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**Book Part**

## Environmental monitoring and reporting by local governments

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## **7.2 Environmental Monitoring and Reporting by Local Governments**

Helmut Weidner

The environmental authorities of Japan's prefectures and municipalities generally gather information for a broad spectrum of environmentally relevant domains ranging from the classical environmental media (air, noise, water, and soil) to data on perception and cultural goods. The frequency and scope of the material collected depends on the financial resources of the agencies involved and the urgency of the related problems in the individual areas. Although local autonomous bodies have a certain degree of latitude in determining what is covered by their environmental monitoring and reporting, there are domains for which information-gathering is mandated by national laws. Local governments receive federal funding to assist them in carrying out these tasks, and those running Regional Pollution Control Programs as well receive additional subsidies.

### **Coordination of Environmental Monitoring**

Normally, the coordination of environmental monitoring and reporting is the responsibility of the local authority, while the task of conducting and analyzing special studies usually falls to the research institutes for environmental protection that have been established in nearly all large municipalities. One such institute is the Pollution Control Laboratory in Kawasaki, which employs about thirty-six people, twenty-six of them being scientists and engineers. Another, located in the prefecture of Tokyo, is the Research Institute for Environmental Protection, which has a total of seventy-five employees.

The Environmental Pollution Control Center was founded in the prefecture of Osaka in 1968 and placed under the prefecture's Department of

Life Environment (which has more than four-hundred employees). The center's main tasks are to monitor, report, analyze, research, investigate, and plan pollution control activities. It receives the information gathered by the continuously operating emission monitoring stations established at major stationary sources of pollution as called for in antipollution agreements. The city of Osaka operates its own monitoring system, but there is a systematic exchange of information between the municipal environmental authorities and those of the prefecture.

In almost all large municipalities, data on air and water quality and on other environmental domains are recorded systematically, including measurements of air pollution and effluents. This task ordinarily falls to a special department of the overall environmental authority.

In the following pages the environmental monitoring and reporting relating especially to air pollution and water pollution control in two large cities are described in detail. Of course, there are other spheres in which data are gathered as well, but air pollution and water pollution control are the main focus of environmental monitoring and reporting by local autonomous bodies.

Whereas an overview of the entire monitoring system in Japan's municipalities is not available in the sphere of water pollution control, there is nation-wide information about the monitoring of ambient air quality and emissions.

### **Monitoring Network for the Ambient Air Quality and Emissions: A Sketch**

Japan has built the world's densest network for the monitoring of ambient air quality. Nearly 1,700 monitoring stations continuously measure the concentration of SO<sub>2</sub>. The presence of other substances are not measured by the same number of monitoring stations, but they are recorded at many locations (see Table 7.2.1; the only stations that can be said to have functioned continuously are those that operated reliably for more than 6,000 hours a year).

Table 7.2.1: Ambient Air Quality Monitoring Network at the Local Level

Pollutants	General Air Pollution Monitoring Stations	Automobile Exhaust Monitoring Stations	Total
SO <sub>2</sub> (a)	1,626	51	1,677
NO, NO <sub>2</sub> (a)	1,279	284	1,563
CO (a)	214	322	536
Oxidants (a)	1,006	49	1,055
NMHC (a)	278	127	405
SPM (a)	366	30	396
Dust fall (m)	1,563	-	1,563

(a) : Automatic monitoring station

(m) : Manually operated monitoring station

NMHC: Nonmethane hydrocarbons

Source: Environment Agency, quoted in M. Hashimoto, "National Air Quality Management Policy in Japan" (Tokyo, 1985), (mimeographed).

The ambient air pollution monitoring network was enlarged rapidly. In 1971 around five-hundred stations were in operation; just a few years later it was well over one thousand. The vast majority of the continuously operating automatic monitoring stations use remote data communication, the telemeter system. The local authorities and the Environment Agency of the central government keep the interested members of the public thoroughly and regularly informed by publishing environmental quality reports containing the results of their monitoring. These reports also include information about special cases of pollution and the hazards they have been found to pose for human health. Within the expansive network of alert and control systems for cases of photochemical pollution, for example, notices on related health hazards are recorded. Another special feature of Japanese environmental monitoring and reporting is that information about air pollution caused by various noxious substances (generally SO<sub>2</sub>, NO<sub>2</sub>, CO, and O<sub>x</sub>) is shown continually on electronic display panels often found at prominent locations in large municipalities. Tokyo alone has erected about fifteen such panels.

For the planning of air pollution control policy, Japanese environmental authorities have access not only to the information available from the dense network for monitoring ambient air quality but also to data on developments in emissions of air pollutants. A great deal of effort has been made to record these emissions continuously. Since about 1970 such emission monitoring systems using the telemeter system were installed directly at major sources of pollution. They generally record fuel consumption, the sulfur content in liquid fuel, and the concentration of nitrogen oxides and sulfur dioxide in flue gas. The data are sent continuously to the responsible environmental authorities over a transmitting system set up especially for this purpose. In some municipalities (such as Kawasaki) the information on single polluters' emissions is also made public on request.

It is of interest that most of the emission monitoring stations of private polluters are not legally required; they are installed as part of antipollution agreements reached between local administrators and firms. In the sphere of water pollution control, however, effluent monitoring stations are usually installed as a result of legal measures, particularly those relating to the Total Pollutant Load Control System. For this purpose, the Water Pollution Control Act was amended in 1978 to establish a system for controlling the total pollutant load. Under this system, the Area-Wide Total Pollutant Load Control System for the chemical oxygen demand (COD) has been established for Tokyo Bay, Ise Bay, and the Seto Inland Sea. The firms themselves bear the investment and operating costs of the emission monitoring stations. The monitoring and maintenance of the gauges, which are sealed, is done under the supervision of the local authorities. Table 7.7.2 shows the state and development of the telemetric emission monitoring stations at the local level.

The Photochemical Smog Alert Systems of local Japanese governments systematically include the data on ambient environmental quality and emissions. These systems and the generally well developed electronic warning system make it possible to counter smog threats or, when serious photochemical smog does develop, at least to keep the number of health hazards considerably lower than would otherwise be the case. The smog alert system is examined in the following examples of environmental monitoring and reporting in two municipalities.

*Table 7.2.2: Number of Telemeter Member Stations for Emission Source Monitoring in Japan, 1973-1983*

Year	Number of telemeter member stations	Local governments that have established this system
1970	66	1
1971	163	2
1972	361	5
1973	477	12
1974	551	17
1975	652	22
1976	684	24
1977	683	21
1978	701	27
1979	702	28
1980	704	29
1981	709	31
1982	704	31
1983	712	34

Source: Environment Agency, 1985.

### **Environmental Monitoring and Reporting Systems in the Cities of Yokohama and Kawasaki**

The large municipalities of Yokohama and Kawasaki were selected as prime examples of the environmental monitoring and reporting systems designed to protect the ambient environmental quality and to assist in water pollution control. Both large cities are centers of industry, transport, and population and have been two of Japan's most polluted areas since the 1960s.

## *Yokohama City*

With three million inhabitants, Yokohama (located in the prefecture of Kanagawa) is Japan's second largest city. In the 1960s, Yokohama suffered from some of the worst urban environmental pollution in the country. The gathering and processing of information comes under the jurisdiction of the Environmental Pollution Monitoring and Control Center run by the Environmental Pollution Control Bureau of Yokohama City.

### Air Pollution

Dust fall in the ambient air has been measured since 1946, and the SO<sub>2</sub> concentration has been measured since 1959. The first automatic and continuously functional SO<sub>2</sub> monitoring stations for ambient air quality began operating in 1964. It was adopted to accommodate telemeter systems and on-line data processing in 1968. The monitoring of photochemical oxidants commenced in 1971, and in the same year special monitoring stations were established to measure air pollution caused by automobile exhaust. Automatic measurement of nonmethane hydrocarbons began in April 1976. In 1982 both the on-line and off-line electronic data processing equipment of the monitoring center was completely overhauled. Presently, the general air is monitored for various pollutants at sixteen locations in the city, and automobile exhaust monitoring stations are found at eight locations.

The automatic emission monitoring system using telemeters began operation in 1974. Continuous measurements of various parameters are made now at forty-six factories and other sources. Over 90% of all SO<sub>2</sub> and NO<sub>x</sub> emissions from stationary sources within the city limits are recorded. The data are transmitted over the telemeters system directly to the Monitoring and Control Center of the City.

### Water Pollution

Systematic monitoring of ambient water pollution was begun in 1971. The entire system was thoroughly modernized at the end of 1982, being



adapted to operate on the telemeter system. At the same time, the construction of the automatic effluent monitoring system was begun at factories and other sources of pollution, whereby the data, like those from the emission monitoring system, are conveyed directly and continuously to the Monitoring and Control Center.

At present there are nine stations for measuring water quality and twenty-four stations for monitoring the content of effluents from factories and waste water treatment plants. There are plans to expand the effluent monitoring system to thirty stations soon, a capacity that would record about 90% of the COD discharge load flowing from Yokohama into Tokyo Bay.

#### Environmental Data Processing and Reporting System

Some sources of air pollution and effluents are not incorporated into the telemeter system of direct, on-site monitoring. Depending on the magnitude and the context involved (as determined by specific relevant laws) measurements must be taken either continually or twice a year. Upon request, the data is received by the Monitoring and Control Center, which has ultramodern electronic equipment to process it. Data on the ambient quality of the environment are published at regular intervals in monthly or annual reports, for example. Current data can be requested by citizens at any time. In Yokohama data on emissions are published only in aggregate form, not according to their individual sources.

According to the Environmental Pollution Control Bureau and to private enterprises incorporated into the monitoring system, the environmental monitoring and reporting system in Yokohama has proven itself well. Technical problems in the operation of the monitoring stations are rare. Because of the great amount of data, their currency, and their variety, the system has helped the Environmental Pollution Control Bureau to develop and implement effective programs for the reduction of emissions.

The well-developed monitoring system also allows administrative bodies to react swiftly and flexibly to smog threats. On the basis of meteorological information and the continuously gathered data on emissions, the concentrations of pollutants in the ambient air (particularly  $\text{NO}_x$ ,  $\text{SO}_x$ ,

and  $O_x$ ) can be predicted very accurately several hours in advance. If a potential smog threat is expected, the factories linked into the emission monitoring system are requested to make a preventive decrease in their emissions of air pollutants.

The smog alert system, too, is largely automatic, allowing the Monitoring and Control Center to contact the pollution control officers in the relevant factories directly through the national communications network, the NTT line. There is no legal obligation for firms to respect the requests to reduce emissions; the calls to reduce emissions are issued as part of the informal system of antipollution agreements and administrative guidance that is typical of Japanese environmental policy as a whole.

### *Kawasaki City*

Located in the prefecture of Kanagawa, the industrial city of Kawasaki (1.1 million inhabitants) is situated on the edge of Tokyo Bay between Tokyo and Yokohama. Kawasaki is still one of Japan's most polluted cities. The Pollution Monitoring Center established in Kawasaki in 1972 is responsible for environmental monitoring and reporting. Environmental data has been gathered in Kawasaki since 1956, however. The center is also responsible for the collection of data to be used in environmental impacts assessments and the formulation of pollution control policies. To improve the data base for this purpose, the technical equipment of the Pollution Monitoring Center was thoroughly modernized in 1983. In addition, there is the Pollution Control Laboratory, at which special scientific and technical studies are conducted. In 1983, 129 people were employed by the municipality's environmental agency. The Pollution Control Laboratory employs 36 persons, including 26 scientists.

### Air Pollution

The first deposit gauges for recording dust fall were installed at sixteen locations in July 1956. The measurement of  $SO_2$  began in 1957 with manually operated gauges using the lead dioxide method at fifteen locations.

In 1964, the automatic SO<sub>2</sub> monitoring network was established, and its expansion to cover other pollutants began in 1970. The first electronic display panel announcing the status of air pollution was erected in front of the Kawasaki city hall in March 1971. In December 1972 the first monitoring stations for recording automobile pollution of the air went into operation. The expansion of the photochemical smog alert system was completed in 1974.

At present there are eighteen air quality monitoring stations in operation, including nine for recording general air pollution and nine for pollution from automobiles. The system functions continuously and automatically, with the data being transmitted constantly by the telemeter system to the Pollution Monitoring Center. An electronic display panel in front of the city hall posts the measurement results and signals a warning if the level of air pollution threatens to rise to dangerous levels. The nine special automobile monitoring stations record the levels of the pollutants CO, NO, and NO<sub>2</sub>. The monitoring stations measuring general air quality usually record the levels of SO<sub>2</sub>, NO, NO<sub>2</sub>, O<sub>x</sub>, dust, sometimes CO and HC, and other parameters such as wind direction. The systematic measurement of emissions from large stationary sources became possible when antipollution agreements were concluded with thirty-nine enterprises in August 1970. Two years later, the first automatic measurements of emissions from these enterprises commenced, first for SO<sub>2</sub>, later also for NO<sub>x</sub> and other substances. The expansion of the system to include NO<sub>x</sub> measurements was completed in December 1978.

Because emissions were reduced considerably, emission measurements were subsequently discontinued in some of the original thirty-nine enterprises. In 1986, twenty-seven large enterprises responsible for over 90% of all SO<sub>2</sub> and NO<sub>x</sub> emissions from stationary sources in Kawasaki were still linked into the automatic emission monitoring system. The data are transmitted continuously to the Pollution Monitoring Center. Changes in emission levels are announced publicly on special electronic display panels.

Since October 1984, the system for publishing pollution data has been expanded to make it possible for information about the pollutant discharge of individual stationary sources to be supplied by the Monitoring and Control Center to any citizen requesting it. The particular enterprise

involved can file an objection to such requests within sixty days, a provision intended to ensure protection of trade secrets.

## Water Pollution

Irregular monitoring of ambient water pollution started in 1971. The development of an automatic and continuous water quality monitoring network covering rivers and coastal areas did not begin until 1981. In March 1983, the establishment of the effluent monitoring system was completed at various factories and other sources of pollution. The water quality monitoring system presently consists of eight automatic measuring stations, which record data on water temperature, PH, conductivity, turbidity, dissolved oxygen, chlorine ions, and the COD, and transmit the information continuously to the Environmental Pollution Monitoring Center. In connection with the national Water Pollution Control Act and the introduction of an area-wide total pollutant load control system for COD, devices for measuring effluents were installed in twenty-two public and private enterprises. They analyze effluents in terms of the COD in enterprises with a daily effluent emission of more than 5,000 m<sup>3</sup> and a daily COD pollution load of more than 50 kg. These data, too, are continuously transmitted to the Pollution Monitoring Center.

## Environmental Data Processing and Reporting System

Similar to the Environmental Monitoring and Control Center in Yokohama, the Environmental Pollution Monitoring Center in Kawasaki is equipped with state-of-the-art electronics for gathering, processing, and disseminating information. The data collected are published as monthly or annual reports or as special reports. In addition, two electronic display panels set up at different locations give continuous information on the concentrations of various pollutants in the air. They also display a warning sign when air pollution reaches a dangerous level. The Pollution Monitoring Center also has an electronic panel that shows the water quality.

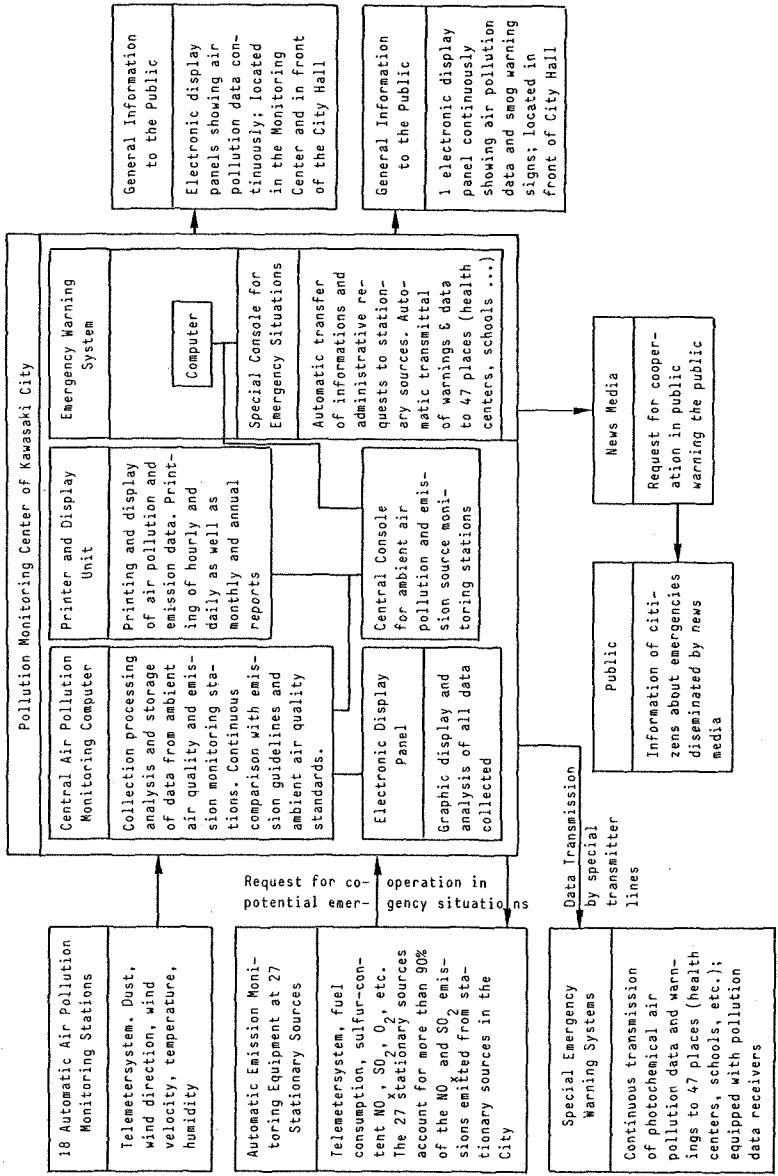
In addition to fulfilling general monitoring responsibilities, Kawasaki's environmental pollution monitoring system also warns of photochemical smog conditions and coordinates concerted measures to counter them. The development of a photochemical smog alert system was completed in March 1974.

Figure 7.2.1 affords an overview of that function and of the general monitoring system pertaining to air quality control. The smog alert system systematically incorporates data on air quality and emissions as well as basic meteorological data. If smog conditions become threatening, the twenty-seven stationary sources hooked into the emission monitoring system are automatically notified by the Pollution Monitoring Center and requested to reduce emissions to levels specified in the general smog regulations. The personnel at the sources also receive constant updates on air quality so that they can observe for themselves the effect of the measures they are taking. Similarly, factories whose emission levels exceed those specified in established guidelines or in antipollution agreements are notified automatically.

The general public is warned of adverse conditions through information disseminated by the public media, with extra notices being sent to health centers and schools. For example, forty-seven schools and health centers within the city limits now have special transmission lines laid exclusively to handle smog alerts. The receivers installed at those locations not only signal a smog alert but also indicate the level of air pollution.

According to the Monitoring and Control Center and to information from interviews conducted at factories, there are few technical problems with the system for monitoring air quality and emissions. Such problems are rare in water pollution control, too, although there are still difficulties with the development of automatic and continuous measuring devices for pollutants and parameters other than those currently covered. In general, all participating groups have stressed the positive function of continuous environmental monitoring for the planning, implementation, and enforcement of environmental protection measures.

Figure 7.2.1: Air Pollution Monitoring and Reporting System



Source: Quoted after Kawasaki City Pollution Monitoring Center, abridged version, Kawasaki 1985.

## **The Significance of Environmental Monitoring and Reporting for Japanese Environmental Policy**

The systematic collection and disclosure of environmental data by the responsible administrative bodies gives polluting firms considerable incentive not only to observe environmental protection regulations but also to implement environmental protection measures that go beyond legally required standards. Some administrative actors use the publication of information selectively and massively in order to change the behavior of polluting factories in general or in specific.

The most potent incentive for 'environmentally sound behavior' is the effort of firms to have a good 'environmental protection image' in public, especially in their local communities. The reason for making such an effort is evidently not only the threat of sanctions (like boycotts by customers or, more subtle, discrimination against employees of firms contributing greatly to the pollution of the local environment) but also the conviction that environmental protection measures are socio-economically necessary and purposeful, a view that has largely been internalized in the corporate world over the years. In these cases, environmental reporting can promote a positive corporate image.

A basic prerequisite for controlling environmental policy by publishing information has long since been fulfilled in Japan, for the system for collecting, processing, and disseminating environmental information was expanded at the end of the 1960s. As a result Japanese environmental authorities now have a comprehensive, highly current body of data provided by constant monitoring.

The environmental monitoring and reporting by Japanese municipalities has clearly had positive effects on environmental protection in Japan. The successes of Japanese clean air policy in reducing emissions of  $\text{SO}_2$  and  $\text{NO}_2$  from stationary sources and in largely halting the discharge of toxic substances into water bodies are attributable in great part to the impact of comprehensive monitoring and information systems.

It is beyond question that the economic efficiency of environmental protection measures can in principle be increased if, as is the case in Japan, they can be planned and implemented by administrative bodies and based on comprehensive environmental monitoring and reporting sys-

tems. The system of environmental reporting described in these pages is a fundamental prerequisite for the functioning of such key instruments of Japanese environmental policy as area-wide total pollutant load control systems for improving ambient air and water quality, compensation systems for pollution-related health impairments, antipollution agreements, administrative guidance for environmental protection, and the K-value system for SO<sub>2</sub> emissions.

Japan's well-developed system of environmental monitoring and reporting also allows flexible and controlled reaction to problematic environmental situations that build up over a short period of time (serious smog levels in particular). The continuously recorded data on emissions and ambient air quality are systematically included in the smog alert system of the country's municipalities. When smog becomes serious, the personnel at the main stationary sources of pollution are notified automatically for the most part and requested to reduce emissions as part of general or special local smog regulations. This comprehensive information system supplies highly discrete data, for it measures the emissions of individual factories; it is also equipped with efficient feedback. For both reasons, it allows the responsible administration to address its directives and guidance directly to specific sources in problem situations. This feature makes it possible to optimize the relation between environmental relief and intervention in factory operations, a result that, in turn, has a favorable economic impact on the enterprises involved.

Considered in terms of democratic theory, the Japanese system of environmental monitoring and reporting creates a key condition for substantial grass-roots participation in environmental policy-making. The approach guarantees the high degree of the intelligibility necessary to allow citizens themselves to judge achievements and shortcomings in environmental protection so that priorities in environmental policy can be set in a rational manner. As far as one can tell, the Japanese practice of largely opening the access to information about environmental protection has decisively increased the influence that citizens have on environmental protection measures without swamping firms with a wave of impossible demands and without compromising the effectiveness of environmental authorities.



Indeed, that effectiveness has actually been enhanced because local administrations actively bring the environmental involvement of the citizenry to bear on the strategies for enforcing environmental protection measures where polluting enterprises are concerned. The only firms disadvantaged by the disclosure of environmental information are those doing little to protect the environment; firms with a positive environmental balance sheet benefit.

In summary, both the administrative guidance that firms receive from Japanese authorities and the practice of systematizing environmental monitoring and reporting are essential resources of planning and control in Japanese environmental policy at all levels of administration. Unlike the means drawn on in the environmental policies of other countries, these are so much a part of Japanese environmental policy and are so prevalent that they can be described as one of its specific characteristics.

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