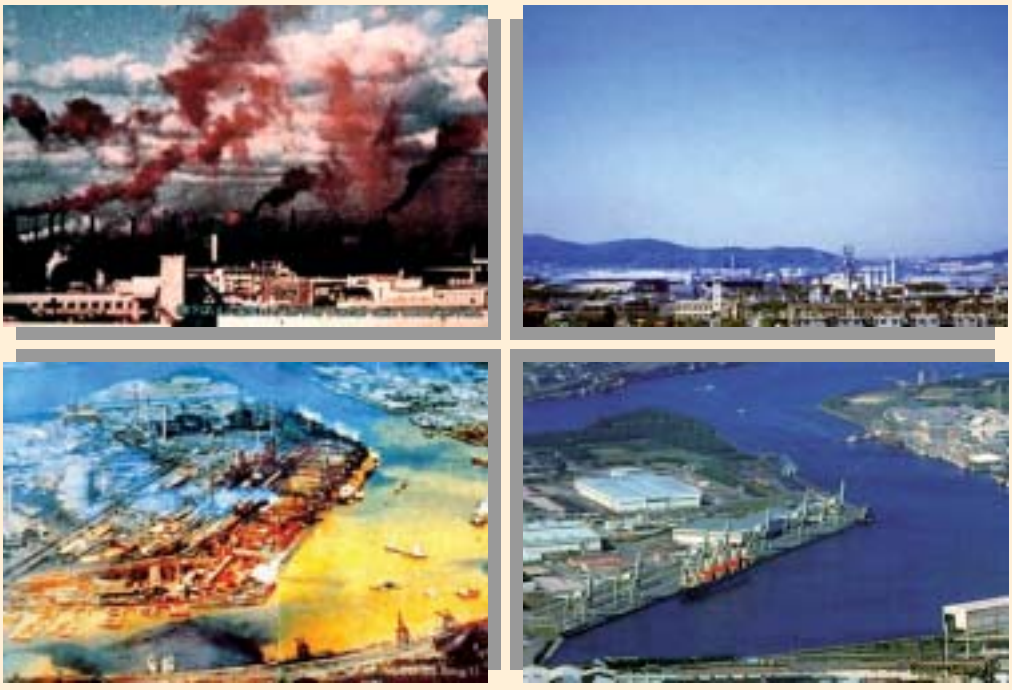
No.

Japanese Experience in Industrial Pollution Control

From the Viewpoints of Pricing, Markets, and Cleaner Production for Developing Countries



Kitakyushu City that has overcome industrial pollution

Final Report

March 2004

Japan International Cooperation Agency (JICA)
EX Corporation

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JR
04-103

Cover Photo: Kitakyushu City that has overcome industrial pollution

Heavy smoke in the 1960s	Present sky situation
Dokai Bay in the 1960s	Dokai Bay at present

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ANNEX

Executive Summary

Executive Summary

1 Utilization of Japanese Experience

In both developed and developing countries, policy formation for industrial pollution control is related to various factors such as industrial pollution problems, responses of stakeholders, institutions (especially legal regulations), market mechanisms, finance, and the like.

In Japan, during the reconstruction after World War II, followed by rapid economic growth, inadequate consideration for the environment, in particular insufficient measures to tackle industrial pollution, resulted in severe damages. Only after Japan experienced the serious damages due to industrial pollution, were comprehensive efforts made to tackle industrial pollution. Although Japan still has several problems, the environment has been significantly improved in terms of those factors related to industrial pollution.

For the formulation of policy measures to tackle industrial pollution problems in developing countries, Japanese experience in this area could be utilized in the following cases:

- As examples to show the necessity for preventive measures (Japanese experience shows what and how severe damages industrial pollution can impose on society)
- As a basis or comparison for formulating policy tools for individual problems
- To estimate the type and scale of positive and negative impacts of policy tools
- To estimate stakeholders' responses to policy tools and prices of goods & services and the impacts on stakeholders
- To simulate how companies take action to implement countermeasures to industrial pollution (e.g. how they implement cleaner production (CP))
- As case examples for decision making in cases where compatibility between economic development and environmental protection is at issue
- As a basis or comparison for exploring possible ways to integrate environmental considerations into the implementation of economic development policies and measures
- To identify important factors for formulating policies and measures to promote companies' actions towards industrial pollution control

2 Some Aspects of Japanese Experience in Industrial Pollution Control

The following case studies were conducted in order to analyze policies promoting industrial pollution control and functions of corporate behavior:

- Analysis of the costs of pollution control measures, particularly cases relating to sulfur oxide (SOx) pollution control
- Analysis of impacts of utility prices, related to industrial water supply and wastewater, and energy
- Analysis of relationships between regulations and the market, referring to cases in industrial waste management
- Analysis of relationships between corporate behavior (especially productivity) and industrial pollution control measures

Major finding are summarized in the following sections.

2.1 Cases in Sulfur Oxides Pollution Control

Existing studies and analyses of the macroeconomic impact of SO_x emission control policies and measures in Japan show that intensive pollution control investment in the 1970s minimized health damages and economic losses due to the SO_x emissions, although from the late 1960s and early 1970s severe damages were caused by such emissions because of the delay of their implementation.

On the other hand, there are opposite findings from evaluations of the SO_x emission control policies and measures in terms of their impact on cost-effective pollution control investments by individual companies. The existing studies and analyses point out that in the process of transforming SO_x emission control measures from end-of-pipe (EOP) technologies (represented as installation of flue gas desulfurization facilities) to in-process technologies (represented as improvements or changes in production processes in order to reduce consumption of fossil fuels such as petroleum), pollution control investments were not necessarily cost-effective. The best mix of EOP and in-process technologies in terms of cost-effectiveness is almost achieved now, but the mix of technologies was not necessarily cost-effective during the development of SO_x emission control measures.

2.2 Cases in Industrial Water and Wastewater Management and in Energy Saving

2.2.1 Water Supply and Wastewater

Companies' actions to promote rationalization of water consumption and discharge responding to changes in external factors such as regulation of groundwater pumping, increases in piped water prices, making sewage fees due to the obligation to connect to the sewage system, and strengthening of wastewater regulations are generally categorized into the following four types:

A. Improvement of production processes:
fundamental changes in raw materials and production methods (change to non-water use or reduced water use processes)

B. Improvement in control systems:
strict implementation of water supply control; separation of effluent from different processes; use of a water circulation or cascading system

C. Optimization of wastewater treatment:
treatment for recycling; systematization of wastewater treatment incorporating separation and reduced water consumption measures

D. Improvement of discharge:
treatment before discharge to the sewage system; systematization of discharge corresponding to water quality regulations and total amount pollution regulations

Type B (improvement in control systems) has been selected to deal with wide-ranging factors. Together with Type A (improvement of production processes), the industrial responses focus on upstream factors. Intensification of regulations on concentration and introduction of regulations on total pollutants are mainly designed to urge industries to employ Type C (optimization of effluent treatment) and Type D (improvement of discharge) by means of monitoring and guidance. Even so, industries have responded by employing Type A and Type B to reduce the volume of discharge to achieve cost savings.

Total costs for water supply and wastewater amounted to about 0.5% of total shipment value per year on average for all the industries. Costs for wastewater discharge accounted for 60% of the total costs for water supply and wastewater for industries with high water demand such as food and paper and pulp, 30% for those with lower water demand, and 50% on average for the whole industry. During the high economic growth period, such cost impact could be absorbed, and industries could maintain sound net profit. It was a relatively small cost impact on business management compared to increased manpower costs during the period. On the other hand, during the slow economic growth period in the mid-1970s, increased costs such as water supply price increases, added sewage connection costs, sewage cost increases, and costs of meeting pollution load regulations placed a major financial burden on industries.

2.2.2 Cases of Energy Saving

During the first and the second oil crises, the import price of crude oil drastically increased; the average nominal price of energy used in the industrial sector increased by 5.6 times from 1973 to 1982. The increase in energy costs was very large compared to the increase in labor costs (nominal unit cost per hour) (2.2 times), raw material costs (excluding energy) (2.3 times), and capital costs (1.3 times) during the same time period. Unit energy consumption of manufacturing industry (value added weighted index of industrial production (IIP)) showed a decreasing trend in all the industrial sectors except for the textile and food industries before the first oil crisis. After the first and the second oil crises, it started decreasing in all industrial sectors, demonstrating the effective promotion of energy saving. Characteristics of energy saving measures implemented in Japan are summarized as follows:

a) Japanese companies started their energy saving measures with no/low cost actions such as combustion management and moved to those with large capital investments such as introduction of energy-saving-type production facilities, rationalization of production processes with high energy consumption, and introduction of waste heat recovery facilities.

b) A payback period was a crucial factor for making decisions on energy-saving investments. In this connection, the increases in energy prices, the introduction of the energy taxes, and the preferential tax treatment of energy-saving facilities contributed to shortening the payback period of the energy-saving investments.

With regard to the reduction of sulfur oxide emissions, it can be concluded that changes in emission factors (by regulations and enforcement) were more effective than reduced energy consumption in reducing sulfur oxide emissions. However, with regard to reduction of nitrogen oxides, it can be concluded that reduction of energy consumption and enforcement of regulations had almost same degree of effect.

2.3 Cases in Industrial Waste Management

The industrial waste management system, introduced by the Waste Management Law of 1970, held the following problems in terms of the development of industrial waste management market:

- Since it was easy to obtain a permit to conduct waste treatment/disposal (waste treater permit), those who violated the law could set up another company and continue their business. There was no permit requirement for construction of waste treatment/disposal facilities; rather notifying on the facilities to local governments was required.
- There was no rule on cancellation of the waste treater permit.
- It was difficult to supervise waste dischargers' responsibility because responsibility for treating/disposing industrial waste was transferred to waste treaters once the waste was commissioned to the latter

- Fines for illegal waste dumping were so light that they had little effect on prevention of recurrence

From the enactment of the Law in 1970 to the major amendment of the Law in 1997, industrial waste treatment/disposal fees had been held lower than the adequate price level because the development of the market for proper waste treatment/disposal was not established. Amendment of the Law in 1997 and 2000 introduced stricter responsibility of waste dischargers, stricter regulations on waste treaters, and stiffer penalties, which made waste dischargers bear the risk and cost of violating proper management of industrial waste. The waste dischargers have now come to select waste treaters with good practices in order to avoid the risk, and the market for proper industrial waste treatment/disposal has been developed. Also, the waste disposal fee has increased to 20,000-35,000 JPY/t for disposal into controlled landfills and 8,000-13,000JPY/t for disposal into inert type sanitary landfills. While the amount of industrial waste disposed to landfills did not decrease during the 1980s and 1990s in which waste treatment/disposal fees stayed at a lower level, the amount has decreased significantly since 1997.

Japan could not prevent improper industrial waste management such as illegal waste dumping because waste dischargers and treaters were not committed to comply with the Law and regulations and because it was difficult for local governments to monitor the status of industrial waste management. As of April 1, 2003, identified cases of illegal waste dumping were 2,505, and their remaining wastes were 10,960,000 tons. Restoring to the status quo from this illegal waste dumping could cost 0.7 to 1 trillion Japanese yen.

2.4 Relationship between Corporate Behavior (especially Productivity) and Industrial Pollution Control Measures

2.4.1 Corporate Attitudes towards Industrial Pollution Control

Companies make management decisions when considering taking environmental measures. Results of interviews with present and former business managers on factors influencing corporate attitudes toward industrial pollution control measures are summarized in Table 2.1.

Table 2.1 Evaluation of Influential Factors

Issue / Factor	Air Pollution		Water Pollution		Waste Treatment /Disposal		Environmental Management	
	’70-85	’86-	’70-85	’86-	’70-85	’86-	’70-85	’86-
Establishment and strengthening of laws and regulations	XXX	X	XXX	X	XX	XX	XX	XX
Trends in legal sanctions	X					X		
Legal responsibility for past pollution	X	X						
Corporate social responsibility on environmental problems	X	X	X	X		XX		XXX
Social pressure by mass media	XX		XX		X	XXX		XX
Pressure by consumers								X

Issue / Factor	Air Pollution		Water Pollution		Waste Treatment /Disposal		Environmental Management	
	'70-85	'86-	'70-85	'86-	'70-85	'86-	'70-85	'86-
Instructions and guidelines by governments	XX		XX	X	X	XX	X	X
Instruction by industry associations	X	X	X	X	X	X	X	X
Relationship with competitive companies								X
Relationship with business partner								XX
Global motivation of regulation	X	X	X	X				XX
Company Image	XX		X					

Note XXX: Very Large Influence XX: Large Influence X: Some Influence Blank: No Influence

2.4.2 Cost Impacts of Industrial Pollution Control Measures

Pollution control investments, accompanied by maintenance costs, increase production costs. Ratios of pollution control investment to total capital investment among the companies in the manufacturing sector were 11.8% in 1974, 17.3% in 1975, and 14.8% in 1976. The ratios were in the range of 1 to 3% during the 1980s and increased to 3 to 5% in the 1990s.

Pollution control investments around 1970 were estimated to increase production costs by about 6% in the power and oil refining industries and less than 3 to 4 % in the other industries. The existing survey results show that business managers usually respond to production cost increases due to pollution control investment by rationalization of business operations or an increase in production and sales. They also show that the major response of large enterprises is to absorb the increased costs by rationalization of business operations and that that of the small and medium size enterprises is to decrease profits and/or pass on product prices. Rationalization of business operations includes reduction of energy costs by energy saving measures, strict quality control, reduction of raw material costs through improvement of the yield ratio by shortening or improvement of production processes, employment adjustment, wage controls, and reduction of labor costs by labor-saving investment. As a result, capital intensity of labor and labor productivity increased, and the ratio of unit input[1] decreased.

2.4.3 Corporate Response to Cost Increases by Improved Productivity (Cleaner Production)

Japan's Total Factor Productivity (TFP) increased by advances in technology, increases in skilled labor, improvement in business efficiency, and achievement of economies of scale. Increases in material productivity have also been one of the factors that have increased the TFP, especially between 1976 and 1985, largely through the energy saving that was promoted after the oil crises.

Table 2.2 summarizes the trend of motivations for introducing CP and the major background factors according to the time periods of historical development of productivity improvement in Japan.

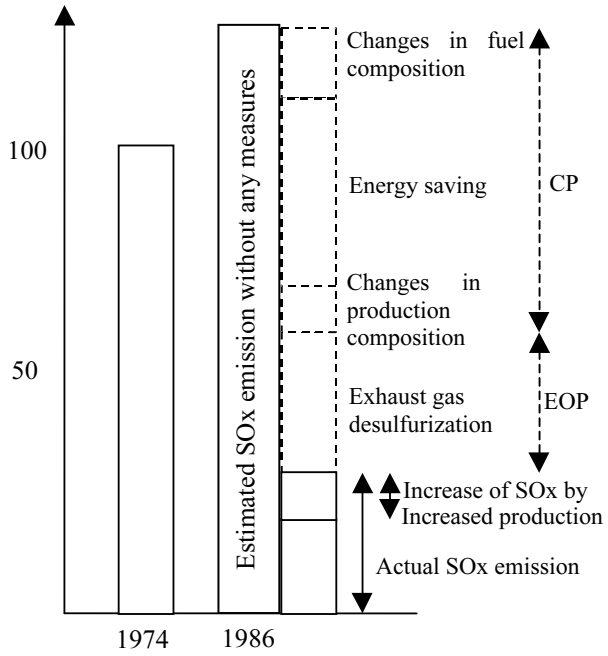
[1] Ratio of unit input = Raw material consumption index / Production index

Table 2.2 Major Motivations for Introduction of Cleaner Production

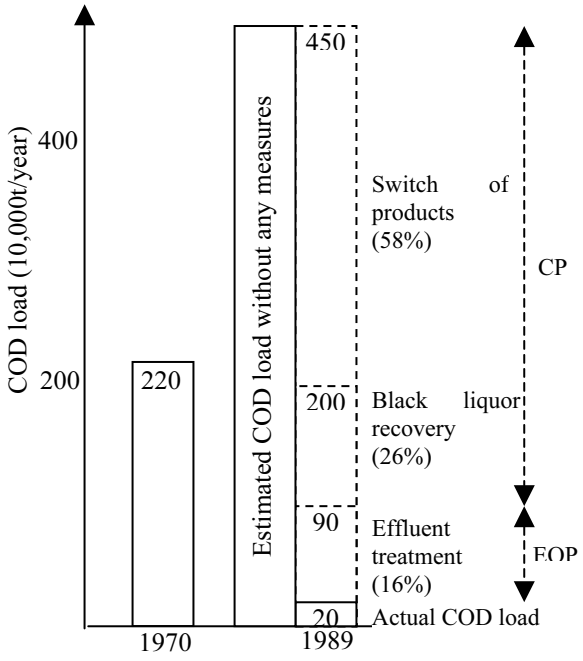
Motivation / Period	a. Response to high prices and acquisition difficulty of input resources	b. Reduction of treatment costs of environmental pollutants	c. Response to price cutting pressure
Reconstruction Period after WW II 1945 - 54	General scarcity of fuels and raw materials including coal (XXX)	-	-
First Stage of High Economic Growth Period 1955 - 64	Regulation of groundwater pumping (XX)	-	-
Later Stage of High Economic Growth Period 1965 - 72	(X)	Enhancement of pollution control regulations, expansion of public sewer system coverage (XX)	-
Period after the First Oil Crisis 1973 - 78	Price increase of petroleum and petroleum products (XXX)	Dissemination of EOP facilities, introduction of total amount control (XXX)	(XX)
Period after the Second Oil Crisis 1979 - 85	Price increase of petroleum and petroleum products (XXX)	Expansion of total amount control area and sewer system (XX)	(X)
Period of Bubble Economy 1986 - 90	-	(X)	High yen value (X)
Period after Burst of Bubble Economy 1991- Present	(X)	Increase of waste disposal cost and tightened waste discharger responsibility (XXX)	Slow growth economy, inflow of cheap imported goods (XXX)

Note: XXX: Major factor, XX: Influential factor, X: Effects to limited sectors - : Not known or none

Figure 2.1 shows the ratio of estimated effect of CP, for the reduction of environmental load as compared to EOP measures.



Breakdown of SOx reduction by measure (emissions in 1974 = 100)



Breakdown of COD load reduction in the pulp & paper industry

Source: EX Corporation, "Japan's Experience in Urban Environmental Management", Metropolitan Environment Improvement Program, World Bank, 1996

Figure 2.1 CP Contribution on the Effect for the Reduction of Environmental Load

3 Implications of Japanese Experience for Developing Countries

Factors related to industrial pollution problems and implementation of countermeasures are summarized by actor in Table 3.1.

Table 3.1 Factors related to Industrial Pollution Problems and Implementation of Countermeasures by Actor

Actor	Factors related to Industrial Pollution Problems and Implementation of Countermeasures
Public sector	Making laws and regulations effective by local governments' competency to tackle industrial pollution
	Integration of industrial pollution control into industrial policy
	Pressures on companies through concluding agreements on environmental pollution control between the local governments and the companies
	Support to the private sector to promote pollution control investments through public financing
	Unintended pressures on companies to rationalize energy and resource utilization through pricing policies
Private sector	Compatibility of increased competitiveness and proper industrial pollution control through cleaner production
	Dissemination of information about industrial pollution control through networking of companies
	Fact that regulations on industrial pollution and pollution control investments were not so critical to the companies
	Development of in-house organizations and human resources to tackle industrial pollution

Actor	Factors related to Industrial Pollution Problems and Implementation of Countermeasures
Citizens and communities	Pressures on companies and governors/mayors to take measures to tackle industrial pollution by citizen and community movements
	Expansion of citizen and community campaigns against industrial pollution control
Intermediation between actors	Insufficient consideration of total social costs of industrial pollution
	Impacts of legal resolution for the pollution lawsuits on companies
	Awareness of citizens toward industrial pollution control raised by mass media
	Problems of the development of the market of industrial waste treatment/disposal
	Formation of mechanisms to rationalize production processes through utility prices
	Development of service providers (pollution control equipment market)

Tools useful for developing countries to tackle industrial pollution identified from Japanese experience are as follows:

a. Enhancing Capacity of Local Governments

- Secure human, material (equipment, etc.) and financial resources for implementation of measures by local governments required by laws and regulations.
- Establish a window to accept complaints against industrial pollution problems and enhance capacity in holding a dialogue with the residents to solve the problems.
- Enhance capacity in identification and monitoring of pollution sources.
- As prerequisite for the above, it is desirable for countries to establish a decentralized system by which authority and responsibility for industrial pollution control are given to local governments who can relatively easily obtain information about pollution sources and the status of pollution.

b. Regulations

- Identify pollution sources and status of pollution.
- Clarify rules of industrial pollution control such as analysis methods of pollutants so that those who are regulated by relevant laws and regulations can understand the contents of the control.
- Put pressure on industrial polluters to improve their pollution control instead of legal penalty through dispatching experts to the pollution generators in order to give guidance on proper pollution control.

c. Development of Utility and Waste Management Market

- Eliminate subsidies and set utility prices that truly reflect costs to provide such goods and services in order to enhance motivation for companies to reduce energy and water consumption.
- Develop a proper waste management market through clarification of rules on the responsibilities of waste generators, entry and withdrawal of waste transporters/treaters, and responses to illegal waste dumping and the like.

d. Changing Corporate Attitudes by Information Dissemination

- Develop mechanisms to disseminate information relevant for industrial pollution control by utilizing industry associations and their federations.
- Train experts in SME management, increase awareness of corporate top management towards production control and business management through practical guidance on production and quality control by the experts; and integrate pollution control into production control and business management.

e. Financing and Credit Guarantee through Private Financial Institutions

- Arrange mechanisms by which private financial institutions can act as agents for public soft loans so that the private financial institutions can provide loans both for pollution control investments and other capital investments.
- Establish a credit guarantee system when collateral is lacking for loans for industrial pollution control facilities.

f. Pressure on Corporate Behavior through Information Disclosure

- Conclude agreements on industrial pollution control between local governments and pollution sources and disclose information about the agreements and their implementation to the public.
- Local governments disclose names of the companies that constantly violate the emission/effluent standards in order to put pressure on pollution control managers and business owners/top executives.
- Require large pollution sources to conduct 24 hour monitoring and send the monitoring data to local governments having jurisdiction over the sources (local governments establish a system to manage the sent data).

g. Organizational Structure and Human Resource Development for Proper Industrial Pollution Control within Companies

- Develop a system to require large pollution sources to establish an internal organization for industrial pollution control.
- Develop a qualification and training system for personnel in charge of industrial pollution control in order to strengthen their capability.

h. Development of Planned Industrial Estates for Plant Relocation

- Develop industrial estates based on appropriate plans, require new locaters to the estates to comply with environmental laws and regulations, and guide pollution sources existing in residential and industrial mixed areas to relocate to the estates.

Introduction

Introduction

1. Background

Japan has experience and know-how in improvement of production processes such as productivity improvement, quality control, energy conservation, and rationalization of water use, all of which are related to pollution control. Japan International Cooperation Agency (hereafter referred to as JICA) has assisted developing countries in tackling industrial pollution by dispatching experts, providing training programs, conducting development studies, and so forth. For example, in recent years, in the field of industrial pollution control, JICA has conducted studies on industrial pollution control, promotion of cleaner production (hereafter referred to as CP), industrial waste management, and energy conservation; it has made recommendations based on the individual conditions of developing countries and Japanese experience.

Although JICA has been conducting the studies and preparing recommendations with the objective to convey the Japanese experiences and practical cases to assisted countries, there is a lack of information material that comprehensively explains not only Japanese systems and development processes but also the conditions that made the measures successful, the effectiveness of the measures, and factors that make Japanese experience applicable to developing countries. The report[1] on promotion of cooperation on CP prepared by JICA points out consolidation of information about Japanese experiences as one of the cooperation strategies to promote CP. In addition, there is a need by developing countries and Japanese concerned parties for information about Japanese experience in industrial pollution control, organized from the viewpoints of market mechanism and corporate behavior; however, such information is very limited and fails to satisfy the needs.

Comprehensive analysis and evaluation of Japanese experience from the above viewpoints is expected to help developing countries further understand the policy recommendations provided by the JICA development studies and to promote effective cooperation in the field of industrial pollution control.

2. Objectives

This report aims at compiling information about Japanese experience in industrial pollution control and developing a tool that can be commonly used for effectively carrying out capacity development in the field of industrial pollution control under JICA assistance. The focus of the Japanese experience in this Study is the function of market mechanisms, corporate behavior, and development of CP in Japan. The information is compiled in a manner for government staff of developing countries and other donors to easily understand.

This report is prepared under the assumption that JICA experts and study teams will use it extensively as explanatory material during their technical cooperation activities on industrial pollution control and so will do JICA trainers. Organization of the report is characterized as not reviewing Japanese experience in industrial pollution control as factors, political and socioeconomic processes and results but deriving topics and lessons from Japanese experience that are to be understood by relevant parties in developing countries. In addition, the report focuses market mechanisms, price, and CP instead of covering all the topics relevant to industrial pollution control.

The Study utilizes existing literature and data; citation and analysis methods are based on authors' judgment.

[1] Committee for the Promotion of Cooperation on Cleaner Production, JICA, "Report on Promoting Cleaner Production in Developing Countries", 2001

3. Organization of the Report

This report is comprised of main text and an attached CD-ROM.

As for the main text, Chapter 1 provides background information on Japanese industrial pollution control measures and activities by major stakeholders, which is the basis of the discussions in the following chapters. Chapter 2 presents the results of the case studies which analyze the policies relevant to industrial pollution control in Japan from the viewpoints of policy formation and impacts on corporate behavior. The policies analyzed are those regarding control of sulfur oxides, water pricing, industrial waste management, and energy. Chapter 3 focuses on Japanese corporate behavior towards industrial pollution control; it attempts to identify factors that influenced Japanese companies in tackling industrial pollution control and lists the factors that should be considered for effective environmental cooperation with developing countries by comparing the status of these factors in Japan and developing countries. Chapter 4 summarizes the development of productivity improvements which contributed to reduction of environmental loads in Japan with emphasis on factors that triggered actions of small and medium enterprises. Chapter 5 provides case studies on successful industrial pollution control measures in Thailand and the Philippines, reviews approaches of Japanese technical cooperation in the field of industrial pollution control, and identifies future challenges to Japanese environmental cooperation. Finally, Chapter 6 summarizes the implications of Japanese experience in industrial pollution control which are useful to developing countries.

As for the attached CD-ROM, it contains electronic files of the report both in Japanese and English in PDF format including pictures of industrial pollution in Japan, the presentation in the seminar that introduced the draft final report, and a training kit for industrial pollution control targeting government staff and industry sector personnel in developing countries.

4. Preparation of the Report

Upon the preparation of this report, an advisory committee comprised of the following members was formed, and the Study Team received helpful advice on the method of the Study and contents of the report.

Dr. Ryo Fujikura, Professor, Hosei University

Mr. Seikichi Fujita, Japan Environment Corporation

Dr. Yu Matsuno, Assistant Professor, Meiji University

Dr. Tadayoshi Terao, Chief Researcher, Institute of Developing Economies

Dr. Osamu Yamamoto, Assistant Director, Osaka Research Institute of Environmental Science

In addition, the Study Team obtained valuable comments on the draft final report from the following experts at home and abroad.

Mr. Julian Amador, Director, Environmental Management Bureau, DENR, the Philippines

Mr. Kosol Jairungsee, Director, Bureau of Industrial Environmental Technology, Department of Industrial Works, Ministry of Industry, Thailand

Mr. Ralph Luken, Environmental Adviser, UNIDO (recently retired)

Mr. Masami Tsuji, Environment Specialist, Environment and Social Safeguard Division, ADB

Mr. Walter Vergara, Lead Engineer-Latin America Environment Department, World Bank

Professor Zhang Kunmin, Ritsumeikan Asia Pacific University (former Deputy Administrator, State Environmental Protection Agency, China)

Professor Zhang Shiqiu, Center for Environmental Sciences, Peking University, China

Mr. Toru Katayama, Executive Director, Overseas Environmental Cooperation Center

Mr. Yasuhiko Kobayashi, Board Chairman, Japan Environmental Sanitation Center

Mr. Tadayuki Morishita, Vice-chairman, Japan Environmental Facilities Manufactures Association

The Study Team deeply appreciates the members of the advisory committee and the experts who provided beneficial comments for their contribution to this study.

Shunsuke Aoyama, Masato Ohno, Satoshi Sugimoto, Tadao Tanaka, Toshiyuki Mizuno, Kaoru Oka, and Shinsuke Okamoto of EX Corporation prepared the report. Upon writing up the report, the Study Team received advice from JICA Philippine Office and JICA Thailand Office. Taisuke Watanabe of JICA Institute for International Corporation reviewed and partly wrote the report.

Chapter 1

Overview of Industrial Pollution Control Measures in Japan

1 Overview of Industrial Pollution Control Measures in Japan

This chapter provides overall information on industrial pollution control measures in Japan. The information, which is used as the foundation for subsequent chapters, covers industrial pollution control for each medium as well as stakeholder activities since the 1960s.

1.1 Japanese Policies for Industry and the Environment

1.1.1 Socioeconomic Factors

Environmental pollution has been a problem faced by all industrialized societies, but the situation in Japan was especially pronounced during the period of rapid economic growth from 1955 onwards. The socioeconomic factors behind this were identified in the 1977 publication *Sangyo to Kogai* (Industry and Pollution*)* as follows[1].

i Since Japan possesses a large population and has deployed a high degree of industrial activities on limited national land, the country is far too overcrowded, as may be gathered from the fact that it has the highest population density and GNP per area of flatland among the developed nations.

ii As a result of policies promoting heavy and chemical industrialization, Japan's industrial structure contains heavy polluting sectors such as iron and steel, electric power generation, chemicals, pulp/paper, gas, cement and glass industries

iii Since Japan's amazing economic growth in such a short time following WWII was promoted under the initiative of plant capital investment from private sector, development of environment-related infrastructure, for example, sewage systems and waste treatment/disposal facilities, and the like, was greatly delayed.

iv During the period of rapid economic growth from 1955 onwards, since enterprises were exclusively concerned with pursuing economic efficiency and had no spare capacity to consider the environmental pollution being caused by their production activities, they continued to expand production without internalizing external diseconomies like pollution.

Major factors are discussed in detailed in the following sections.

a. Growth of the Japanese Economy

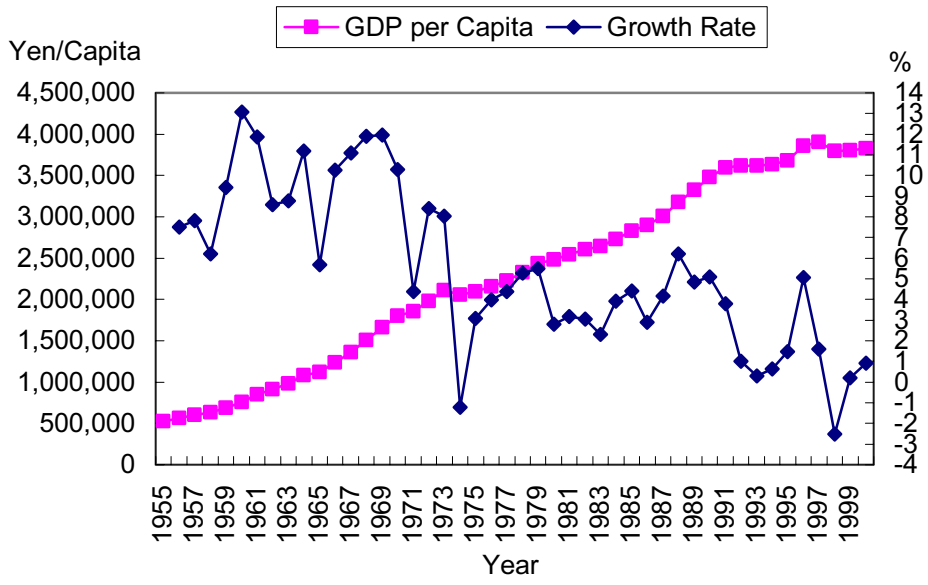
Japan's economy suffered devastating damage as a result of its defeat in WWII. However, prior to the war, Japan had achieved fairly high-level of development in the areas of legal systems, corporate organization and industrial capacity, national education, and major infrastructure construction.

Enterprises gradually resumed economic activities after the war, and Japan surpassed its pre-war GNP by 1950. The economic white paper of that year proclaimed that the postwar period had come to an end. Japan's economy was characterized by extremely high growth in the period from 1960 to the 1980s; in specific terms this was 9.1% per year in the 1960s, 4.1% in the 1970s and 3.5% in the 1980s.

[1] Ministry of International Trade and Industry, *Industry and Pollution*, 1977, p.32

Per capita GDP was 760,000 JPY in 1960, but this increased to 1,800,000 JPY by 1970 and 2,500,000 JPY by 1980, and Japan continued to record strong economic growth in subsequent years too (see Figure 1.1.1).

When per capita national income is compared internationally, it was 100 for the U.S.A, 44.8 for West Germany, and 15.0 for Japan in 1960, and 100 for the U.S.A, 51.9 for West Germany, and 23.5 for Japan in 1965[2].



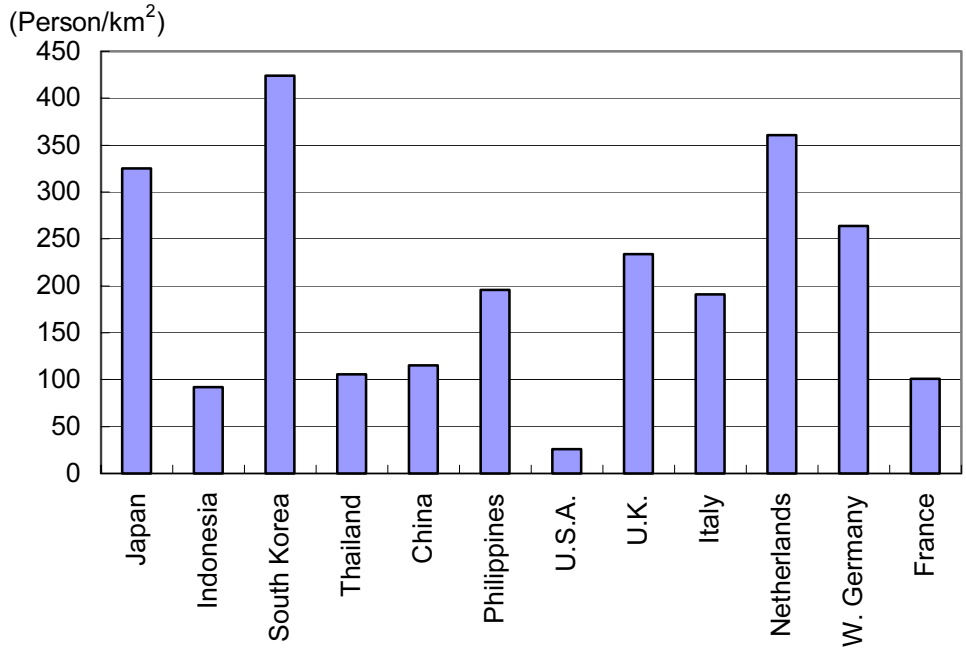
Note: 1990 price
Source: GDP: Economic and Social Research Institute, Cabinet Office, "Statistics of National Accounts (SNA)", Population: Ministry of Internal Affairs and Communications, *The 53rd Japan Statistical Yearbook 2004*, Exchange Rate: materials from Bank of Japan

Figure 1.1.1 Real GDP per Capita in Japan (1955-1999)

b. Population Density and Urbanization

In Japan, 66% of the national land is covered by forest[3] and 32.3% is habitable area[4]. Since more than 100 million people live in such a limited setting, Japan has an extremely high population density compared to other countries and regions in the world.

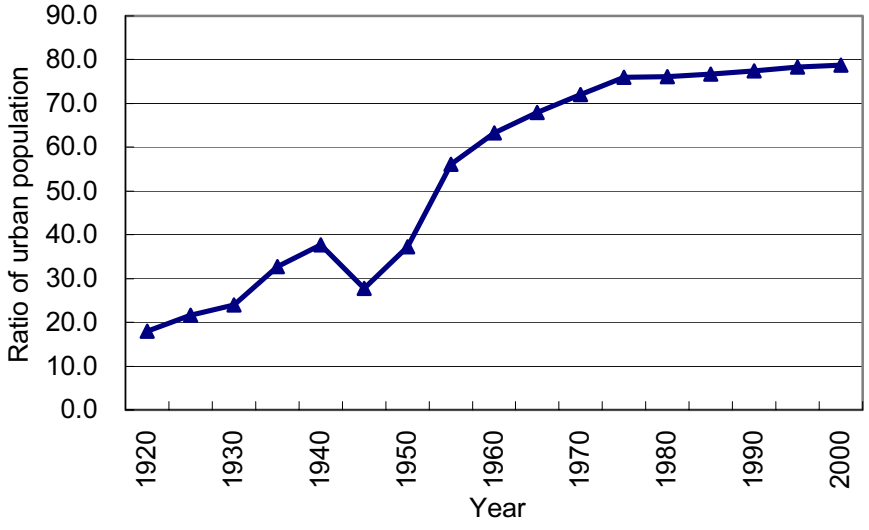
2 Economic Planning Agency, *1967 White Paper on Economics* (Table 36)
3 Ministry of Internal Affairs and Communications, *The 53rd Japan Statistical Yearbook 2004*
4 Ministry of Internal Affairs and Communications, *2003 Social Life Statistical Indicator*



United Nations Statistics Bureau, *1988 Population Statistical Yearbook*
Source: Ministry of Internal Affairs and Communications, *The 53rd Japan Statistical Yearbook 2004*

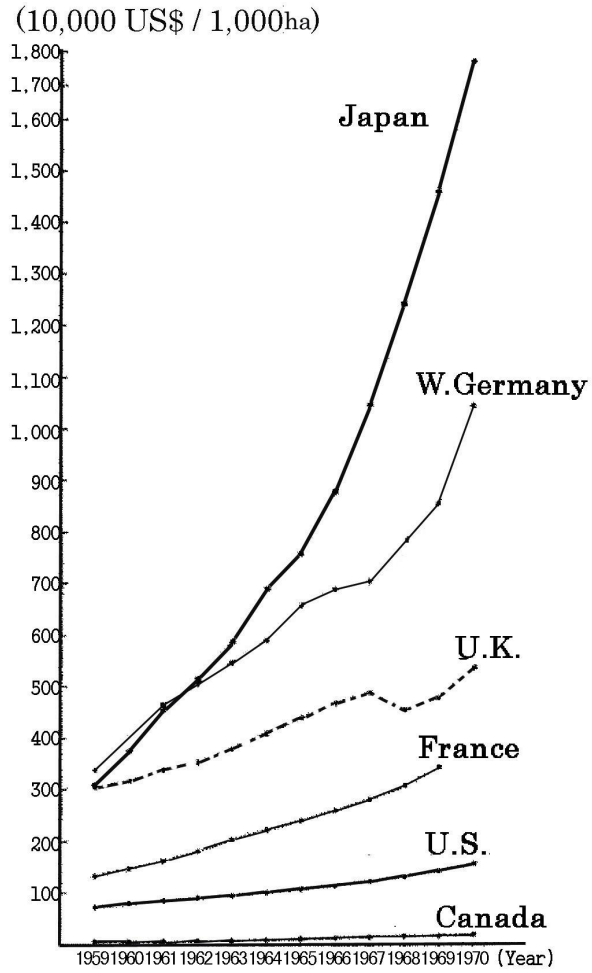
Figure 1.1.2 Population Density of Selected Countries

The urban population also increased rapidly from the 1950s, when migration to the cities started occurring in line with the industrial development of the time.



Source: Ministry of Internal Affairs and Communications, *The 53rd Japan Statistical Yearbook 2004*

Figure 1.1.3 Changes in Ratio of Urban Population in Japan (1920-2000)

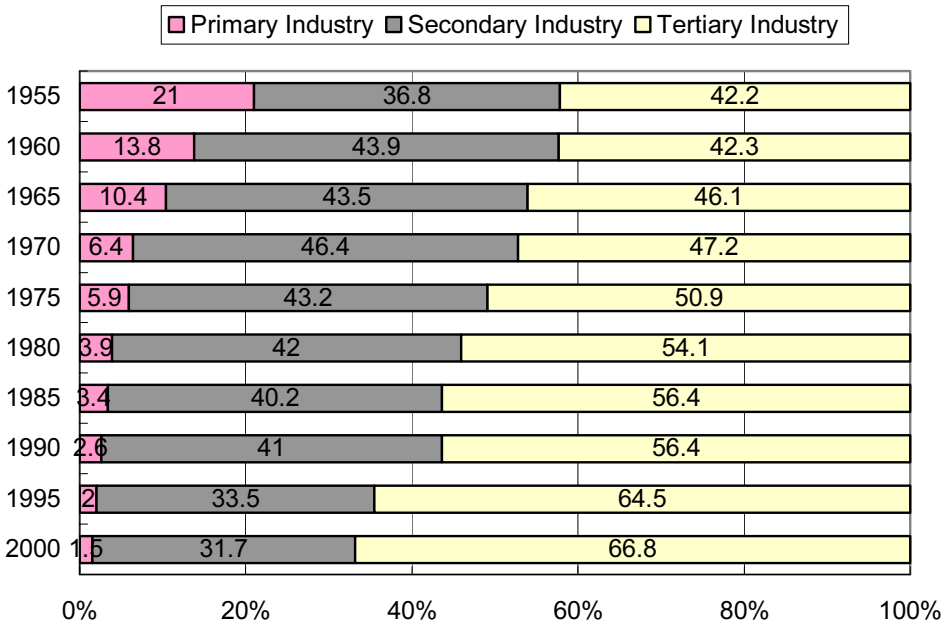


Source: Environment Agency, *1972 White Paper on the Environment*

Figure 1.1.4 Changes in GNP per Flat Area in Selected Countries

c. Industrial Structure

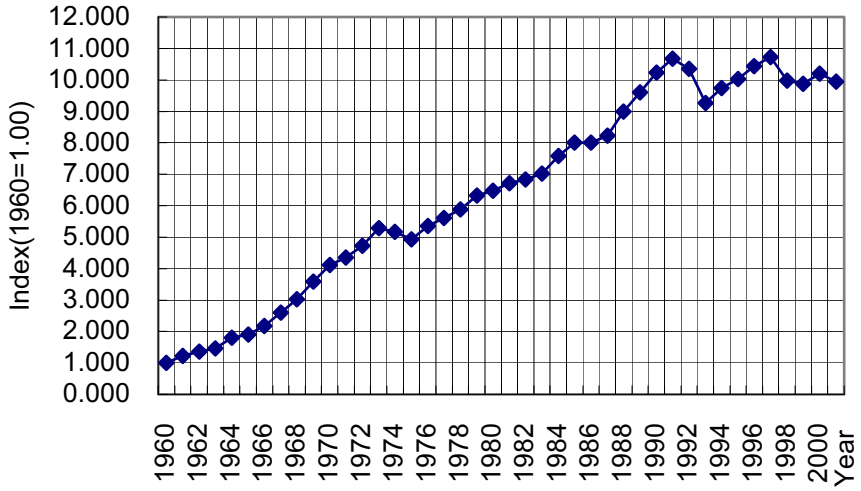
In line with economic growth, Japan's industrial structure also underwent a major transformation. Whereas the ratio of GDP occupied by primary industry was 13% and that of secondary industry was 49% in the 1960s, these figures in 1970 were 6.2% and 46.2% respectively, giving indication of Japan's transition to an advanced industrial economy.



Note: Values for 1995 and 2000 are based on 93SNA
Source: Economic and Social Research Institute, Cabinet Office and Government of Japan (ed.), "Report on National Accounts", 2001. Ministry of Internal Affairs and Communications, *The 45th Japan Statistical Yearbook 1996* and *The 53rd Japan Statistical Yearbook 2004*

Figure 1.1.5 Changes in Industrial Structure in Japan
(GDP in Industrial Sector=100%, 1955-2000)

Growth of real value of production in the manufacturing industry was dramatic, increasing by 4.1 times in just 10 years from 1960 to 1970.

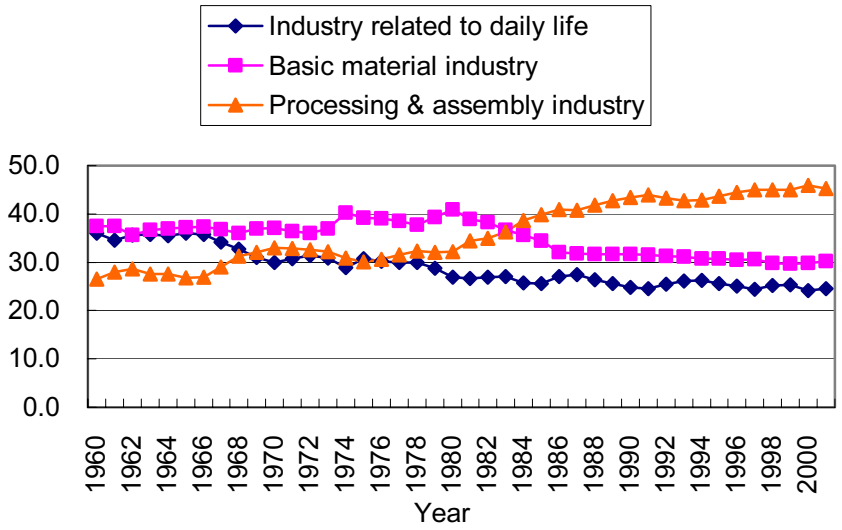


Source: Ministry of International Trade and Industry, *Industrial Statistics Table - Industry*

Figure 1.1.6 Changes in Value of Production Index in Manufacturing Industry
(1960 = 1.00, 1960-2000)

Concerning the composition of sectors of the manufacturing industry, basic materials had the largest share from 1960 to 1980, whereas the share of processing and assembly sector increased from 1984 onwards in a trend that has become even more pronounced in recent

years. Generally speaking, the industrial structure of Japan's manufacturing industry underwent a major change around 1980 as a turning point.



Note: Industry related to daily life: Food, Beverage, Textile, Clothing, Furniture, Publishing, Leather, and others. Basic material industry: Woods, Paper, Plastics, Rubber, Chemicals, Oil refining, Ceramics, Iron and Steel, Non-ferrous Metal, and Metal. Processing & assembly industry: Machinery, Electricity, Transportation, and Precision instrument.
Source: Ministry of International Trade and Industry, *Industrial Statistics Table - Industry*

Figure 1.1.7 Trends in Index of Real Production in Manufacturing Industry (price in 2000, 1960-2000)

Regarding the contribution to environmental pollution by different industries, those that pose a particularly large environmental load are iron and steel, non-ferrous metals, oil refining, chemicals (including petrochemicals), and the pulp/paper industries. (see Table 1.1.1)

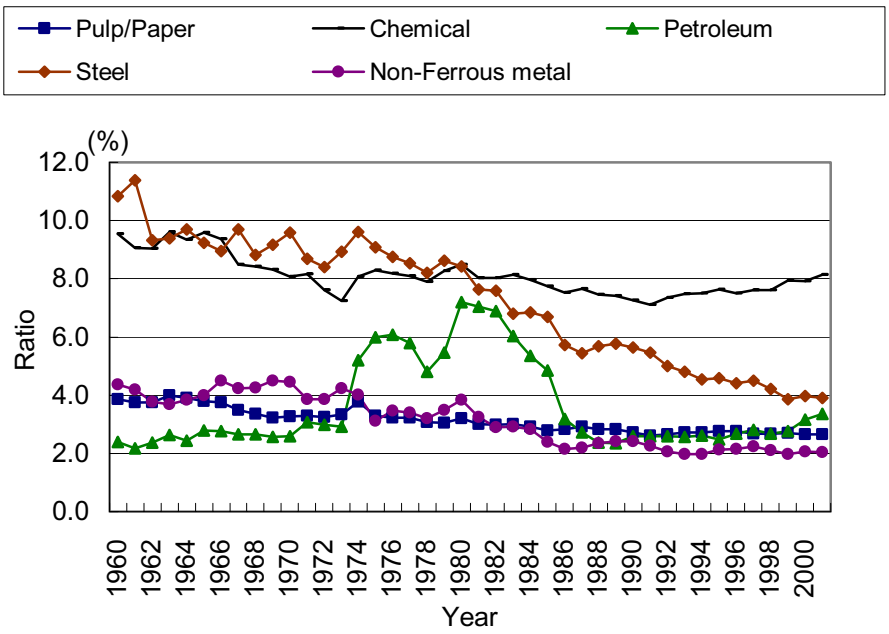
Table 1.1.1 Environmental Loads by Industry Sector

	Emissions per 1 million JPY of shipment value		Ratio of Pollutant Emission by Industry	
	SOx kg	BOD load kg	SOx %	BOD load %
Food	22.4	115.4	3.4	13.8
Textile	48.8	34.9	4.8	2.7
Pulp & Paper	125.1	1252.8	5.5	43.2
Chemicals	99.5	284.7	10.5	23.8
Oil Refining/ Coal	59.5	8	2	0.2
Rubber	-	3.8	-	0.05
Ceramic	254.5	5.5	11.5	0.2
Leather/tanning	-	29.2	-	0.2
Steel	57.9	10.2	6.9	1
Non-ferrous Metal		3.5		0.1
Metal	2.7	1	1.3	0.04
Machinery		1.1		0.3
Whole Manufacturing	47	86.9	49.4	85.6
Electricity	99.3	-	29.2	-
Transportation	28.8	-	3.3	-
Non-Manufacturing	46	-	32.5	-
Household/ others	9	26	6.3	14.4

Note: Electricity shows emissions per 1 million JPY of gross product by industry. Household and others show emissions per 1 million JPY of private consumption expenditure. Agriculture, fishery, mines, construction and other manufacturing are excluded, so the total does not add up to 100%.
Source: Environment Agency, *1972 White Paper on the Environment*

Trends in the ratio of total value of production turnover occupied by these industries are indicated below. Decline in the contribution of the iron and steel industry has been particularly noticeable. The oil industry increased in importance up to 1980, but displayed a major decline during the ensuing decade. Generally speaking, the importance of the other sectors also declined.

It can thus be seen that the relative status of industries with large pollution loads, which had occupied a major weight from the 1960s into the 1970s, entered into decline and these industries were gradually replaced by processing and assembly-type industries with lower pollution loads. As a result, emissions/discharge of pollutants due to the industrial sector growth were partly reduced.



Source: Ministry of International Trade and Industry, *Industrial Statistics Table - Industry*

Figure 1.1.8 Changes in Ratio of Material Industries' Value of Production to Whole Industry (1960-2000)

d. Industrial Development and Industrial Zones

Japan's industrial sector achieved dramatic growth based on the heavy and chemical industries from the second half of the 1950s to the 1960s. During this period, massive plant investment was made, and new factories were constructed with the aim of increasing production capacity. More than half the new factories constructed during this period were in basic materials, machine and metal industries.

In 1960, the four major industrial zones developed before WWII, i.e. Keihin, Hanshin, Chukyo and Kitakyushu-industrial zones, accounted for approximately 60% of the total value of shipments. New plant investments continued to be made in these industrial zones, however, because basic materials industries such as iron and steel, oil refining and petrochemicals, and the like required extensive industrial land, and in view of the transportation of raw materials and products as well as the positional relationship with consumer areas, industries came to be located in coastal development centers on the Pacific Ocean seaboard where the central and prefectural governments prepared the industrial infrastructure. Examples of such coastal centers were Chiba, Sodegaura and Kimitsu in Chiba Prefecture, the border of Osaka Prefecture, Kakogawa in Hyogo Prefecture, Mizushima in Okayama Prefecture, Hiroshima and Fukushima in Hiroshima Prefecture, Yokkaichi in Mie Prefecture, Kashima in Ibaraki Prefecture, Sendai in Miyagi Prefecture, and Oita in Oita Prefecture, and the like.

Machine and metal industries also tended to locate in coastal areas in close proximity to base materials industries, whereas transport machinery and electrical machine-related industries also came to be located in inland areas mainly around the major urban centers of Tokyo, Osaka and Nagoya[5].

[5] KASUGA Shigeo / FUJIMORI Tsutomu, *Keizai Chiri II*, Taimeido, 1991, pp.143-157

1.1.2 Occurrence of Pollution and Countermeasures

a. Occurrence of Pollution and Damage

In line with the recovery and growth of industry in Japan, pollution from the discharge of pollutants became a major social problem. The economic white paper of 1956 proclaimed the end of Japan's post-war rehabilitation, but that year's white paper on health and welfare stated that, with 1955 as a turning point, disputes caused by increasing pollution and contamination of the living environment in mainly urban areas were occurring throughout the country and could no longer be ignored[6].

In the decade starting in 1955, there was a dramatic spate of pollution problems with frequent damage occurring every year. At the end of the 1960s, areas of heavy air pollution were listed as follows[7].

- Areas of high-degree and complex advanced pollution over a wide area: Tokyo, Kanagawa, Osaka, Hyogo
- Areas of localized high-degree and complex advanced pollution: Yokkaichi, Fukuoka (Kitakyushu, Omuta), Fuji
- Areas of growing large-scale industrial development and emerging air pollution problems: Chiba (Chiba, Ichihara, Kimitsu), Southpart of Nagoya & Kinuura, Mizushima, Oita, Kashima

The number of citizens suffering from inflammation of respiratory organs increased in those areas where pollution was far advanced and intertwined in complex ways.

Water pollution also caused considerable damage in related industries and impacts on public health. The Director of the Economic Planning Agency at the end of 1968 designated 30 water zones as being in need of water quality standards based on the implementation of surveys according to the Water Quality Protection Law of 1958. The main source of pollution in these water zones was industrial wastewater, and damage from this extended to agriculture, fisheries, water supply and other aspects of environmental health. Water pollution was mainly caused by organic substances, however, there were also prominent cases of health damage caused by heavy metals, namely damage caused by consumption of fish contaminated by methyl mercury compounds around Minamata Bay in Kumamoto Prefecture and Agano River Basin in Niigata Prefecture, and health damage caused by cadmium contamination in Jintsu River Basin in Toyama Prefecture[8].

It was in light of such a background that civil actions were brought for damages caused by industrial pollution in the second half of the 1960s.

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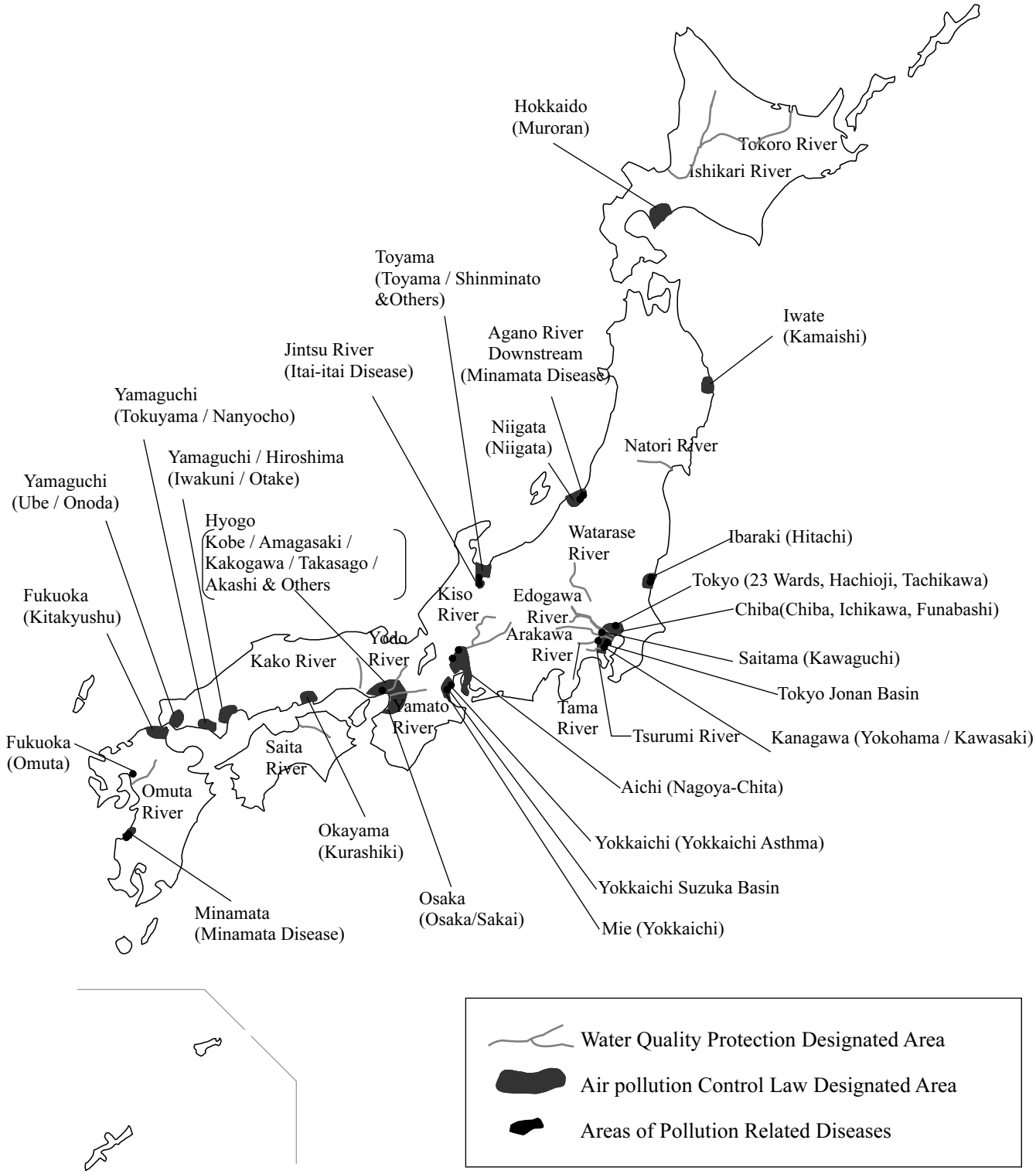
6 According to the *1956 White Paper on Health and Welfare*, there were approximately 30,000 cases of health damages while 2,550,000 people were suffering from the pollutions.

7 Prime Minister's Office / Ministry of Health and Welfare, *1970 White Paper on Environmental Pollution* and *1971 White Paper on Environmental Pollution*

8 Prime Minister's Office / Ministry of Health and Welfare, *1971 White Paper on Environmental Pollution*



Source: International Center for Environmental Technology Transfer, "Yokkaichi Kogai – Kankyo Kaizen no Ayumi", 1992, p.76

Figure 1.1.9 Occurrence of Industrial Pollution around 1965

b. Initial Response to Pollution Problems

Even prior to WWII, industrial pollution control measures were implemented to some extent in the form of regulations on the location and operation of factories based on the Factory Law and prefectural ordinances; however, these measures were mainly concerned with policing of industry and coordinating interests between labor and management. Moreover, because pollution controls at this time were extremely abstract, with actual implementation left to people on the ground, they were unable to achieve much result in the face of social emphasis on economic growth[9].

Public and private investments during the 1950s and 1960s caused serious environmental pollution and irreversible damages to natural resources and public health. Responding to people's protests against these damages, the government enacted the Basic Law for Environmental Pollution Control in 1967[10]. However, as seen in its provision stating that the environmental protection measures must be in harmony with sound economic development, the government failed to show its commitment to control industrial pollution. Existing mechanisms prevented the government from establishing strict regulations. Formulating regulations was the responsibility of several ministries; however, they were concurrently implementing industrial pollution control measures as part of their duty to promote industrial development under their jurisdiction, which made it impossible for them to take strict measures against industrial pollution[11].

From a legal viewpoint, reasons behind the serious pollution occurred in Japan were: 1) legal systems to prevent pollution were not established early enough, but were only adopted in response to the disastrous damage after they had happened, and 2) necessary existing legal systems were not actively applied, resulting in detrimental effects that were neglected after they had occurred.

Moreover, taking the case of the Soot & Smoke Control Law that was established in 1962, deficiencies concerning the area designation system and concentration controls were pointed out from the beginning. As a result, air pollution damage cases, for instance health damage at Yokkaichi, increased even after the law was put into effect. Also, taking the case of Minamata disease, it was pointed out that this would never have spread as much as it did if existing legislation had been applied when damage to fisheries was first reported or if laws had been utilized following establishment of the water quality related laws[12].

In terms of personnel and budget, the number of government staff exclusively assigned to pollution control measures was less than 300 out of approximately 1,700,000 local government employees in Japan in the beginning of the 1960s. Likewise, the national budget on pollution control in fiscal 1963 was approximately 100 million JPY, but this was only a tiny fraction compared to that year's total budget allocations from the central and local governments for public works projects of 1,736.1 billion JPY (almost twice the equivalent amount in the United Kingdom)[13].

Looking at emissions of environmental pollutants in the 10 years up to 1970, it is estimated that sulfur dioxide increased by 3.51 times, nitrogen dioxide by 2.85 times, COD (Chemical Oxygen Demand, an indicator of water pollution) by 2.97 times, and industrial waste by 3.64 times[14].

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9 KOBAYASHI Hikaru, "Kankyotyo no Kankyo Gyosei no Kaiko to Tenbo", *Sangyo Kogai,* Vol. 28 No. 9, 1992, pp.874-880

10 OECD (ed.), *OECD Report: Environmental Policies Achievement and Assignment - Japan*, Chuo Hoki Shuppan, 1994, p.14

11 Chikyu Kankyo Keizai Kenkyukai (ed.), *Nihon no Kogai Keiken*, Godo Shuppan, 1991, pp.16-17

12 AWAJI Takehisa, "Hoseido kara Mita Nihon no Kogai Taiken", *Nihon no Kogai Keiken*, Godo Shuppan, 1991, pp.76-79

13 SHOJI Hikaru / MIYAMOTO Kenichi, *Osorubeki Kogai*, Iwanami Shoten, 1964, pp.79-82, p.174

14 KAWANA Hideyuki*, Document Nihon no Kogai Volume 2 - Kankyotyo*, Ryokufu Shuppan, 1988, p.18

Another factor delaying industrial pollution control was the balance of power between pollution sources (companies) and victims (residents). When a pollution source was an important contributor to the local economy and employed local residents (victims), dominant-subordinate relationships arose between the pollution source and the victims. This relationship constrained the victims' ability to take action against the damages individually or as a group in spite of the fact that freedom of speech and assembly were ensured by the Constitution[15].

Around 1955, local governments in Japan were confronted with unprecedented budget deficits and were desperate to attract industries and promote local development as means of rebuilding local finances. For this reason, numerous local governments adopted plant attraction ordinances and a servile attitude towards industry. However, in effect this meant that they adopted a policy of not establishing pollution control ordinances that could have incurred the displeasure of industry[16].

In the drive for industrialization, industrial centers were developed all over the country. Many industrial centers were constructed close to existing urbanized areas, so the pollution failures previously experienced by existing industrial belts and major urban centers were repeated in the newly emerging industrial centers and regional cities.

In the beginning of the 1960s, it was rare that companies voluntarily installed pollution control equipments. Equipment installations were most common in those cases where raw materials could be recovered from processing facilities. As for other cases of installation, there were two major reasons. The first was seen where citizens who had suffered health damages filed legal complaints against factories. According to a survey by the Ministry of International Trade and Industry in 1961, out of disputes raised at 225 factories, compensation was paid in 74 cases, new facilities were installed in 100 cases, and both actions were taken in 6 cases. In such cases, it appears that factories selected the cheaper alternative, either of paying compensation or installing facilities. The other major reason for installation of pollution control equipment was the establishment of laws and ordinances by the central and local governments calling for such facilities, as well as administrative steps making such installations compulsory[17].

c. Socioeconomic Factors

Miyamoto points out the following four factors behind the occurrence of pollution in the then "modern economies"[18].

i. Despite the fact that the potential for pollution generation increased when enterprises become more concentrated and integrated in the pursuit of higher production and profits, spending on environmental protection was curtailed both within enterprises and throughout society as a whole. The expansion of business scale and integration of industries increased the possibilities of large-scale and complex pollution occurring. In particular, in the years following WWII, Japan adopted the industrial-complex approach whereby factories in differing industries shared equipment, raw materials, fuel and technology, and the like by means of connecting pipes. These industrial complexes were designed to realize the highest possible agglomeration advantages, however, at the same time they spewed out massive quantities of pollutants that combined to produce a plethora of pollution problems.

ii. Faulty industrial structure. As a result of making productivity the top priority under modern economic conditions, industry was given priority over agriculture, and

15 IIJIMA Nobuko, *Kankyo Mondai no Shakaishi*, Yuhikaku, 2000, pp 146-149
16 SHOJI Hikaru / MIYAMOTO Kenichi, *Osorubeki Kogai*, Iwanami Shoten, 1964, pp.72-73
17 Ibid. pp.70-71
18 MIYAMOTO Kenichi, *Nihon no Kankyo Mondai*, Yuhikaku, 1975, pp.31-36

by the same token heavy and chemical industries were prioritized ahead of light industries. Within the heavy and chemical industries, basic materials supply-type industries such as iron and steel, oil and energy, and the like were prioritized as the key industries. However, these also happened to be the industries most likely to consume resources and destroy the environment.

iii. Pollution was also caused by the excessive urban concentration of enterprises and population. In terms of pollutant load per square kilometer, major cities suffer disadvantages of agglomeration compared to other areas. However, in the modern economy, the burden of these disadvantages of agglomeration does not fall on the causing parties. The economic system enabled enterprises, which caused the pollution, to enjoy the advantages of agglomeration imparted by the external economies of cities, whereas the disadvantages of agglomeration such as pollution were passed on to citizens and local governments as social costs.

iv. Mode of living was one of the factors. Mass production led to the emergence of mass consumption-oriented lifestyles, whereby individuals own all kinds of consumer goods and scrap them after a short while to replace them with new products. This mode of living led to the generation of massive quantities of solid waste.

1.1.3 Background Social and Cultural Conditions

In response to the pollution problems that were resulted during the period of high-level economic growth from 1955 onwards, industrial pollution control measures were eventually implemented in the 1960s and 1970s. These measures were underpinned by the following social and cultural factors:

- High level of education
- Freedom of speech
- System of local self-government
- Emphasis on the natural environment

a. Education

Compulsory school education in Japan began in the 1900s, and by 1950 Japan had achieved one of the highest average education levels in the world. The literacy rate was reported as almost 100% by the 1960s. Moreover, the university advancement rate increased dramatically from the 1960s and was in excess of 30% by 1973. With this background of the national spread in basic and higher education, citizens became aware of the scientific aspects of pollution problems and took an interest in such matters (see Figure 1.1.10).

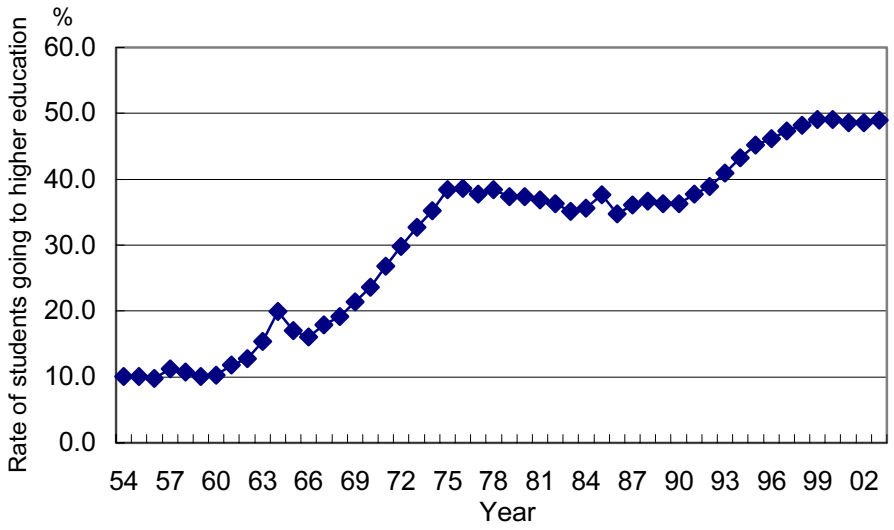
b. Freedom of Speech

Although it is taken for granted somewhat, Japan is a country that appreciates freedom of speech. In particular, freedom of speech of anti-establishment political groups is guaranteed and a certain level of political debate based on information is secured[19].

c. System of Local Self-government

Following the end of WWII, local government chief executive officers came to be elected by direct popular vote, thereby making it impossible for elected parties to ignore the opinions of the electorate.

[19] Intense debate was reported during the Industrial Pollution Control Committee in the House of Representatives at 49th assembly in 1965.



Source: Ministry of Education, Culture, Sports, Science and Technology, "Statistics 2003 school attendance rate & advancement rate", http://www.mext.go.jp/b_menu/toukei/002/002b/15/jpg/015_2.jpg

Figure 1.1.10 Trend in Ratio of Student advancing to Higher Education (1957-2002)

d. Emphasis on the Natural Environment[20]

Japan's major industries up to the start of the 20th Century were agriculture, forestry and fisheries. Almost all the farmland that exists today had already been developed by 1900. These industries attached very high importance to protection of farmland and the nature. In particular, when it came to developing other industries, it was necessary to give consideration to the natural environment, which was the basis of these industries. In spite of the dramatic transformation that took place in the Japanese economy and industrial structure, this attitude of laying emphasis on the traditional natural environment remained.

1.1.4 Economic Background to Pollution Control Investment by Enterprises

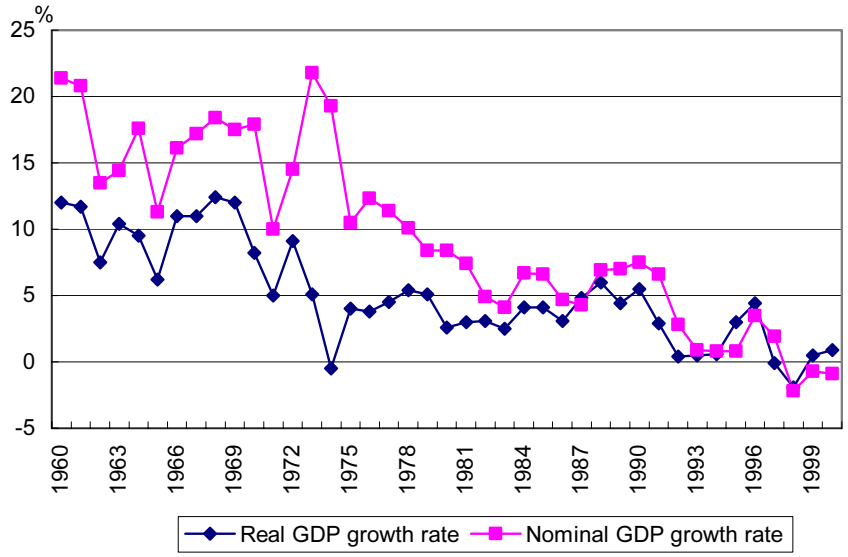
It has already been described how the failure of enterprises to implement timely pollution control measures led to damage of human health and living environments; however, in the late 1960s and early 1970s, legal regulations were reinforced and pollution control measures by enterprises were rapidly advanced. Although business owners generally tended not to prefer pollution control investment because it led to higher production costs, enterprises could no longer avoid taking such measures. A high rate of growth was sustained throughout the 1970s and 1980s when pollution control measures by enterprises were promoted. However, the economic environment surrounding investment changed dramatically during this period. In order to ascertain the economic environment, we will discuss the trends concerning economic growth, plant investment, real rate of interest, exchange rates and prices of raw materials in the following sub-sections.

a. Economic Growth Rate

Section 1.1.1.a. showed the real GDP growth rate, and this trend of growth was sustained during the period in which industrial pollution control measures were promoted after the 1970, although negative growth was temporarily recorded in 1974 in the wake of the 1st Oil Crisis. The 1970s was a time of high nominal economic growth and created an atmosphere where companies felt they could sell as much the products as they produced. However, the

[20] EX Corporation, "Japan's Experience in Urban Environmental Management", Metropolitan Environment Improvement Program, World Bank, 1996

growth rate fell dramatically to 1.6% in the early 1990s, and the business environment ceased to be conducive to active plant investment by enterprises.



Source: Data from Economic and Social Research Institute, Cabinet Office, *Statistics of National Accounts (SNA)*

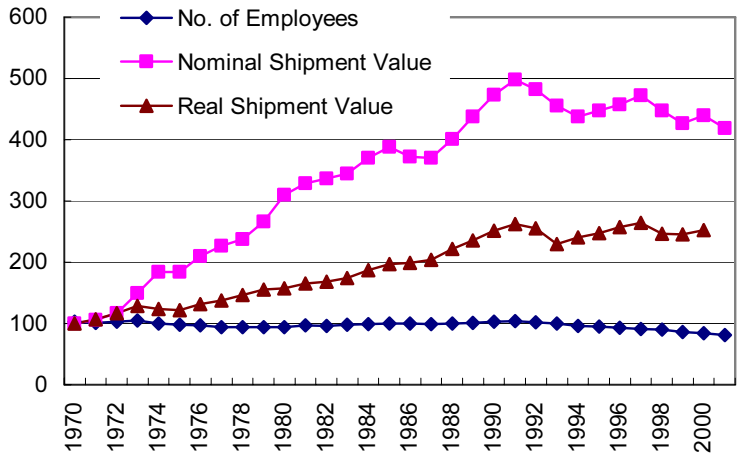
Figure 1.1.11 Growth Rate of Real GDP (1960-1999)

b. Movements in Manufacturing Shipments

The value of manufacturing shipments (at 2000 prices) increased by 6% on average during the 1970s and was 1.6 times higher in 1979 than in 1970s. An extremely high growth rate was sustained in the nominal value of shipments. During this period, the most pressing business issue for enterprises was how to secure supply capacity as quickly as possible by implementing plant investment.

The value of manufacturing shipments increased steadily up to the start of the 1990s. However, this fell to 0.52% or almost zero during the 1990s.

The number of employees engaged in manufacturing did not increase while the increase in the value of manufacturing shipments increased. This was indicative of efforts to increase productivity.



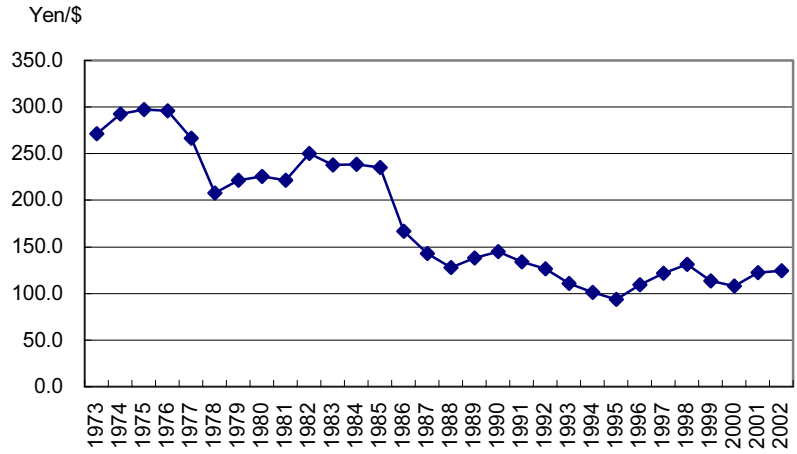
Source: Ministry of International Trade and Industry, *Industrial Statistics Table - Industry*

Figure 1.1.12 Changes in Number of Employees and Shipment Value in Manufacturing Industry (1970=100, 1970-2000)[21]

[21] Ministry of Economy, Trade and Industry, *Statistics Library*

c. Exchange Rates

The yen appreciated from 270-280 JPY to the dollar in the 1970s to around 250 JPY in the first half of the 1980s, and then to less than 200 JPY following the appreciation that occurred in the wake of the Plaza Accord in 1985. This trend continued until the yen reached 79 JPY to the dollar in 1996, after which the exchange rate rebounded and has since moved between 100 - 150 JPY to the dollar. This appreciation in the yen led manufacturing enterprises to conduct investment in construction of overseas centers mainly for carrying out exports.

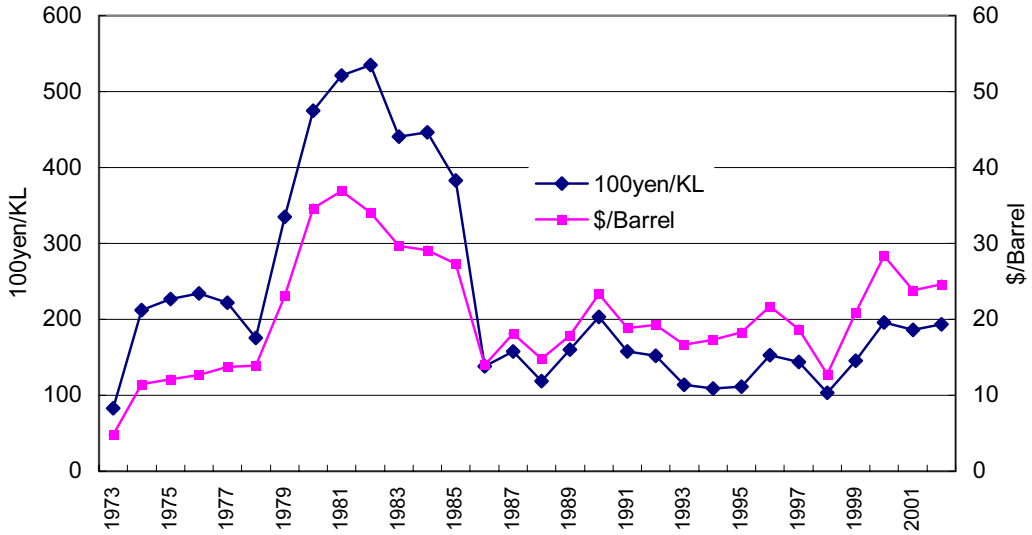


Source: Data from Bank of Japan, Monthly average in Tokyo Market (Dollar / Yen Rate)
http://www.boj.or.jp/stat/stat_f.htm

Figure 1.1.13 Changes in Yen/Dollar Exchange Rate (1973-2002)

d. Price of Crude Oil

Two oil crises occurred, in 1973 and 1979. On each occasion, the price of crude oil skyrocketed, to 2,100 JPY per kl in 1975 and to 5,300 JPY per kl in 1983. In turn, this led to increases in raw materials prices, inflation and recession for enterprises. Having experienced the effects of rapid increases in crude oil prices on corporate profits, enterprises subsequently implemented thoroughgoing energy saving measures to ensure that the same thing did not happen again.

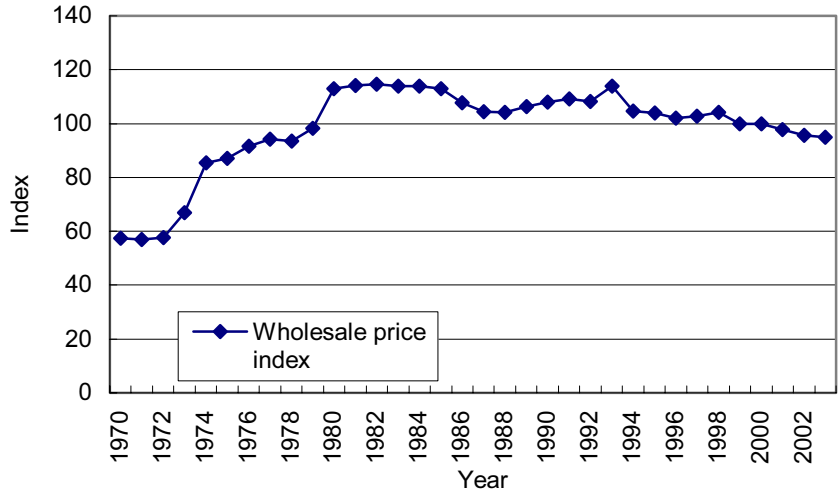


Source: Ministry of Finance, "Customs Statistics", http://www.customs.go.jp/toukei/info/topmenu_j.htm

Figure 1.1.14 Changes in Crude Oil Price (1973-2002)

e. Wholesale Price Index

Japan's economy experienced a period of inflation from the 1970s to the early 1980s. It could be said that this was indicative of an excess of demand. During this period, enterprises were more afraid of losing sales opportunities rather than experiencing higher costs. Following collapse of the bubble economy in 1992, however, the economy experienced continuous deflation and the environment for plant investment by corporations became much harsher.

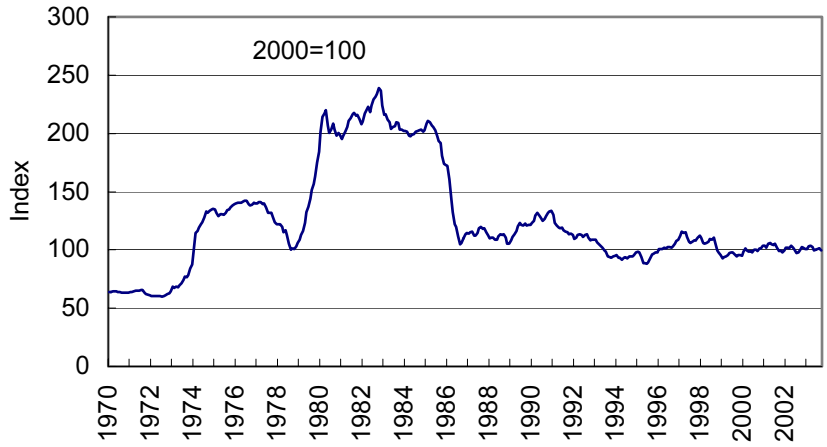


Source: Bank of Japan, "Shift of Company Price Index", http://www.boj.or.jp/stat/stat_f.htm

Figure 1.1.15 Changes in Whole Price Index (Average in 2000 = 100, 1970-2002)

f. Import Price Index

The price of imports declined after 1985. Accordingly, enterprises manufacturing products intended for the domestic market lost their competitiveness with respect to imports and were placed in a tough situation.

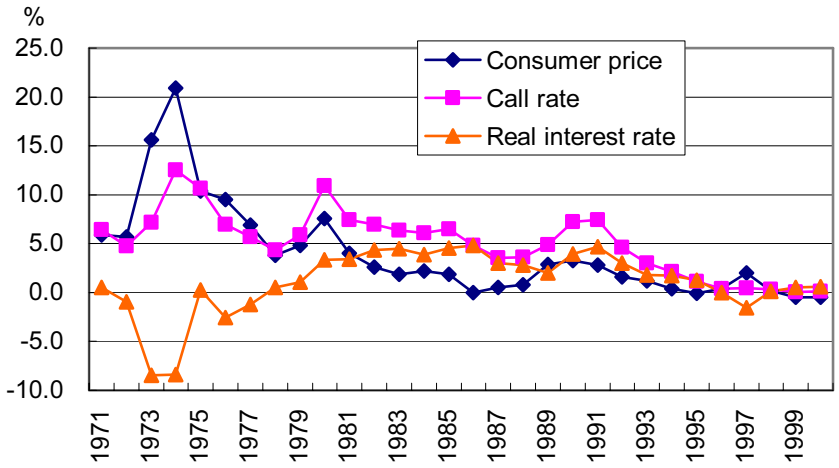


Source: Bank of Japan, "Import Price Index", http://www.boj.or.jp/stat/stat_f.htm

Figure 1.1.16 Changes in Import Price Index (Average in 2000 = 100, 1970-2002)

g. Real Rate of Interest

During the inflationary period of the 1970s, interest rates were held relatively low, and the real rate of interest was also fairly subdued. As a result, interest did not act as a major constraint on borrowing by business owners. With the advent of deflation in the 1990s, however, the real rate of interest increased and became a major impediment to investment by enterprises.

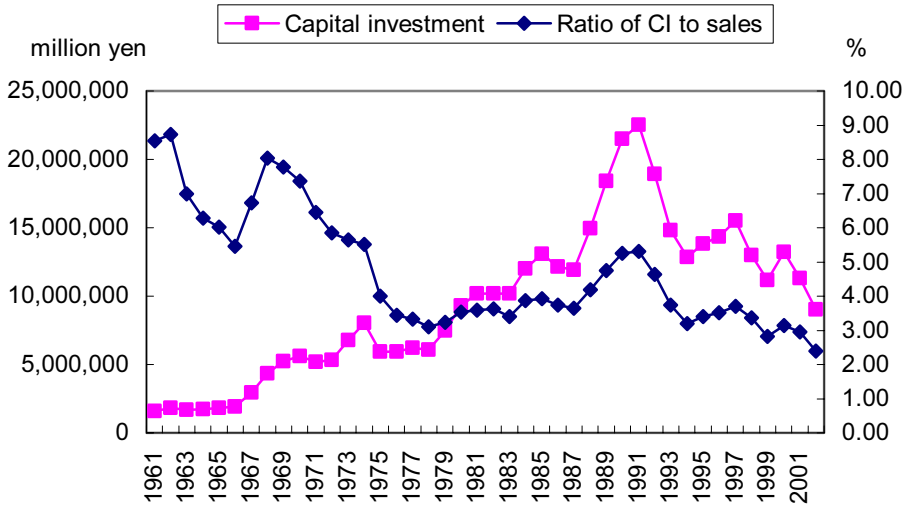


Source: Coal Rate: Bank of Japan, Consumer Price Index: Statistics Bureau, Ministry of Internal Affairs and Communications, *Consumer Price Index Annual Report*, 2003

Figure 1.1.17 Real Interest Rate (1971-1999)

h. Capital Investment

As is indicated below, capital investment displayed major growth during the 1970s. It may be seen that the ratio of capital investment to sales was more than 5% from the 1960s through to the middle of the 1970s.



Source: Bank of Japan, "Shift of Company Price Index", http://www.boj.or.jp/stat/stat_f.htm

Figure 1.1.18 Ratio of Capital Investment in Sales in Manufacturing Industry (1961-2001)

In contrast, the 15 years from the second half of the 1970s through to 1990 was a period of active capital investment by corporations and consequent expansion in production capacity.

The industrial shipment value index increased greatly during this period. Capital investment increased under the so-called bubble economy that persisted from the late 1980s to the early 1990s. However, following collapse of the bubble in 1992, capital investment fell off sharply and the ratio of capital investment to sales dropped to 2.5% in an increasingly harsh environment.

i. Summary

Looking at the external economic environment for enterprises, the period from the 1970s through to around 1985 was one of continuous economic growth, apart from the oil crisis, which had a major impact on the economy. It can be seen that enterprises carried out active capital investment during this period.

Structural transformation started to occur from 1986 onwards. This was a manifestation of yen appreciation in the wake of the 1985 Plaza Accord. The wholesale price index displayed a deflationary trend from 1986, while the import price index fell to half the pre-1985 level. As a result, products that could be produced in developing countries were exposed to harsh competition with cheap imports. As a result, overseas capital investment increased and hollowing out of the domestic economy emerged as a new issue.

1.2 Industrial Pollution Control Policies and Legal Framework for Pollution Control Measures

1.2.1 Industrial Pollution Control Policies

Policies for industrial pollution control in Japan were introduced based mainly on the Basic Law for Environmental Pollution Control. In retrospect, the following features can be identified in past pollution control measures.

a. Integrating Environmental Factors into Industrial Policies

Prior to the enactment of the Basic Law for Environmental Pollution Control in 1967, economic development aimed at increasing national income was the primary national objective. Rapid industrialization induced by development policies led to the dramatic spread of pollution caused by emissions/discharges of pollutants into the environment, and control measures were too slow to respond. Moreover, because the government took a centralized approach to industrial pollution problems, the central government was slow to become aware of and respond to local pollution issues. Furthermore, in the Industrial Wastewater Control Law (1958) and Soot & Smoke Control Law (1962) that preceded the Basic Law for Environmental Pollution Control, it was stipulated that pollution countermeasures should be harmonized with economic development. Thus the opinions of business representatives were reflected in control measures, thereby leading to excessive delay in the adoption of strict and preventive measures.

The Basic Law for Environmental Pollution Control was enacted in 1967. However, with respect to protection of the living environment, it retained the provision stating that environmental protection measures must be in harmony with sound economic development. Although this provision was limited in application to the living environment, it was a reflection of the strong resistance of industry to the adoption of excessively strict regulations. The provision was however removed in revision of the law in 1970.

Industrial policy purporting development was subjected to severe criticism for contributing to the major delay in pollution control measures. However, based on the awareness that adequate industrial pollution control measures could not be implemented by regulations alone, the government incorporated pollution control elements into its industrial policy. The following measures incorporating pollution control elements were implemented under the government's industrial promotion policies:

- Factory location (relocation of factories to newly constructed industrial estates, and the like)
- Combining of industrial activities with the environment via improvement of productivity and promotion of quality control
- Establishment of pollution control organizations within factories (assignment of pollution control managers, and the like)
- Establishment of pollution-related standards
- Expansion of low-interest loans and preferential tax measures for industries to promote installation of pollution control equipments

The fact that these measures were advanced in tandem with pollution regulations targeting sources can be pointed to as an important feature of industrial pollution control measures in Japan.

BOX: Negative Features of Industrial Pollution Control Measures in Japan

Miyamoto claims that the following three features of industrial pollution control measures in Japan slowed down industrial pollution controls: 1) acquiescence with private enterprises (harmonization with sound economic development, and the like), 2) stopgap measures treating only symptoms (for example, dispersion of air pollutants through adoption of high smokestacks, and 3) bureaucracy (centralization of power).

MIYAMOTO Kenichi, *Nihon no Kankyo Mondai*, Yuhikaku, 1975, pp. 133-142

b. Pollution Prevention via Target Setting and Phased Controls

b.1 Environmental Standards

Environmental standards were set as "desirable standards for protecting human health and protecting the living environment" and they became policy targets. Even before enactment of the Basic Law for Environmental Pollution Control, observation of pollutant concentrations in the environment and epidemiological surveys were implemented, and these data together with scientific data from WHO and other international agencies were used in order to provide the basis for setting environmental standards. This emphasis on scientific data is reflected in the provisions of the Basic Law for Environmental Pollution Control concerning revision of environmental standards. Moreover, when the government set emission gas/effluent standards concerning air and water, it again fully considered scientific factors in order to examine the applicability of pollution control technologies.

Various regulatory standards were set and revised to provide the targets for attaining environmental standards.

b.2 Phased Regulations

Both emission/effluent regulations and land use regulations were implemented. Emission/effluent regulations were set upon giving consideration to the feasibility of control measures for business operators. Rather than suddenly adopting harsh regulations with a view to achieving environmental standards, a phased approach was adopted whereby regulatory standards were reinforced or new standards were adopted in cases where the environmental standards were not attained.

Emission gas and effluent standards were set giving consideration to the response capability of industry. Concerning application of effluent standards, target specified facilities (facilities discharging to the targeted wastewater) were successively increased. Moreover, out of uniform effluent standards, concerning living environment items, provisional standards were set together with certain reprieve periods in which to gradually transfer to the uniform standards while taking into account depreciation of already existing pollution control measure investments, and the like.

Out of emission gas standards, concerning soot and NOx in particular, consideration was given to the applicability of control measure technologies. Concerning soot, the general standard was set at the level that could be handled by ordinary soot control technology, while a special standard was set as the level that could only be attained by adopting advanced technology of that age. With respect to NOx emissions standards, regulations were started from facilities with large NOx emissions, and these were steadily reinforced while paying attention to the applicability of NOx emission control technologies.

b.3 Economic Measures Based on Financial Support

Control measures were mainly composed of regulations. Economic measures were mainly composed of low-interest loans and preferential tax measures, but other measures were a levy

system on emission of SOx by the Pollution-related Health Damage Compensation Law and charges based on the Law for Allocation of Pollution Clean-Up Cost

c. Decentralization and Capability of Local Governments

c.1 Empowerment by Law

In the Air Pollution Control Law and Water Pollution Control Law, local governments were empowered to implement regulations. As a result, prefectural governments were able to adopt standards (additional standards) more stringent than national standards based on ordinances that took local conditions into account. Such standards were implemented with respect to soot and hazardous substances under the Air Pollution Control Law, and living environment-related items under the Water Pollution Control Law. Local governments throughout the country utilized this authority to establish additional standards that were more stringent than the uniform standards based on unique local circumstances.

The Air Pollution Control Law and Water Pollution Control Law also made it compulsory for business operators to notify prefectures (including ordinance-designated cities) when installing pollutant emission sources. Also, prefectures were empowered to implement on-the-spot inspections, demand submission of reports and issue improvement orders and suspension orders in cases that there was risk of nonconformity with emissions standards.

These steps empowered prefectural governments to execute regulations and promoted pollution controls including administrative guidance with respect to emission sources.

This decentralization reflected the fact that prefectural governments have the capability to implement regulations in line with actual local conditions. This capability existed because many prefectures had introduced pollution regulations based on pollution control ordinances prior to the establishment of legal regulations by the national government.

c.2 Capability of Local Governments

Local governments in Japan have a high degree of independence from central authority. Moreover, because authority concerning personnel and budget affairs is concentrated in local government chiefs, there is more scope for governor/mayors to exert leadership than at the central level. In addition, because they are elected by direct popular vote, they have to be sensitive to the wishes of citizens. If a mayor/governor displays a clear commitment to actively tackle pollution control, the staffing and budgeting of related departments will be immediately bolstered while systems enabling concrete guidance to be executed with respect to enterprises will be established.

Since civil servants have traditionally held high social standing, receive salaries to match with the private sector, and are guaranteed lifetime employment in Japan, local governments have been able to secure highly capable employees, in particular technical personnel. This is one of the factors why local governments have sustained high administrative capacity. In order to persuade enterprises, the local government side must possess high administrative capacity that enables it to collect and collate data, conduct debate with the engineers of major corporations on an equal footing, and offer pertinent technical guidance to small and medium enterprises (SMEs). Enterprises sometimes give a negative response to measures proposed by local governments, saying that they are too difficult to implement. At such times, local government employees must be able to rebuff such claims and persuade otherwise based on their knowledge of control measures and the effects of measures at other companies in the same sector. The municipal governments in Yokohama, Osaka and Kitakyushu were able to acquire employees with such high technical capacity[22].

[22] FUJIKURA Ryo, “Nihon no Chiho Kokyo Dantai no Iosankabutsu Taisaku – Kodo Keizai Seityoki ni Jissisareta Kogai Bosi Kyotei to Gyosei Shido”, TERAO Tadayoshi / OHTSUKA Kenji (eds.), *Kaihatsu to*

d. Tense Partnership between Public and Private Sectors

d.1 Emphasis on Communication Between Local Governments and Enterprises

In encouraging enterprises to take industrial pollution control measures, prefectures and ordinance-designated cities did not simply ask enterprises to abide by regulations prescribed by law. Rather, they provided fine-tuned conciliation and guidance with regard to plant relocation measures and pollution control measures, and this was especially true with respect to SMEs.

Moreover, in binding pollution control agreements too, local governments conducted dialog with enterprises based on scientific information and avoided imposing unrealistic regulations on enterprises.

Some local governments even established research workshops and councils, and the like in order to improve communications with enterprises in the implementation of regulations.

Once the coordination function between the central government and industry associations was established, even though this sometimes was utilized by industries to express strong resistance to regulatory measures, industry-wide efforts were generally made to abide by regulations.

d.2 Relationship Between Local Governments and Citizens

Prior to establishment of the Basic Law for Environmental Pollution Control, local governments had to face complaints from citizens concerning pollution. Citizens' complaints not only provided the fundamental background for making local governments take control measures but also put pressure on enterprises. Local governments obtained a certain degree of trust from citizens by striving to sincerely respond to citizens' grievances [23]. It was the potential pressure exerted on enterprises and local governments by such citizens' complaints that enabled local governments to effectively promote pollution control agreements and administrative guidance and persuaded enterprises to accept such controls.

In view of the importance of handling citizens' complaints in terms of finding quick solutions to problems, the Pollution Dispute Settlement Law was enacted in 1970, thereby institutionalizing the complaints handling process.

In Yokohama, disclosure of information concerning pollution control agreements helped establish a trust relationship between citizens and enterprises. At the national level too, information in the environmental standard setting was disclosed. Furthermore, by disclosing environmental monitoring data, citizens could be aware of the points where environmental standards were not achieved. Local governments also disclosed information concerning administrative penalties imposed on enterprises.

e. Clarification of Obligations and Polluter Pays Principle

The Basic Law for Environmental Pollution Control stipulated the obligations of related parties in the following manner. These obligations were also prescribed in individual regulatory laws.

Business operators: Business operators were obliged to take necessary measures for pollution control, for example, treatment of soot, wastewater, waste, and the like generated in line with their business activities. Business operators were also obliged to cooperate with pollution control measures implemented by the central or local governments.

Kankyo no Seisaku Katei to Dynamism - Nihon no Keiken Higashi Asia no Kadai, Institute of Developing Economies, 2002, pp.64-72

[23] Ibid.

Central government: In view of the government's mission to protect the health and living environment of citizens, it was obliged to compile and implement basic and comprehensive measures on pollution.

Local governments: Local governments were obliged to take measures based on national measures, and to compile and implement pollution control measures corresponding to the natural and social characteristics of local areas.

Citizens: Citizens had to strive to prevent pollution by, for example, cooperating with pollution control measures of the central and local governments.

According to the above principles, the cost of pollution control measures in factories and business establishments was borne by business operators. The polluter-pays-principle that was introduced by the OECD in 1972 states that the cost of pollution control should be borne not by the government but by polluters, and this is frequently quoted in Japan. Concerning its application, the Japan Environmental Policy Review implemented by the OECD Environment Committee between 1976-1977 stated the following: "For many people, this principle means simply that polluters are guilty and must accordingly be punished."[24]

BOX: Relationship between Industrial Policies and the Environment

Terao has pointed out the following regarding the relationship between industrial policies and the environment.

"The impact of development-first policy on the manifestation of industrial pollution and society's response to it can be summarized as follows based on Japan's experience. (1) Rapid industrialization induced by policies increased the environmental load placed on the environment and accelerated environmental destruction and pollution, and thereby delayed the response of control measures. (2) Industrialization promoted by centralized decision-making processes slowed awareness of environmental pollution and other social issues and led to haphazard and passive control measures being taken. (3) The methods of industrial policies used to achieve industrialization were effective, although in the short term, they were no more than passive pollution control measures by direct regulations. (4) The limited success of industrial pollution control measures also served to impede formation of the kind of decentralized decision-making systems, for example, institutionalization of environmental assessment and public participation in long-term plans for national land utilization, that were required in order to find fundamental solutions to environmental problems and improve amenities."

"In the process of industrialization based on the development-first policy, industrial policies were important methods. Based on Japan's experience, industrial policies were sometimes accompanied by strong government regulatory authority, however, nothing like the forceful regulations of a controlled economy were attempted and the government was basically content to limit its role to that of coordinator. **The problem was that, even when it came to industrial pollution control measures, because the industrial policy approach of negotiation and coordination between the government, individual enterprises and industry was retained, it became difficult to form policies and systems that adequately reflected the preferences and interests of ordinary citizens.**

TERAO Tadayoshi, "Kaihatsu to Kankyo no Seiji Keizaigaku wo Megutte", TERAO Tadayoshi / OHTSUKA Kenji (ed.), *Kaihatsu to Kankyo no Seisakukatei to Dynamism – Niho no Keiken Higashi Asia no Kadai*, Institute of Developing Economies, 2002, pp. 23-25

[24] Japan Environment Association, *OECD Report: Nihon no Keiken – Kankyo Seisaku ha Seikoshitaka*, 1978, p.19

1.2.2 Legal Framework of Pollution Control Measures

a. Establishment of Legal Systems (up to the early 1970s)

As was demonstrated in the enactment of pollution control ordinances by the metropolitan government of Tokyo in 1949 and enactment of pollution control ordinances for business establishments by Kanagawa Prefecture in 1950, prefectural governments promoted organization and institution building earlier than the central government. The first pollution legislation at the national level was the Industrial Water Law of 1956, which was intended to counter ground subsidence. In the following years, the following organizations and legislation were established up to the first half of the 1970s.

Table 1.2.1 Institutional and Legislative Structures relating to Industrial Pollution Control

Year	Institutions / Organizations	Laws enacted
1956		Industrial Water Law
1958		Water Quality Protection Law Industrial Wastewater Control Law
1961	Pollution Section was established in the Environmental Health Division of Ministry of Health and Welfare.	
1962		Soot & Smoke Control Law
1963	Ministry of International Trade and Industry established Industrial Pollution Division.	
1964	Ministry of Health and Welfare established Pollution Division. Office of the Prime Minister established an Inter-ministry Liaison Committee for Pollution Control.	
1965	Ministry of Health and Welfare established a pollution control council Diet (Upper and Lower Houses) established an special committee for industrial pollution control	Pollution Control Service Corporation Law
1967		Basic Law for Environmental Pollution Control
1968	Economic Planning Agency established Water Quality Division	Air Pollution Control Law Noise Regulation Law
1969		Measures for the Relief of the Pollution-related Patients
1970	The government established pollution control headquarters (organization headed by the prime minister that manage all countermeasure relating to pollution, and Conference on Environmental Pollution Control	Basic Law for Environmental Pollution Control (amended) Air Pollution Control Law (amended) Noise Regulation Law (amended) Pesticides Regulation Law (amended) Water Pollution Control Law Waste disposal and Public Cleansing Law Law concerning the Special Measures for Environmental Pollution Disputes Law for the Punishment of Environmental Pollution Crimes relating to Human Health

Year	Institutions / Organizations	Laws enacted
1971	Establishment of the Environment Agency, Central Council for Environmental Pollution Control	Law for the Establishment of Organization for Pollution Control in Specified Factories
1973	Environment Agency established Training Institute for Pollution Control.	Pollution-related Health Damage Compensation Law Industrial Location Law Law concerning Examination & Regulation of Chemical Substances
1974	Environment Agency established National Environment Research Institute.	
1975		Law concerning Public Pollution Control Works by the Expense of Business Operators

b. Before Implementation of Comprehensive Industrial Pollution Control Measures

The foundations for comprehensive industrial pollution control measures were established in 1967 with enactment of the Basic Law for Environmental Pollution Control. However, national pollution policies prior to this are introduced here.

Early laws relating to industrial pollution were as follows:

- 1956: Industrial Water Law (related to groundwater regulations)
- 1958: Industrial Wastewater Control Law, Water Quality Protection Law
- 1962: Soot & Smoke Control Law

As for ground subsistence, in response to serious damage in buildings and public facilities, and the like caused by ground subsidence resulting from groundwater pumping for industrial water supply, the Industrial Water Law was enacted and put into effect in order to control groundwater intake. This legislation was effective in rationalizing water use.

The Industrial Wastewater Control Law and Water Quality Protection Law resulted in the development and introduction of wastewater treatment systems, although these were regarded as not fully effective. Similarly, the Soot & Smoke Control Law only had a minor regulatory effect, although it too resulted in the technical development and introduction of soot control measures.

The Ministry of Health and Welfare prepared draft bills for a living environmental pollution control standard law twice in 1955 and 1957. This legislation was intended to prevent pollution and promote the creation of a healthy living environment. However, in the face of opposition claiming that such legislation was premature by the Japan Federation of Economic Organizations, Japan Chemical Industry Association, Tokyo Chamber of Industry and Commerce and Kansai Economic Federation, and the like, the government split over this bill and it eventually came to nothing. During this period, pollution spread out of control throughout the country[25].

c. Enactment Policy Framework of the Basic Law for Environmental Pollution Control

It was after 1964 that policy debate concerning pollution control measures began in earnest. The debate and preparation of the Basic Law for Environmental Pollution Control from 1965

[25] SHOJI Hikaru / MIYAMOTO Kenichi, *Osorubeki Kogai*, Iwanami Shoten, 1964, p.75

to 1967[26] started the approach and policy framework about environmental pollution officially.

The Basic Law for Environmental Pollution Control of 1967 established the basic framework for pollution control measures in Japan. The following paragraphs describe the salient background and course of the legislation.

Concerning the background of legislation, nobody doubted the existence of serious pollution was spread as described earlier, in particular the damage to human health and life caused by Minamata disease and Yokkaichi asthma, this being evidenced by the up-swell of public protests against such harm. The government organized a special survey team to investigate air pollution in Yokkaichi in 1963, and also organized an industrial pollution study team (known as the Kurokawa Study Team) to implement a comprehensive preliminary survey of industrial pollution accompanying development, i.e. an environmental impact assessment, at the petroleum industrial complex planned in Numazu-Mishima. The plan for development of the Numazu-Mishima petroleum industrial complex was eventually scrapped the same year after Mishima municipal government came out against the project and the city assembly of Numazu City adopted a resolution of opposition

Next, in 1964 the first pollution control agreement in Japan was signed between Yokohama City and a developer of a power plant. In the same year, the Japan Federation of Bar Associations called on the government to enact the Basic Law for Environmental Pollution Control.

The Kurokawa Study Team published its findings in April 1969 in a report containing a wide variety of recommendations; however, the issue was how to respond to these, and this became the starting point for the Ministry of Health and Welfare to examine the Basic Law for Environmental Pollution Control.

With this background, on the central government level, the Ministry of International Trade and Industry set up an industrial pollution division in 1963, and the Ministry of Health and Welfare established a pollution division in 1964. The same year, the Inter-Ministry liaison committee for the promotion of pollution control measures was established in the Office of the Prime Minister, while special committees on industrial pollution control were established in both houses of the Diet. Both the ruling and opposition parties put pollution control at the top of their list of policies. Underpinned by the up-swell in public feeling, local governments became more vociferous in their criticisms and demands regarding pollution administration by the central government and the political debate between conservative and progressive interests began to grow.

In October 1965, the Environmental Pollution Control Council was established in the Ministry of Health and Welfare, and started deliberations on pollution control measures in general. Similarly, the Ministry of International Trade and Industry started deliberations in its Council on Industrial Structure. The Environmental Pollution Control Council deliberated for approximately one year before submitting its findings to the Minister of Health and Welfare in October 1966. Based on this report, the Ministry of Health and Welfare compiled and published an outline of draft proposals on the Basic Law for Environmental Pollution Control.

In response to this, the various government agencies in charge of economic affairs called for harmony with the sound development of industry and economy. Moreover, the Japan Federation of Economic Organizations claimed that it was inappropriate to discuss pollution control measures only from the standpoint of environmental protection and that the pollution

[26] HASHIMOTO Michio, *Kankyo Seisaku*, Komuin Kenshu Sosho, 1999, p.79

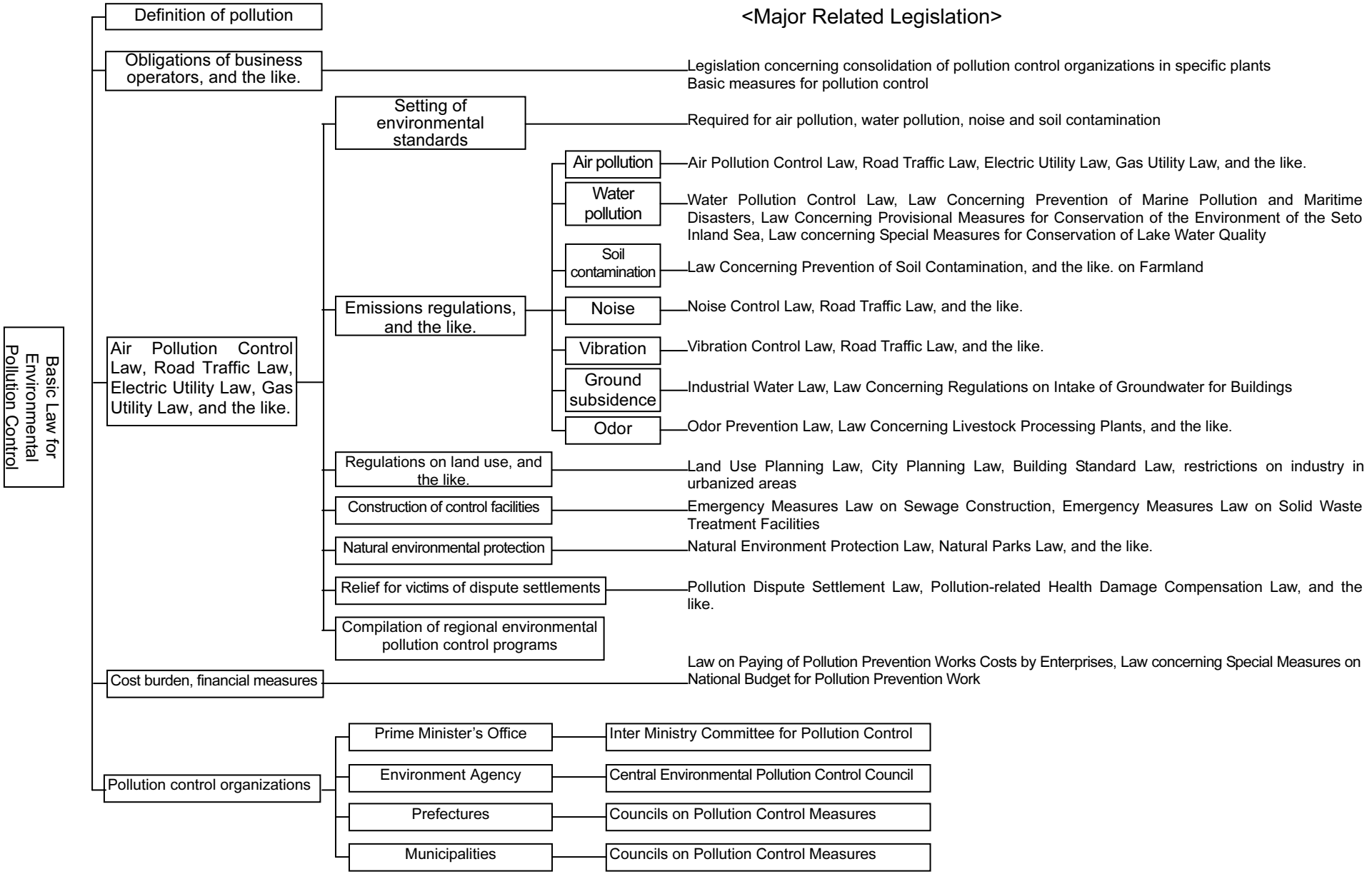
control responsibilities of enterprises should not be unlimited but should rather be held to reasonable levels. The other major industry associations also opposed the draft bill[27].

Following the staging of 34 meetings by the liaison conference for the promotion of pollution control measures and four meetings of administrative vice-ministers, the outline of draft proposals for the Basic Law for Environmental Pollution Control was finally compiled and publicly announced with Cabinet approval in February 1967. The draft was put into statutory form mainly within the Ministry of Health and Welfare, presented to the Diet in May 1967, and officially became law in July that year.

The Basic Law for Environmental Pollution Control was intended to establish common goals, principles and approaches within administrative organizations. Although it was not an administrative procedure law, it clarified the definition of pollution and institutionalized comprehensive pollution control policies by the government as well as the integrated basic policy of environmental standards and pollution control planning.

The structure of measures under the Basic Law for Environmental Pollution Control is as follows.

[27] HASHIMOTO Michio, *Shishi Kankyo Gyosei*, Asahi Sinbunsha, 1988, p.112
KAWANA Hideyuki, *Document Nihon no Kogai Volume 2 - Kankyotyo*, Ryokufu Shuppan, pp.86-90



Source: TAKATSUJI Masami / TSUJI Kiyoaki (ed.), *Gendai Gyosei Zenshu 19 - Kankyo*, Gyosei, 1985

Figure 1.2.1 Structure of Basic Law for Environmental Pollution Control and Relevant Laws and Regulations

d. Environmental Standards

Under the Basic Law for Environmental Pollution Control of 1967, enactment of environmental standards was made the responsibility of the government. These standards were defined as, "Standards that are desirable to maintain for the protection of human health and preserving the living environment." Environmental standards were established in the four areas of environmental media, i.e.; air, water, noise and soil.

These environmental standards were not maximum permissible limits, but rather were set as standards that were desirable for more vigorous maintenance. As was indicated above, environmental standards were administrative targets that were subject to monitoring. Where the government found the standards were not met, the law held the government responsible for taking the pollution control measures necessary to achieve the standards. Therefore, environmental standards were significant as the starting point of pollution control.

Environmental standards consisted of those relating to human health and those relating to the living environment. Health-related standards were uniformly applied throughout the country, whereas living environment-related standards allowed prefectures and other local governments to apply standard values according to actual local conditions.

It was prescribed that environmental standards should be set based on scientifically verified relationships between pollutant quantities and human health and the living environment, and the like.[28] In the Basic Law for Environmental Pollution Control, it was stipulated that the government should make periodic scientific judgments and carry out revisions when necessary. As a result of new scientific discoveries and accumulation of knowledge, the environmental standards for NO_2 were revised in 1978 and new standards concerning hazardous substances were added.

In the process of establishing environmental standards, the Director-General of the Environment Agency referred the issue to the Central Council on Environmental Control Measures, and the Environment Agency issued a notification based on the resulting report from the Council.

BOX: Environmental Standards

For items requiring the setting of environmental standards, the Central Council on Environmental Control Measures established a specialist committee composed of experts from each field. The committee examined criteria based on scientific know-how classified according to, a) impact on human health, b) impact on living organisms other than humans, and c) impact on the living environment, conducted analysis and examination of measurement methods of the actual state of pollution, and prepared a report that would provide the basic data for submitting the report on setting standards. Concerning impact on human health, available materials on a) animal experiments, b) experiments on human volunteers, and c) epidemiological surveys, and the like were utilized.

Environmental standards for air pollutants were established as standards pertaining to protection of human health; however, in view of their character as administrative non-binding targets for environmental protection, actual values of standards did not signify scientific maximum permissible levels. Environmental standards concerning air pollution were set for five items: sulfur dioxide, carbon monoxide, suspended particulate matter, nitrogen dioxide, and photochemical oxidant.

Environmental standards for water pollutants pertaining to human health were set by referring to WHO drinking water criteria, factors that were unique to Japan taken into account.

[28] Central Council for Environment Pollution Control Report of October 7th, 1966

e. Environmental Pollution Control Plans

Another specific measure based on the Basic Law for Environmental Pollution Control was compilation of "environmental pollution control plans" by local governments. Areas that required comprehensive and local pollution control measures due to occurrence or risk of occurrence of concentrated pollution were designated as regional environmental pollution control planning areas by the Prime Minister, who instructed prefectural governors to compile plans upon hearing the opinions of prefectures and receiving resolution by Inter Ministry Liaison Committee for Pollution Control[29]. The Prime Minister then approved the resulting plans compiled by prefectural governors[30].

Since it was difficult to maintain environmental standards simply by strengthening regulations on emissions at sources, regional environmental pollution control programs were regarded as land use control measures by, for example, regulating the location of emission sources in areas of extreme pollution occurrence.

Concerning the pollution control measures adopted by prefectures, regional environmental pollution control programs prescribed regulations on emission sources, location guidance, appropriation of land use, measures for SMEs, pollution control projects (sewage, waste management facilities, buffer green belts, monitoring and measurement setups, and the like) and pollution-related projects (park and green belt development, traffic control measures, and the like). These plans underwent review every five years. Areas targeted by such plans covered all major industrial cities and urban areas throughout Japan between 1971-1977. As of 1980, the number of such areas was 47, accounting for approximately 9% of the national land area, 54% of the population, and 66% of the value of manufactured product shipments, and the like. In 2003, the number of the areas was 32.

Pollution control measures by local governments prescribed in the Law Concerning Government Budget Special Measures for Public Pollution Control Works (1971) were entitled to a higher level of central government financing and subsidization as well as special local government budget measures.

f. Emission Controls

As was indicated in the diagram shown earlier, regulations concerning emissions of pollutant substances from emission sources were prescribed under individual control laws. Emission/effluent standards are described in articles 3 and 4, but these standards were characterized by the fact that they underwent phased application in consideration of the economic capacity of enterprises. Moreover, strengthening of standards was carried out in line with technical advances.

In areas that could not attain their environmental standards, unique follow-up standards were set, and if it was still difficult, measures based on total amount control of pollutants were implemented.

g. Environmental Protection in Land Use

The City Planning Law designated special use districts such as exclusive industrial areas, and the like within urbanized areas to prevent pollution. Also, the government strengthened application of the "Law Concerning Restriction of Industry, and the like in Regulated Urban Area in the Metropolitan Area (1959)" and the "Law Concerning Restriction of Industry, and the like in Regulated Urban Area in the Kinki Region (1964)." Moreover, the Industrial Relocation Promotion Law enacted in 1972 adopted measures to control location of new

[29] Inter-ministry Liaison Committee for Pollution Control was headed by the Prime Minister and consisted of staffs of relevant ministries. Since the enactment of the Basic Environment Law, the Minister of Environment has been leading the Committee.

[30] The responsibilities lay the Prime Minister on the Basic Law for Pollution Control but transferred to the Minister of the Environment when the Basic Environmental Law was put into effect.

industries in major urban areas and to encourage relocation of factories from transfer-promotion areas to inducement areas as well as attraction of new factories to inducement areas as means of promoting the proper location of industry.

In addition, the Pollution Control Service Corporation and Japan Small Business Corporation promoted the relocation of small, medium and micro factories operating in mixed residential and industrial areas in large cities. Moreover, the Factory Location Law (revised in 1973) established standards for the location of factory facilities, and the like and promoted measures for "greening" of factories and so on (see section 1.8.5 for details).

h. Cost Burden and Fiscal Measures

h.1 Cost Burden of Public Pollution Control Works

In accordance with the provision of Article 22 of the Basic Law for Environmental Pollution Control that stated, "Business operators shall bear in whole or part the cost of measures implemented by the central or local governments for the control of pollution from the operator's activities," the Law concerning Burden of Public Pollution Control Works Costs by Operators was established on December 25, 1975.

Public pollution control works referred to those implemented by the central or local governments concerning the dredging of public water bodies that were polluted by industrial activities, dredging of water bodies, construction of buffer green zones in industrial areas, sewage works, installation of noise control facilities for schools, and so forth. The burden of such costs to be paid by operators was determined by local governments upon taking the views of local environmental pollution control councils into account.

A total of 66 public pollution control works costing 155 billion JPY were implemented between 1976 and December 1984, and the burden of these imposed on operators amounted to approximately 76.1 billion JPY or 49.1%.

Incidentally, concerning the remaining costs borne by local governments, steps were taken in accordance with the above-mentioned Law Concerning Government Budget Special Measures for Public Pollution Control Works (1971).

h.2 Pollution Control Subsidies

Article 24 of the Basic Law for Environmental Pollution Control stipulated that the national government should strive to take financial measures to support business operators, in particular to give special consideration to SMEs[31].

In accordance with this, measures were adopted concerning loans by government financial agencies including the Pollution Control Service Corporation, construction & transfer projects by the Pollution Control Service Corporation, and a tax exemption system for pollution control measures, and the like (see section 1.8.2 for details).

i. Private Sector Pollution Control Setups

The Law for the Establishment of Pollution Control Organizations in Specified Factories was enacted in June 1971 to promote organized pollution control activities in factories. Under this law, specified factories were obliged to appoint pollution control supervisors for overseeing pollution control activities, and pollution control managers, and the like possessing the expert knowledge and skills required for pollution control. A system of national examinations for pollution control managers was also established in an effort to develop the required human resources (see section 1.8.4 for details).

[31] Financial assistance to back up companies' efforts was inherited to the Basic Environment Law, but special consideration for SMEs was removed.

Factories and business establishments that discharged effluent and emission gases from facilities targeted by regulations were required to measure concentrations of pollutants at set intervals under the Air Pollution Control Law and Water Pollution Control Law. In line with this, in order to secure greater reliability of environmental measurements, the Measurement Law (1951) underwent revision in 1972. As a result, application of the law was extended to densitometers and noise meters, and the designated certification agency system was established to ensure that these measuring devices were certified by reputable agencies. Furthermore, in the revision of 1974, environmental measurement certification concerning concentrations and noise levels, and the like was added to certification schemes, and the new classification of certified environmental measurer was added to the certified measurer system. In addition, business operators conducting measurement authentication schemes were required to register with prefectures.

j. Environmental Assessment

Since the Environmental Impact Assessment Law had not been enacted until 1997, it is generally believed that Japan was very slow to introduce the environmental impact assessment system. However, in 1965, the Ministry of International Trade and Industry implemented a comprehensive preliminary survey of industrial pollution pertaining to air and water quality and assessed the environmental impacts of new and additional construction of factories in areas of large-scale industrial concentration by using scientific forecasting techniques[32]. This comprehensive preliminary survey was continued up to 1985.

Since this survey did not originally carry any legal binding force, assistance to corporations was limited to administrative guidance. However, based on the Factory Location Law revised in 1973, surveys for control of pollution in line with factory location came to be implemented in order to prevent complex pollution in areas of projected concentration by large factories, and comprehensive preliminary surveys came to be implemented with strong legal backing. As a result of such surveys, factories intending to locate in districts that were designated by the Minister of International Trade and Industry were required to notify the Minister of peak emissions/discharges of air and water pollutants, and in cases where problems were found to exist, the Minister was empowered to recommend necessary countermeasures to the operators concerned[33]. Based on this setup, measures considering environmental impacts accompanying factory location in areas of factory concentration came to be implemented, and the fact that these measures in reality were equivalent to environmental impact assessment deserves special mention (see section 1.8.5).

k. Controls on Manufacturing of Chemicals

Although not included in the framework of the Basic Law for Environmental Pollution Control, the Chemical Substances Control Act, which was significant for industrial pollution control measures, was enacted in 1973. A major factor behind this legislation was the PCB contamination that became a major social problem in 1971[34].

The aim of this law was to examine the safety of chemical substances and prevent environmental pollution before it happened. The law imposed an obligation for notification and regulations concerning the granting of permission for the manufacture, import and use of persistent, accumulative and chronically toxic specified chemical substances. Concerning new chemical substances, the law required that substances be submitted to the responsible

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[32] 'Preliminary Study for Comprehensive Industrial Pollution' carried out by the Ministry of International Trade and Industry since 1965 was an environmental impact assessment with scientific approach. Paralleling to this study, the Agency of Industrial Science and Technology developed various technique such as study approach, forecasting method and simulation. Outcomes from these activities contributed to improve EIA capacity of consultants. (Japan Society for Atmospheric Environment (ed.), *Nihon no Taiki Osen no Rekishi III*, 2000)

[33] Ministry of International Trade and Industry, *History of International Trade and Industry Policy,* Volume 15, 1991

[34] Ibid.

minister for review under the above three items and classification (or not) as specific chemical substances.

l. Study and Research

Concerning the role of the state, the Basic Law for Environmental Pollution Control stipulated the implementation of studies needed to compile pollution control measures (Article 14) and the promotion of science and technology (Article 15).

Prior to establishment of the Basic Law for Environmental Pollution Control, the Ministry of International Trade and Industry commenced research and development into pollution control technologies through the Agency of Industrial Science and Technology which had been under its jurisdiction since 1965. Its research and development into flue-gas desulfurization technology, implemented from 1966 to 1971, was a well-known major technical development project of this period.

The Environment Agency commenced study and research into pollution control measures, and the like with establishment of the National Institute for Environmental Studies in 1974. Related ministries and agencies also initiated their own study and research programs. The Ministry of Education established a grant system for subsidizing scientific environmental research at universities, and the like. Moreover, the Environment Agency compiled the budget measures for the environmental protection study and research activities of all these related agencies in the government.

m. Publicity and Environmental Education

The Basic Law for Environmental Pollution Control stipulated that the government should disseminate knowledge concerning pollution and enhance public awareness towards pollution control.

n. Relief for Health Damage

Because of the high cost of treating patients with health problems caused by industrial pollution, and due to the fact that compensation of expenses under civil law systems took too long to provide relief, it became necessary to establish a system for providing immediate relief to victims of pollution-related health damage. Yokkaichi City established the first such relief system in 1965, and this was followed by similar systems by other local governments. Following enactment of the Basic Law for Environmental Pollution Control, the central government established the Special Measures Law for Relief of Health Damage Caused by Pollution (the Relief Law) in December 1969 as a unified national system. However, the Relief Law was no more than an emergency measure and did not include any compensation for lost earnings. The fact that the Relief Law could provide no compensation for such damages did not become apparent until the strict liability of the accused was recognized by the verdict in the Yokkaichi litigation in July 1972.

Accordingly, in order to provide smooth institutionalized relief for victims in damage compensation cases that were conventionally settled in civil proceedings between causing parties and victims, the Relief Law was scrapped and replaced with the Pollution-related Health Damage Compensation Law in October 1973 (see section 1.3.2 for details).

o. Dispute Settlement and Crackdown on Environmental Pollution Crimes

o.1 Dispute Settlement

Article 21 of the Revised Basic Law for Environmental Pollution Control of 1970 called on the government to set up a system for settling pollution disputes by conciliation and arbitration, and the like. In response to this, the Environmental Pollution Dispute Settlement Law was enacted in 1970. This law stipulated that environmental grievance counselors be assigned to prefectures and municipalities.

The same law also established a system for environmental pollution dispute settlement by administrative agencies separate from the law courts in cases where both sides were unable to reach a satisfactory agreement.

o.2 Crackdown on Environmental Pollution Crimes

The Air Pollution Control Law, Water Pollution Control Law and Waste Management Law each stipulated penalties for violations. In addition, based on the Law Concerning Punishment of Environmental Pollution Crimes Affecting Human Health that was enacted in December 1970, the police started to consider violations of the law as environmental pollution crimes.

1.2.3 Administrative Organizations Concerning Environmental Pollution Control Measures

a. National Level

The highest-ranking organization was the Inter-ministry Liaison Committee for Pollution Control, which was chaired by the Prime Minister and was composed of the heads of related ministries and agencies based on the Basic Law for Environmental Pollution Control. The Environmental Pollution Control Measures Headquarters to deal with pollution issues was established based on Cabinet resolution in 1970 and contributed to establishment of environmental pollution-related legislation. However, this was merely an ad hoc agency, so establishment of a permanent administrative organization based on law was demanded. In response to this, the decision to establish the Environment Agency was made at the end of 1970[35].

With the establishment of the Environment Agency in 1971, a national environmental control measure administration that had previously been managed by 13 ministries and agencies was unified under a single organization. The main duties of the Environment Agency were to execute and coordinate environmental protection administration beginning with pollution control. In specific terms, its duties could be summarized as follows:

- Setting of environmental standards
- Environmental pollution regulations covering monitoring, measurement and control, and the like.
- Estimation of environmental protection budgets for each ministry and agency
- General coordination of environmental administration including the blanket accounting of examination and research expenses, and the like.
- Research of impacts of environmental pollution on human health and the living environment, and the like.

However, jurisdiction over solid waste and sewage remained with the Ministry of Health and Welfare[36] and the Ministry of Construction, respectively.

b. Local Level

Environmental pollution administrative organizations at the prefectural level rapidly advanced from 1965 onwards and spread to all prefectures following enactment of the Basic Law for Environmental Pollution Control in 1967 (see section 1.7.4 for details).

As a result of the Basic Law for Environmental Pollution Control, local governments assumed responsibility for promoting control measures, implementing monitoring, regulation and guidance, and settling grievances and disputes concerning all aspects of environmental

[35] Industrial Location and Environmental Protection Bureau at the Ministry of International Trade and Industry, *Industry and Pollution*, 1977, p.22

[36] Waste administration was integrated into the Ministry of the Environment by the reorganization of government ministries in 1999.

pollution such as air pollution and water pollution, and the like. In more specific terms, prefectures mainly implemented wide area control measures and coordinated the measures conducted by municipalities. Environmental pollution research institutes and environmental pollution centers were established in almost all prefectures.

Departments specializing in environmental pollution and specially appointed personnel were assigned in numerous municipalities. Some major cities also established their own environmental pollution research institutes and environmental pollution centers.

The Basic Law for Environmental Pollution Control also required prefectural governments to establish environmental pollution control councils and enabled municipalities to do the same based on ordinances.

1.3 Air Pollution Control

1.3.1 Background of Air Pollution Control

a. From Meiji to WWII

Following the Meiji Restoration, the government embarked on a policy of industrialization, and air pollution generated by the spinning, copper refining and iron manufacturing industries, and the like occurred in major cities and areas around refineries. In Osaka, where industrialization started early, citizens aggrieved by black smoke from coal-burning factories complained of smoke problems, and a smoke control ordinance prohibiting the construction of forging and copper blowing plants in certain areas was passed by Osaka Prefecture in 1883. Then in 1888, Osaka Prefecture passed an order prohibiting construction of smoke-generating factories with chimneys within the former limits of Osaka City.

At the central government level, the Factory Law was promulgated in 1911. Article 23 of this empowered administrative officers to order business owners to prevent or remove plants or incidental facilities that harmed the public good or suspend operation of such facilities in whole or part where necessary. The Factory Law was eventually enforced in 1916, and prior to this, factory superintendents were assigned to the National Police Agency and eight prefectural police agencies, and prefectural governors were empowered to require factories to implement controls concerning factory safety and public health. However, even though citizens aggrieved by air pollution made demands to close down factories based on the Factory Law, no direct action was taken, so this legislation failed to have any effect in terms of air pollution control[37]. The Factory Law was subsequently scrapped under special wartime administration legislation in 1943.

b. Postwar Reconstruction Period

Factories everywhere resumed operations in the years following the end of WWII. However, since coal was the main source of energy in industrial areas, air pollution caused by intensified dust fall, and cases of damage to human health and vegetation around factories started to appear[38]. Local governments, which bore the brunt of citizen grievances, were hurried into taking countermeasures[39], as typified by the adoption of environmental pollution control ordinances by Tokyo City in 1949, Osaka Prefecture in 1950, Kanagawa Prefecture in 1951 and Fukuoka Prefecture in 1955. However, such measures offered only limited solutions to the burgeoning industrial pollution, which became so serious that the amount of dust fall in major cities exceeded 10 tons/km^2 per month (see Figure 1.3.1).

Meanwhile, as the primary source of energy gradually changed from coal to oil, the nature of air pollution also changed from dust-based pollution to sulfur oxide-based pollution while at the same time becoming more widespread and serious[40] (see Figure 1.3.2).

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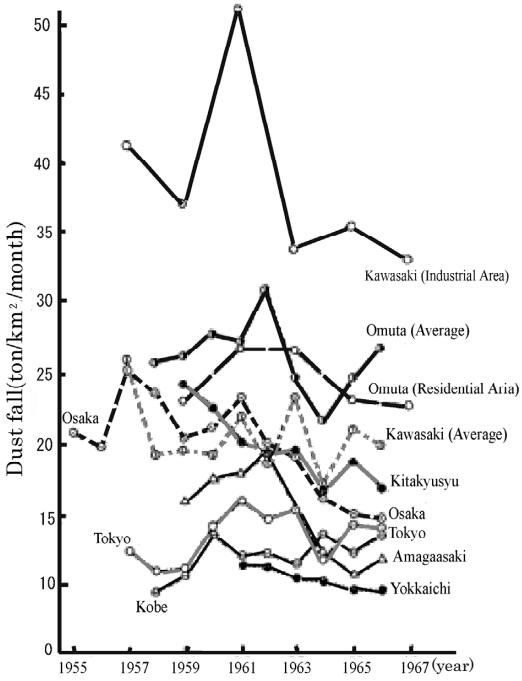
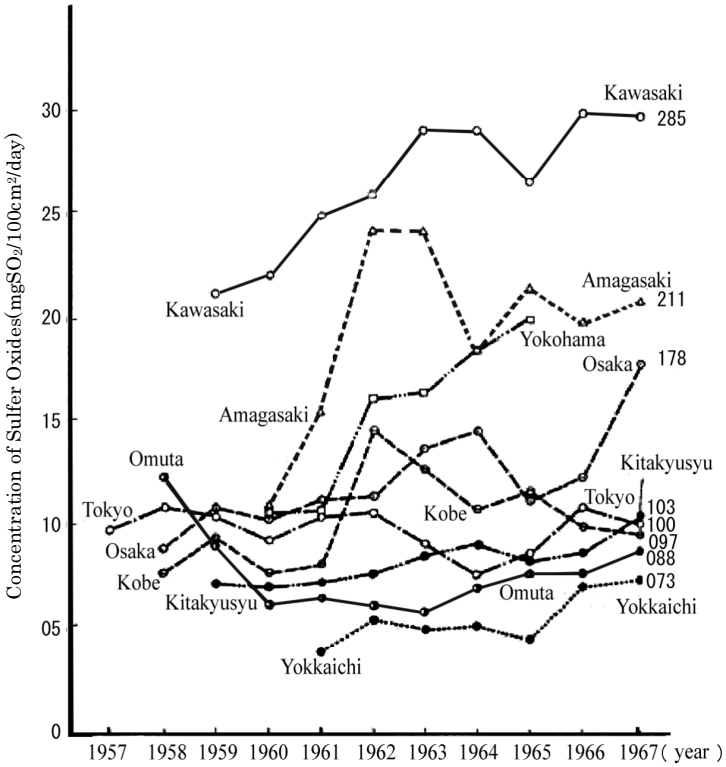
37 Japan Society for Atmospheric Environment (ed.), *Nihon no Taiki Osen no Rekishi I*, 2000, p.21
38 Japan Society for Atmospheric Environment (ed.), *Nihon no Taiki Osen no Rekishi III*, 2000, p.788
39 Japan Society for Atmospheric Environment (ed.), *Nihon no Taiki Osen no Rekishi I*, 2000, p.27
40 Executive Committee for Environment Agency's 20 Year-Anniversary Memorial Project (ed.), *20 Year History of Environment Agency*, Gyosei, 1991, p.6



Source: General Administrative Agency of the Cabinet, Ministry of Health and Welfare, *1969 White Paper on Environmental Pollution*

Figure 1.3.1 Changes in Amount of Dust Fall in Major Cities in Japan (1955-1967)



Source: General Administrative Agency of the Cabinet, Ministry of Health and Welfare, *1969 White Paper on Environmental Pollution*

Figure 1.3.2 Changes in Concentration of Sulfur Oxides in Major Cities in Japan (1957-1967)

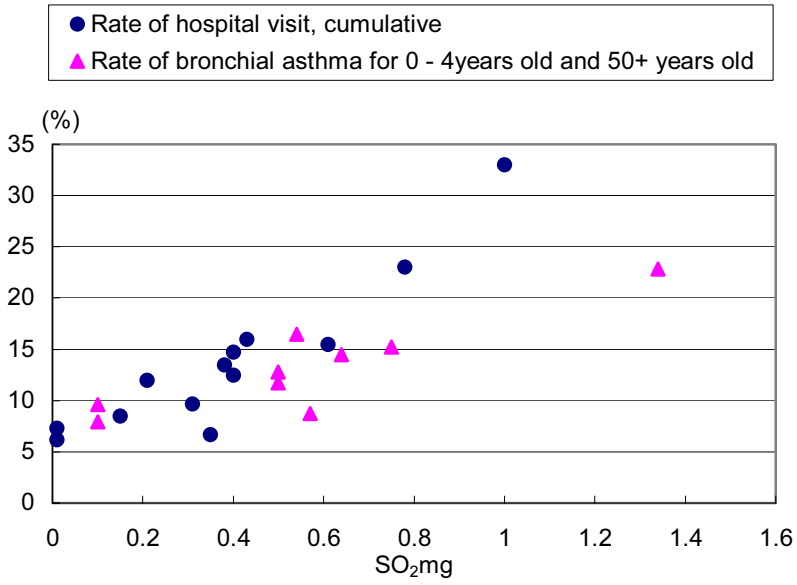
1.3.2 Damage Caused by Air Pollution

Damage caused by air pollution can be classified into damage to health, damage to agriculture and forestry, and damage to property.

a. Damage to Health

Ailments that are frequently attributed to air pollution include chronic bronchitis, bronchial asthma and asthmatic bronchitis. Although these diseases also occur in areas not affected by air pollution, the problem is that incidence rates increase as air pollution becomes more pronounced. Because of the difficulty in clarifying the cause-and-effect relationship between air pollution and ailments, the Ministry of Health and Welfare conducted a survey to compare disease incidence rates and fatality rates between citizens in polluted areas and citizens in non-polluted areas. The survey, which was implemented in Chiba, Yokkaichi and Osaka from 1965, clearly showed that increase in the level of pollution had an adverse effect on lung functions and the like[41].

A survey of health damage had already been carried out prior to this in Yokkaichi City in August 1968. In that survey, as a result of studying chronic bronchitis sufferers among males of 40 years and over, it was shown that incidence rates were at least three times higher in polluted areas. These sufferers of air pollution gradually strengthened their solidarity and staged campaigns to overcome their problems. A specific example of this was the Yokkaichi pollution litigation that was filed in 1967. In the course of this case, the dire nature of air pollution was brought out into the open[42].



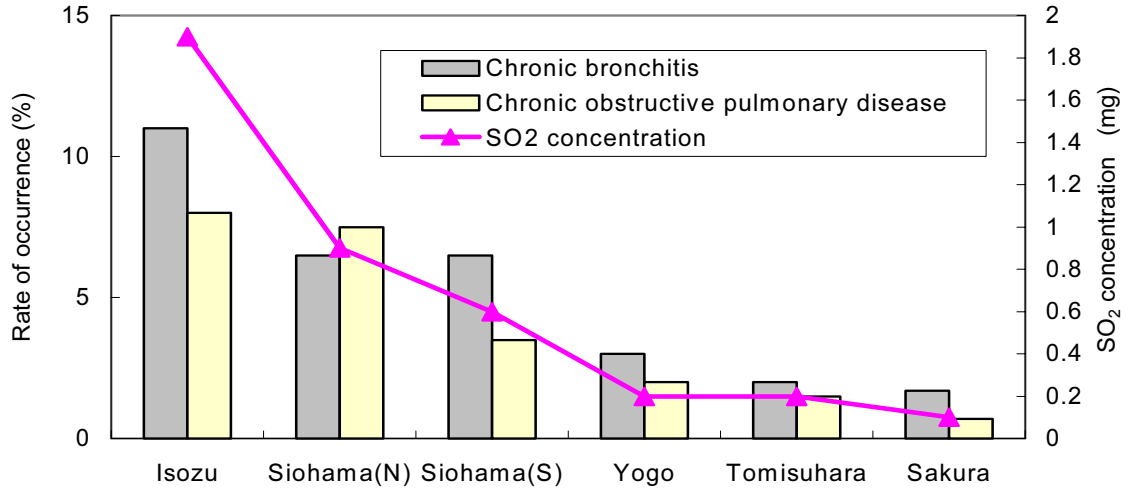
Source: Data from Prof. YOSHIDA at Mie University; 0-4 yrs old, 50+ yrs old, rate of bronchial asthma (April 1972 - March 1973), hospital visits by patients with 50+ yrs old for bronchial asthma (same period)[43].

Figure 1.3.3 Cumulative Number of Hospital Visits for Bronchial Asthma and Concentration of SO_2

41 Environment Agency, *1971 White Paper on Environmental Pollution*

42 Committee for Japan's Experience in the Battle against Air Pollution (ed.), *Japan's Experience in the Battle against Air Pollution*, Japan Times, 1997, pp.42-43

43 International Center for Environmental Technology Transfer, "Yokkaichi Kogai – Kankyo Kaizen no Ayumi", 1992, p.27 Table1-6
YOSHIDA Katsumi, *YokkaichiKogai*, Kashiwa Shobo, 2002, p.74



Source: Data from YOSHIDA Katsumi, *Yokkaichi Kogai,* Kashiwa Shobo, p.79, Figure 5-6

Figure 1.3.4 Occurrence of Chronic Bronchitis in 6 Wards in Yokkaichi-city

b. Damage to Agriculture and Forestry

Damage to agriculture and forestry occurred in areas with high factory concentration in the late 1960s.

Sulfur dioxide:	Rice paddy damage, silkworm poisoning, withering of orange leaves
Hydrogen fluoride:	Rice paddy damage, silkworm poisoning, and dropping, stunting, and withering of oranges and vegetables
Chlorine gas:	Rice paddy damage, mulberry leaf contamination, vegetable discoloration
Particulate:	Orange skin contamination

c. Damage to Property

Damage to property included damage to laundry, tin roofs, exterior wall painting and goods for sale, and the like.

The 1967 White Paper on Economics referred to damage to health and property caused by air pollution. Table 1.3.1 indicates the losses caused by air pollution in Kawasaki City in 1965 in terms of household budgets and damage to goods for sale. The said report had the following to say[44]:

"The cost of damage over the whole city in all households including shops is more than 1.7 billion JPY, which is equivalent to 0.5% of added value in Kawasaki (331.3 billion JPY in enterprises with 20 or more employees) in the same year. This breaks down as 399 million JPY in health damage, 727 million JPY in damage to housing and housing effects, and 593 million JPY in other lifestyle damages. In addition, in shop households, damage to goods and fixtures amounts to 19 million JPY. The cost per household is 6,941 JPY in ordinary households and 8,642 JPY in shop households. Although the estimation methods and survey items include some difference, another survey shows the cost of damage in Osaka (1965) to amount to 13 billion JPY or 1,000 JPY per household per year in terms of household budgets."

[44] Economic Planning Agency, *1967 White Paper on Economics*

Table 1.3.1 Examples of Estimated Damages caused by Air Pollution (in 1965)

	Total damages (million JPY)	Average compensation paid per household (JPY)
Health related	399	1,609
Cost of hospital visit or hospitalization	298	1,202
Cost of other preventive measures	101	407
Houses, and household article related	727	2,936
Cost of repair and improvement of the house	315	1,271
Cost of repair of household articles, interior, exterior, garden plants	412	1,665
Merchandise and equipment related	19	1,701
Cost of cleansing	9	790
Cost of returned goods	7	635
Other costs	3	276
Other damages in daily life	593	2,396
Cost of pest control and deodorization	159	640
Cost of cleaning in-, out-side house	73	296
Cost of purchasing necessary items	225	512
Cost of filling subsided land, and other miscellaneous cost	135	548
Total	1,738	7,022
(in which, per household)	1,642	6,941
(in which, per commercial household)	96	8,642

Note: Data from Kokumin Seikatu Kenkyujo
Source: Economic Planning Agency, *1967 White Paper on Economics*

1.3.3 Legal Systems Concerning Air Pollution Prevention

a. Soot & Smoke Control Law

As the Japanese economy grew dramatically, problems of air pollution crossed over the boundaries of local governments, so it became necessary to implement measures at the national level[45]. In 1962, the Soot & Smoke Control Law was enacted. This law, targeting soot, other particulates, sulfur dioxide and sulfur trioxide, designated areas of air pollution and established emission gas standards for each type of generating facility. In 1963, designated areas for control of soot and smoke were established and emissions standards were set. The first areas to be designated were the three major industrial regions of Keihin, Hanshin and Kitakyushu, and the government took its first steps towards air pollution control later that year. Although these emission controls were effective to a certain extent with respect to soot and particulates, controls for sulfur dioxide were loose (0.18-0.2%) and could be satisfied without resorting to emission gas control measures even if burning fuel with 3.0-3.5% sulfur content[46].

b. Air Pollution Control Law

The Basic Law for Environmental Pollution Control was enacted in 1967; as one of its specific laws, the Air Pollution Control Law was enacted in the following year (1968). This law, which represented a drastic revision to the above Soot & Smoke Control Law, expanded designated areas (enabling areas of projected pollution due to future concentration of factories to be designated from the preventive standpoint) and added automobile exhaust gas

[45] General Administrative Agency of the Cabinet at the Ministry of Health and Welfare, *1969 White Paper on Environmental Pollution*
[46] EX Corporation, "Technical Manual for Air Pollution Control – Petroleum Refining Industry", 2003, p.108

controls, K-value controls on sulfur dioxide and special emission controls (adoption of strict standards in new facilities) to existing controls.

The Air Pollution Control Law was revised in 1970. As a result of this, some of the major items of upgrading and strengthening were as follows:

1) The provision stating that environmental protection measures must be in harmony with sound economic development was removed from the stated objectives.
2) The designated area system of the former law was abolished, and controls were expanded to cover the whole country.
3) As the causes of air pollution, the scope of substances and facilities targeted by controls was expanded.
4) Measures pertaining to violations were reinforced by, for example, introducing direct penalties on nonconforming emission standards of soot and smoke.
5) Controls on fuel use were introduced in areas in which there was a risk of extreme air pollution due to SOx as a result of seasonal increases in fuel consumption.

To regulate sulfur oxide emissions, the central government introduced the K-value system, which specifies emission gas standards according to the height of a stack and the type of area where the stack could be located. Because flue-gas desulfurization technology was not far advanced at that time, it was necessary to promote high-stack dispersion in order to maintain and achieve environmental standards. However, this system was criticized for being ineffective to grouped small-scale smoke-generating facilities and only dispersing smoke rather than reducing the total emissions[47]. The regulation (K-value system) underwent strengthening 8 times up to 1976. Regulation of fuels, which required industries to use low-sulfur fuels, was introduced in 1970. Total amount control was introduced in 1974 to suppress sulfur dioxide emissions from individual sources.

The government set air quality standards for suspended particulate matter (SPM) and nitrogen oxides (NO_X) in 1972 and 1973 respectively, and this led to enhancement of regulations for soot and NOx. Concerning soot, it was not possible to guarantee regulatory values without installing dust collectors. However, because enterprises needed to install dust removal facilities which operates 8-10 years, target facilities were later expanded to smaller ones, but emission gas standards did not become stricter for some years. In contrast, the regulation on NOx was not strict at the time of its introduction since industries had not established the technology to comply with the regulation. As the improvements in fuel qualities and combustion systems as well as generalization of low-NOx burners and development of a NOx removal system converting NOx in exhausted gas into non-poisonous nitrogen (N_2), and steam (H_2O) went on, regulations for NOx were gradually strengthened. The total amount control of NOx was introduced in parts of Tokyo, Kanagawa and Osaka areas in 1981[48].

c. Environmental Standards

Based on the Basic Law for Environmental Pollution Control, the environmental standard for sulfur oxides was set in 1969 as a desirable standard for the protection of human health. Following this, based on scientific know-how deepened via revision of the Basic Law for Environmental Pollution Control and the Yokkaichi smog trial, and the like, the standard for sulfur oxide was revised as the standard for sulfur dioxide in 1973, and the standards for carbon monoxide, suspended particulate matter and optical oxidants were also established.

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47 Committee for Japan's Experience in the Battle against Air Pollution (ed.), *Japan's Experience in the Battle against Air Pollution*, Japan Times, 1997, p.67

48 EX Corporation, "Technical Manual for Air Pollution Control-Petroleum Refining Industry", 2003

d. Pollution-related Health Damage Compensation Law

In December 1969, the Law concerning the Special Measures for Relief of Pollution-related Patients (hereafter referred to as the Relief Law) was enacted to provide people whose health was damaged by industrial pollution along with the necessary administrative support. From March 1970, financial support and other assistance were provided to those living in certain areas officially designated as severe air pollution or water pollution zones and suffering from officially designated diseases. Half of these costs were borne by business operators, and the other by the central, prefectural and municipal governments[49].

In 1972, the Law Concerning Amendment of the Air Pollution Control Law and the Water Pollution Control Law including the strict liability clause, was enacted. According to this, irrespective of intent or error, in cases where environmental pollution activities generated damages in excess of maximum permissible levels, the parties causing the pollution would be held responsible for paying compensation. Nevertheless, the Relief Law failed to cover lost earnings and only provided limited payouts; moreover, people found it difficult to use the Strict Liability Law since they had to make time-consuming civil actions. Therefore, in order to protect pollution victims in a prompt and fair manner, the Pollution-related Health Damage Compensation Law (PHDC law) was introduced in 1973[50]. For environmental pollution-related health damage victims seeking satisfactory compensation, and also for industries seriously affected by the frequent occurrence of pollution, the new system was intended to create a certain type of insurance system[51].

In consideration of the fact that it was impossible to prove the cause-and-effect relationship between ailments such as chronic bronchitis and air pollution in every individual case, the PHDC law eased the difficulty in attesting causal relationships between air pollution and diseases in cases where those suffering from the designated diseases have lived in or commuted to the officially listed dangerously polluted areas, i.e. class A area, for a certain time. Under the PHDC law, those who were registered by the governor of a prefecture or the mayor of a city as a patient were provided with compensation, e.g. benefits package for medical expenses, disability compensation, bereaved family compensation, temporary payment of bereaved family compensation, child allowance, medical treatment allowance and funeral allowance. Polluters were obliged to pay for the compensation. For the compensation for air pollution related health damages such as chronic bronchitis, this was the money from the Pollution Load levy collected from industrial plants according to volume of sulfur dioxide emissions. Furthermore, because air pollution caused by automobiles could not be overlooked, a percentage of vehicle weight tax was allocated to pay 20% of the compensation payout. The PHDC law also proposed to restore, maintain and boost the health of parties aggrieved by designated diseases and to implement rehabilitation and treatment by environmental measures to prevent health damage. Concerning the cost of these measures, 50% was collected from responsible parties in the form of a pollution load levy, while the remaining 50% was borne by the central, prefectural and municipal governments of ordinance-designated cities[52].

The pollution load levy was charged to facilities generating at least 5,000 Nm^3 of emission gas per hour in type 1 areas designated by ordinance and at least 10,000 m^3 in other areas. The pollution load levy is reassessed every year according to the necessary cost of compensation payouts and the quantity of pollutant emissions (targeting sulfur oxides). In 1974, the levy rate for factories and business establishments was 15.84 JPY per 1 Nm^3 of sulfur oxide in type 1 districts designated by ordinance and 1.76 JPY in other districts[53].

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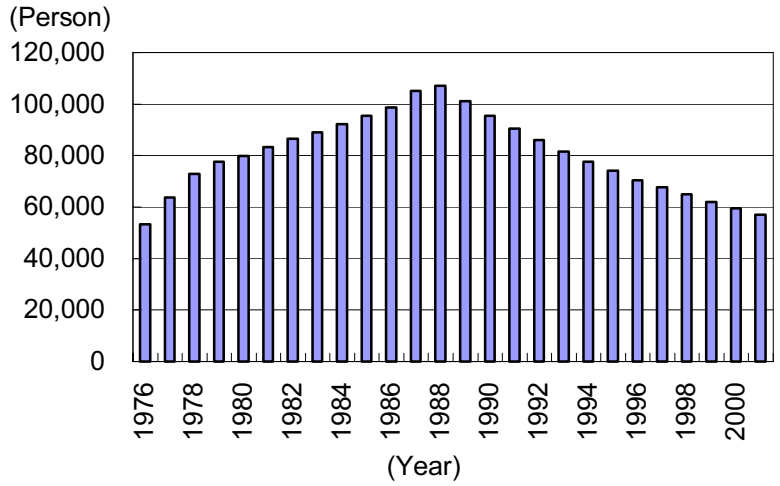
49 Environment Agency, *1974 White Paper on the Environment*
50 Environment Agency, *1975 White Paper on the Environment*
51 Committee for Japan's Experience in the Battle against Air Pollution (ed.), *Japan's Experience in the Battle against Air Pollution*, Japan Times, 1997, p.47
52 Environment Agency, *1974 White Paper on the Environment*
53 Environment Agency, *1975 White Paper on the Environment*

The number of patients recognized to be suffering from air pollution-related diseases under the PHDC law continued rising until 1988, when the figure reached 107,207. Since the air quality was improved after that, the system underwent review and, although it could not be denied that air pollution in general had an impact on the natural history of obstructive pulmonary diseases (chronic bronchitis, bronchial asthma, and the like), this impact was nothing like the level it was between the late 1950s and early 1970s. Accordingly, the designation of type 1 areas was cancelled on March 1, 1988, and no new patients have been recognized since then. As a result, the number of recognized patients has been declining ever since (see Figure 1.3.5). Nevertheless, compensation payouts to previously recognized patients have been maintained.

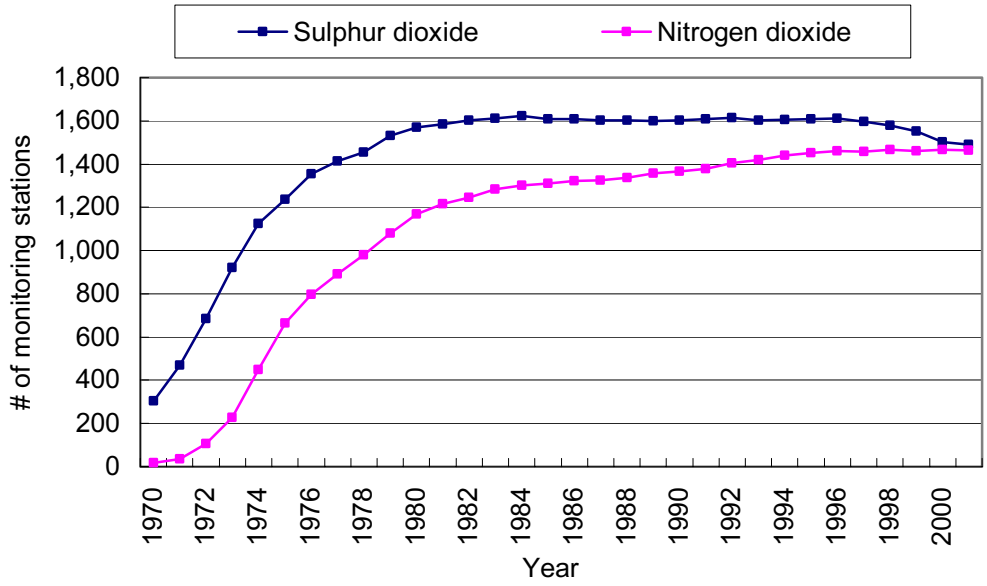


Source: Ministry of the Environment, *2003 Environmental Statistics*

Figure 1.3.5 Changes in Number of Patients with Air Pollution Induced Disease based on the Pollution-related Health Damage Compensation Law (1976-2000)

e. Air Pollution Monitoring

In Japan, air pollution monitoring is carried out in order to gauge local conformance with environmental standards, to obtain necessary data for setting local emissions standards, and to speed up emergency measures to deal with localized deterioration in air quality (advisories and orders to polluters to reduce emissions, restrictions on vehicular movement, and the like). Since the Air Pollution Control Law made it compulsory to continually monitor and disclose the results of air pollution conditions in prefectures and ordinance-designated cities, the installation of devices for automatically measuring and recording data on sulfur dioxide, dust, wind speed, wind direction and temperature, and the like was advanced. Monitoring stations that constantly monitor sulfur dioxide, nitrogen dioxide, suspended particulate matter and carbon monoxide were rapidly constructed throughout the country up to 1975, as can be seen in Figure 1.3.6. The central government provided subsidies for the installation of measuring devices, and the like necessary for the monitoring setup in prefectures and ordinance-designated cities (the subsidy rate is 1/2 in pollution control planning areas and 1/3 in other areas). Also, monitoring and measurement were implemented in local governments other than ordinance-designated cities.



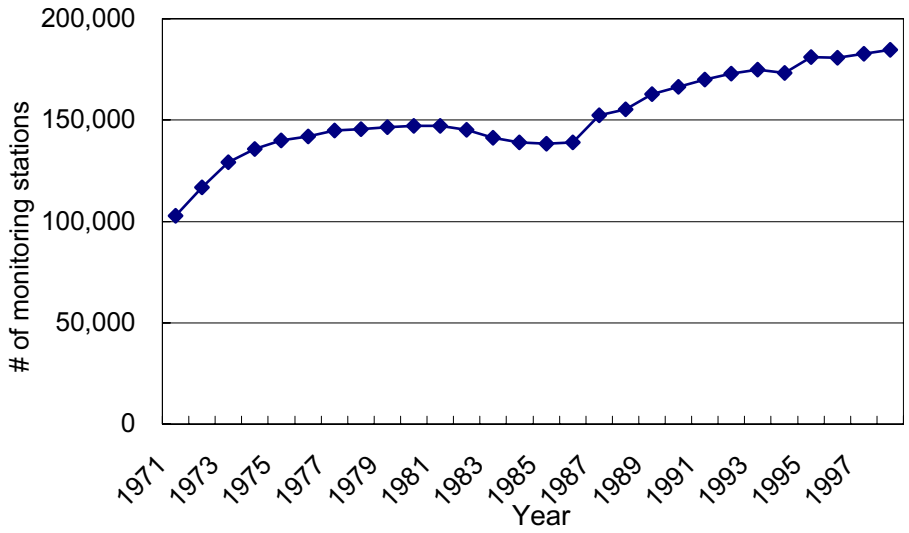
Source: Ministry of the Environment, *2003 Environmental Statistics*

Figure 1.3.6 Changes in Number of Air Pollution Continuous Monitoring Stations (1970-2000)

f. Implementation of the Air Pollution Control Law

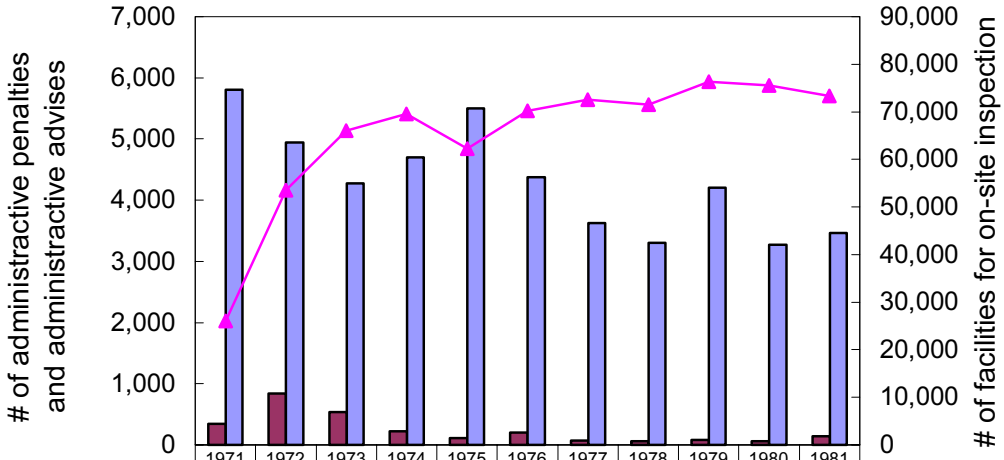
The Air Pollution Control Law was executed by prefectures (and ordinance-designated cities) in unison with related ordinances. Soot and smoke-generating facilities targeted by the law had to notify prefectural governors, and then prefectural employees undergo on-site inspections. Soot and smoke emissions that did not comply with emission gas standards were subject to penalties irrespective of deliberate or accidental cause. Moreover, with respect to facilities that continued to emit soot and smoke in violation of emission gas standards, prefectural governors could issue orders to improve treatment methods or temporarily suspend plant operations. Moreover, in cases where air pollution reached serious levels (determined by government ordinance), prefectural governors could inform residents of the situation and also demand that discharging parties reduce emissions. Figure 1.3.7 shows changes in the number of soot and smoke generating facilities.

Under the Air Pollution Control Law, governors are empowered to enter and inspect plants possessing soot and smoke generating facilities when deemed necessary. Based on this provision, soot and smoke generating facilities underwent regular inspection, prioritized on-the-spot inspections were implemented at problematic facilities, and guidance and recommendations were made at any time based on the resulting findings. As is shown in Figure 1.3.8, which shows conditions regarding the implementation of on-the-spot inspections and improvement orders, there were no emission gas standard violations (prosecutions) but, in addition to improvement orders and fuel standard conformance recommendations based on law, numerous other instances of administrative guidance not based on the law were conducted.



Note: Exclude soot/smoke generating facilities that are categorized as electric/gas facilities.
Source: For 1971 - 81: Environment Agency, *White Paper on the Environment*, for 1982 - 85: Environment Agency, "Status of Enforcement of Air Pollution Control Law", for 1986 - 90: Ministry of the Environment, *2003 Environmental Statistics*, for 1991 - 98: Environment Agency, "Study on Current Status of Air Pollution from Stationary Sources".

Figure 1.3.7 Changes in Number of Soot/Smoke Generating Facilities (1971-1997)



	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
# of administrative penalties	342	838	532	222	113	202	67	63	78	65	142
Administrative advices without legislative base	5,809	4,942	4,271	4,700	5,500	4,374	3,629	3,303	4,202	3,269	3,463
# of facilities targeted for on-site inspection	26,032	53,467	66,027	69,526	62,230	70,160	72,558	71,487	76,377	75,550	73,366

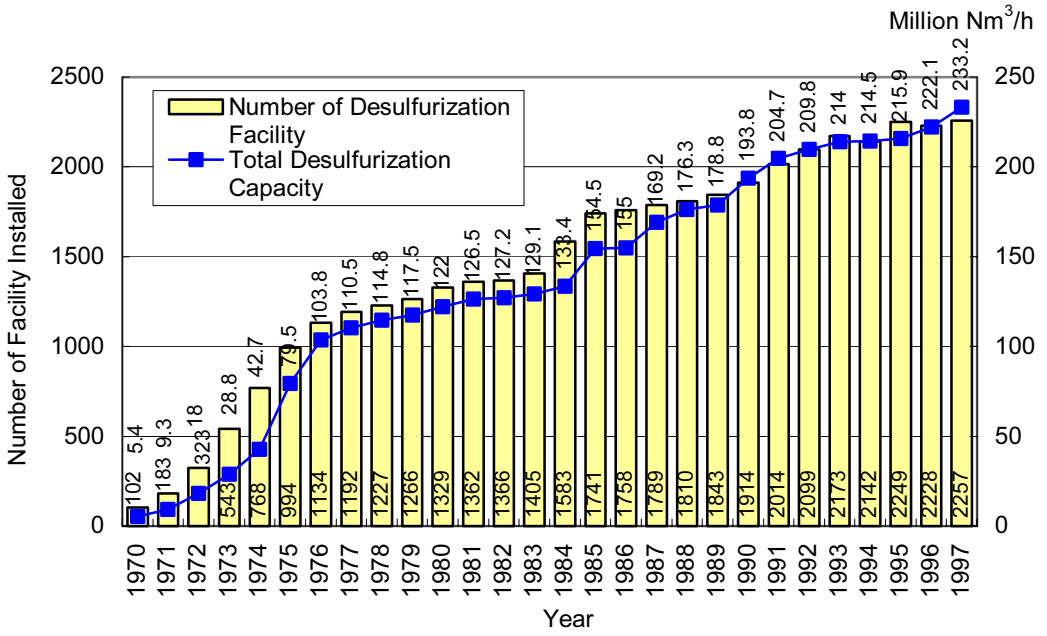
Source: Environment Agency, *White Paper on the Environment*, 1973 - 1983

Figure 1.3.8 Trend in Administrative Actions for Soot/Smoke Generating Facilities

1.3.4 Implementation of Measures and Environmental Improvement

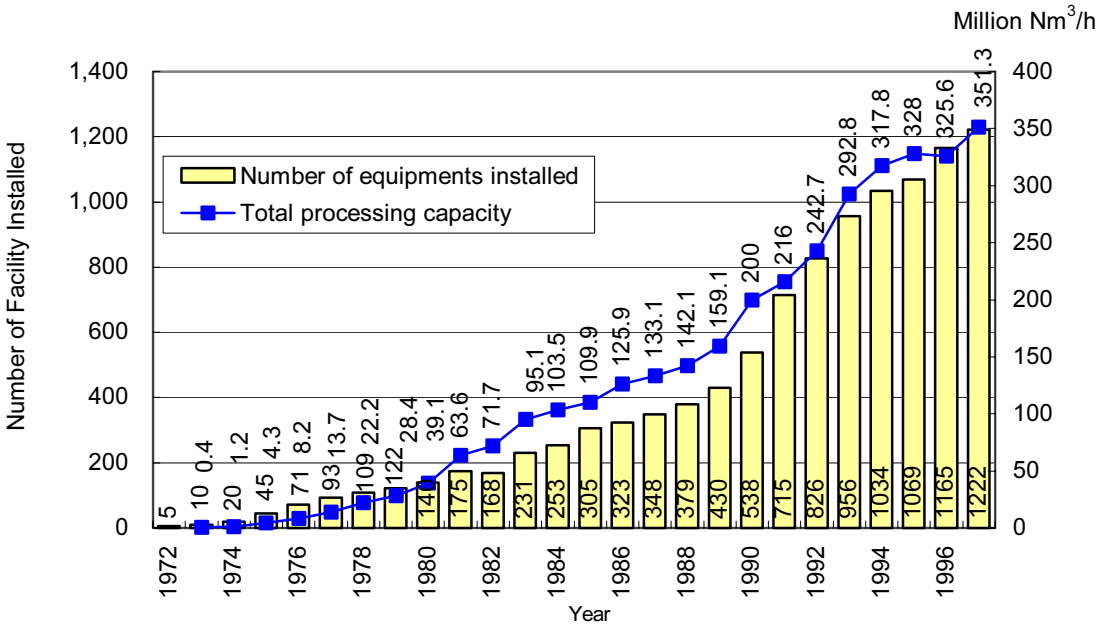
a. Air Pollution Control in Factories

As examples of the implementation of air pollution control measures in factories and so on, Figure 1.3.9 shows changes over time in the installation of flue-gas desulfurization equipment, and Figure 1.3.10 shows the situation regarding installation of flue-gas denitrification equipment.



Source: Environment Agency, *2000 White Paper on the Environment – Kakuron*

Figure 1.3.9 Installation of Flue-Gas Desulfurization System by Year (1970-1997)



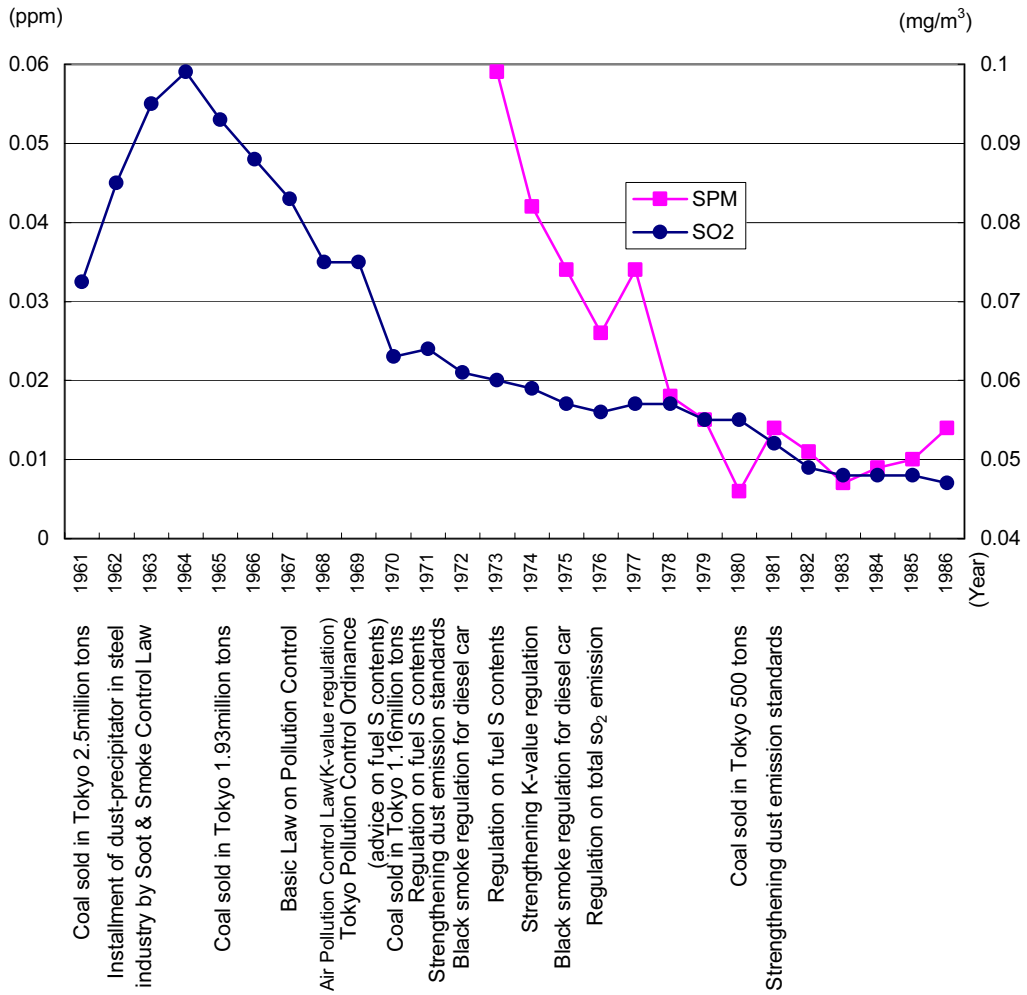
Source: Environment Agency, *2000 White Paper on the Environment - Kakuron*

Figure 1.3.10 Installation of Flue-gas Denitrification System by Year (1972-1997)

b. Situation of Environmental Improvement

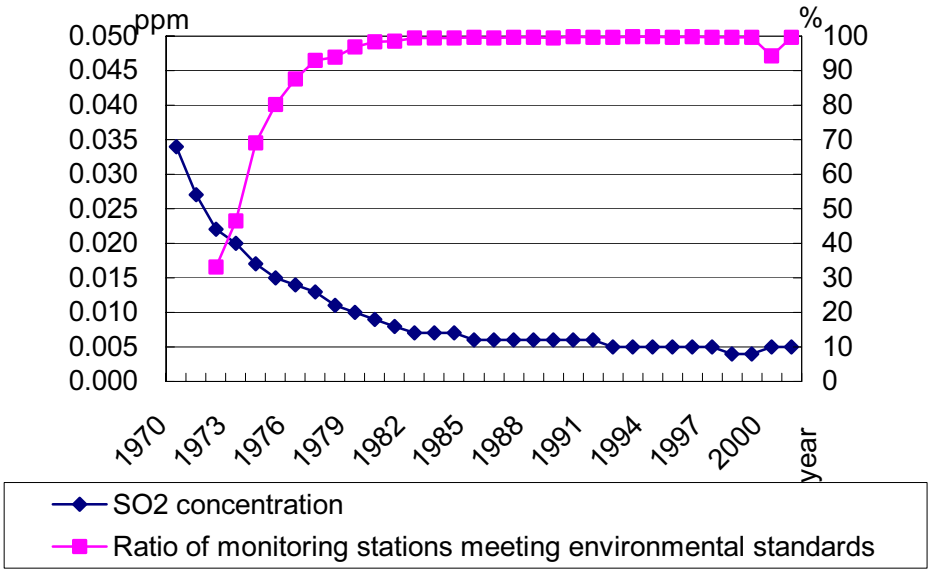
Since it is difficult to clearly demonstrate the effect of control measures for the whole of Japan, Figure 1.3.11 indicates the improvement over time for Tokyo in terms of suspended particulate matter and SO_2 concentrations in line with the combined implementation of various measures, for example, use of high-quality fuel, reduction in use of coal fuel, execution of the Air Pollution Control Law and Tokyo metropolitan ordinances, and so forth. The peak concentration of suspended particulate matter was 0.3 mg/m^3 in 1964.

Thanks to the setting of emissions standards based on the Air Pollution Control Law, the implementation of total emissions regulations, the reduction of sulfur content in fuels and the implementation of energy saving measures, compliance with the environmental standard for sulfur dioxide was almost attained by around 1980. Figure 1.3.12 shows movements in the simple annual average figure of sulfur dioxide concentration at environmental measurement stations as well as the ratio of stations where compliance with the environmental standard was achieved.



Source: Data from Mr. Kazuo HISHIDA (developed from *White Paper on the Environment* and measured value investigated by the Tokyo Metropolitan Government)

Figure 1.3.11 Improvement of Environmental Concentration by Various Measures in Tokyo (1961-1986)



Note: Values indicate unweighted average of annual average concentrations at SO_2 monitoring stations indicated in Figure 1.3.6.
Source: Ministry of the Environment, *2003 Environmental Statistics*

Figure 1.3.12 Annual Average of SO_2 Concentrations and Ratio of Monitoring Stations Meeting Environmental Standards (1970-2000)

1.4 Industrial Wastewater Control

1.4.1 Background to the Full-scale Implementation of Water Pollution Control Measures

a. Prior to Rapid Growth from 1955

Japan experienced frequent cases of water pollution caused by major industries like mining (for example, Ashio copper mine), chemical and the pulp & paper industry from the start of the 1900s. However, citizens did not have the capability to claim compensation or file suspension charges based on civil law, and they got minimal compensation or some minor wastewater countermeasures resulting from negotiations through administrative authorities or direct negotiations with factories (frequently primary industry associations such as agricultural cooperatives or fisheries associations, and the like). In effect, citizens were forced to give in and accept their difficulties.

Except for a few measures on the public health front, few policies existed regarding water pollution. In particular, rivers in cities were no more than odorous open sewers for industrial and domestic wastewater, similar to the urban rivers seen today in most developing countries.

Moreover, outside the cities, water pollution resulting from wastewater generated by key industries such as mining, large-scale chemical engineering, textiles, paper manufacturing and iron and steel manufacturing, although contained to limited areas, was extremely serious. Attempts were made mainly by farmers and fishermen to respond to the need for measures. However, because of the predominant status of industrial development under the policy of increasing wealth and military power at that time, measures were restricted to minor palliatives and this situation continued right up to the period of rapid growth after the war.

As for water pollution control measures by the central government before WWII, revision of the Mining Act (1905) in 1939 led to the adoption of strict liability provisions, and crackdowns by local police were enforced under the Factory Act. This was the only concrete control measure at that time.

Meanwhile, in local governments, environmental sanitation measures centering on sewage system development and human waste treatment were implemented fairly actively, even compared to the advanced nations of the time. However, regarding water pollution, guidance on industrial wastewater control was provided based on ordinances, though these were only implemented in response to agriculture and fisheries damages and did not entail any special controls.

Construction of sewage systems was quite advanced in Japan before 1900, but was only intended to eliminate sanitary sewage, and construction of treatment plants was only given secondary status. In other cases, full-scale development of sewers did not take place because priority was placed on waterworks development.

b. Water Pollution and Damages in the Rapid Growth Period

Water pollution and subsequent damages occurred all over Japan in line with growing industrial activities during the period of rapid economic growth. In particular, following the irruption to a paper mill along the Edo River by angry fishermen, in 1958, the Water Quality Protection Law and Industrial Wastewater Control Law were enacted in 1958. This legislation, however, did not stem the continued occurrence of pollution and damage. In response to this situation, the responsible government organization, the Economic Planning Agency, designated water bodies based on the Water Quality Protection Law. In marine designated water bodies, the following cases of damage caused mainly by the manufacturing industry were recorded.

Table 1.4.1 Major Pollution Sources and Damages in Coastal Areas

Coastal Area	Prefecture	Damages	Major Pollution Sources
Yokkaichi / Suzuka	Mie	Water supply / fishery	Heavy chemical industry
Ootake / Iwakuni	Hiroshima	Fishery	Pulp/paper plants
Mitajiri-bay	Yamaguchi	Fishery	Brewing factory
Mizushima	Okayama	Fishery	Steel / Chemical plants
Port of Tagonoura	Shizuoka	Fishery / Function of the port	Pulp/paper plants
Kamaishi-bay	Iwate	Fishery	Steel / marine product processing factory
Dokai-bay	Fukuoka	Living Environment / Fishery	Chemical / Steel plants
Harima Sound (an arm of the Inland Sea)	Hyogo	Fishery	Heavy chemical plant
Saiki-bay	Ohita	Fishery	Pulp plant
Kashima-nada	Ibaraki	Fishery	Steel / Chemical plants
Iyomishima / Kawanoe	Ehime	Fishery	Pulp/paper plants
Kojima-bay	Okayama	Fishery	Paper Plant
Yatsushiro Sea	Kumamoto	Fishery	Pulp/paper plants, brewing factory
Matsushima-bay	Miyagi	Fishery / living environment	Marine product processing factory
Nagoya-bay	Aichi	Fishery / living environment	Urban sewage / heavy chemical plant
Atsumi-bay	Aichi	Fishery / living environment	Food processing plant

Note: Surveyed by Economic Planning Agency
Source: Ministry of Health and Welfare, *1971 White Paper on Environmental Pollution*

The main source of pollution causing damage in specific water bodies was industrial wastewater.

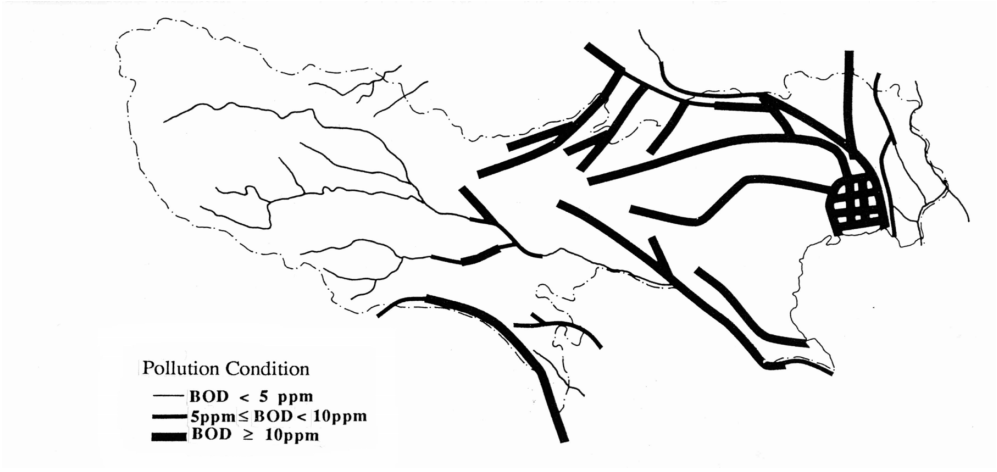
Table 1.4.2 Major Pollution Sources and Damage in Rivers

River	Damages	Major Pollution Sources
Ishikarigawa	Agriculture / fishery/ water supply	Pulp/paper, chemical fertilizers, urban sewage
Edogawa	Fishery	Pulp and chemicals
Yodogawa	Water supply / environmental hygiene	Various factories / urban sewage
Kisogawa	Water supply / fishery	Pulp / paper, various factories, urban sewage
Watarasegawa	Agriculture	Copper mine
Downstream of Arakawa	Environmental hygiene	Various factories, urban sewage
Kakogawa	Fishery / water supply	Dye / pulp
Neyagawa	Environmental hygiene	Various factories, urban sewage
Tokorogawa	Fishery	Pulp, starch, beet, urban sewage
Sumidagawa	Environmental hygiene	Various factories, urban sewage
Tamagawa	Water supply / fishery / environmental hygiene	Leather, chemical, dye, urban sewage

River	Damages	Major Pollution Sources
Mouth of Yamatogawa	Agriculture / Fishery / Water supply	Various factories, urban sewage
Saitagawa	Agriculture / Fishery / Water supply	Paper mill
Omutagawa	Environmental hygiene / Fishery	Chemical plants / urban sewage
Urban river		
Tokyo Jonan water body	Environmental hygiene	Various factories, urban sewage
Tsurumigawa	Environmental hygiene	Environmental hygiene
Fukuoka inner city rivers	Fishery / Water supply / Environmental hygiene	Various factories, urban sewage
Osaka inner city rivers	Environmental hygiene	Various factories, urban sewage
Sendai inner city rivers	Environmental hygiene / Fishery	Various factories, urban sewage
Ujigawa	Environmental hygiene / Water supply	Various factories, urban sewage
Hiroshima inner city rivers	Environmental hygiene / Fishery	Various factories, urban sewage

Source: Ministry of Health and Welfare, *1970 White Paper on Environmental Pollution* (original source: research conducted by Economic Planning Agency)

Figure 1.4.1 shows BOD concentrations in major rivers in Tokyo in 1969, just as the period of high-level growth had completed its first cycle. Concentrations in excess of 10 ppm were found in numerous tributaries of these rivers, and DO (dissolved oxygen) in the main rivers was limited to just 1-2 ppm.



Source: EX Corporation, "Japan's Experience in Urban Environment Management", Metropolitan Environment Improvement Program, World Bank, 1996

Figure 1.4.1 Water Quality of Major Rivers in Tokyo (1969)

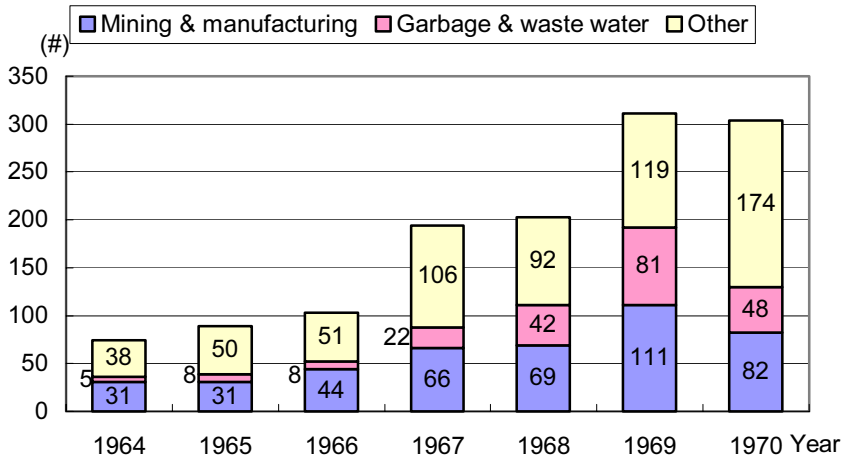
c. Water Pollution and Health Damages

From the late 1950s, terrible cases of health damage caused by water pollution appeared, for example, Minamata disease and Itai-Itai disease. Minamata disease, which was caused by consumption of fish contaminated by methyl mercury compounds, occurred in 181 designated patients and resulted in 52 fatalities in Minamata, while Niigata Minamata disease

occurring in the Agano River Basin in Niigata Prefecture resulted in 102 designated patients and 8 fatalities until 1972. Moreover, in Jintsu River Basin in Toyama Prefecture, Itai-Itai disease caused by cadmium poisoning occurred in 132 designated patients and caused 34 fatalities[54].

d. Water Pollution and Waterworks Damage

The following figure indicates waterworks damage caused by water pollution. According to this, damage caused by industrial activities was the most frequent.

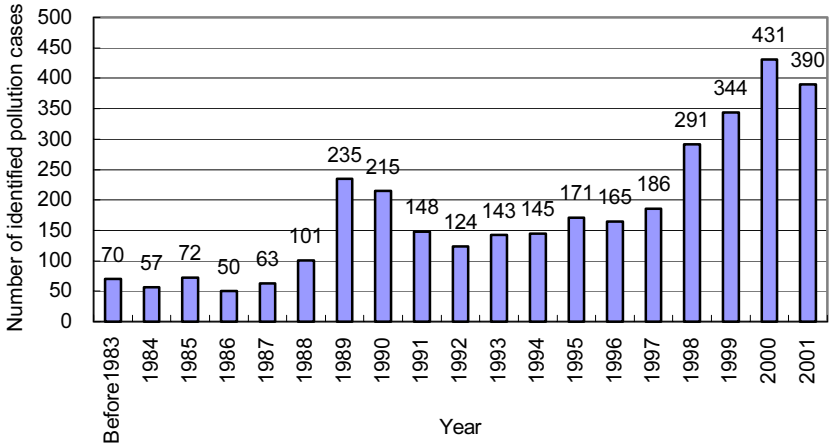


Source: Environment Agency, *1972 White Paper on the Environment*

Figure 1.4.2 Damage to Water Supply from Water Degradation (1964-1970)

e. Groundwater Pollution

The extent of groundwater pollution became more and more apparent in the 1980s, and the Water Pollution Control Law was revised in 1989. Regulations were introduced concerning the ground percolation of wastewater containing hazardous substances. As indicated below, the number of groundwater pollution cases coming to light has continued to increase.

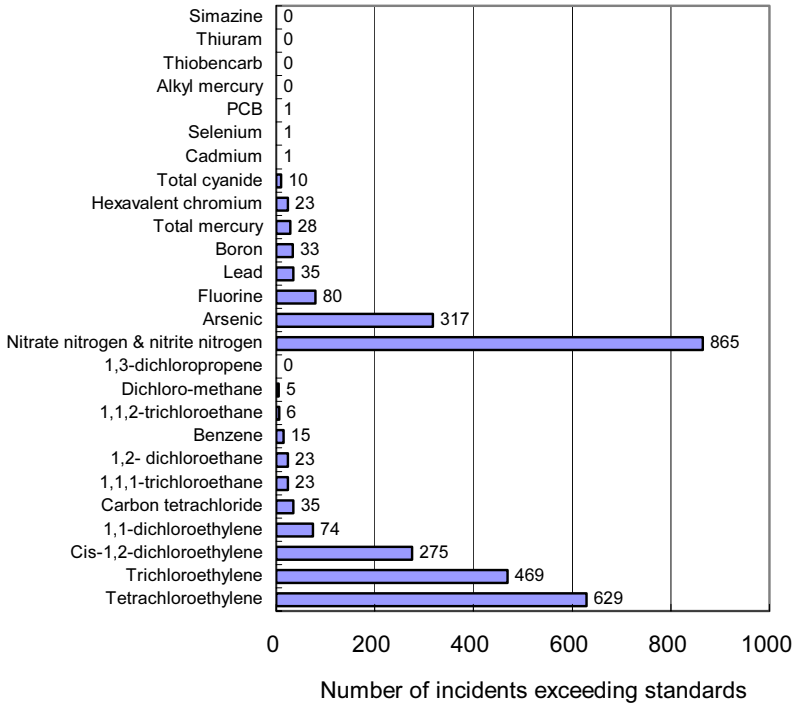


Note: Numbers for groundwater contamination refer to wells whose water quality exceeded environmental standards, as identified by prefectural governments and designated municipalities.
Source: Ministry of the Environment, "Study on Cases of Groundwater Contamination 2001"

Figure 1.4.3 Trend in Groundwater Contamination (before 1983-2001)

[54] Environment Agency, *1972 White Paper on the Environment*

Looking at a breakdown of these pollutants, it can be seen that pollution caused by substances used in industry was extremely common[55].



Note: 2,330 incidents of groundwater contamination indicate the number of such contamination revealed by prefectural and designated city governments, of which wells exceed the environmental standards as of the end of FY 2001.
Source: Ministry of the Environment, "Study on Cases of Groundwater Contamination 2001"

Figure 1.4.4 Groundwater Contamination Revealed by Types of Pollutants

1.4.2 Legal Systems for Water Pollution Control

a. Water Quality Protection Law and Industrial Wastewater Control Law

The Water Quality Protection Law and Industrial Wastewater Control Law were enacted in 1958. However, because of delays in the designation of water bodies they could not function as effective legal systems. Although the Economic Planning Agency determined effluent standards, actual application to factories was enforced by five ministries in charge of each industrial sector; moreover, designations were delayed although these laws incorporated the designation of areas based on surveys. Furthermore, because the five said ministries provided regulatory guidance in tandem with industrial promotion, cases of wastewater discharge in excess of standards rarely resulted in improvement orders, so the legislation was lacking in actual effectiveness.

Rather, around this time, major cities such as Tokyo, Osaka and Yokohama independently strengthened guidance to factories, while SMEs in the major water- consuming sectors advanced treatment technology development.

Also, noteworthy industrial measures by the Ministry of International Trade and Industry were the development of industry-specific wastewater control measures, publication of technical guidelines and commentaries on wastewater control measures in cooperation with industries, and dissemination of treatment technologies

[55] Nitrogen pollution was the most severe, and it was caused mainly by agricultural and domestic wastewater.

b. Environmental Standards

As for environmental standards pertaining to water quality, those concerning protection of human heath and of living environment were established in 1970 based on the Basic Law for Environmental Pollution Control. The former were applied to water systems throughout the country, while the latter were applied according to classifications based on the purpose of water use in each water body. As administrative targets, the government advised that environmental standards should be attained in 5 years in water bodies where severe water pollution resulting from population concentration and industrialization had occurred or was occurring, and in around 10 years in water bodies where this was considered to be unfeasible.

Concerning living environment-related items, standard values were set for each type of water body corresponding to the applicability of each type of water use, for example, natural environmental protection, waterworks, fisheries and agriculture.

As for environmental standards pertaining to protection of human health for cadmium, total mercury, alkyl mercury and PCB, biological accumulations were taken into account for fish and shellfish, but for other items the values were based on drinking water standards. An additional 8 items including cadmium and cyanide, and the like were added in 1971, and PCB was added to the list in 1975. As a result of subsequent efforts to comply with these standards, they came to be almost fully realized. Based on scientific knowledge acquired provided by the Basic Law for Environmental Pollution Control, a further 15 items were added in 1993. Moreover, the Environment Agency announced a further 25 items requiring monitoring (though not targeted for environmental standards) in the same year.

Environmental standards for groundwater were established in 1997 along the same lines as those adopted for health.

c. Water Pollution Control Law

In the late 1950s, terrible cases of health damage caused by water pollution, such as Minamata disease and Itai-Itai disease were followed by the filing of pollution lawsuits between 1967-1968. In the wake of this, legislation concerning water quality controls was enacted, for example, the Water Pollution Control Law and Marine Pollution Control Law. This marked the beginning of wastewater controls on a national scale. Compared with the former Water Quality Protection Law, the new Water Pollution Control Law was reinforced in the following ways:[56]

i The water body designations adopted under the former law were scrapped and designated areas were expanded to cover the whole country. The scope of public water bodies was also expanded.

ii By adopting direct punishments for effluent standard violations, wastewater regulations were strengthened.

iii Based on prefectural ordinances, it became possible to set stricter standards than the national effluent standards.

iv It generally became possible to expand the scope of regulated industries (specified facilities).

v Effluent standards were revised from general standards for factories, and the like to standards for each drainage conduit.

Under the Water Pollution Law, nationwide uniform effluent standards were set to regulate effluent discharges from plants and business establishments into public water bodies in order to achieve the ambient water quality standard. There were two types of effluent standard;

[56] Japan Society on Water Environment (ed.), *Nihon no Mizu Kankyo Gyosei*, Gyosei, 1999

one was for hazardous substances and was applied to all specified plants and business establishments (designated by cabinet order), and the other was for protection of the living environment and was applied to those discharging over 50m^3/day.

These standards were set as general standards to be applied to all factories throughout the country. However, the Law also granted local governments power to set stricter effluent standards if the required water quality could not be achieved with the nationwide effluent standards due to high concentrations of population and industrial plants.

Business operators were obliged to inform prefectural governors of their plans to construct or alter specified facilities, and governors could order plans to be changed if they were deemed inadequate. Moreover, in cases where there was a risk that effluent standards would not be conformed to, governors had the right to issue facilities improvement orders or temporary suspension orders on wastewater discharge. If these orders were breached or effluent standards were not complied with, penalties could be applied. This designation of specified facilities and prescription of corresponding effluent standards were methods in line with actual conditions of water consumption and discharge in each industry.

Following revision of the Water Pollution Control Law in 1978, total amount control of pollutants was introduced to expansive closed water bodies with extreme pollution. Moreover, as the problem of groundwater pollution came to light, the law underwent further revision in 1989, by which ground percolation regulations were introduced for wastewater containing hazardous substances. Moreover, following further revision in 1996, it became possible to order current or former proprietors of specified establishments that caused pollution to implement purification measures in areas where groundwater was contaminated by hazardous substances.

d. Water Quality Protection of Closed Water Areas e.g. Seto Inland Sea (Total Amount Control and Clean Lake Law)

Although introduction of total amount control of water pollutants had been withheld by the national government, the local governments had virtually implemented it as a form of guidance for rationalization of industrial water and regulation of effluent volumes. Following the breakout of the serious red tide in the Seto Inland Sea in the 1970s, the Law Concerning Provisional Measures for Conservation of the Environment of the Seto Inland Sea was enacted in 1973. The legislation aimed to halve the pollution load of 1972 into the Seto Inland Sea and allocated a maximum pollutant discharge quota to each of the local governments along the Seto Inland Sea coast. To achieve the reduction goal, local governments in the area set ordinances more stringent than the national effluent standards and improved their sewage systems.

Furthermore, in 1984 the government enacted the Law concerning Special Measures for Conservation of Lake Water Quality, the Clean Lake Law, in order to improve water quality of lakes and ponds that had been degraded by eutrophication.

1.4.3 Implementation of Measures

a. Setup of Measures

Following enactment of the Water Pollution Control Law, water pollution control in Japan was promoted based on the setup indicated in Figure 1.4.5.

b. Division of Administrative Roles

As indicated in Table 1.4.3, numerous government agencies have been concerned with water pollution control measures and other administrative measures concerning the water environment. It can thus be seen that water pollution control was deployed under the

initiative of the Environment Agency but also through the coordination of numerous other organizations.

Table 1.4.3 Authorities and Jurisdiction of National and Local Governments in Water Quality

Item	Authority and Jurisdiction
Regulation	Environmental Agency established environmental standards and effluent standards aiming to achieve them through coordination with relevant government agencies. In addition, the prefectural and designated city governments could set up stricter standards (add-on standards) by their own ordinances. In addition, the Environment Agency and/or prefectural governments draw up plans, based on relevant legislations, to achieve the environmental standards.
Management of rivers, lakes, and dams	River Bureau of Ministry of Construction, has jurisdiction and management responsibility for major streams for flood control, water resource development, and dam management. Local governments' river divisions manage the other water bodies. Some dams for water source are under the authority of local government water supply departments while irrigation dams and canals are under the Ministry of Agriculture, Forestry and Fisheries.
Management of bay areas	Fishing ports are managed by the Ministry of Agriculture, Forestry and Fisheries, while other port areas are under Port Bureau of Ministry of Transportation, and other coastlines are under Ministry of Construction - Jurisdictions are same as for rivers.
Wastewater treatment	Regarding treatment of discharged water from factories and business establishments, technical advice is given by governing agencies such as Department of Trade and Industry, and Ministry of Agriculture, Forestry and Fisheries.
Development of sewage systems	Local governments are responsible for the development of sewage systems, though jurisdictions are spread among relevant bodies. For example, sewage is under the Ministry of Construction and septic tanks are under Ministry of Health and Welfare while domestic sewage treatment in rural areas is under Ministry of Agriculture, Forestry, and Fisheries.
Management of groundwater	For utilization or pumping of groundwater, Ministry of International Trade and Industry has authority over industrial use. With regard to use in buildings, the Prime Minister's Office asks for opinions from the prefectural government, and establishes designated areas or permitting standards prior to granting authority for permit to local governments.
Financial aid	Low interest loans for cooperating projects, common facilities, and wastewater facilities within a factory are systematically implemented by publicly run financial institutions.

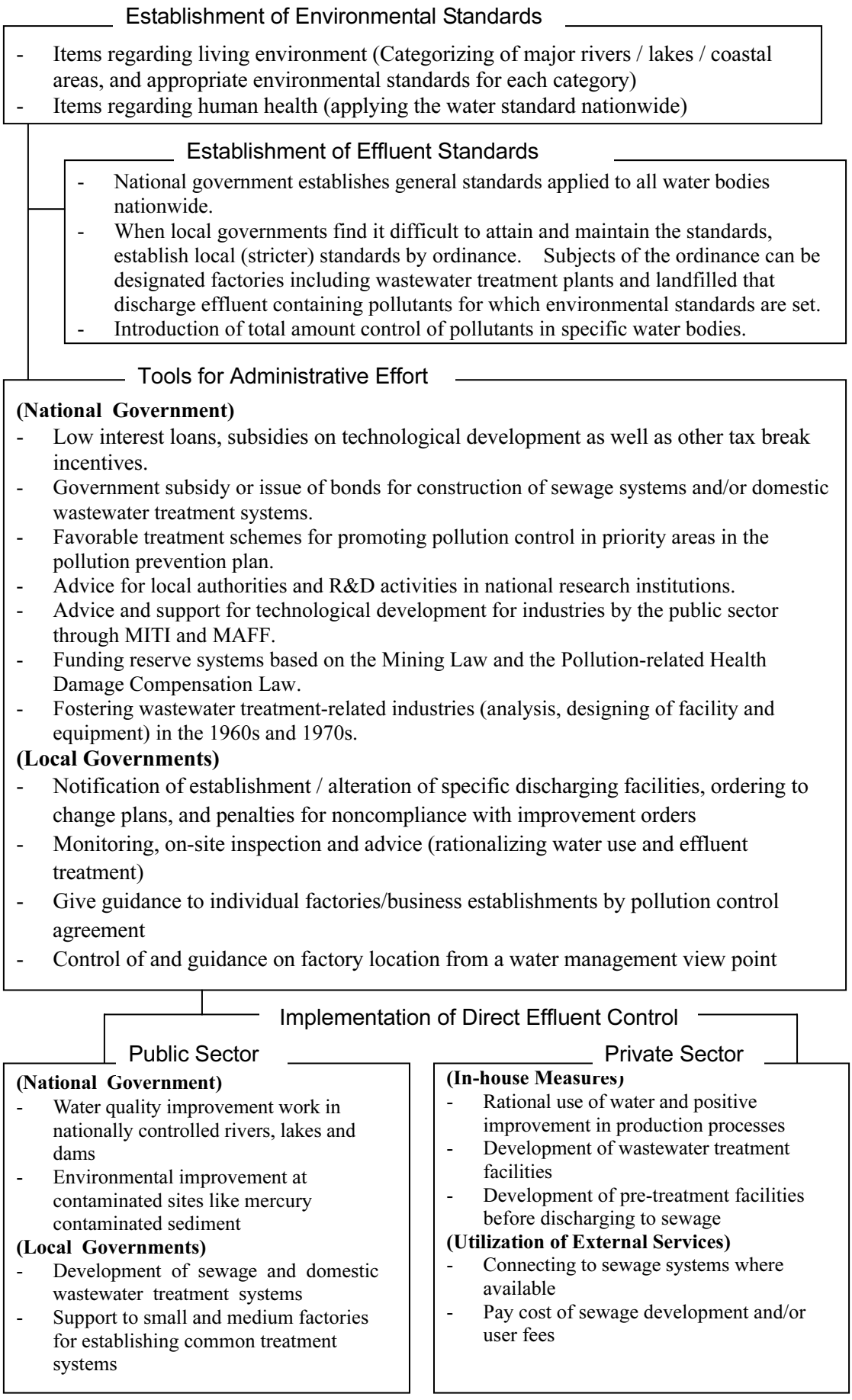


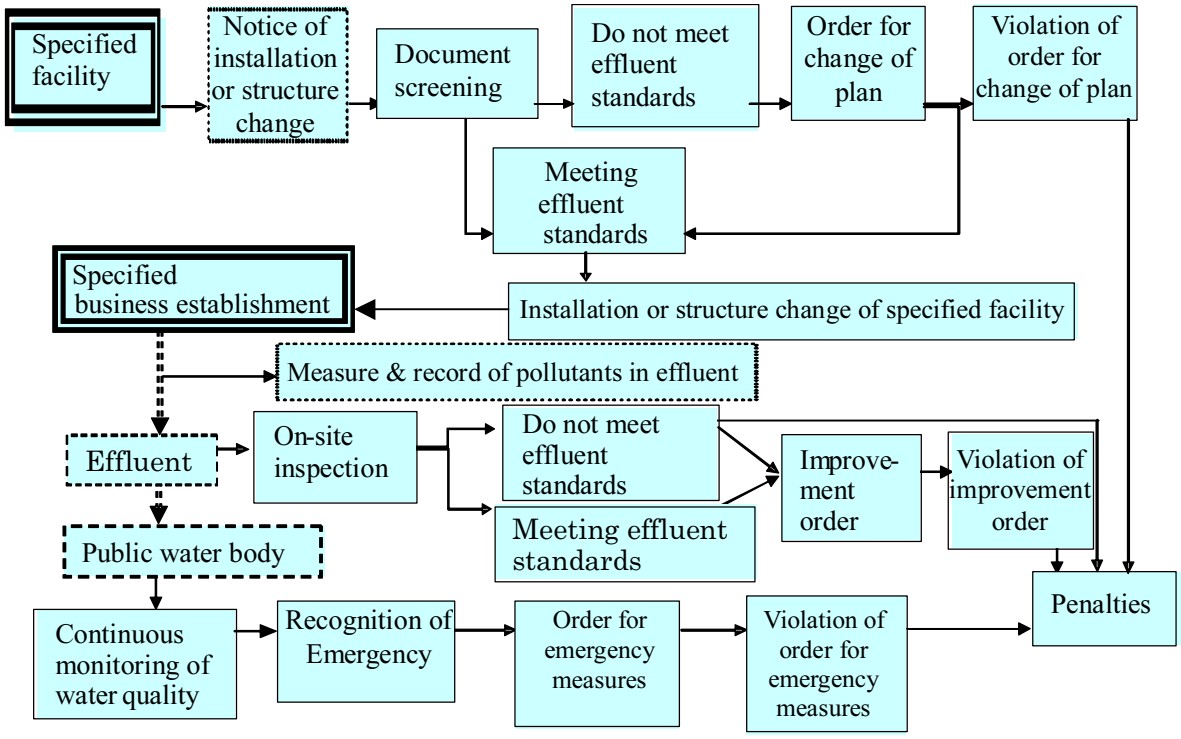
Figure 1.4.5 Summary of Water Quality Management

c. Implementation of Regulations for Pollution Emission Sources

In prefectures and ordinance-designated cities (cities granted equivalent authority to prefectures based on cabinet orders), public officers implemented on-the-spot inspections and guidance in plants. Figure 1.4.6 shows the regulatory setup concerning monitoring, guidance and administrative disposition for pollution sources.

The number of specified business notifications made based on the Water Pollution Control Law was 250,000 in 1976, of which 28,000 had effluent discharges of 50 m^3 or more. In 2000, the figure had reached 298,000, with 38,500 establishments discharging 50 m^3 or more of effluent.[57] The number of specified establishments using hazardous substances in 2000 was approximately 17,000. Figure 1.4.7 shows movements in the total number of specified business establishments as well as the number of cases of improvement orders were issued based on on-the-spot inspections. The effective functioning of effluent standards and other legal systems was underpinned by the implementation of inspections and guidance by local governments.

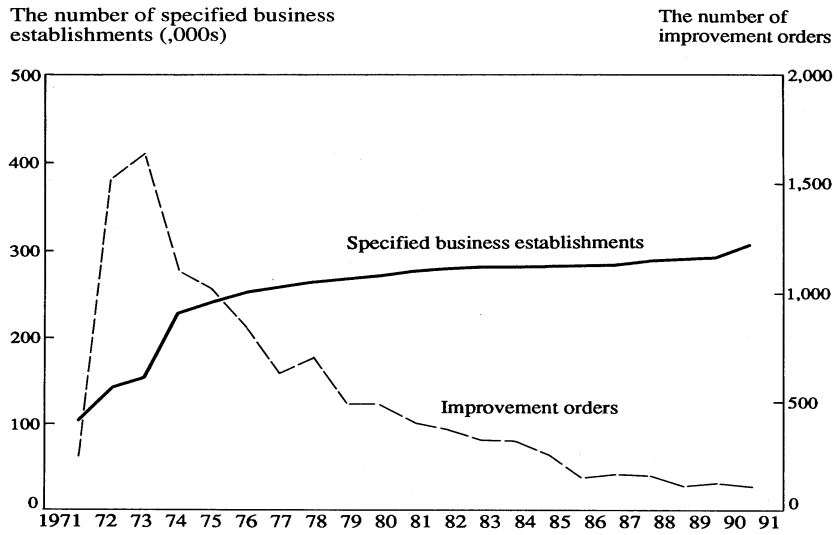
In addition to on-the-spot inspections and guidance conducted from the viewpoint of wastewater control measures, local governments provided vigorous guidance to factories concerning rationalization of water use. This water use rationalization led to water conservation, higher re-circulation rates and process improvements, in turn contributing to higher wastewater treatment efficiency due to reduced wastewater flows and higher concentrations. Because effluent regulations functioned as pollution load regulations, they improved the effectiveness of water quality control.



Note: Except total environmental load regulation
Source: TAKATSUJI Masami and TSUJI Kiyoaki (ed.), *Gendai Gyosei Zenshu 19 - Kankyo*, Gyosei, 1985

Figure 1.4.6 Scheme of Wastewater Discharge and Penalties

[57] Ministry of the Environment, *2002 Environmental Statistics* and *2003 Environmental Statistics*

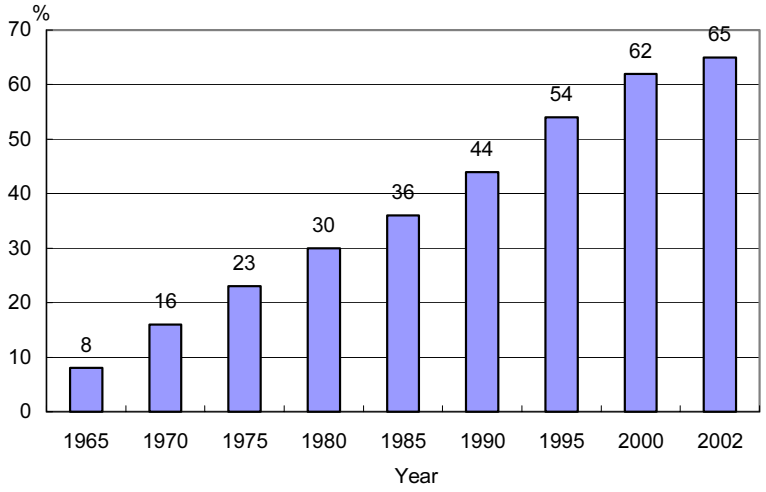


Source: EX Corporation, "Japan's Experience in Urban Environmental Management", Metropolitan Environment Improvement Program, World Bank, 1996

Figure 1.4.7 Trend in Number of Specified Business Establishments and Improvement Orders (1971-1991)

d. Development of Sewage Systems

Sewage development in Japan, which had mainly been advanced in the cities, was interrupted during after WWII. However, it steadily resumed following enactment of the Sewage Law in 1958. This was followed by the Law on Urgent Measures for Sewage Development in 1967. This entailed strengthening of the national subsidy system and budget expansion, and resulted in the full-scale advancement of sewer systems. Because of the slow pace of development in comparison to the progress of urbanization, development costs were high and the dissemination rate from 1980 onwards remained low at around 1% increase a year compared to investment costs at around 1%. In spite of this, sewage development, in tandem with industrial wastewater control, may be called the single most important measure that contributed to improvement of the water quality environment in Japan.



Source: Data from City and Regional Development Bureau, Ministry of Land, Infrastructure and Transport[58]

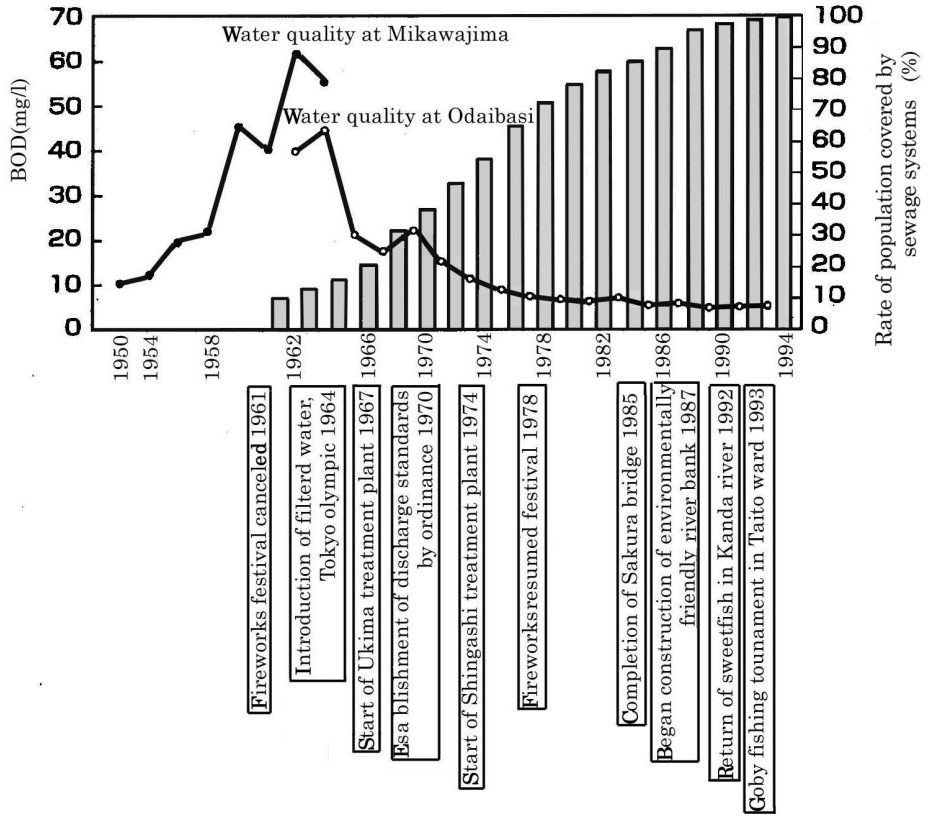
Figure 1.4.8 Prevalence of Sewage Service (1965-2002)

[58] Prevalence of sewage service represents the rate of wastewater treatment covered per population under the jurisdiction of the Ministry of Land, Infrastructure and Transport. Overall rate of sewage service coverage that included rural drainage treatment facilities, community plants, and septic tanks, were 75.8% in 2002.

Houses and business establishments locating in areas equipped with sewage systems were obliged to connect to the sewer systems. It became necessary for wastewater to be discharged into the sewer systems for factories located in such areas. When discharging such wastewater, effluent standards equivalent to those applied to public water bodies were adopted with respect to hazardous substances. Therefore it was required to install treatment facilities in the same way as the case of discharging into public water bodies.

e. Effect of Control Measures

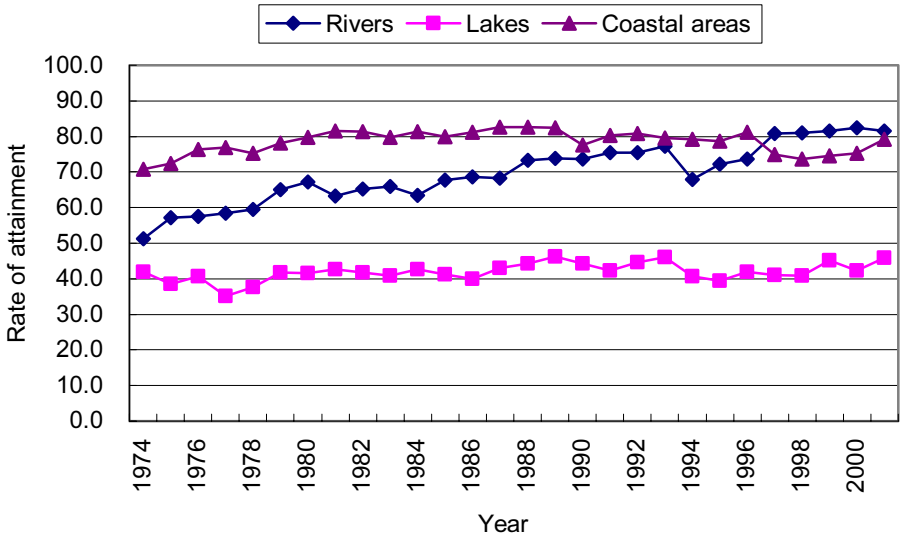
The following figure indicates the case of Sumida River in Tokyo as an example of water quality improvement in line with sewage development.



Source: Japan Society on Water Environment (ed.), *Nihon no Mizu Kankyo Gyosei*, Gyosei, 1999

Figure 1.4.9 Changes in Water Quality of Sumida River – one of the major rivers in Tokyo (1950-1994)

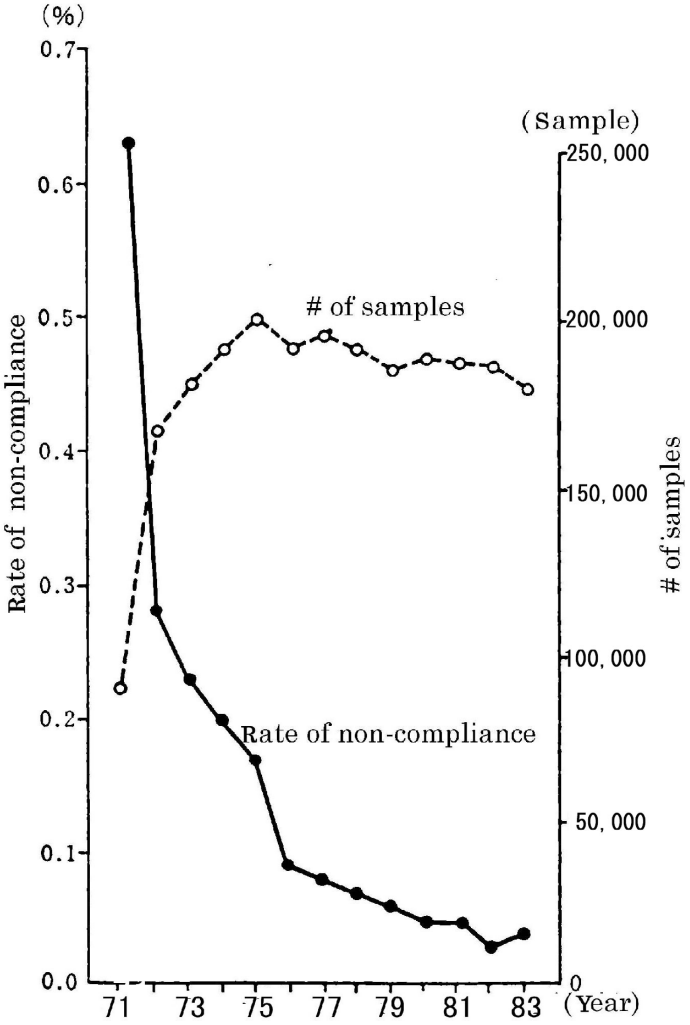
As is shown in Figure 1.4.10, the overall environmental standard achievement rate in rivers increased from 50% in 1974 to more than 80% in the 1990s. However, the situation did not improve greatly in coastal waters and lakes and marshes. This was due to the effects of eutrophication. Concerning loads of phosphorous and nitrogen, which were the substances that generally caused eutrophication, industry occupied a smaller weight than domestic sources.



Source: Ministry of the Environment, *2002 Environmental Statistics*

Figure 1.4.10 Trend in Attainment of Water Quality Standards (1974-2000)

Measurements of hazardous substances in public water bodies were carried out for just under 200,000 samples following establishment of the monitoring system at the beginning of the 1970s. Whereas the environmental standard nonconformity rate was under 1% at the start, this dropped further after 1976 and is now less than 0.1%.



Note: Nonconforming rate for alkyl mercury remained 0% since 1971.
Source: TAKATSUJI Masami / TSUJI Kiyoaki (ed.), *Gendai Gyosei Zenshu 19 - Kankyo*, Gyosei, 1985

Figure 1.4.11 Changes in Noncompliance Rate for Hazardous Substances at Polluted Sites (1971-1983)

1.4.4 Groundwater Regulations and Industrial Water Supply

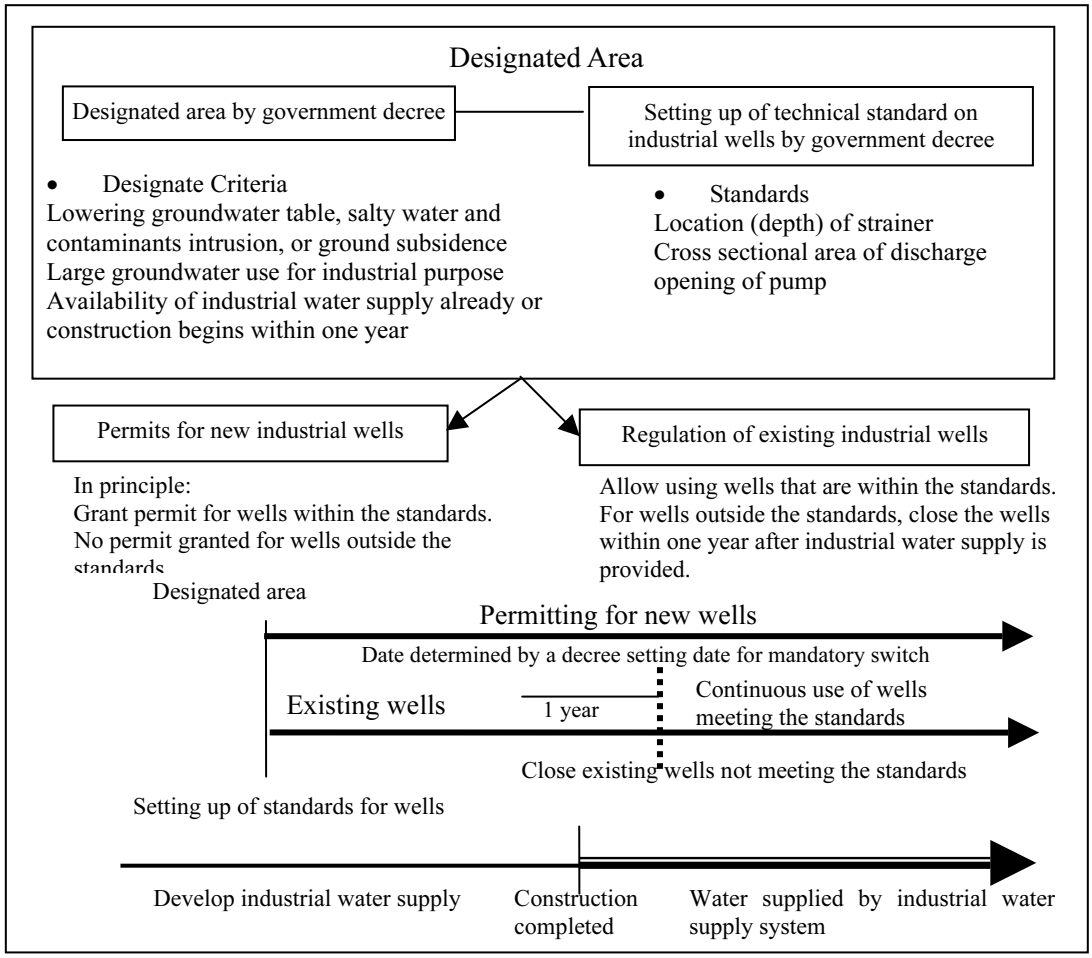
a. Ground Subsidence and Groundwater Regulations

Before 1955, most factories in coastal areas depended on groundwater for water supply and discharged wastewater into rivers and sea areas without any proper treatment. This was a favorable situation for factories because their water supply and wastewater discharge costs were almost negligible. Ground subsidence had already been occurring in Tokyo and Osaka before WWII, and excessive pumping of groundwater during the postwar economic recovery made this a major problem from the late 1950s. In particular, extreme ground subsidence in the western part of Osaka and the Koto district of Tokyo led to major social problems in the form of structural damage to buildings and damage accompanying high tides. As economic reconstruction progressed, groundwater consumption rapidly increased and areas affected by ground subsidence grew ever wider.

Since excessive pumping of groundwater was the main cause of ground subsidence, the government enacted the Industry Water Law of 1956 to restrict groundwater pumping in designated areas (10 prefectures including Tokyo, Osaka Prefecture, Aichi Prefecture, Saitama Prefecture, and Chiba Prefecture) and promoted development of industrial water

supply systems as alternative water sources. Furthermore, although not going as far as legislation, the meeting of Cabinet members concerned with measures for ground subsidence prevention, enacted ground subsidence control measure guidelines and set targets for groundwater pumping with respect to the Chikugo-Saga Plain and Nobi Plain in 1985 and the Northern Kanto Plain in 1991.

Subsidence control consisted of groundwater pumping regulations and conversion of water sources through construction of industrial water supply systems. At first, groundwater regulations were only applied to new wells, while existing wells were exempted until industrial water supply systems were constructed. However, because ground subsidence became even worse, application of regulations was extended to existing wells in a revision to the law in 1962. Figure 1.4.12 shows the outline of groundwater control measures based on the Industrial Water Law.



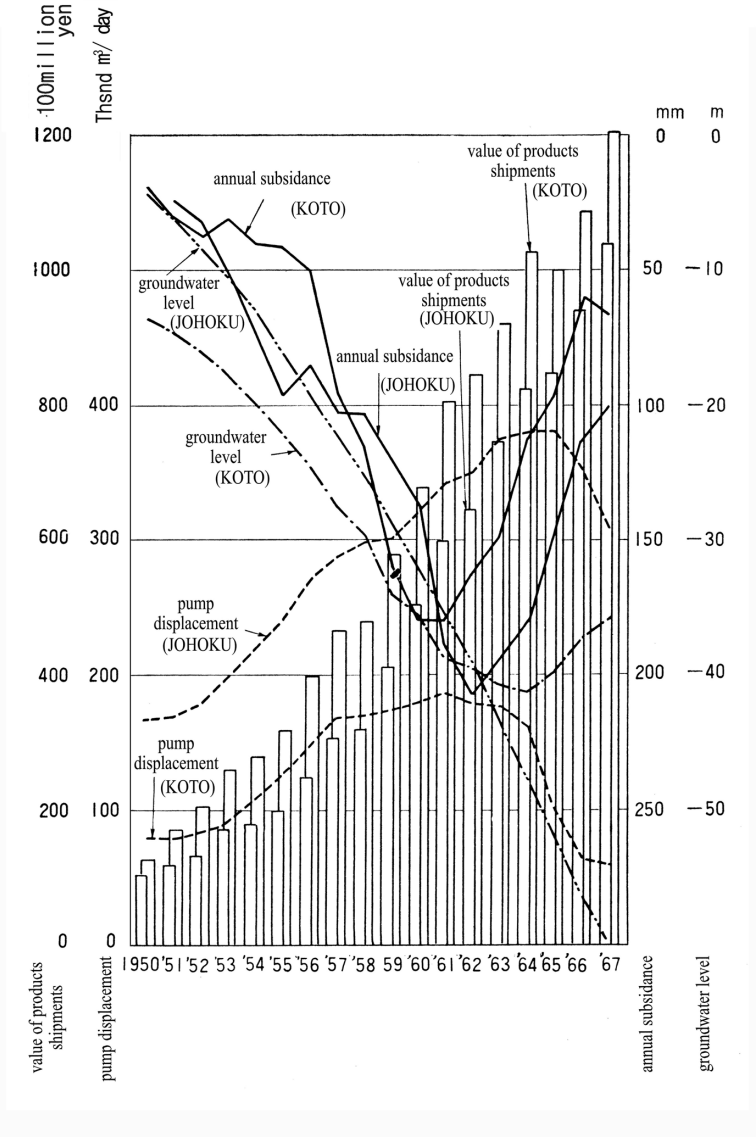
Source: Ministry of International Trade and Industry, *Industry and Pollution*, 1977

Figure 1.4.12 Summary of Groundwater Pumping Regulation by Industrial Water Law

In cases of urgently required ground subsidence control, administrative bodies provided guidance to factories on rational groundwater use since there was no time to wait for construction of industrial water supply systems. The number of industrial water supply systems constructed in response to ground subsidence problems as of 1985 was 27, accounting for a daily water supply capacity of 3,150,000 tons.

As pump displacement of groundwater decreased with the implementation of the pumping regulations, subsidence also receded and groundwater levels started rising again. The

Figure 1.4.13 shows an example of this. We can see a noteworthy trend that the pump displacement of groundwater decreased in spite of the increasing value of product shipments.



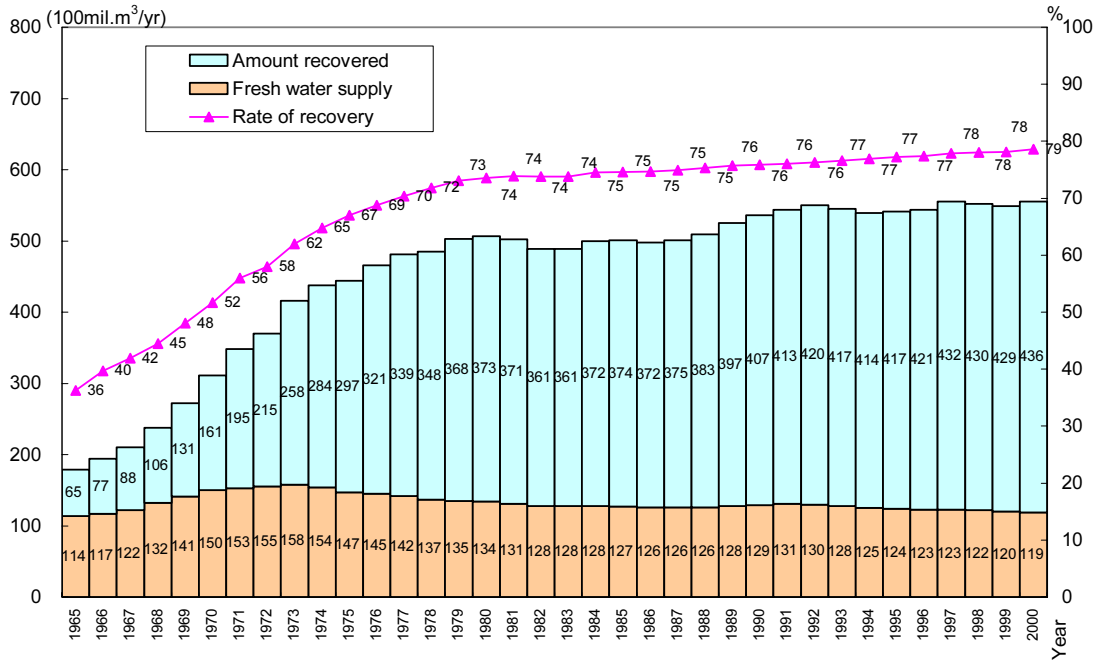
Source: Tokyo Metropolitan Research Institute for Environmental Protection (ed.), "Pollution and Tokyo", 1970

Figure 1.4.13 Trend in Groundwater Displacement, Groundwater Table, and Annual Subsidence (1950-1967)

b. Quantity of Industrial Water Usage

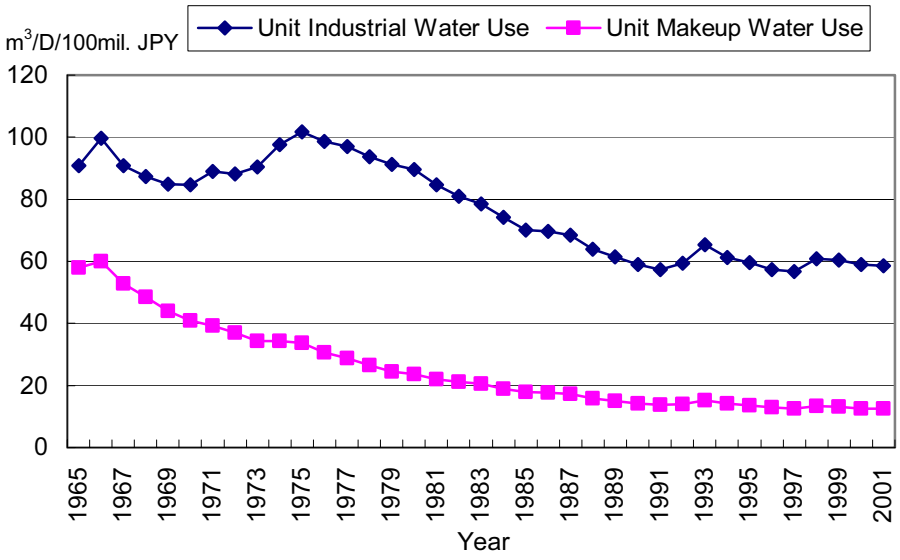
Industrial water usage increased in line with economic growth. However, since demand was largely met by recycled water, the amount of makeup water slowly declined following the peak in 1973. Looking at the unit water use per unit value of shipments, the base unit of freshwater use declined following the peak in 1975. The base unit of makeup water use also fell, although it has leveled off in recent years. Judging from these data, it is inferred that rationalization of water use has more or less reached its limit.

Meanwhile, looking at movements in water intake by water source, intake in industrial water supply systems increased rapidly from 1965, and after reaching 12,000,000 tons/day in 1975, it remained more or less at that level. As for the groundwater intake volume, after peaking at 15,400,000 tons/day in 1970, it steadily declined and was 46% of the peak value in 2001.



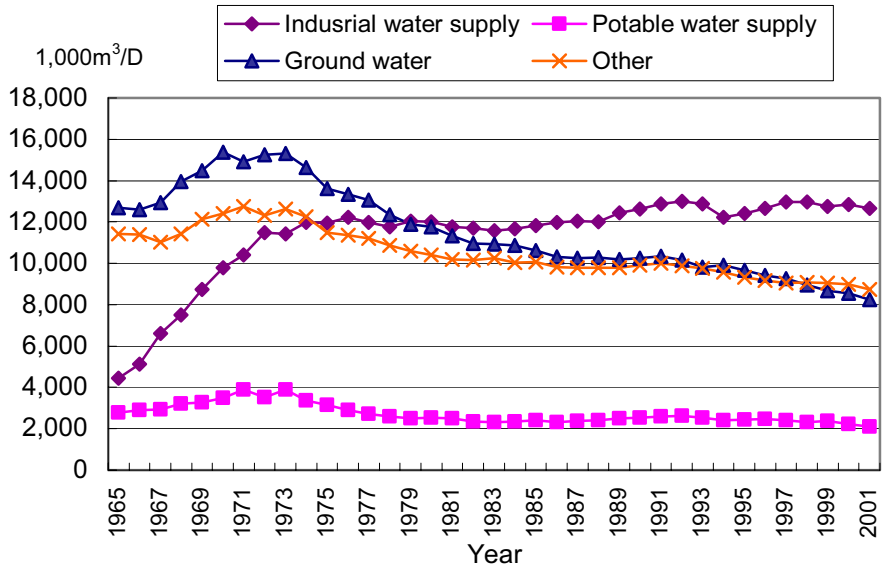
Note: Businesses with 30 or more employees
Source: Ministry of Land, Infrastructure and Transport, *Water Resources in Japan,* 2002

Figure 1.4.14 Changes in Industrial Water Use (1965-2000)



Note: Businesses with 30 or more employees. Shipment value is in 2000 prices after calculating deflator factors for wholesale price index.
Source: Ministry of International Trade and Industry, *Industrial Statistics-Land and Water*

Figure 1.4.15 Changes in Unit Price of Industrial Water Supply (1965-2001)

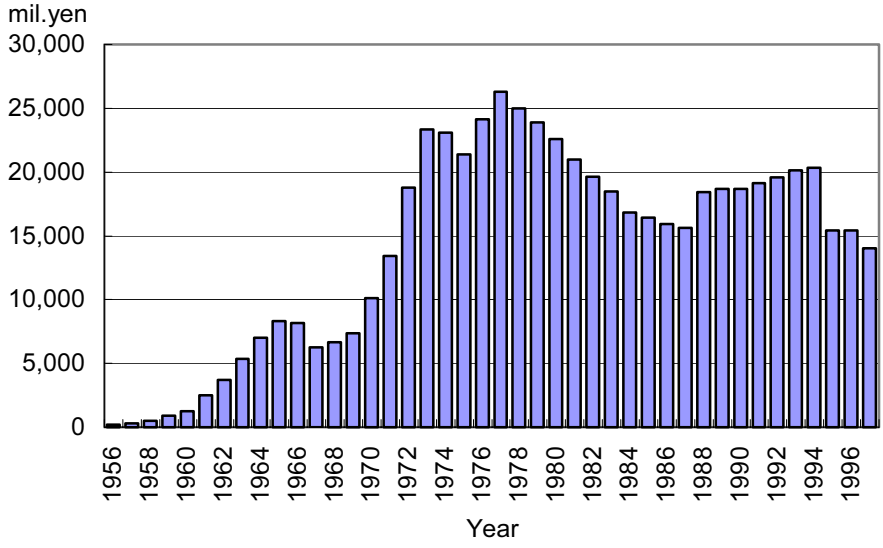


Note: Businesses with 30 or more employees
Source: Ministry of International Trade and Industry, *Industrial Statistics-Land and Water*

Figure 1.4.16 Trend in Amount of Water Intake by Source (1965-2001)

c. Industrial Water Supply, Waterworks and Sewage Fees

Construction of industrial water supply systems as an alternative to groundwater started in the late 1960s. Because the cost of groundwater at that time was just 1-3 JPY/m^3, the government adopted a policy of holding the industrial water charge to 3.5 JPY/m^3 by granting subsidies in order to keep the cost of shifting water sources low[59]. The aim of this system was to provide business operators with subsidies so that expenses could be held to within the standard tariff level set by the government. Figure 1.4.17 shows trends in the subsidies for industrial water supply construction and reconstruction works from 1956. The cumulative amount of subsidies since then surpassed the 600 billion JPY mark.

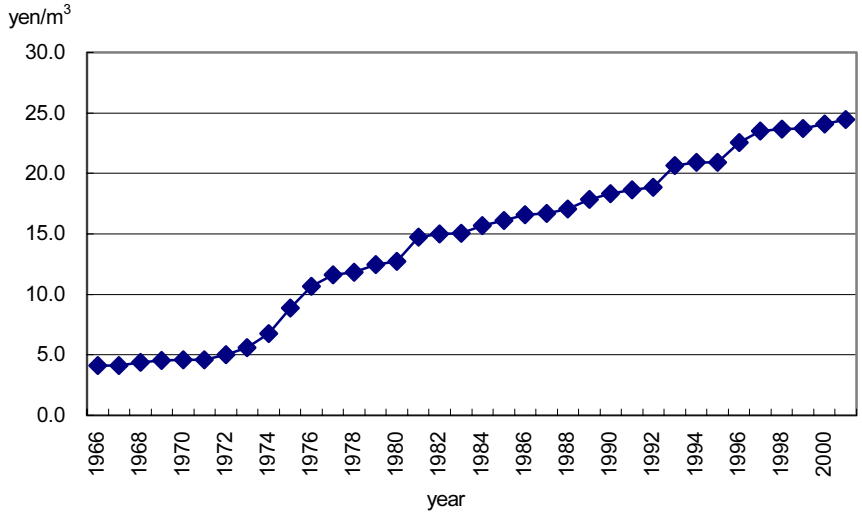


Source: Ministry of Economy, Trade and Industry, *Overview of the Environment 2001*

Figure 1.4.17 Subsidies for Industrial Water Supply (1956-1996)

[59] OHSONO Hideo et al. (eds.), *Chiho no Jidai to Kogyo Saihaichi*, Toyokeizai Symposia, 1980, p.180

Industrial water charges were restrained as a result of these subsidies. Changes in the average level of charges are shown in the Figure 1.4.18. The average industrial water rate in 2001 was 24.4 JPY/m^3, which was lower than the drinking water one. Incidentally, the base cost of drinking water in 1975 was 70 JPY, which was 8 times higher than the industrial water rate, and in 2000 it was 180 JPY/m^3 or 7.5 times higher.



Note: Weighted average of basic charge
Source: Ministry of Land, Infrastructure and Transport, *Water Resources in Japan*, 2002

Figure 1.4.18 Changes in Average Charges for Industrial Water Supply (1966-2000)

Under the industrial water supply systems, the industries were supposed to inform industrial water supply organizations (often local governments) of their water demand and paid a fixed price unless they used water more than they had estimated. The industries also shared the construction costs of the water supply systems. However, the actual demand for water was far lower than the estimates due to reduction in water demand in line with energy conservation following the oil crisis and transfer of production facilities to overseas locations, and the like. As a result, enterprises ended up having more water sources than they needed and didn't strive to rationalize water use.

Concerning factories connected to sewage systems, the sewage fees were still relatively inexpensive in the 1970s, although it was already at between 30-50 JPY/m^3. By 1983, however, the unit cost increased to 70 JPY/m^3 and further still to 90 JPY/m^3 in 1990 and 125 JPY/m^3 in 2000. They were, therefore, much more expensive than the industrial water rate. Since factories located in sewage constructed areas were obliged to connect to sewage systems as a rule, the sewage fees became a major burden for them.

d. Water Use Rationalization and Load Reduction

As was indicated above, even in shift of water source from groundwater to industrial water supply, the motivation for water use rationalization was dampened by the artificial restraint of industrial water rates. However, amidst serious ongoing environmental problems such as ground subsidence and water pollution, the importance of rationalization of water use was recognized and local governments changed the fixed water fee system to a pay-as-you-use system in order to encourage more factories to connect to sewage systems. Accordingly, cost burden conditions were gradually prepared to provide incentives for factories to rationalize water use and reduce discharge volumes. As a result, the unit makeup water use fell despite increases in the value of production, i.e. the level of makeup water use was consistently held steady. In turn, this also led to reduction in industrial wastewater loads.