

Chapter 3

Measures to Control Environmental Pollution

1 Regulation of Factory Effluent

From 1932, effluent containing methyl mercury, created in the acetaldehyde manufacturing process of Chisso Minamata factory, was discharged into Minamata Bay (once also into the mouth of Minamata River).

Whilst imperfect, the refined drain recycling system, thought to be partially effective in extracting mercury, was adopted in August 1960. In June 1966, due to the realization of a complete effluent processing system, effluent containing methyl mercury in principle, ceased to be discharged, and in May 1968, the pollution source disappeared due to the discontinuation of acetaldehyde production.

In February 1969, The Economic Planning Agency designated the Minamata ocean expanse as an appointed water expanse under the (now former) Water Quality Control Law, also establishing a standard on water quality, and initiating regulation of methyl mercury under the (former) Factory Effluent Control Law.

In December 1970, the Water Pollution Control Law was enacted, followed by nationwide uniform regulation of the discharge of toxic substances such as mercury.



The present Hyakken Waterway (1999). Industrial effluent was discharged from here to Minamata Bay.

Table 1 The drainage standard for mercury based on the Water Pollution Control Law

Total mercury	0.005mg/l
Alkyl mercury	Should not be detected. (Fixed quantity limit of 0.0005mg/l)

2 Measures taken regarding the Contamination of Fish and Shellfish

Instruction to Fishermen to Voluntarily Refrain from Catching and Consuming Fish - The Self-Imposed Fishing Bans

From around the end of 1956, during the pursuit of the cause of Minamata disease, initial recognition that the extraction of large quantities of fish and shellfish from Minamata Bay was inducing the disease, set in.

For this reason, Kumamoto Prefecture implemented voluntary restrictions on fishing and consumption of fish and shellfish, and later began consideration of the implementation of the Food Sanitation Act. On July 24, 1957, the Committee on Measures Against the Minamata Unknown Disease, decided to announce its plan under Article 4 of the Food Sanitation Act, to prohibit the capturing of fish and shellfish for retail purposes from Minamata Bay. (This committee consisted of the Chairman=Vice Governor, a vice-chief and relevant section chiefs from the Departments of Health, Public Welfare, Engineering & Construction, and Economics). On August 16, the Committee made inquiries to the Ministry of Health and Welfare on the possible implementation of the Food Sanitation Act regarding fish and shellfish taken from Minamata Bay.

On September 11, the Ministry of Health and Welfare replied, "As there is no clear evidence that all fish and shellfish of a specific area of Minamata Bay are contaminated, the Food Sanitation Act is not applicable to fish and shellfish caught in Minamata Bay".

Thus, Kumamoto Prefecture was unable to implement the Food Sanitation Act, resulting in continued enforcement of voluntary restrictions on consumption of fish and shellfish from Minamata Bay. Administrative guidance beseeching the Minamata Fisheries Cooperative Association (hereafter called the Minamata Fisheries Co-op) to exercise self-regulation of fishing in the bay was also subsequently enforced.

Even after the Ministry of Health and Welfare refused to implement the Food Sanitation Act, Kumamoto Prefecture and Minamata City continued to petition to related ministries, demanding special legislation prohibiting fishing and designating danger water areas, however, no legislation to this effect was passed.

note

In the period 1955-1964, black porgy containing 24ppm of mercury, and barracuda containing 58ppm of mercury had been confirmed in the Minamata Bay and surrounding areas.

The Minamata Fisheries Co-op placed self-imposed restrictions on harvests from Minamata Bay from August 1957. From July 1960, together with the cooperation of the town, the Co-op was able to provide guidance to ensure harvesting did not take place by expanding the regulated area to within a 1000 meters of land, and through activities such as patrolling the area with a patrol boat.

Due to the Minamata Fisheries Co-op's self-imposed restrictions on fishing, as well as the Chisso Minamata factory setting up a sedimentary pool and effluent processing device after 1960, it was believed that the phenomenon of patients falling ill to Minamata disease had come to a halt in this same year.

It was under these circumstances that the Minamata Fisheries Co-op, in April 1962, lifted the voluntary restrictions on fishing, with the exception of restrictions in Minamata Bay. Subsequently, in May 1964, the Co-op completely abolished all restrictions on harvesting in the bay.

On May 22, 1973, when the Kumamoto University Second Minamata Disease Medical Study Group announced "the fish and shellfish of Minamata Bay and surrounding areas are still unsafe. If consumed in large quantities, there is a danger that there will be an outbreak of the disease", the Minamata Fisheries Co-op, with the guidance of Kumamoto Prefecture, once again enforced voluntary restrictions, by establishing restricted fishing areas, and organizing patrol boats.

National Government establishes "Provisional Regulatory Standards for the Level of Mercury in Fish and Shellfish"

On July 23 1973, given the social situation, to dissolve consumers' anxieties regarding mercury contamination, the government enacted the "Provisional Regulatory Standards for the Level of Mercury in Fish and Shellfish", requiring total mercury to be less than 0.4ppm, and methyl mercury to be less than 0.3ppm.

Installation of Dividing Nets by Kumamoto Prefecture

In an effort to calm social panic and stabilize plummeting fish prices, Kumamoto Prefecture began construction in January 1974, of dividing nets, which would close off the mouth of Minamata Bay and prevent the spread of contaminated fish. The nets closed off the bay for a period of 23 years until their complete removal on October 14, 1997.



Dividing Nets extended from Kojishima island

Prohibition of (Fishery) Operations while Pollution Prevention Project works underway

Having established the 'Agreement on Compensation for the Fishing Industry' with Kumamoto Prefecture, from April 1, 1975 to March 31, 1990, during the implementation of pollution prevention operations, the Minamata Fisheries Co-op, prohibited fishing in Minamata Bay.

Call for Recreational Anglers to Refrain from Fishing



Announcement calling for Recreation Anglers to Refrain from Fishing

In September 1975, Kumamoto Prefecture, Minamata City and the Minamata Fisheries Co-op set up a public notice board, calling for the public to cooperate in exercising voluntary restraint regarding fishing in Minamata Bay. This was prompted by the inhabitation of fish and shellfish containing levels of mercury exceeding the temporary regulation enacted by the government, in the dividing nets in Minamata Bay.

Again, from June of 1978, with a view to protecting the health of local residents, Minamata City, employed a full time supervisor to police people shell-fishing and fishing from land. Then from October 1981, the city set up an ocean patrol using fishing boats to police fishers in the bay, as well as making a call to the public to refrain from fishing.

Buy-Back of Fishing Hauls while Dividing Nets in Place

On January 25, 1989, the Kumamoto Prefecture Special Committee on Fish and Shellfish in Minamata Bay, consisting of 23 members including scholars, staff of related administrative organizations, members of the Prefectural Government and local citizens was held for the first time to carry out comprehensive investigations into the fish and shellfish inhabiting Minamata Bay, and to determine effective countermeasures against contaminated fish.

Results of research and analysis on the level of mercury concentration in fish and shellfish in Minamata Bay, were carefully reviewed by the committee, and formed the basis for the continued deployment of the dividing nets, as well as establishment of potential treatment and countermeasures against contaminated fish in the bay. Because a 1989 investigation cited 16 fish species exceeding the provisional regulatory levels on mercury contamination in fish and shellfish, the committee decided to leave the dividing nets in place for longer, to ensure against the circulation of contaminated fish from the bay into the local market place.

From April 1, 1990 to July 5, 1992, the Minamata Fisheries Co-op did not carry out harvesting operations in the bay, due largely to continued deployment of the dividing nets, and difficulties in negotiations with Chisso, regarding compensation for the fishing industry.

In an attempt to prevent the spread of fish containing levels of mercury exceeding the provisional regulatory levels, to the market place, under the "Agreement Relating to Compensation for the Fishing Industry", Chisso was forced by members of the Minamata Fisheries Co-op to purchase fish and shellfish caught in the bay, from July 6, 1992 to October 15, 1997 (until the day after the dividing nets were removed).

Removal of the Dividing Nets from the Nanatsuse Region

Due to consistent decline in the mercury levels in the fish and shellfish of the bay, the Kumamoto Prefecture Special Committee on Fish and Shellfish in Minamata Bay met in August 1993, and with the recommendation of the Minamata Fisheries Co-op, proposed a gradual phasing out of the dividing nets. In October the prefecture installed inner dividing nets separating Minamata bay and Nanatsuse zones. In an investigation in the latter part of fiscal 1994, it was confirmed for the first time that the mercury levels of all fish and shellfish inhabiting both zones were below the provisional regulatory levels. In February 1995, the Committee concluded that the complete removal of the nets was still premature and instead proposed the removal of only a part of the nets (the outer dividing nets of the Nanatsuse sea area). In April, Kumamoto Prefecture began work on the dismantling of the dividing nets on the outer side of the Nanatsuse zone. Dismantling of the nets was completed in June, and the Nanatsuse sea area was opened.

"Minamata Bay Declared Safe" -Removal of the Minamata Bay Dividing Nets

In February 1997, Kumamoto Prefecture drew up its "Basic Policy on Measures for Fish and Shellfish of Minamata Bay" which included provisions for removing the Minamata Bay dividing nets in 1997 if confirmation could be made, after an investigation to be conducted in the first half of the 1997 fiscal year, that mercury levels were below regulatory levels and had been so for three years. This report was given to the meeting of the Committee on Fish and Shellfish. Having given its unanimous approval of the policy, the committee was then dissolved.

In accordance with its policy, Kumamoto Prefecture initiated a follow up investigation in the first half of fiscal 1997, confirming the continuing decline of mercury levels in all fish species, and that the mercury levels had remained below provisional regulatory standards for the past three years. This report was then sent to former members of the Committee on Fish and Shellfish, for verification. Meanwhile, meetings were held for interested local parties and all coastal fishing associations, in an attempt to obtain the public's understanding and acceptance of evidence that the bay fish and shellfish were safe. The meetings proceeded without a single dissenting opinion from those in the fishing industry, other related residents of the prefecture or the citizens of Minamata City.

Stressing the fact that confirmation had been made regarding the safety of the marine products of Minamata Bay, and that a consensus had been reached by the citizens of the prefecture, Kumamoto Prefecture Governor Fukushima issued the "Minamata Bay Safety Declaration" on July 29, 1997. The declaration announced the decision to completely remove the last of the dividing nets, which had been set in place in January 1974, 23 years before. Removal operations began on August 21, and on the 23rd of the same month, the net section was removed. The entire operation of removing the anchors, sounding equipment and supplemental facilities was completed on October 14. On the afternoon of the following day, October 15, Minamata Bay was re-opened as a general fishing zone, and the Minamata Fisheries Co-op re-commenced harvesting for the fish market after a period of 24 years. After the removal of the dividing nets, erring on the side of caution, it was decided that investigations into the level of mercury in fish species in Minamata Bay, should be carried out twice a year for a period of three years, until 2000.



Removal of the Dividing Nets

Fisheries Compensation paid by Chisso

As inquiries into the cause of Minamata disease progressed, and it became evident that the disease occurred upon consumption of contaminated fish from Minamata Bay, fish caught in the nearby Minamata Bay stopped selling completely, and even fresh seafood retail shops in the city experienced poor sales.

On July 31, 1959, the Minamata City Fresh Seafood Retailers Union, which had seen business take a turn for the worse due to declining sales of fish, held a general meeting. The meeting resulted in resolve "not to buy any fish or shellfish taken from the Minamata Sea, or fish caught by local fishermen". This proposition was put to the Minamata Fisheries Co-op, and also discussed with the town, however, no conclusion was reached. In the special general meeting held on the next month, on August 1, resolve to carry out a boycott was again confirmed, and then actually implemented on August 3.

On August 6, based on the resolve of the 4-day Special General Meeting and the Fishermen's General Meeting, the Minamata Fisheries Co-op, which had suffered a serious blow as a result of the boycott, together with the City Fresh Seafood Retailers Union, demanded the following from Chisso. compensation to the fishing industry, complete removal of sedimentary sludge, installation of an effluent-processing device.

In response, Chisso maintained that "the cause of Minamata disease is still undetermined", and whilst it agreed to provide urgent compensation, this fell a long way short of the Minamata Fisheries Co-op's demands. Consequently negotiations came to a stand still. On August 17, negotiations took place again, however, came to a head when local fishermen revolted against the amount of compensation, which Chisso had offered, claiming it was not enough. Angry fishermen stormed into the meeting place of the negotiations in noisy protest, and on the following day, August 18, the prefectural police mobile unit intervened, exercising its influence. Fishermen, representatives from the factory, and police were wounded (the 1st Fishermen's Dispute).

After that, in order to solve the predicament, with the Mayor of Minamata acting as Chairman, a mediatory committee was established. Through the mediation of this committee, on August 29, Chisso concluded an agreement with the Minamata Fisheries Co-op, which included clauses for the company to pay compensation to the cooperative. In particular, 20 million yen in compensation to the fishing industry, 15 million yen as funds to promote the fishing trade, 2 million yen in pensions, and the installation of an effluent-processing device.

On October 17, the fishing communities from the Shiranui Seaboard held a general meeting (sponsored by the Kumamoto Prefectural Fishery Federation), whereby the demands of the Minamata Fisheries Co-op, and compensation to patients of Minamata disease were decided upon. It was then proposed to Chisso that negotiations be held, however, upon Chisso's outright refusal, 1500 fishermen gathered uninvited at the factory, throwing stones and protesting loudly, resulting in police invention.

On November 2 the Shiranui Seaboard Fishermen's General Meeting was held again, and after demonstrative marches in the city, it was proposed to Chisso that group negotiations be held regarding the termination of operations. However, as Chisso turned down the proposal, angry fishermen stormed into the factory, clashing with the police who were trying to intervene, resulting in a huge scene with more than 100 people wounded, and 35 people arrested (the 2nd Fishermen's Dispute).

On November 24, at the request of both the Prefectural Fisheries Association and Chisso, the Shiranui Sea Fisheries Dispute Mediation Committee (Governor, Chairman of the Prefectural Assembly, Minamata Mayor, Towns and Villages President, President of the Kumamoto Daily Newspaper) was established and arbitration commenced.

On December 17, both parties agreed to an arbitrary proposal containing clauses for the installation of a purification device, loss compensation (35 million yen), funds for getting the industry back on its feet (65 million yen).

In 1973, the Minamata Fisheries Co-op received 4 hundred million yen from Chisso as compensation to the fishing industry, for the so-called "third outbreak of Minamata Disease". 2.28 billion was also paid to the 30 fishing cooperatives of the Shiranui Seaboard, and 729.6 million to the three fishing cooperatives of Izumi City, Azuma Town, and Nagashima Town.

Even after the completion of the Pollution Prevention Project in 1989, due to the discovery of fish and shellfish in Minamata Bay containing levels of mercury exceeding provisional regulatory levels established by the government, it was decided that the dividing nets should be left in place.

Following this, Chisso and the Minamata Fisheries Co-op came to an agreement, involving compensation to the fishing industry for the reduction in fish harvests in Minamata bay caused by the continued deployment of dividing nets, the compulsory purchase by Chisso, of fish and shellfish caught in Minamata Bay. Compensation to the fishing industry totaled approximately 9 hundred million yen.



Minamata Fisheries Co-op demanded fisheries compensation to Chisso. However, the negotiations came to a rupture, Chisso factory was then blocked by fishing boats from the sea and by fishermen on the ground. (July 1973)



Buy-back of fishing hauls

Administrative Aid to Support the Fishing Industry

To aid local fishermen, Kumamoto Prefecture provided advice regarding finance under the Family Corrective Funds System, to families whose income had decreased due to the inactivity of fishing operations. The prefecture also provided advice regarding employment to those wishing to change their occupation.

In March 1958, the Shallow Waters Landfill Project, (the set up of concrete blocks for fish nests and the depositing of rocks to encourage seaweed growth), was established by the Government and Kumamoto Prefecture, in areas of the sea thought to be pollution free. In 1958, in planning a change of harvesting area, fish nests and rock structures were established in Modo. In fiscal 1959, the prefecture provided assistance in a plan to convert the fishing industry, actively encouraging fishing operations in nearby seas, and the culturing of mother pearls. In 1960, the national government, and Kumamoto Prefecture provided monetary aid to the Minamata Fisheries Co-op for the purchase of fishing vessels, to be used in new fishing activities. From June 1973, Kumamoto Prefecture provided finance, loaning funds for living expenses to members of the Minamata Fisheries Cooperative. Minamata City absorbed the interest costs associated with these finance amounts.

Following this, in the period from April 1975, until the Pollution Prevention Project was completed in March 1990, the Minamata Fisheries Co-op stopped fishing operations within the dangerous zone, and Kumamoto Prefecture provided compensation (total amount 3.315 billion yen) to the Fisheries Co-op.

3 Environmental Restoration Project

Minamata Bay Pollution Prevention Project

From 1932, for approximately 40 years, the Chisso Minamata factory used mercury as a catalyst in the process of manufacturing acetaldehyde and vinyl chloride. During this period, it is said that approximately 70-150 tons or more of mercury, mixed in with effluent from the factory, was discharged into Minamata Bay. Sedimentary sludge, which settled on the floor of the ocean, containing more than 25ppm total mercury, had an approximate total volume of more than 1.51 million m³ and an area exceeding approximately 2.09 million m². There were also areas in the depths of the bay, where the thickness of this sludge reached 4m.

Again, even after the Chisso Minamata factory stopped manufacturing acetaldehyde in 1968, fish and shellfish containing levels of mercury exceeding the provisional regulatory standards on the level of mercury in fish and shellfish, enacted by the government, inhabited the bay.

Due to the fact that, if the situation had continued as it was, not only would the local residents have been left in a state of anxiety, but the fishing industry would have been severely hindered, and management of the maintenance of the bay, would have been hampered, it was necessary to urgently and safely dispose of the sedimentary sludge in the bay, and to plan restoration of the environment to its original state. For this reason, on October 1, 1977, the Minamata Bay Pollution Prevention Project was initiated to dispose of sedimentary sludge containing over 25ppm of mercury (the standard calculated based on the regulatory standards for the removal of bottom sedimentary sludge, established by the Environment Agency).

This project saw the deepest part of the bay (approximately 580,000m²), where mercury content was high, enclosed with a metal sheet, and the areas of low mercury density (approximately 1,510,000m²) which had about 780,000m³ of sedimentary sludge, dredged with a cutterless pump ship and poured into a reclaimed land area. The ground surface was then treated with a synthetic sheet and loam, and covered with soil from nearby mountains to confine the mercury-contaminated sludge. The 4th Port and Harbors Construction Bureau belonging to Ministry of Transport supervised these difficult marine engineering operations, whilst the prefectural government was in charge of the ground operations and overseeing operations.

On December 26, 1977, soon after the commencement of the project, a temporary injunction concerning the dredging of sedimentary sludge was filed at Kumamoto District Court by some of the residents of the area who feared secondary contamination due to dredging operations. Due to this development, and the need to ensure the success of the project, Kumamoto Prefecture was forced to stop operations. On April 16, 1980, the court decided that the safety of the project had been established and subsequently rejected the call for a temporary injunction, enabling Kumamoto Prefecture to resume dredging on June 6.

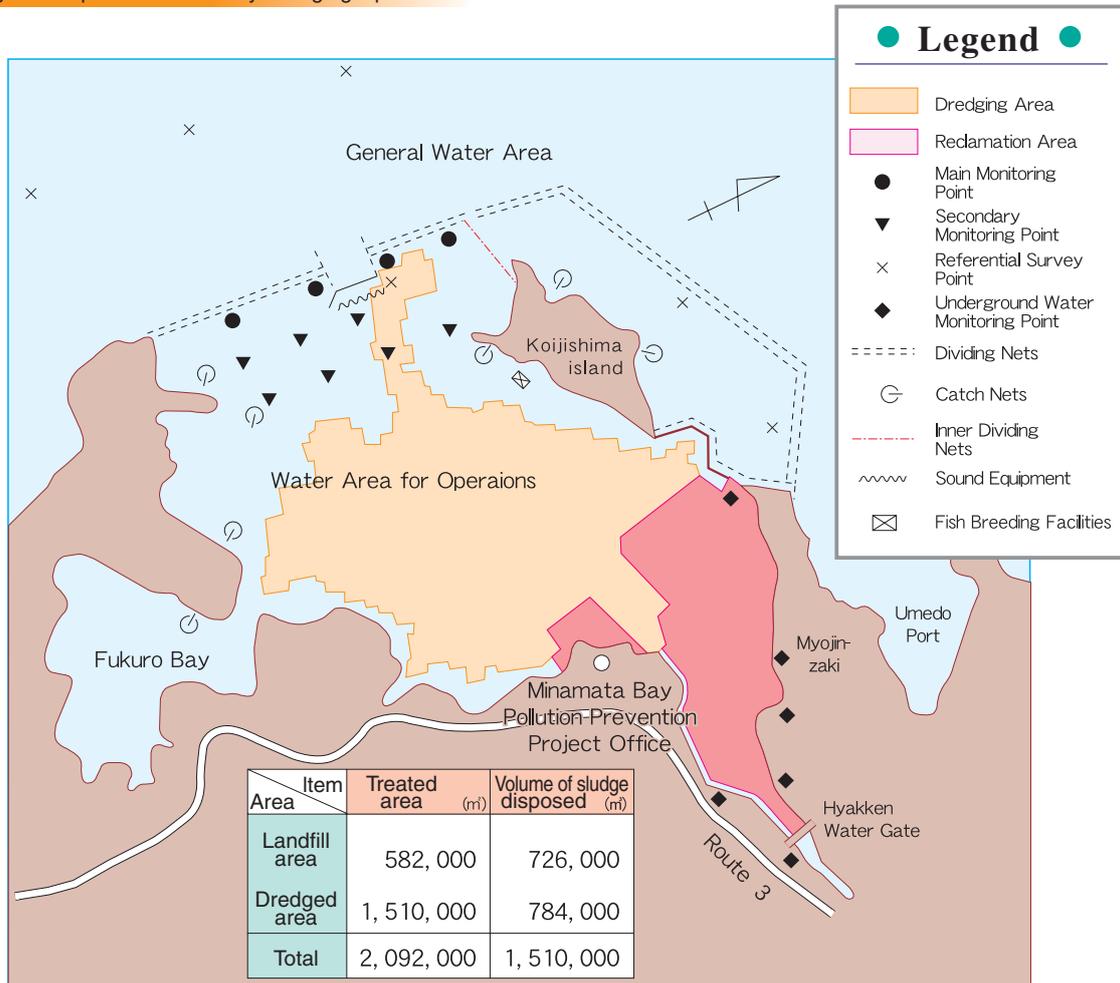
During the course of the project, an extremely strict surveillance plan was put in place to ensure the prevention of secondary pollution, and comprehensive examinations of water quality and fish and shellfish were carried out. Also meetings of the Kumamoto Prefecture Minamata Bay Pollution Prevention Project Monitoring Committee, consisting of experienced scholars and local representatives, were opened to the public. The contents of operations and the results of monitoring were also displayed daily at three places in Minamata City so as to gain the understanding of city and prefectural residents.

Just after the completion of dredging, in 1987, measurements at 84 monitoring points revealed that the total amount of mercury in the bottom sediment had fallen to 0.06ppm-12ppm with an average of 4.65ppm, from 0.04ppm-553ppm as measured at 610 different monitoring points in 1985, before dredging began.

In March 1990, after 13 years and 48.5 billion yen (more than 30.5 billion yen born by the offending company, Chisso+, the remainder halved between the government and Kumamoto Prefecture) the Minamata Bay Pollution Prevention Project was safely completed, and the environment returned to its original state.

(notes) +The Law concerning Entrepreneurs' Bearing of the Cost of Public Pollution Control Works was applied to the Minamata Bay Pollution Prevention Project, as well as 2 other projects for Marushima Port, and Marusima and Hyakken Waterway.

Fig. 4 Map of Minamata Bay Dredging Operations



(Taken from Environment Agency, Environmental Health Dept.
 Our Intensive Efforts to Overcome the Tragic History of Minamata Disease.
 Tokyo:Environment Agency. 1997. slightly amended)



Construction of the Reinforced Shore using Steel Sheet Pile Cells



Dredging using a Cutterless Pump Dredging Ship

Marushima Port Pollution Prevention Project

Sedimentary sludge, which had been highly contaminated with mercury contained in the effluents from the Chisso Minamata factory and Minamata Chemical Industrial Plant & Co., Ltd. accumulated in Marushima Port.

<Note>

In the 21-year period from 1953 to 1974, the Minamata Chemical Industrial Plant & Co., Ltd. purchased mercury waste catalysts (activated charcoal) produced by vinyl chloride factories nationwide, and used this to extract metal mercury.

The Marushima Port Pollution Control Project was a clean-up project to remove accumulated sludge and return the environment to its original state. Kumamoto Prefecture was in charge of the project, which started in July 1987, and paralleled the operations of Minamata Bay.

The standard for bottom sediment disposal was established using the same standard as for Minamata Bay, that is any sedimentary sludge containing more than 25ppm total mercury. 11,880m³ in volume of sludge, which had settled in an area of 36,550m², was dredged.

To prevent the sludge from spreading into neighboring marine areas, the mouth of the port was closed off with a pollution prevention sheet, and cutterless pump ships were utilized in dredging as in the operations in Minamata Bay.

Dredged sludge was carried to the landfill in Minamata Bay by a closed system carrier, and deposited with sludge from Minamata bay.

During operations, water quality checks were carried out according to the monitoring plan, and the results examined by the Minamata Bay Pollution Control Monitoring Committee, however, no mercury contaminated water was detected. In 1985, before dredging operations commenced, mercury levels ranged from 0.04 to 99.9ppm (average of 13.12 total mercury), however, after completion of operations in 1988 mercury levels ranged from 0.34-13.8ppm (6.65ppm average). It was thus confirmed that mercury levels were well below the regulatory standard of 25ppm.

Of the approximated 171 million yen of total project expenditure, more than 139 million yen was born by the offending company, Chisso and Minamata Chemical Industrial Plant & Co., Ltd., and the remainder halved between the government and Kumamoto Prefecture.

This project was carried out smoothly with no secondary contamination occurring, and in March 1988, the project was safely completed, and the environment returned to its original state.

Marushima and Hyakken Waterway Pollution Prevention Project

The Marushima/Hyakken Waterways flow into Minamata Bay and Marushima Ports. Due to the discharge of effluent and mercury from Chisso Minamata factory and Minamata Chemical Industrial Plant & Co.,Ltd. (discharged into the Marushima Waterway only), sedimentary sludge containing a high concentration of mercury had settled.

With the objective of removing sedimentary sludge and returning the environment to its original state, Minamata City acted as the main body in charge of the Marushima/Hyakken Waterway Pollution Prevention Project which commenced in October 1986, paralleling the Minamata Bay Project.

As in Minamata Bay, the standard for the removal of bottom sediment sludge was set at 25ppm of mercury. The 12,124m³ of sedimentary sludge, which had settled in the 15,000m² of Marushima Waterway Pool and the 1,148m length of the Marushima and branch Waterways, as well as the 21,645m³ of sludge, settled in the 9,630m² of the Hyakken Waterway Pool, and the 1,129m Hyakken Waterway total length (total of 33,769m³) was removed.

In order to avoid harming the surrounding sea, sludge removal was carried out by closing one section of the waterway at a time while keeping the water level of the closed section lower than others.

Contaminated sludge from the closed section which was excavated mechanically, was carefully loaded into dump trucks with completely sealed beds to prevent the sludge from flying or oozing out, by which it was then transferred to the landfill site of Minamata Bay.

To prevent further environmental pollution during dredging operations, a monitory plan was enforced, whereby the quality of water at the end of both waterways was closely monitored. To gain the understanding of residents, the results of the observations made regarding water quality were announced and discussed in meetings of the Minamata City Marushima/Hyakken Waterway Pollution Prevention Project Monitoring Committee, and posted on notice boards set up in front of the municipal office, and factory sites.



Current Hyakken Waterway Pool (as of 1999)

The result of these operations confirmed the reduction in mercury level from a total of 0.396ppm-7700ppm (dry base) in February 1978 before dredging operations commenced, to 0.10ppm-14.7ppm upon completion of operations.

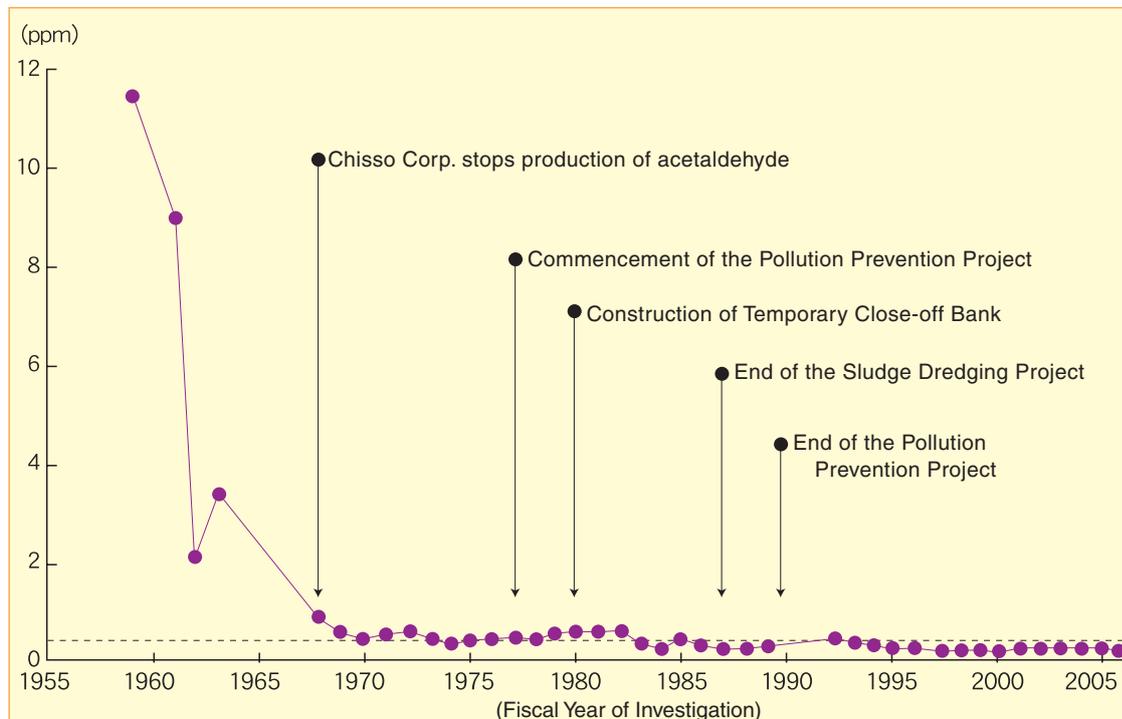
Of the more than 1,554 million yen total project expenses, the offending company, Chisso, and the Minamata Chemical Industrial Plant & Co., Ltd., absorbed 660 million yen, with the remainder being absorbed by the government and Minamata City.

The project was safely completed in March, 1988, and the environment was restored to its original state.

4 Degree of Pollution Over Time

In neighboring areas surrounding Minamata Bay, studies into environmental pollution of water quality, the ocean bottom sediment, fish and shellfish and human hair were conducted. The result of these studies, showed that the concentration of mercury in the hair of Minamata City residents, had begun to parallel to the level of those in other areas after 1969, and that mercury contamination in the umbilical cord of newly born infants, also parallel to the level of newly born infants in non-contaminated areas after 1968. From these results, it was concluded that continuous methyl mercury exposure at the level which could cause Minamata disease existed until no later than 1968, and that after that, there has not been such exposure that could lead to the onset of Minamata disease.

Fig.5 Trends in Total Mercury Levels of Fish and Shellfish in Minamata Bay



- (Notes)
- Mercury levels are average levels taken from all fish species examined in each fiscal year
 - Test results: fiscal 1959-1989 Kumamoto University testing, fiscal 1968-1972 prefecturally commissioned Kumamoto University testing, fiscal 1973-1988 from monitoring tests (on 10 species of fish) accompanying the pollution Prevention projects, fiscal 1989 from follow up tests accompanying Measures on Fish and Shellfish (from fiscal 1992 and later, tests conducted on 7-23 species of fish).
 - Dotted line of the graph reflects the provisional regulatory level of mercury for fish and shellfish set by the national government (total mercury level: 0.4ppm)

(Taken from Kumamoto Prefecture. *An Outline of the Environmental Restoration of Minamata Bay*. 1999. slightly amended)