended solids (SS)	Gravimetric	2-50 mg/l	---
SO_4^{2-}	Nephelometry	2.0-50 mg/l	0.1 + 0.17C
Surfactants (detergents)	Colorimetry after extraction	0.010-0.050 mg/l 0.050-0.400 mg/l	0.006 0.12C
Phenols		0.002-0.018 mg/l 0.018-0.025 mg/l	0.6 + 0.13C 1.6+0.05C
$N\text{-}NO_2^-$, $P\text{-}PO_4^{3-}$	Colorimetry	0.010-0.300 mg/l	0.004 + 0.13C
NH_4^+		0.30-4.00 mg/l	0.05
Si		0.1-2.0 mg/l	0.05 + 0.045C
Fe_{Total}		0.05-1.00 mg/l	0.006 + 0.12C
NO_3	Potentiometry	0.01-6200 mg/l	20%
F		0.2-4.0 mg/l	0.01 + 0.096C
pH		4.0-10	0.01
O_2	Titration	1.0-15.0 mg/l	0.034C
Cl		2.0-15.0 mg/l	0.17C
Ca, Mg		1.0-100 mg/l	0.2 + 0.044C
COD ($K_2Cr_2O_7$)		4.0-80 mg/l	1.3 + 0.057C
BOD_5		1.0-11.0 mg/l	0.3 + 0.06C
Petroleum Hydro-carbons(PHC)	Infrared spectrophotometry	0.02-2.0 mg/l	0.004 + 0.20C
ά, γ-HCH	Gas chromatography	0.002-0.050 μg/l	0.0008 + 0.17C
DDE		0.005-0.150 μg/l	0.002 + 0.093C
DDD		0.010 –0.300 μg/l	0.001 + 0.22C
DDT		0.020-0.500 μg/l	0.010 + 0.096C
Na	Flame spectrometry	1.0-50 mg/l	0.08 + 0.04C
K		1.0-5.0 mg/l	0.03+0.06C
Cu, Ni, Co, Pb, Hg	Voltamperometry (ASV) and/or Atomic Absorption (AAS)	0.1-1000μg/l	20%
Mn, Zn		5–300 μg/l	5%
Cd		0.005-50 μg/l	15%

Note: "C" in the last column means "concentration"

The QA/QC procedures in Primorsky Kray Environmental Monitoring Center (EMC) are being performed according to the following documents/programs:

- Recommendation No. 52.24.509-96 of the State Committee of Russia on Standards, Metrology and Certification, *"Implementation of Measures Regarding the Quality of Hydrochemical Information"*.
- Recommendation No. 2335-95 of the State Committee of Russia on Standards, Metrology and Certification, *"The Government System of Ensuring the Uniformity of Measurements. Internal Quality Control of Quantitative Chemical Analysis"*.
- Recommendation No. 52.18.599-98 of the State Committee of Russia on Standards, Metrology and Certification, *"Implementation of Inspections of the Accredited Laboratories (Centers)"*.
- Program of the State Hydrochemical Institute (Rostov-on-Don) *"Periodic External Quality Control of Measurements of Water Quality"*.
- Program of External Quality Control of the Center of Accreditation, Scientific-Production Association "Typhoon" (Obninsk).
- International Intercalibration Program (ADORC, Niigata, Japan).

Internal quality control includes the following procedures:

- *Control of sampling procedures.*
- *Operational internal control of accuracy, precision and repeatability.* This procedure is necessary to take timely necessary measures in such situations when measurement errors are not in compliance with the established standards.
- *Internal statistical control.* This is random statistical check of repeatability and accuracy in order to estimate the real quality of quantitative chemical measurements and to take necessary measures to improve this quality.

External quality control by the State Hydrochemical Institute (Rostov-on-Don), Scientific-Production Association "Typhoon" (Obninsk) and the ADORC Center (Niigata) is being done by organizing and implementing the internal laboratory control; by regular checking of some analytical techniques; and by sending blind samples (not less than once a year).

4.4 Research Activities

4.4.1 PGI and FERHRI Studies

PGI and FERHRI specialists carry out research on river inputs to the marine environment for several decades. The recent book on riverine transport of different chemical substances in the Russian Far East from Chukotka to Primorski Krai has been published by V.A.Chudaeva (2002). In this report we use the data on the concentration of metals in the suspended matter of Sakhalin rivers from (Chudaeva, 2002). The evaluation of macro-ions transport to the sea, as well as data on broad range of trace elements including rare earth elements concentration in surface and ground waters has been done in this overview. The issues of isotopic and chemical composition of the underground and mineral waters of Primorski Krai and Kamchatka peninsula are the other subjects of study of this research team including specialists of PGI and FEGI (Chudaeva et al., 1999, Chudaev et al, 2000).

New data on the level of Zn, Cd, Pb, Cu, Mn and Fe concentration in the main rivers of Primorski Krai – Tumen River and Razdolnaya River were obtained in PGI and has been published by V.M.Shulkin (2004). Change of concentration of metals within the Russian part of Razdolnaya River testifies to significant anthropogenic input of Mn, Zn, Fe, Cd with sewages of Ussuriisk. However distribution dissolved Cd and Pb and their concentration in suspended solids specifies probable additional input from China. Anthropogenic influence on metal contents in river water and suspended solids is caught on distance of 5-20 km downstream from prospective sources due to absorption and dilution by uncontaminated material. The self-cleaning ability of the investigated rivers is sufficient so far for the significant reduction of metal concentrations at the mouth areas. This data allow to enhance the possibility to use metal concentration in river water to trace the level of anthropogenic press on the ecosystems. Recently (Shulkin, Semykina, 2004) seasonal and annual variability of concentration and volumes of carrying out of the dissolved forms of nitrogen and other nutrients by the Razdolnaya River during last 20 years is considered. The natural and anthropogenic factors influencing change of concentration of nutrients are characterized. It is shown, that seasonal variability of carrying out of nutrients is determined basically by variations of the water discharge.

Several investigations were carried out on the chemical composition of small rivers and streams of Vladivostok area (Yurchenko, 2004). The nutrients phosphorus and nitrogen, ammonia first of all, are the most contrast contaminants in the streams under influence of municipal wastes, though elevated metal concentrations are registered also (Yurchenko, 2004). The information on the possible sources polluting the sea adjacent to Vladivostok is collected and analyzed by Gavrilevski et al., 1998 (FERHRI). Major types of pollution sources are identified. List of contaminants that can be used at the water quality assessment includes suspended solids, BOD_5, ammonia, phosphate, surfactants (detergents), petroleum hydrocarbons and phenols. The volumes of wastes and contribution of main sources are assessed for different parts of coastal waters near Vladivostok and for different contaminants (Gavrilevski et al., 1998).

A batch of investigations were carried out by PGI specialists in Rudnaya River area situated in Dalnegorsky district – center of mining industry of Primorski Krai (item 5 in Table 3-1) (Elpatyevski, 1993, Shulkin, 1998). Accordingly, drainage waters, and wastes contaminate the nearby environments, and concentration of some metals in river waters reach up 100-200 mg/l. As a result, the Rudnaya River carries considerable additional amounts of Pb, Zn, Cu, Mn and Cd, to the sea, and vast and distinct geochemical anomaly have been formed in the coastal sediments adjacent to the Rudnaya River mouth. Zn, Cu, Pb, and Cd contents are elevated to 20-50 times in the vicinity of mouth and to 5-20 times in the sediments southward in comparison with unpolluted sites. Levels of metals in sediments were equaled to the heavily polluted coastal localities even when the sediments were situated at 5-10 km from the Rudnaya River mouth. The action of the southward Primorskoe Current determined the shape and direction of the contaminated plume.

Extensive research has been implemented on the behavior of some metals (Fe, Mn, Zn, Cu, Pb and Cd) in estuaries of Primorski Krai. These research included field study (Gordeev et al., 1983, Shulkin, 2004) and laboratory experiments as well (Shulkin, Bogdanova, 2003). Removal of dissolved Fe was always obtained at the initial stage of river and sea waters likewise other estuaries of the world. Behavior of Mn, Zn, Cu depends on relation of dissolved and suspended forms in the incoming river waters: at the elevated concentration in the river suspended solids, the release to the solution takes place. This is especially true and typical for Cd. The possibility of Cd, Zn and Cu release from riverine suspended matter to the sea water was verified by laboratory experiments.

Some other data on Tumen, Razdolnaya and Rudnaya rivers were also published during last years (e.g., Transboundary Diagnostic Analysis…, 2002).

4.4.2 POI studies

Comprehensive investigations of river-sea interactions were carried out by specialists of the Pacific Oceanological Institute (POI). Field surveys within the NOWPAP region were implemented in Razdolnaya river (flowing to the Amursky bay) and its estuary. Different kinds of laboratory experiments and computer modeling of the “river-sea” system (e.g., carbonate system components in estuaries) were also performed (Tischenko et al., 2005, Zvolinski et al., 2005).

In June 2000 and July 2001, extensive surveys were performed in Razdolnaya river estuary (upper part of Amursky bay). During field studies, the following parameters were measured (calculated): temperature, salinity, pH, Alk, DO, SS, Na, K, Ca, Mg, SO_4, Cl, Si, SS, DIC (dissolved inorganic carbon), pCO_2, bottom sediment characteristics, etc. As a result, numerous data on behavior of different substances in Razdolnaya river estuary were collected. The behavior of suspended solids (SS) in Razdolnaya river estuary can be described as follows. During normal synoptic conditions, the area of mixing of river waters and sea waters is located at a few kilometers from the river mouth, SS content at this site is about 1 mg/l. After summer rains, the extent of the mixing zone increased to about 10-12 km and SS content there was 1.5 times higher. And during the high flood conditions, fresh waters could be traced down to the entrance of Amursky bay (30 km southward) and SS content measured at the mixing zone was as high as 140 mg/l.

Modeling data allowed to estimate river inputs of metals and other components in dissolved and particulate forms. For example, it was found that the predominant forms of mercury in Razdolnaya River waters are complex compounds with humic and fulvic acids (99%), while for cobalt, chromium, vanadium and arsenic prevailing forms (in both river waters and sea waters) are non-organic compounds.

The modeling of the sorption process has shown that mercury, vanadium, and arsenic in sea water and river water occur practically completely in the adsorbed form, while the share of suspended cobalt and chromium in the river water makes just 14.4 and 4.6% correspondingly. In the sea water they are presented completely in the dissolved form.

POI researchers also estimated the discharge of trace metals to the marine environment via different routes: river inputs, industrial wastewaters and atmospheric deposition (e.g., Mishukov et al., 2001). The results of recent calculation of contaminant inputs to the coastal zone from different sources show that for the small and semi-enclosed Amursky bay (with total area 1 10^9 m^2), the main source of contaminants is wastewaters (except Mn and suspended solids). For the more open and large Ussuriysky bay (total area 1.8 10^9 m^2), atmospheric deposition supplies more than 40% of Zn, Cd and Mn. It's clear that for the whole NOWPAP region atmospheric deposition of contaminants would be the major source of trace metals (as well as for other areas of the World Ocean: see, e.g., Martin, Whitfield, 1981; Hong et al., 1998). Nevertheless, significant fraction of Mn, Co and suspended solids are supplied with rivers.

4.5 Training Activities

Training of specialists of Primorsky Hydrometeorological Service is carried out in Moscow and Rostov-on-Don, at ROSHYDROMET central institutions. Depending on funds availability, training of specialists from China, Japan and Korea can be also organized.

In research institutions, training is being done using "hands-on" approach, i.e. young researchers are being trained during field surveys, expeditions, laboratory experiments, etc.

5. Present situation

5.1 River Input

Current status on chemical composition and concentration of contaminants in the river waters presented at this Report is based on the data obtained by Environmental Monitoring Center (EMC) of Primorsky Territorial Office on Hydrometeorology and Environmental Monitoring in 2002. The data were used on the stations of State Observation Network much close to the sea coast. At some stations (northern ones first of all) observations of some parameters were not carried out in 2002 due to financial or organization reasons. In such case the existing data were taken into account even if these data were obtained before. It is worthy to note that covering of territory by hydrochemical observations is rather uneven. A lot of pretty large rivers of the northern practically unpopulated part including Koppi River, Botchi River and Tumnin River are not described from the point of view concentration of contaminants.

Concentration of trace metals in dissolved and suspended forms in the river water were borrowed from the results of PGI research. The data on water discharge, nutrient concentrations and concentration of some contaminants in the rivers of Primorski Krai is presented in Table 5-1.

Table 5-1 Chemical composition of Primorsky Kray rivers flowing into the sea

(average for 2002)

Rivers	**Water* discharge (m^3/s)**	**SS* (mg/l)**	**BOD_5 (mg/l)**	**COD (mg/l)**	**DO (mg/l)**	**Si (mgSi/l)**
Tumen**	287	124	1.93	18.8	10.5	12.2
Tsukanovka	3.9	9.6	3.79	4.32	12.1	7.96
Razdolnaya	71.9	73	11.9	15.1	12.1	6.4
Artyomovka	4.9	38.7	1.94	7.76	11.4	5.7
Partizanskaya	42.0	38.7	2.2	6.7	11.7	3.9
Margaritovka	12.2	22.5	1.75	5.4	10.7	4.6
Avvakumovka	31.9	22.5	1.81	5.9	12.4	5.0
Zerkalnaya	17.5	22.5	1.28	5.4	11.5	4.0
Rudnaya	14.5	19.6	1.03	6.5	12.5	4.5
Serebryanka	16.4	21.7	1.4	4.3	11.8	5.3
Maksimovka	32.1	21.7	2.4	7.5	13.2	5.4
Samarga	89.9	21.7	0.7	9.0	13.4	5.3
MPC			2.0	15	<3.0	
Rivers	**NH_4 (mgN/l)**	**NO_2 (mgN/l)**	**NO_3 (mgN/l)**	**PO_4 (mgP/l)**	**Phenols (mg/l)**	**Sufract (mg/l)**
Tumen	0.17	0.014	0.29	0.013	0.003	0.020
Tsukanovka	0.03	0.004	0.01	0.007	0.001	0.015
Razdolnaya	0.44	0.03	0.22	0.047	0.004	0.024
Artyomovka	0.03	0.003	0.01	0.006	0.001	0.008
Partizanskaya	0.02	0.004	0.01	0.003	0.001	0.012
Margaritovka	0.05	0.001	0.02	0.001	0.001	0.005
Avvakumovka	0.04	0	0.02	0.002	0.001	0.005
Zerkalnaya	0.08	0.003	0.05	0.034	0.003	0.014
Rudnaya	0.10	0.022	0.02	0.117	0.002	0.018
Serebryanka	0.07	0	0.12	0.002	0.002	0.005
Maksimovka	0.04	0	0.01	0.003	0.001	0.005
Samarga	0.05	0	0.08	0.002	0.002	0.016
MPC	0.4	0.020	9.1	0.050	0.001	0.100

Notes: * – averaged for all period of observation; SS = suspended solids; DO – dissolved oxygen; All nutrients in filtered samples; Sufract – concentration of anionic detergents; MPC = maximum permissible concentration for the Russian fresh waters analogous to Water Class I-II (Korea) or A-AA (Japan). DDT (sum of DDT and its metabolites DDD and DDE) was < 0.035 ug/l; HCH (sum of HCH isomers) was < 0.004 ug/l.

The data on petroleum hydrocarbons (PHC) and dissolved forms of some metals is presented in Table 5-2. Unfortunately, the reliable data on concentration on dissolved metals in river water are available for the some rivers, only. Therefore we have to use extrapolation procedure for the some rivers of the north part of Primorski Krai.

Table 5-2 Concentration of petroleum hydrocarbons (PHC) and dissolved forms of metals in the rivers flowing into the sea in Prymorski Krai

Rivers	PHC (mg/l)	Pb d (µg/l)	Cu d (µg/l)	Mn d (µg/l)	Fe d (µg/l)	Cd d (µg/l)	Zn d (µg/l)	Ni d (µg/l)
Tumen	0.02	0.14	1,82	115	75.3	0.030	1.14	0.63
Tsukanovka	0.01	0.037	0.44	5.6	11.5	0.025	0.21	0.14
Razdolnaya	0.04	0.023	1.27	14.9	23.7	0.012	0.36	0.80
Artyomovka	0.06	0.19	0.75	10	44	0.014	0.7	0.61
Partizanskaya*	0.07	0.19	0.075	10	44	0.014	0.7	0.61
Margaritovka*	0.03	0.19	0.05	10	11.5	0.014	0.21	0.14
Avvakumovka*	0.13	0.19	0,05	10	11.5	0.014	0.21	0.14
Zerkalnaya*	0.08	0.19	0,05	10	11.5	0.014	0.7	0.61
Rudnaya	0.04	0.64	1.35	110	21	0.25	120	0.8
Serebryanka*	0.04	0.037	0.05	5.6	11.5	0.025	0.21	0.14
Maksimovka*	0.01	0.037	0.05	5.6	11.5	0.025	0.21	0.14
Samarga*	0.08	0.037	0.05	5.6	11.5	0.025	0.21	0.14
MPC	***0.050***	***6***	***1***	***10***	***100***	***5***	***10***	***10***

Notes: Me d – concentration of dissolved metal forms in filtered samples; PHC - concentrations of petroleum hydrocarbons in unfiltered samples; * - data on dissolved metals are extrapolated from Artyomovka river and Tsukanovka river.

For the assessment of annual runoff of dissolved substances we use the concentrations presented in Tables 5-1 and 5-2 for the calculation of averaged concentration in the water of rivers on the areas distinguished by geographical and socio-economic criteria (Table 3-1). The chemical composition of Serebryanka, Maksimovka and Samarga Rivers was disseminated on the other rivers of north part of Primorski Krai and south-east part of Khabarovski Krai.

The information available on the PO_4, NO_3, and Si concentration in the rivers of southwest Sakhalin Is. was borrowed from the (Major Hydrological Characters…, 1967). Data on the concentration of metals in the Sakhalin’s rivers were used from (Chudaeva, 2002).

Water discharge is a first grade variable factor determining the annual runoff of dissolved substances. For the assessment of water run-off we based on the instrumental observation carried out in 2002 mainly (Table 5-1). To take into account the rivers where discharge was not measured, the data of water run-off, evaluated by the relation between watershed square and water run-off, was used (Long-year data…, 1986). The results of summary water run-off assessed by areas distinguished in Table 3-1 is presented in Table 5-3. The run-off of nutrients and some contaminants evaluated by multiplication of concentration data from Table 5-2 on the volume of water run-off are presented in Table 5-3 and Table 5-4.

Table 5-3 Annual run-off of water (km^3), nutrients, organic matter, petroleum hydrocarbons and phenols (tons) with rivers from the Russian part of NOWPAP area*

River (Basins, area)	Water	PO_4	NO_2	NO_3	NH_4	Si	BOD_5	OM	PHC	Phe-nols.
Tumen River	9,05	118	127	2625	1539	110410	17467	7685/ 74862	181	27,2
West Peter the Great Bay, (1)**	0,8	6	3	8	20	6368	3032	1334/ 1514	10	0,8
Razdolnaya River, (2)	2,27	107	68	499	999	14528	27013	11886/ 15082	100	9,1
East part Peter The Great Bay, (3)	1,97	8	8	20	45	8156	4137	1820/ 5981	128	3,9
Primorsky coast area "south"(4)	3,67	11	7	73	206	16515	6239	2745/ 9043	128	3,7
Rudnaya River (5)	0,46	54	10	7	45	2070	474	208/ 1316	17	0,9
Primorsky coast area "north"(6)	21,7	43	22	260	977	104160	26040	11458/ 84022	282	21,7
Southwest Sakhalin coast (7)	3,33	123	nd	50	nd	12321	nd	nd	nd	nd
Total	43,25	469	245	3543	3830	274528	84401	37137/ 191819	847	67,3

Note: * - annual output evaluated for averaged water discharge ; ** - in brackets number of regions from Table 3.1 ; OM – dissolved and suspended organic matter assessed by BOD/COD values as tons C_{org} ; nd – no data

Table 5-4 Annual output of some dissolved metals (tons) with rivers from the Russian part of NOWPAP area*

River (Basins, area)	Pb	Cd	Fe	Mn	Cu	Zn	Ni
Tumen River	1,27	0,272	681,5	1040,8	16,5	10,3	6,6
West part of Peter The Great Bay	0,03	0,020	9,2	4,5	0,4	0,2	0,1
Razdolnaya River	0,05	0,027	53,8	33,8	2,9	0,8	1,8
East part of Peter The Great Bay	0,37	0,028	86,7	19,7	1,5	1,4	1,2
Primorsky coast area (4)	0,18	0,092	42,2	36,7	2,8	0,8	1,8
Rudnaya River	0,29	0,115	9,7	50,6	0,6	55,2	0,4
Primorsky coast area (6)	1,09	0,543	249,6	217,0	16,3	4,6	3,0
Southwest Sakhalinsky coast	nd	nd	68,9	27,3	3,3	57,9	nd
Total	3,29	1,096	1201,5	1430,4	44,1	131,2	15,0

Note: * - annual output evaluated for averaged water discharge; nd – no data

The runoff of suspended solids (SS) is very important characteristic of rivers itself, and river influence on the estuaries and adjacent coastal areas. Besides run-off in dissolved forms, the migration in suspended solids is very significant for many chemical elements, including metals. The assessment of suspended solids runoff and metals runoff associated with solid phase is presented in Table 5-5.

At the comparison of the assessments of the metals run-off in the dissolved forms and with suspended solids, it is obviously (Figure 5-1), that more than 80% of overall run-off of metals carried in solid phase. For such particulate bound elements as Fe and Pb, the role of particulate forms increase up to 98 - 99%.

Table 5-5 Annual discharge of suspended solids SS, (thousand tons) and metals (tons) with rivers suspended solids from the Russian part of NOWPAP area*

River (Basins, area)	SS	Pb	Cd	Fe	Mn	Cu	Zn	Ni
Tumen River	1122,2	72,9	0,505	68679	4480	62,8	159,4	41,5
West part of Peter The Great Bay (1)**	7,7	0,2	0,005	363	6	0,3	0,7	0,3
Razdolnaya River (2)	165,7	7,0	0,058	8915	253	5,3	19,2	8,9
East part of Peter The Great Bay (3)	76,2	2,4	0,023	3095	95	2,2	9,5	2,4
Primorsky coast area (4)	82,6	26,3	0,776	2593	85	12,1	117,3	13,5
Rudnaya River (5)	9,0	7,1	0,335	334	23	1,6	33,8	0,7
Primorsky coast area (6)	470,9	150,2	4,426	14786	485	69,2	668,7	77,2
Southwest Sakhalinsky coast (7)	353,0	15,2	nd	13060	162	17,6	83,0	16,6
Total	**2287,3**	**281,4**	**6,1**	**111826**	**5589**	**171,2**	**1091,5**	**161,2**

Note: * - avaraged for all period of observation, ** - number in brackets is region from Table 3.1

5.2 Direct Input

The assessment of direct input of contaminants was done on the data of contaminant concentrations in the combined municipal/industrial wastes and storm water runoff (Gavrilevski et al., 1998) (Table 5-6).

Table 5-6 Concentration (mg/l) of some substances in the waste waters and in the stormwater wastes of Vladivostok district by Gavrilevski et al., 1998

	BOD_5	NH_4	PO_4	Detergents	PHC	Phenols
Waste waters	32.6	4.2	1.9	0.11	0.92	0.015
Stormwater wastes	17.8	3.5	0.25	0.17	1.09	0.011

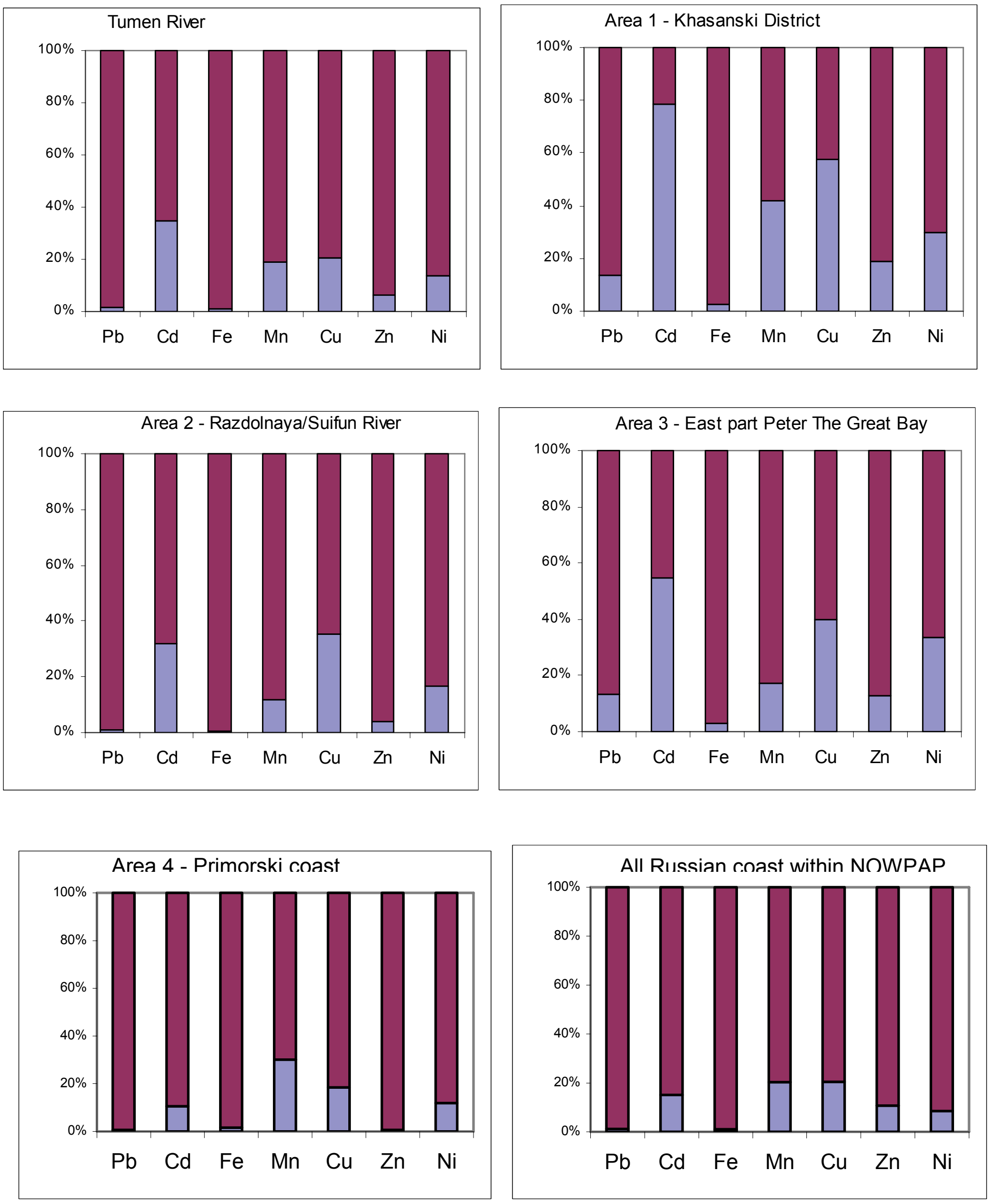
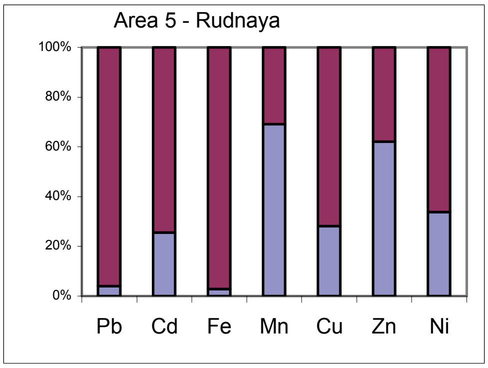


Figure 5-1 The role of suspended (black) and dissolved (grey) forms of metals in the river runoff from Primorski Krai



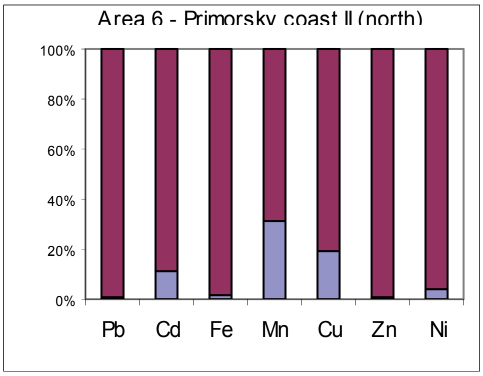


Figure 5-1 (continue)

Volume of wastes from the official statistic data (Natural Resources and Protection of Environment…, 2003) allow to evaluate the input of these contaminants with waste waters from the different districts of Primorski Krai (Table 5-7).

Table 5-7 Annual input of some chemical substances (tons) with waste waters from the different districts of Primorski Krai

Districts	**V*, 10^6 m^3**	**BOD_5**	**OM**	**NH_4**	**PO_4**	**Sufra ctants**	**PHC**	**Phe-nols**
Khasanski (1)	4.4	144	63	19	8,4	0,5	4,1	0,1
Vladivostok+Artem + Nadezhdinski (2)	346	11281	4962	1453	657,0	38	318	5,1
Shkotovski+Fokino +Nakhodka+Partizansk (3)	31.8	1037	456	134	61,0	3,5	29,3	0,5
Lazovski+Olginski +Kavalerovski (4)	2.3	74	32	10	4,0	0,2	2,1	0,0
Dalnegorski (5)	13.3	435	191	56	25,0	1,5	12,3	0,2
Terneiski (6)	0.3	11	5	1	0,6	0,0	0,3	0,0
Total	398.2	12982	5709	1673	756,0	43,7	366,1	5,9

Note: V* - volume of waste waters (municipal and industrial) in 2002 by official data (Natural…, 2003). OM – organic matter, assessed from BOD5 as oxidizing substances in tons of C.

The overall volume of wastes from the southern and eastern districts of Primorski Krai was 390 - 398*10^6 m^3 in 1997-2002 by official data (Natural Resources and Protection of Environment…, 2003). Assessment by the experts

(Gavrilevski et al., 1998) gives only for Vladivostok annual volume of waste waters about $420*10^6$ m^3, plus $63*10^6$ m^3 of the storm-water wastes. This information allow to re-calculate the annual input of some chemical substances coming to the coastal zone with municipal/industrial wastes and storm-water runoff (Table 5-8). Unfortunately for the time being we have not information reliable enough for the assessment of direct input of other contaminants (metals, pesticides etc.).

Table 5-8 Summary annual input of some chemical substances (tons) with waste waters and stormwater wastes from the different districts of Primorski Krai

Districts	V*, 10^6 m^3	BOD_5	OM	NH_4	PO_4	Sufra ctants	PHC	Phe-nols
Khasanski (1)	6,16	189	83	25	10,4	0,73	5,8	0,10
Vladivostok+Artem + Nadezhdinski (2)	484,4	14859	6536	1990	816,5	57,06	456,4	7,01
Shkotovski+Fokino +Nakhodka+Partizansk (3)	44,52	1366	601	183	75,0	5,24	41,9	0,64
Lazovski+Olginski +Kavalerovski (4)	3,22	99	43	13	5,4	0,38	3,0	0,05
Dalnegorski (5)	18,62	571	251	77	31,4	2,19	17,5	0,27
Terneiski (6)	0,42	13	6	2	0,7	0,05	0,4	0,01
Total	557,5	17101	7522	2291	939,6	65,67	525,2	8,07

Note: V* - summary volume of wastes equal to official data (V* from Table 5.7) corrected by increasing coefficient 1.22 plus 15% addition of storm water wastes.

We can compare data from Table 5-8 and 5-3 for the assessment of the role and significance of the anthropogenic influence on the fluxes of chemical substances from the land to the coastal waters. Taking in mind that some part of river runoff (for the Razdolnaya River first of all) includes anthropogenic material, comparison of Table 5-8 and 5-3 data (Figure 6-1) will give the minimal evaluation of anthropogenic load. Obviously, that north part of Primorsky Kray coast with very low population has negligible anthropogenic influence on fluxes to the sea, and Peter The Great Bay has the maximum one

(Figure 6-1). For the whole Russian mainland coast within NOWPAP region the anthropogenic flux of phosphate reaches up 80% of total river plus direct input of phosphor to coastal water. For ammonia and petroleum hydrocarbons the anthropogenic flux reaches up 50%. BOD5, oxidazable organic matter and phenols fluxes from anthropogenic sources form at least about 20% of total fluxes.

6. Proposals for Future Regional Activities and Priorities in the NOWPAP Region

The compilation and comprehensive joint analysis of the National Reports seems the one of the obvious regional activities on the river and direct input in the NOWPAP region. As a result the integrated Report will be compiled. This activity is in the working Plan of POMRAC already. However even now it is clear that some methodological features should be discussed and highlighted along with or after the preparation of integrated Report. First problem is a BOD5 and COD data compatibility. The participation of specialists from NOWPAP countries in the training courses of Japan or Korea could be one of opportunity to get over this gap. The special workshop after the preparation of integrated Report could be the next step in this field.

The comparative assessment of the different parts within NOWPAP region from the point of view of nutrients and suspended solids input to the sea could be another issue for NOWPAP activity. Ecological problems due to euthrophication have great importance in the lower reaches of rivers themselves and coastal waters as well, and the exchange of information and methodological approaches continue to be actual and desirable for the NOWPAP countries.

For the effective monitoring of trans-boundary water bodies Russian experts suggest to establish monitoring stations at Tumen River and at Khanka Lake

(Russia, China, DPRK).

Another problem is a need to define the list of persistent toxic substances (PTS) of serious concern carried with river and direct inputs to the coastal environment of the NOWPAP region. This is necessary for the successful implementation of PDF-B activities of the proposed project “Addressing Land-based Activities that affect the Marine and Coastal Environment of the Northwest Pacific Region”. Obviously that list of persistent toxic substances will be different in different countries, but close interaction and information exchange during the preparation of this list is very desirable for the maximum possible coherence of substances of concern.

For the proper identification of toxic substances of most serious concern and correct assessment of possible influence of LBA/LBS on the input of PTS to the sea the small scaled pilot project (s) could be useful. The aim of this project could be analysis of fine grained deposits in the lower reaches of main rivers for the set of most potentially toxic organic substances. For Russia this set should include DDTs, PCBs, phenols, HCH. We propose to use bottom sediments for sampling due to relative simplicity and reliability of analysis of PTS in sediments compare with water. Moreover chemical composition of bottom sediments reflects integrated and averaged influence of land based sources.

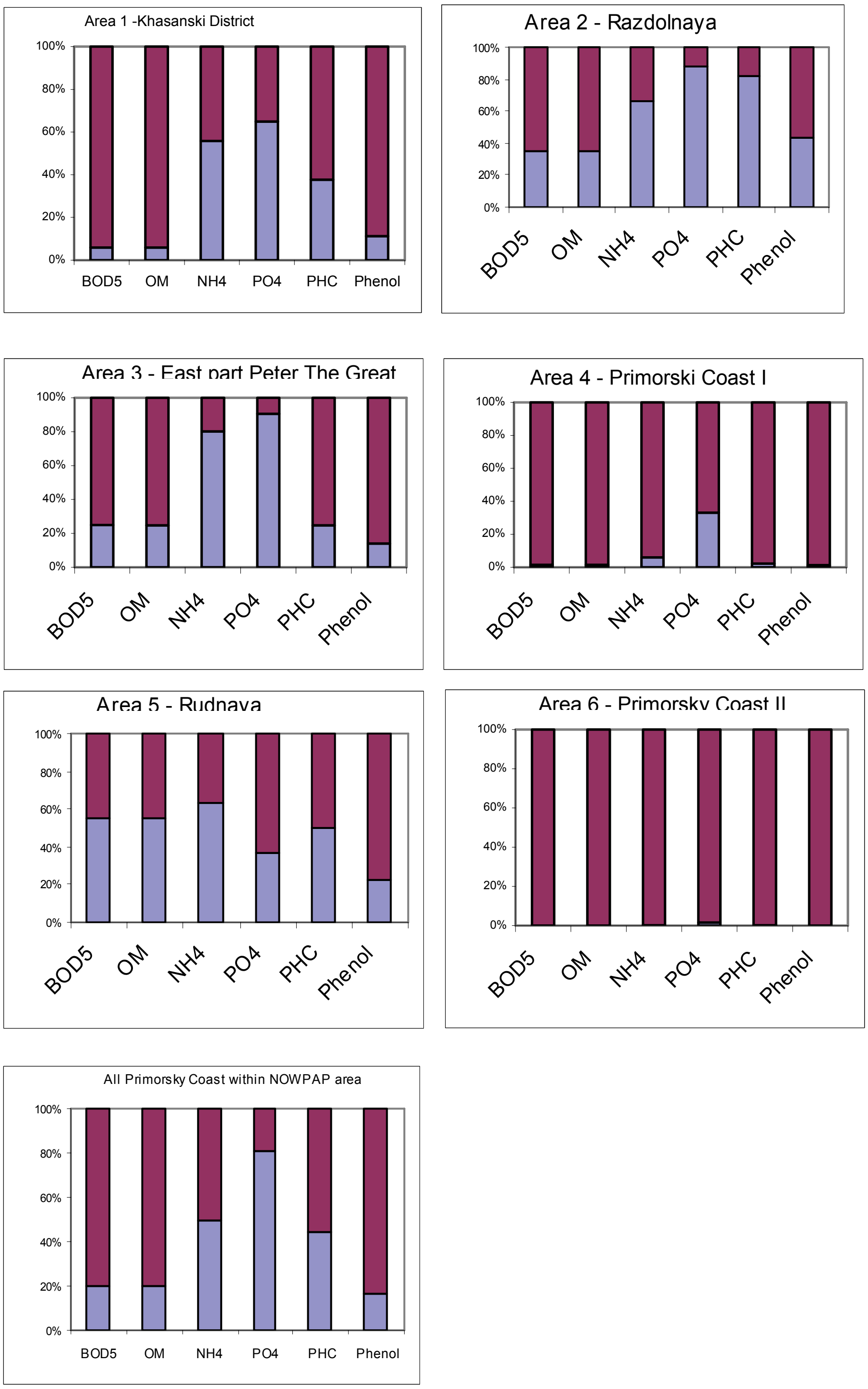


Figure 6-1 The role of river runoff (black) and wastewaters (grey) in the input to the coastal waters of Primorski Krai.

The participation in the regional program, namely "The Water Environmental Partnership in Asia (WEPA)" aiming an enhancing governance in conservation of aquatic environments and capacity building in Asia would be very useful for Russia. Also, the Network of Asian River Basin Management Organizations (NARBO) was established in February 2004, which aims at sharing technology and information among the Asian countries is another regional program for future cooperation.

National priorities for the Russian Federation, related to River Inputs of contaminants in NOWPAP region include (1) re-establishing monitoring stations which were closed in recent years; (2) monitoring of bottom sediment quality of rivers and lakes; (3) increase of measured parameters (e.g., Hg, As, new pesticides).

7. Conclusions

The current status on the concentration of chemical substances in river water and chemical substances run off is described with regard to pollution loads being discharged into rivers or directly into coastal environments from the Russian watersheds within the NOWPAP Region.

The brief description of natural environmental conditions and socio-economical factors is done for the analysis of natural and anthropogenic influence on the chemical substances input to the sea.

The legislative base of water quality monitoring in Russian Federation, executive agencies, methods used, and water quality criteria are described in this report. Under the existing legislative base the Federal Service for Hydrometeorology and Environmental Monitoring is responsible for the monitoring of ambient waters, and State Office for Supervision on the Protection of Consumer's Rights and Human Welfare of the Ministry of Health and Social Development jointly with local authorities is responsible for the quality of drinking water. The scientific research organizations conduct a number of projects connected with different aspects of water quality monitoring. The main criteria of water quality is a compliance with maximum permissible concentration (MPC).

The chemical characteristics of river waters in 2002 are presented as well as estimated runoff of chemical substances with rivers and wastewaters based on the official data and scientific research. The averaged annual runoff was 84,401 tons for BOD, 7617 tons for dissolved inorganic nitrogen, 469 tons for phosphate, and 2,287,300 tons for suspended solids. Runoff of metals is evaluated for dissolved and suspended forms separately. More than 80% of overall run-off of metals carried in solid phase. For such particulate bound elements as Fe and Pb, the role of particulate forms increase up to 98-99%.

For the whole Russian mainland coast within NOWPAP Region the anthropogenic flux of phosphate reaches up 80% of total river plus direct input of phosphor to coastal water. For ammonia and petroleum hydrocarbons the anthropogenic flux reaches up 50%. BOD5, oxidazable organic matter and phenols fluxes from anthropogenic sources form at least about 20% of total fluxes.

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