

Pollution Control in Japan

By Jumpei Ando

Foreingers who visit Japan to study the state of pollution control here often ask why this country takes such stringent measures in this area. In fact, by world standards Japan sets extremely severe standards for various pollutants such as mercury, cadmium, sulfur dioxide, and nitrogen oxides. And the cost of reducing these pollutants is reaching astronomical proportions. The stringency of Japan's anti-pollution measures reflects a series of pollution-induced tragedies in the 1960s, the best known being the so-called Minamata disease, which made pollution control one of the nation's greatest concerns.

The remarkable progress in pollution control may be compared with the spectacular achievements the United States has made in the field of space technology, which that country selected as one of its priority technologies and in which it has invested huge sums of money. Pollution control may not be as spectacular as space technology, but it is essential for keeping the earth clean.

Japan has proved that pollution control is possible even in a densely-populated, highly-industrialized country. It has also demonstrated that many of its industries can remain internationally competitive even if they take stringent anti-pollution measures and keep wages on a par with Western industrialized nations. Today, Japan is moving beyond simple pollution control toward the creation of a better environment.

Prevention or compensation?

Smoke-belching factory chimneys were a symbol of future prosperity before World War II and in the immediate post-

war years. However, pollution quickly worsened as the country enjoyed the growing affluence brought by high economic growth. The smoke that was once likened to a seven-color rainbow became a symbol of gloom and vice.

In the Minamata case, a chemical company found guilty of discharging organic mercury into the environment has now paid about ¥30 billion (\$125 million) in compensation to some 2,000 patients and the bereaved families of another 600 dead. The Minamata case taught the industrial world that prevention is cheaper than compensation. The entire tragedy need not have happened had it been known that part of the metallic mercury used in the aldehyde manufacturing process changes into organic mercury, and if the chemical company had constructed a facility early on to remove the organic mercury from waste water.

It is an established rule in criminal law that one cannot be punished simply because one appears suspicious. However, in cases involving potentially harmful substances, the precedent in Japan is often to punish the suspect before proven guilty. The Minamata case, for example, began as a civil case for the payment of compensation, but it later evolved into a criminal case. The Minamata disease had brought home to the Japanese people the tragic consequences of industrial pollution.

Stringent regulations

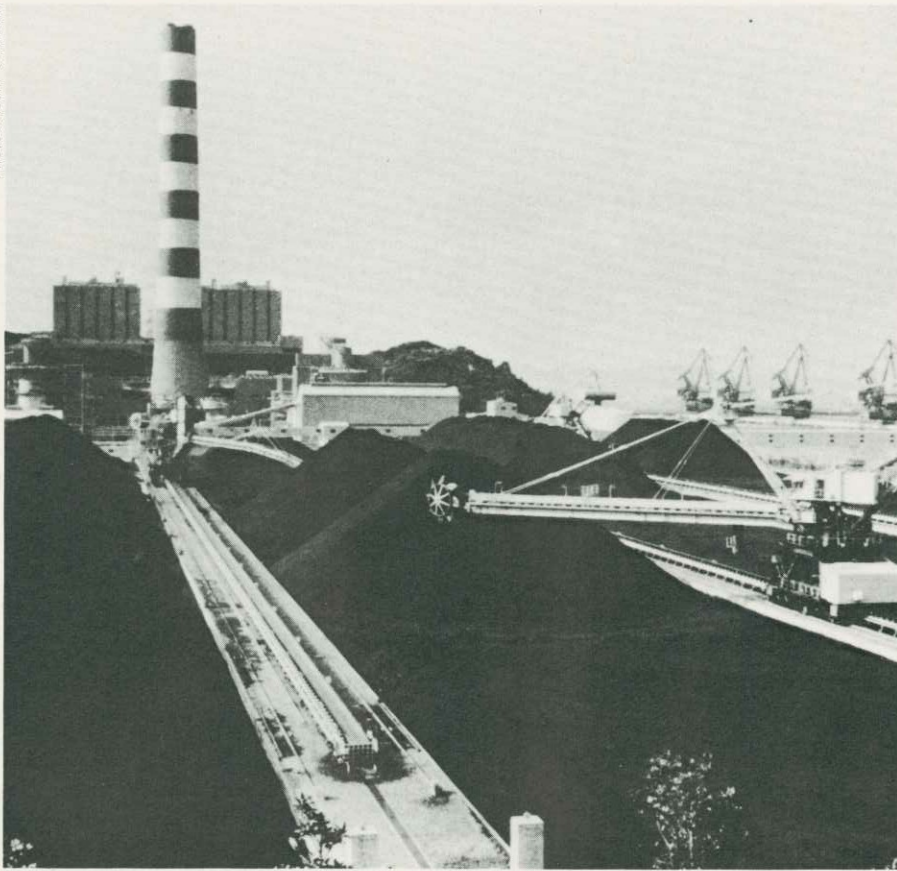
Many of Japan's pollution control regulations are the most stringent in the world. For example, sodium chloride electrolysis using mercury is banned in Japan. The conversion to the alternative diaphragm method is estimated to cost nearly ¥1 trillion (\$4.167 billion). While the mercury process does discharge a small amount of metallic mercury, there are no identifiable effects on health, and it is still being used in other countries. The level of waste mercury resulting from the mercury process in Japan is the lowest in the world, and Japanese control methods have been adopted in some foreign countries. Yet it is only Japan that has gone so far as to ban the mercury process altogether.

The two substances considered the worst sources of air pollution in many countries around the world are SO₂ (sulfur dioxide) and NO₂ (nitrogen dioxide). The ambient air quality standards set by various nations are compared in Table 1. Ambient standards should theoretically be universal as regards their impact on human health. Japan's standards are so much higher simply because of the greater demand for environmental safety in this country.

Both the central and local governments have regulations concerning the emission of pollutants. In addition, pollution con-

Table 1 Ambient Air Quality Standards

Country	SO ₂ , ppm		NO ₂ , ppm	
	Daily Average	Yearly Average	Daily Average	Yearly Average
Japan	0.04	0.02	0.04-0.06	0.02-0.03
U.S.A.		0.03		0.05
West Germany		0.05		0.05



A coal-fired power plant in Nagasaki, southern Japan. It is equipped with flue gas cleaning facilities.

trol agreements between private enterprises and residents' groups provide for even more stringent measures. This explains why Japan has more flue gas treatment plants for SO_2 and NO_x removal than any other country (Table 2). Ambient concentrations of SO_2 and NO_2 in Japan's large cities and industrial areas are lower than in Western nations (Figure 1).

Table 2 Number of Commercial Plants for Flue Gas Cleaning (Rough Numbers in 1982)

	Japan	U.S.A.	West Germany	Others
SO_2 removal	1,400	250	10	5
NO_x removal	200	10	0	0

Pollution control costs

The installation of pollution control facilities in Japan has been encouraged by loans not only from private organizations but also from the Environmental Pollution Control Service Corporation, Japan Development Bank and other semi-governmental bodies. Because of this "carrot and stick" approach, pollution control has made rapid progress since 1970. Annual production values of the pollution control equipment supplied by machinery manufacturers since 1970 are indicated in Figures 2 and 3. The cost of constructing

pollution control plants has been nearly as much again. And added to this is the continuing cost of operating the plants.

The annual production value of SO_2 removal facilities in Japan reached a record ¥150 billion (\$625 million) in 1974 (Figure 2). Yet SO_2 ambient concentrations had already reached the U.S. standard (0.03 ppm) in most areas in 1973. Investment costs in and after 1974 would have been markedly reduced had Japan adopted the U.S. standard. West European nations are seeking to reach the U.S. standard in about 10 years, when Japan has already reached a lower standard (0.02 ppm). Thus it is no surprise that pollution control investment in Japan is the highest in the world (Tables 3 and 4).

Air pollution control efforts in Japan are currently aimed at reducing NO_x . Nearly half of all artificial NO_x emissions are from automobiles. The world's most severe NO_x standard (0.25 grams/km) has been applied to new Japanese automobiles since 1978. As for stationary sources, construction of NO_x removal facilities is being accelerated, while similar efforts are going into combustion control (Figure 2).

Coal-fired power plants in Japan are equipped with flue gas cleaning facilities to remove particulates, SO_2 , and NO_x . The total pollution control cost—the sum of the air cleaning cost and all other costs including ash disposal and waste water treatment—exceeds ¥4/kwh (Table 5). It is

Fig. 1 Ambient Concentrations of SO_2 and NO_2 in Major Cities (Annual Average)

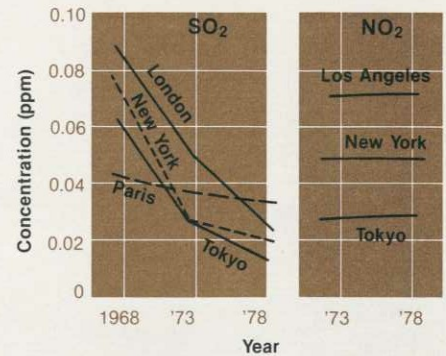


Table 3 Pollution Control Investment and GNP (1975)

	Amount (¥billion)	Percent of GNP
Central government	285	0.2
Local government	1,200	0.8
Enterprises	1,403	1.0
Total	2,888	2.0

Table 4 Pollution Control Investment by Private Enterprises in Major Countries in 1974 (OECD Report)

Country	Percent of total investment by private enterprises*	Percent of GNP
Japan	4.0	1.0
U.S.A	3.4	0.4
Netherlands	2.7	0.3
Sweden	1.2	0.1
West Germany	2.3	0.3
Norway	0.5	0.1

*Including those which cause no pollution.

Fig. 2 Yearly Production of Air Pollutant Removal Facilities

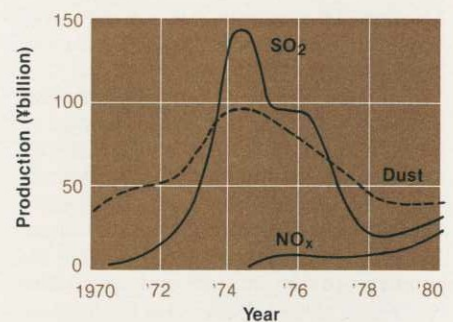


Table 5 Power Generation Cost (yen/kwh, in 1982)

Fuel	Pollution control			Fuel	Other	Total
	SO_2	NO_x	Other			
Coal	1.9	0.8	1.8	6.5	7.0	18.0
Low-sulfur oil	0	0.1	0.5	14.0	6.4	21.0



Izumi Sakai Kita industrial complex near Osaka, a typical industrial complex scene in Japan.

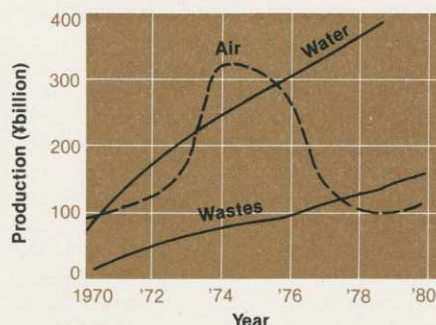
thus now possible to get flue gas about as clean as when using good quality low-sulfur oil. As the power generating cost is lower for coal than oil plants, construction of coal-fired power plants is gaining momentum.

Improvement in environmental quality

Air quality in Japan has been greatly improved thanks to these efforts. From high buildings in Tokyo one can now see Mt. Fuji 100 km away. And damage from acid rain and photochemical smog is practically non-existent.

Dramatic progress also has been made in improving water quality. In the case of harmful substances such as heavy metals and cyanate, the number of water samples found to exceed the standards dropped from 476 in 1972—out of a total of about 160,000 samples taken annually across the country—to 140 in 1976 and 75 in 1980 (0.05% of the total). Salmon fry have recently been planted in a number of rivers in large cities. People can be seen fishing at quays near factories and power stations along Tokyo Bay, which is said to be relatively polluted. Fish from those areas are safe to eat, and delicious too. In recent years investment in water purification and waste treatment has increased even further (Figure 3).

Fig. 3 Yearly Production of Environmental Control Facilities



What measures are desirable?

Not only Japan's pollution control costs, but its energy costs as well are the highest in the world. Many Japanese industries have succeeded in absorbing these costs through rationalization and improved efficiency, thereby maintaining their international competitiveness. But some industries that consume large quantities of energy or require major pollution control investment are in trouble. Examples include aluminum smelting and soda electrolysis.

Pollution must be controlled, whatever the cost, to protect human health. However, economic factors should also be taken into account and the most cost-effective

measures selected to achieve greater safety and create a better environment. In Japan the emphasis is shifting from pollution control to environmental protection. Further efforts must be made to provide more greenery in the cities and to improve the quality of life. In this respect Japan has much to learn from Western nations.

What environmental action is most desirable in order to keep the earth beautiful and enable people to enjoy a more affluent life in a congenial environment? It is hoped that people in many lands will work together to find the most effective answer to this question in keeping with the special situations prevailing in each of their countries. Japan should stand ready to offer its bountiful experience and technology in pollution control to help meet this great challenge.

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