

Chapter 2.

The Process of Investigation of the Cause of Minamata Disease and of Decision of the Pollution Source

(Part 1)--Circumstances during the period from May 1956 when Minamata disease was officially discovered to July 1959 when the Study Group of Kumamoto University School of Medicine, (Kumamoto University Research Group) presented the organic mercury hypothesis--

1. Construction of the quick investigation system for the cause immediately after the official discovery of Minamata disease

(1) The day of official discovery of Minamata disease

In late April 1956, a 5-year-old girl with peculiar nervous symptoms, who lived at Tsukinoura, was brought to Chisso Hospital, which was a medical institution with the most arranged facilities in Minamata City in those days. Then, her sister aged 2 years was also admitted to the hospital with the clinical features similar to those in the elder sister. According to their mother, there were some patients with similar disease in her neighborhood.

Kaneki Noda, a pediatrician-in-charge, suspected the patients to have had infectious diseases, and consulted with Hajime Hosokawa, the Director of the Hospital. In fact, Director Hosokawa has also examined 2 patients with clinical manifestation similar to those in these sisters in the previous year, but they died in 2-3 months after examination without decision of the cause. In the situation, Noda knew that Hikoji Misumi of the Department of Internal Medicine of the Hospital also examined adult inpatients with symptoms similar to those in the pediatric patients.

Hosokawa, the Director of the Hospital, paid specific attention to the situation, and visited Minamata Public Health Center with Noda on May 1. They reported that a disease of unknown cause, which showed cerebral symptoms, occurred in Tsukinoura District and 4 patients have been admitted to the hospital. The day will be described later, "the day of official discovery of Minamata disease".

(2) Construction of the quick countermeasure system composed of physicians, universities or colleges, and local government

Hasuo Ito, the Director of Minamata Public Health Center, who knew the situation, went to the actual locate immediately. He was surprised at the pitiable conditions of the patients, and presented a report entitled "A strange disease of child occurring in the vicinity of aza-Tsukinoura, Minamata City" to the Director of Department of Health, Kumamoto Prefectural Government on May 4. The report included other phenomena as follows: In addition to the two sisters, there were several more patients with similar symptoms; cats of the patients' houses and those in the neighborhood had spasms or ran around to die. Ito asked the Prefectural Institute of Health to examine well water in the vicinity of these houses. These movements were reported for the first time in the issue as of May 8 of The Nishinippon, which reported the disease as "a strange infectious disease in Minamata, induced the dead and mad persons".

The measure to counter "the strange disease (kibyō)" of unknown cause was initiated on a full scale from the establishment of Minamata Strange Disease Countermeasures Commission of Minamata City consisting primarily of the Public Health Center on May 28. Other organizations involved with the Commission were the Medical Association, the Municipal Hospital, Chisso Hospital, and Public Health Section of Minamata City. Research on the actual condition of the occurrence of the patients and review of charts for the dead and the patients, which had been kept at the practitioners, were performed mainly by Ito, the Head of the Public Health Center, and Hosokawa, the Director of the Hospital. As a result, 30 patients, who had been diagnosed as having had alcoholism, cerebral syphilis, stroke, and Japanese encephalitis, etc., were

confirmed to have been diagnosed from the symptoms similar to those in the sisters described above. It was ascertained that the occurrence of the disease could be retrospectively assessed until December 1953 by the research and review. It was also revealed that the patients have been observed mainly in the district of fishing villages and many patients have been observed in one same family. These facts were compiled by Hosokawa, and reported to the Prefectural Government on August 29, 1956.

As of the end of 1956, 54 patients were confirmed to be present, and 17 of them were already dead.

Major clinical features, the time of the onset, and the outline of the regional spread were clarified by the early epidemiological survey performed actively by Minamata Strange Disease Countermeasures Commission, which was established by consolidation of the institutions interested in the district. The achievements were supportive and valuable for the subsequent studies by the Kumamoto University Research Group. The clinical epidemiological survey in this period is evaluated highly, because it shows the attitude of practitioners in the district, who reviewed the charts of their patients and corrected their diagnoses, and devoted survey on visiting patients by physicians including Hosokawa, the Director of Chisso Hospital.

(3) In about 6 months, the Kumamoto University Research Group narrowed down the cause of the disease to consumption of the fishes and shellfishes, which were contaminated by chemical substances.

A. Establishment of the Kumamoto University Research Group

On August 13, 1956, at the request of Minamata Municipal Hospital, Prof. Shibanosuke Katsuki and Asst. Prof. Haruhiko Tokuomi of the First Department of Internal Medicine, Kumamoto University School of Medicine, visited Minamata, and examined the patients for the first time. Minamata Strange Disease Countermeasures Commission of Minamata City also asked the Kumamoto University School of Medicine, to investigate the cause on August 14. On August 24, Prof. Shibanosuke Katsuki, Prof. Tadao Takeuchi (2nd Dept. of Pathology), Prof. Sukenori Nagano (Dept. Pediatrics), Prof. Tokichi Rokutanda (Dept. Microbiology), and so on conducted a field survey in Minamata, and held a joint conference with the Commission to discuss future studies. On the same day, the Study Group of Kumamoto University School of Medicine for the Strange Disease in Minamata (hereinafter referred to as "the Kumamoto University Research Group") was established, including each department (Internal Medicine, Pediatrics, Pathology, Microbiology, Public Health, etc.) of Kumamoto University School of Medicine. Soon thereafter, Dept. of Hygiene also participated in the Research Group. The members of the Research Group visited Minamata immediately, and proceeded to narrow down the cause in cooperation with the Minamata Strange Disease Countermeasures Commission.

B. The 1st meeting of the Kumamoto University Research Group

The Kumamoto University Research Group held the 1st research meeting on November 3, 1956. There were no clinical findings of inflammation, and the results of the bacteriological and virological tests were also negative. At this time, possibility of the disease would be an infectious disease has almost disappeared. From the patients' symptoms, Prof. Shoji Kitamura (Dept. of Public Health) doubted whether the disease was poisoning with heavy metals (particularly manganese). With regard to the route of invasion to humans, Prof. Katsurou Irukayama (Dept. Hygiene) consider that fishes and shellfishes might be involved with the outbreak of the disease from the situation in which many of the patients were fishing people. He paid special attention to waste water from the Chisso Minamata plant as the cause of the pollution.

Since the presentation at the 1st meeting suggested the ingestion of large quantities of fishes and shellfishes as the cause of the disease, the consumption of fishes and shellfishes by the inhabitants decreased. There have been no reports on any new patient until August 1958.

Prof. Kitamura has considered the following factors as the possible causes of seawater contamination in the vicinity of the districts in which the patients were observed: Waste fluid from a slaughter house in the Tsukinoura District, spring water in the sea in the Yudo District, disposal of explosive compounds accompanying the termination of the war at the ex-navy ammunition storage house in the Modo District, and so on. However, there was no fact of abandonment of ammunition in the sea, and none of these factors was related to the cause of the disease of unknown etiology.

The Kumamoto University Research Group obtained the data on the measurements of the waste water at the Hyakken Seaport drainage channel in Minamata Bay in October 1956 by the Technology Division of the Chisso Minamata plant. The data included the values of analyses of copper, lead, arsenic, manganese, etc., but mercury was not included. Prof. Irukayama also analyzed the factory wastes at the Hyakken drainage channel by the sewerage test in October and December, 1956, but manganese, lead, etc. were only detected as harmful metals.

C. Report by the Public Welfare Science Research Group Sponsored by the Ministry of Health and Welfare

The 1st research meeting was held by the Public Welfare Science Research Group Sponsored by the Ministry of Health and Welfare (Public Welfare Science Research Group), in the Institute of Public Health on January 25-26, 1957. The Group consisted of the Institute of Public Health, the Kumamoto University Research Group, the Director of Minamata Public Health Center, and so on. At the meeting, the hypothesis for the fishes and shellfishes being regarded as carriers of the disease was evaluated as most plausible.

On March 30, 1957, the Public Welfare Science Research Group presented a report entitled, "A strange disease (kibyō) occurring in the Minamata District, Kumamoto Prefecture", to the Ministry of Health and Welfare. It describes the following: "The strange disease is most suspected of poisoning by ingestion of the fishes and shellfishes caught in the seaports of Minamata Bay, as revealed from the results of epidemiological surveys. The toxic substances that may have contaminated the fishes and shellfishes still remain unknown, but they are estimated to be a certain type of chemical substances or metals." As the research policy in the future, epidemiological, pathological, and toxicological inspection is most important. According to the report, "the etiology of the disease should be clarified by adequate research on the actual condition of the Chisso Minamata plant and by specification of components in the factory wastes and abandoned mine and the situation of pollution of harbors with the components".

D. Endeavors to analyze chemical substances in drainage from the Chisso plant

At the meeting of the Japanese Society for Hygiene in July 1957, the Director of the Epidemiology Division of the Institute of Public Health, Shinichi Matsuda, in the Public Welfare Science Research Group, Prof. Kitamura and his co-workers reported that the strange disease in Minamata is caused by the ingestion of large quantities of fishes and shellfishes taken in Minamata Bay, and that chemical substances in the factory wastes are suspected of being causative materials.

Waste water has been released without treatment into Minamata Bay from the Chisso Minamata plant over a long term of years, and sludge has accumulated considerably in the vicinity of the outfall.

The investigators of Kumamoto University could not collect any sample from the plant because they could not obtain the cooperation from the Chisso plant. Therefore, they conducted energetic inspection of the sludge as well as the seawaters and fishes and shellfishes. In the beginning, 64 types of heavy metal compounds were enumerated in the list.

Prof. Kitamura described the following in the article entitled, "Minamata disease--A study of organic mercury poisoning--" (published in March 1966): "Mercury came to be excluded from the subjects of screening, partly because that expensive mercury should not have been drained in large quantities into the factory wastes." In addition, mercury was so volatilized by heating in the way the samples are analyzed

(by wet calcification) that it has not been detected at all. Thus, mercury was not enumerated in the subjects of the assessment.

Apart from this report, an article by Prof. Kansuke Sera (Dept. Forensic Medicine) et al. was published in Kumamoto Igakukai Zasshi (Journal of the Kumamoto Medical Society) (vol. 31, Supplement No. 2). The results of the qualitative determination of mercury are described in the table of results of the determination of various samples. In the results, mercury was not detected, and no comments were given to this result.

In actuality, at least 10 kinds of harmful substances were detected in the sludge and fishes/shellfishes. To estimate a causative agent for the disease, the departments participating in the Kumamoto University Research Group vied with each other in having repeated animal experiments. The steady research for investigation of the causative agent was continued for about 2 years thereafter.

Although It has spent much time for searching the causative agent among the chemicals other than mercury, it was correct that the Kumamoto University Research Group narrowed down the Chisso Minamata plant as the source of pollution on the basis of the concept that Minamata disease is a poisoning with heavy metal.

On the other hand, however, it has not been sufficiently understood what kind of substances were used, generated, and abandoned in the Chisso Minamata plant, because no investigator in the industrial field was not added to the Research Group at the time of the establishment. Under these circumstances, mercury was not included in the subjects of the analysis in the beginning. Even after special attention was paid to mercury thereafter, much attention was paid to the process mainly of vinyl chloride producing process rather than acetaldehyde as the causative source. Thus, there was no conception that the causative agent was narrowed down from the aspect of the production process. In the Kumamoto University Research Group as well, no importance was placed on sharing information or partial charge of research. Each department carried forward research by its own way.

(4) Initial countermeasures by the Government

Department of Health of Kumamoto Prefecture has already reported the outbreak of Minamata disease to the Epidemic Prevention Section of the Public Health Bureau, Ministry of Health and Welfare on August 3, 1956.

The Ministry of Health and Welfare established the Public Welfare Science Research Group for Minamata disease in November, and sent Shinichi Matsuda, the Director of the Epidemiology Division of the Institute of Public Health, and others to the actual locate, and performed an epidemiological survey in Minamata City and Akasaki, Tsunagi-machi adjacent to the city on the north side of the city, which served as the control. The results were reported at the research meeting in January 1957. In the Fukuro District of Minamata, there were overtly many children, who had mild intellectual disturbance with difficulty of moving. As shown by this phenomenon as well, the results were consistent with the following opinion of the Kumamoto University Research Group: everything other than factory drainage was hardly regarded as the cause of Minamata disease.

In the Prefectural Government, the department in charge of the relevant problem was placed under the authority of the Public Health Section from the Prevention Section that deals with infectious diseases, and the Countermeasures Commission was established in the Health Department in January 1957. In February of the year, a petition, which complained of straitened circumstances of the fishing people, was presented to the Governor from the MFCA. At the meeting of the Welfare Committee of the Prefectural Assembly as well, an opinion was presented to the Prefectural Government to ask for early consideration of the measures taken for the relief of the people in the district by establishing the countermeasures commission.

Therefore, the Prefectural Government established Liaison Committee of Countermeasures against the Minamata Strange Disease. The committee consisted mainly of the Health Department, and included Public Welfare, Engineering Works, and Economics Sections, and at the 1st meeting on March 4, 1957, the

policy including the following items was decided: (1) Promotion of the investigation of the cause at the prefectural expense; (2) treatment of inpatients; (3) guidance for self-control of consumption of the fishes and shellfishes; (4) guidance for self-control of fishery and for change in fisheries; (5) investigation of the prefectural countermeasures against the Hamamatsu short-necked clams affair in Shizuoka Prefecture; and (6) the Minamata disease is dealt with by taking the position that the causal relationship between the disease and Chisso is unknown for the time being.

After the Ministry of Health and Welfare accepted the report of research from the Public Welfare Science Research Group on March 30, 1957, the administrative Vice Minister, Chujiro Kimura, of the Ministry of Health and Welfare invited directors of the relevant ministries to ask for their cooperation in investigating the cause of the disease.

[*Comments*] In the districts around Lake Hamana there were 334 patients with short-necked clam poisoning and 114 deaths associated with the poisoning in 1942. In 1949 there were 93 patients, and 7 died of the poisoning. Shizuoka Prefecture immediately prohibited the collection, selling, and transfer of shellfishes in the districts.

In 1950 as well, there were 12 patients with the poisoning. The cause remained unknown, but the Prefectural Government showed the articles of the Food Sanitation Act and prohibited selling shellfishes (oysters and short-necked clams) in the relevant districts around Lake Hamana.

(5) *Experiments on cats*

The Kumamoto University Research Group has collected the fishes and shellfishes caught in Minamata Bay, which were suspected of having caused the disease, since around November 1956. The Group intended to induce the disease to cats with the fishes and shellfishes, but the typical onset was not acquired.

[*Comments*] According to the report by Prof. Kitamura et al. [Kumamoto Igakukai Zasshi (Journal of the Kumamoto Medical Society), vol. 31, Supplement No. 2, 299, 1957], they have performed the experiment on 3 cats, to which the fishes and shellfishes sent directly from the actual locate are given, since November 19, 1956. One of the cats had paralysis of the hind limbs and died on December 23. The pathological findings extremely resembled the findings on the cats that had the disease in the actual locate. This experiment is considered the first experiment of the onset, but the onset could not be confirmed in the other 2 cats.

Furthermore, Haruhiko Tokuomi, Assit Prof. of Kumamoto University School of Medicine, said: “It was soon after the commencement of the research when inflammation was clinically ruled out and poisoning became considered because of the onset after ingestion of fishes. To demonstrate the possibility, the disease must be induced to cats by giving the fishes caught in Minamata Bay. Every department started the experiment all at once.” (“Minamatabyo – 20-nen no Kenkyu to Konniti no Kadai [Minamata disease - Experience over the two decades and the present tasks confronting the disease]” edited by Sumio Arima, p. 275) “On November 17, 1956, the Health Section of the City Government sent the fishes and shellfishes to the 1st Dept. of Internal Medicine, Kumamoto University School of Medicine, and since then the fishes and shellfishes have been sent to each Dept. of Kumamoto University School of Medicine as specimens and samples.” [A chronological table, *ibid.*]

Ito, the Director of Minamata Public Health Center, who initiated experiment for the disease at the request of Prof. Takeuchi, succeeded in the experiment of the onset in cats for the first time. Ito, who has been a research student of the Second Dept. of Pathology, Kumamoto University School of Medicine in those days, maintained 7 cats in a room of Minamata Public Health Center by the request of Prof. Takeuchi. He has given the fishes and shellfishes caught in Minamata Bay to the cats since March 1957. As a result, the same symptoms as those in the cats with spontaneously developing Minamata disease appeared after a week

at earliest and after about 40 days at latest of the experiment. The Director Ito recorded the dyskinesia of the cats on 8 mm cinefilms, and performed pathologic autopsy and histological examination in cooperation with Kumamoto University School of Medicine. He reported to the Health Department of the Prefectural Government that the condition observed in the cats is the same as Minamata disease in human. The experiment has the deep significance, because it scientifically demonstrated that the fishes and shellfishes caught in Minamata Bay are responsible for the outbreak of Minamata disease.

On the other hand, Prof. Sera has also investigated the toxicity of the fishes and shellfishes, which have been given to the cats in this district, by sending healthy cats to fishermen's houses at Modo and Yudo in Minamata City and making them to maintain these cats. All 8 cats sent to them developed the disease after 33-65 days of the experiment. The experiment also demonstrated that the fishes and shellfishes are responsible for the development of Minamata disease.

At the Kumamoto Prefectural Assembly on February 8, 1957, some questions were presented about the cause investigation and the prefectural countermeasures against reliefs of patients and fishing people. In July of the year, the results of the experiments on cats by the Director Ito and Prof. Sera were also presented, showing the need for taking urgent measures to avoid consumption of the fishes and shellfishes in Minamata Bay.

2. A reply from the Ministry of Health and Welfare in September 1957 regarding the application of the Food Sanitation Act and movements in response to the report of research by the Public Welfare Science Research Group in June 1958

(1) A reply from the Ministry of Health and Welfare regarding the application of the Food Sanitation Act

Since Minamata disease has become increasingly suspected of being caused by consumption of the fishes and shellfishes in Minamata Bay, the Kumamoto Prefectural Government has discussed a ban of consumption of the fishes and shellfishes of Minamata.

The Prefectural Government referred to Shizuoka Prefecture for reference about the Shizuoka Prefectural Government's countermeasures against the Hamamatsu short-necked clams affair, which were included in the policy established by Liaison Committee of Countermeasures against the Minamata Strange Disease in March 1957. The causative agent for the short-necked clams affair was yet to be confirmed, as in Minamata disease. In spite of the similarity to these affairs, there was no information used for the decision of the types of dangerous fishes and of the range of restriction of fisheries in the case of Minamata disease in Kumamoto Prefecture. Therefore, it was concluded in Kumamoto Prefecture that the case in Kumamoto Prefecture could not follow the case in Shizuoka Prefecture.

In July 1957, the members of the Public Welfare Science Research Group, i.e., Ito (the Director of Minamata Public Health Center), Hosokawa (the Director of Chisso Hospital), Shigeo Arita (Director of the Health Dept. of the Prefectural Government), Noriaki Morizumi (the Chief of the Public Health Section of the Prefectural Government), etc., reported the following as the results of epidemiological and clinical studies: "The present disease was regarded as a sort of poisoning due to consumption of the fishes and shellfishes caught in Minamata Bay, judging from the epidemiological and clinical evidence, (an ellipsis).....since the department (the 2nd Dept. of Pathology, Kumamoto University School of Medicine) succeeded in the experiment as well, in which the disease was experimentally induced to cats by giving the fishes and shellfishes caught in Minamata Bay to them, the disease was revealed to have been caused by the fishes and shellfishes in Minamata Bay".

The Health Dept. of the Prefectural Government evaluated the situation as that following the regulations described in Paragraph 2, Article 4 of the Food Sanitation Act, and decided a policy to officially announce under the name of the Prefectural Governor that the capture and consumption of the fishes and shellfishes

were prohibited. On August 16, 1957, the Medical Dept. referred to the Ministry of Health and Welfare regarding the propriety of applying the Food Sanitation Act to the situation.

On September 11, 1957, however, the Governor received the following reply from the Director of the Public Health Bureau of the Ministry of Health and Welfare: "Since consumption of the fishes and shellfishes caught in the specific areas of Minamata Bay may induce central nervous diseases of unknown cause, the people must be guided to avoid consumption of the fishes and shellfishes caught in Minamata Bay in the future as well. However, there has been no distinct evidence showing that all the fishes and shellfishes in the specific areas of Minamata Bay are toxified. Therefore, it appears to be impossible for Paragraph 2, Article 4 of the Food Sanitation Act to be applied to all the fishes and shellfishes caught in the relevant specific areas."

(2) Narrowing down of chemical substances by the Public Welfare Science Research Group Sponsored by the Ministry of Health and Welfare

In October 1957, the Public Welfare Science Research Group reported, at the meeting of the Japanese Society of Public Health, that "attention is paid to selenium, manganese, and thallium" as the causative agent narrowed down by the studies.

Thereafter, these three kinds of heavy metals of high concentrations were detected from the dregs in the Chisso plant and the mud at the drainage channel, and in February 1958, the Kumamoto University Research Group suggested the needs for elucidation of the intermediate routes of the three agents discharged from the Chisso plant and for the experimental reproduction of the symptoms by using these agents as future tasks. Although these three agents have neurotoxicity, it was impossible to experimentally make a reproduction of the symptoms specific to Minamata disease by the single use of them.

In the Diet session (Committee on Social and Labour Affairs, the Upper House) on June 24, 1958, Moriyoshi Morinaka, a Dietman, gave an inquiry, and Takehisa Omura, the Director of the Environmental Hygiene Dept. of the Ministry of Health and Welfare, replied to the inquiry by citing a report by the Kumamoto University Research Group, as follows: "The causative agent is a sort of metal, i.e., any of thallium, selenium, and manganese, or a complex of some of them. These three heavy metals were used in the chemical plant located adjacent to Minamata Bay, and future tasks confronting investigation of the causative agent include the determination of roles of the fishes and shellfishes as media and the pathogenic influence".

On July 7, 1958, the Ministry of Health and Welfare notified the ministries and offices interested and municipalities of the research achievements of the Public Welfare Science Research Group and the countermeasures to Minamata disease on the basis of the report from the group. In response to this, Chisso brought forth a counterargument, explaining that there is no problem with manganese, selenium, or thallium, because their levels in waste water are under the standards for indications for harmfulness. These agents were replaced by organic mercury when the organic mercury hypothesis was suggested later, and thus, they were ruled out from the candidates for the causative agent for Minamata disease.

On August 7, 1958, the Ministry of Health and Welfare established the Liaison Council of Countermeasures against Minamata Strange Disease with the aim at realizing the intensive studies and countering the disease from the administrative aspect. It was comprised mainly of the Ministry of Health and Welfare and of the ministries and offices interested including MITI, the Ministry of Agriculture, Forestry, and Fisheries, the Ministry of Education, and the Ministry of Transport. On the other hand, the Ministry of Health and Welfare decided to establish a liaison council of general research on the strange disease in Minamata (which is comprised of branch offices of the ministries and offices interested, Kumamoto Prefecture, Kumamoto University, and Kyushu University) in Kumamoto Prefecture with the aim at generally investigating the disease. However, this plan was left off, and on January 16, 1959, a Special Task Group on Minamata Food Poisoning was established in the Food and Sanitation Investigation

Committee, the Ministry of Health and Welfare.

3. Movements in response to the change of the drainage channel in the process of acetaldehyde production in September 1958

(1) Change of the drainage channel in the process of acetaldehyde production by Chisso

The pollution in Minamata Bay persisted, and the occurrence of a patient with the disease was reported in August 1958, i.e., after an interval of about 1.5 years. The mass media of the district also reported the occurrence simultaneously. The Director of the Department of Economics of the Prefectural Government notified the guidance of absolute prohibition of operation in the sea areas of Minamata Bay for the unions interested to the Kumamoto Prefectural Alliance of Fishing Cooperatives and to the Fishermen's Cooperative Association interested. In response to this, MFCA decided to request indemnification of damages to fishing people from the prohibition of operation in the sea areas, which were estimated to be dangerous and quick elucidation of the cause of Minamata disease.

Chisso, which went on increased production of acetaldehyde, intended a dilution of the waste water with the Shiranui Sea by discharging the waste water from the mouth of the Minamata River as a measure to tentatively cease the pollution in the vicinity of Hyakken Seaport. Hajime Hosokawa, who had stayed at Chisso Hospital even after the retirement age continued experiments on cats, suggested Chisso to cease the operation because the appearance of a patient in the vicinity of the mouth of the Minamata River would demonstrate that the drainage from the plant is responsible for the disease.

[*Comments*] Hajime Hosokawa reached the age limit in September 1956, but served as the Director of the hospital until September 1957 when a new director came. Thereafter, he has assisted medical examination as a part-time employee and continued the experiments on cats.

However, in September 1958, Chisso changed the drainage in the process of acetaldehyde production to the Hyakken Seaport in Minamata Bay; i.e., the drainage was changed to the release of the supernatant stored tentatively in a reservoir, "Hachiman Pool", into the mouth of the Minamata River. The "Hachiman Pool" was originally produced by reclamation of the foreshore as the dump of carbide residues. It was not a facility for waste water management; the substances dissolved in water percolate downward the "Hachiman Pool" through the sea. The person who was the Chief of the plant in those days gave testimony in the court, which will be held later, that they had known the solid materials to be purified but the substances dissolved in the "pool" to be excreted unchanged.

(2) Broadening of the contaminated area and the new patient of Minamata disease, which were due to changes of the drainage channels for the waste water

In March 1959, the anxiety of Hajime Hosokawa became reality. The occurrence of Minamata disease was reported from the fishing people in the vicinity of the mouth of the Minamata River, and thereafter as well, new patients were successively reported among the people by the mouth of the river. The observation of the disease in many cats has become reported at Tsunagi-machi and Yunoura-machi on the north side and even in the Amakusa Islands on the opposite shore of the Shiranui Sea. The influence of the changes of the drainage channels, which can be regarded as an experiment on human bodies, led to the serious results, i.e., the new occurrence of the patient and broadening of the contaminated areas.

The changes of the drainage channels, an increase in the number of the patients, and the broadening of damages strongly suggested that drainage from the process of acetaldehyde production must be the cause of Minamata disease in Kumamoto Prefecture, regardless of the causative agent.

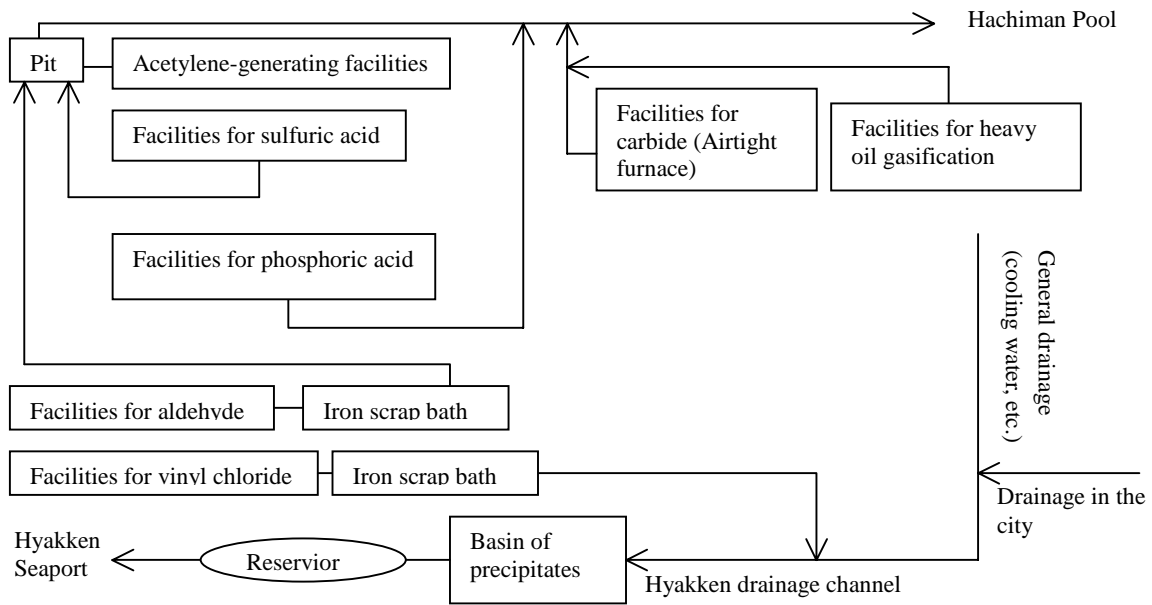


Figure a. Diagram of wasted water management (in Sep. 1958)

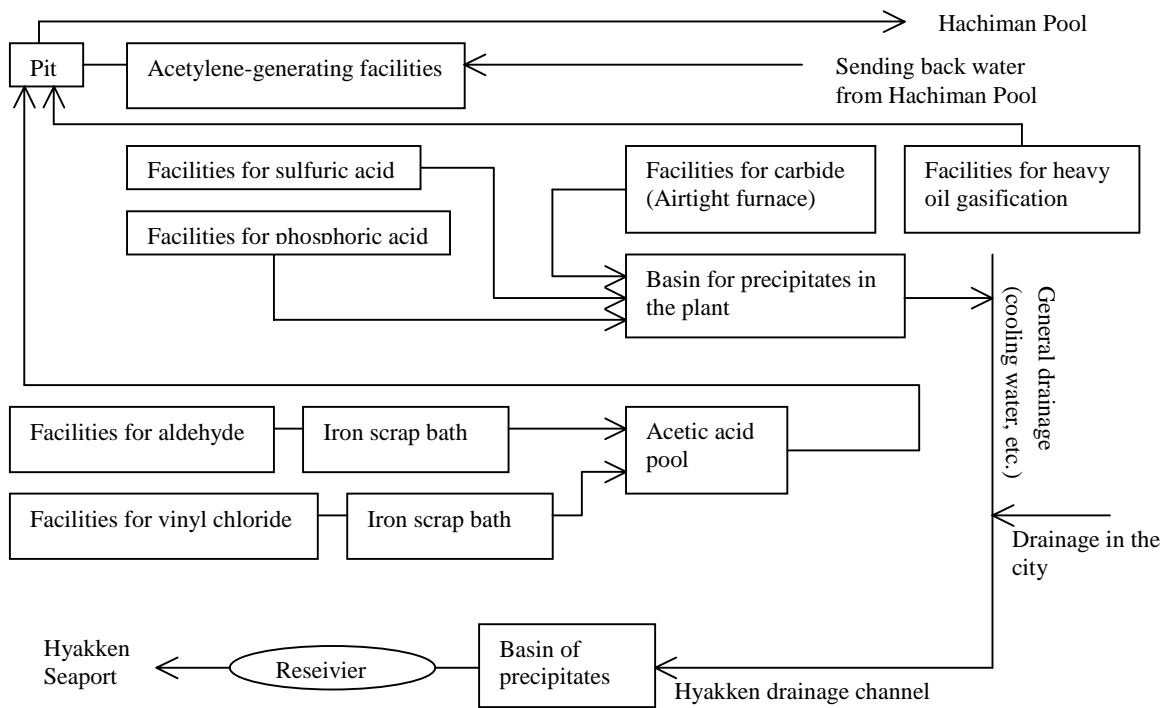


Figure b. Diagram of wasted water management (in October 1959)

Cited from "Minamatabyo Mondai no 15-nen sono jitsuzo wo otte (Minamata disease, over the 15-year period--In pursuit of the real facts--)" edited by Chisso

Figure 4. The drainage system of Chisso Minamata plant (in September 1958 and October 1959)

The changes of the drainage channels were not reported to any man on the outside of Chisso. In June 1959, however, an engineer of Kumamoto Fisheries Experiment Station, who went to check the information on the sweetfishes having floated in the mouth of the Minamata River, reported the following to his superior officer in a report of mission: "Waste water appears to have been currently drained into the Minamata River". Since the president and others of the Minamata Municipal Assembly, who petitioned the Ministry of Health and Welfare, explained to the effect that "Chisso appears to have recently drained waste water into the Minamata River" in June 1959, the staff members of the Government and the Prefectural Government also started to notice the changes of the drainage channels.

Nine of the 10 patients, who were newly reported by Asst. Prof. Tokuomi and his co-workers during the period from February to October, 1959, were revealed to be the inhabitants in the mouth of the Minamata River or in the area north of the mouth. From these findings, they indicated that the polluted area broadened to the north, suggesting that this phenomenon had a causal relationship to the changes of drainage channels of the plant (according to the investigation by the Kumamoto Prefectural Government). Prof. Kitamura and his co-workers also reported a list of changes of the drainage channels, which was obtained from Chisso, paying much attention to the correspondence between the places of the incidence and the changes of the channels of the process of acetaldehyde production [Kumamoto Igakkai Zasshi (Journal of the Kumamoto Medical Society) vol. 34, Suppl (3), March 1960]. However, the important epidemiological fact was not led to any concrete approach to the changes.

It is not clear when MITI knew the changes in the drainage channels of Chisso, but in October 1959 the Ministry verbally gave Chisso instructions to abolish the drainage channels, through which the waste water was directly discharged into the Shiranui Sea, to hasten construction of facilities for waste water management, and to complete the construction within the year or by January of next year. In November 1959, the Ministry notified by writing Chisso of the following: "You may be thinking of various countermeasures including abolition of a part of the drainage channels, but on this occasion you must prepare fully facilities for waste water management as early as possible, and make efforts to solve the anxiety of the people of the district by inspecting the cause as fast as possible in much cooperation with the organizations interested".

Chisso has ceased to release the discharge in the process of acetaldehyde production into the mouth of the Minamata River since November 1959, and the drainage channel was replaced to the Hyakken Seaport. Chisso adopted the method of reusing the supernatant fluid, which was drawn up from the Hachiman Pool and sent to the acetylene generator in the plant.

[*Comments*] In the trials in which the President of Chisso and the manager of the Minamata plant were called to account penal responsibilities for the outbreak of Kumamoto Minamata disease later, the appearance of the new patients due to the changes in the drainage channels provided the important material for judgment of "guilty".

[*Comments*] Even after Chisso started to draw up the supernatant fluid from the Hachiman Pool, the outflow of mercury from the pool continued, mainly because (1) that the sending back was inadequate, (2) that the structure of the pool led to the outflow of the waste water containing mercury from the bottom, and (3) that the overflow due to heavy rain could not be suppressed.

4. The situation of the patients

(1) Measures taken under suspicion of an infectious disease

Minamata Strange Disease Countermeasures Commission of Minmata City devised measures to make the Health Section of the Minamata City Government to spray disinfectants and insecticides in the districts of the outbreak of the disease, taking into consideration the possibility of an infectious disease, because a

number of patients were detected in specific districts during the limited period as a result of the research on the actual condition in 1956.

Many families of the patients have led their lives by making their own supplies; they practiced fishery and ate fresh fishes and shellfishes abundantly at each meal. Since the people's cash incomes were poor at all, however, their lives fell to the bottom when patients appeared in families. Under the situation, they could not pay the expenses for admission of the patients to hospitals. Therefore, even though some physicians, like Hosokawa, have long considered it difficult to regard the disease as an infectious one, the Minamata City Government admitted patients to municipal isolated wards for infectious diseases as an immediate measure in July 1956. In this case, hospital charges would be borne at public expense as "suspected cases of Japanese encephalitis". Approximately a month later, most of the patients were transported to the Kumamoto University Hospital, but on this occasion, there was no system, with which hospital charges were borne at public expense. For this reason, these patients were admitted to the hospital as those for teaching and education, and they were relieved from bearing the medical expense and hospital charges.

Some of the fishery patients family let the patients eat the fishes, expensive prawns, etc. They caught these fishes by themselves in order to have the sick family members take nutrition of good quality even in the small amount. On the contrary, this behavior got all the worse for the symptoms. None of them noticed that.

(2) Poverty of the patients' families that were not improved despite the denial of the possibility of infectious disease

In those days when the disease was officially discovered in May 1956, Minamata disease was reported as "a rare infectious disease", and the patients have been dealt with as patients with an infectious disease. In November of the year, a suspicion of excessive eating of the fishes and shellfishes contaminated with some heavy metals as the cause of Minamata disease was increased. Next year (in 1957), the department in charge of the disease was placed under the authority of the Public Health Section from the Prevention Section. Thus, from the aspect of administration as well, the suspicion of infectious disease was dispelled. Thereafter, researches by the Kumamoto University Research Group and the Public Welfare Science Research Group progressed, and none of the physicians or investigators have suspected infectious disease as the cause.

In spite of the circumstances, patients with the disease have still been treated discriminately through the misunderstanding about infectious disease in the districts of the outbreak of the disease. The concept of discrimination created from the misunderstanding in the beginning has been succeeded thereafter as well. As the name of Minamata disease has become known throughout Japan, the whole district of Minamata has been misunderstood to be the district contaminated with endemic diseases, thereby having received various adverse influences. The situation, in which the patients are treated discriminately for only the reason that they have Minamata disease, persisted.

In fishing villages, moreover, the families of patients were boycotted by the villagers, because the fishes caught in the village where patients appeared would not be sold, leading to lives of extreme poverty not only in the patients' families but also in all fishing people of the villages. Even the new patients could not announce themselves to the public as patients with the disease under the situation. There have been some examples of the situation: A fisherman patient, who was just admitted to hospital by the family, was taken back from the hospital to home by a leader of the fishermen's cooperative association; despite the fact that a patient with typical symptoms of Minamata disease was bedridden at home, the patient could not announce him-/herself to the public as a patient with the disease, because the patient was told by his/her child(ren), "I will disown you as a child, if you announced yourself to the public as a patient with the disease".

If the cause of Minamata disease had early been revealed to be poisoning with the fishes and shellfishes

contaminated with the factory wastes and if the system of compensation for patients and the MFCA by causative companies had been established, the patients would not have later been suppressed to speak in the local community or discriminated strictly by other people in the district.

In actuality, however, Chisso has not admitted in the beginning their responsibility for the outbreak of the disease. Furthermore, there was another situation; Chisso has had strong influence economically and politically in the local community, and the citizens have hesitated in speaking out about the cause of Minamata disease, out of regard to feelings of Chisso, since many citizens have participated in some “benefits” of Chisso.

<Column> *A story based on experience of Tsuginori Hamamoto*, a patient certified to have Minamata disease by the Government*

I was born and brought up in Minamata, and have already gone fishing in the sea when I began to take notice. After graduation from a school in 1951, I have led my very common natural life by going fishing in the sea with my parents.

The sea became dirty during the period from 1952 to 1953. Large fishes have also been floated up in dead. Since this period, I have frequently had falls and poor physical condition. Therefore, I started being examined on an outpatient basis at a hospital. Since I was suspected of having poisoning with acetylene used as a light in fishing on examination, I quit fishing, and changed the job.

In 1956, similar symptoms started being observed simultaneously in patients. The condition was dealt with as “a strange disease (kibyō)” at hospitals and as “an infectious disease” in the district. I have long kept it to myself, because it was not clear that my condition was Minamata disease. My parents had the disease successively. My father’s condition deteriorated rapidly after admission, and soon he died of fulminant Minamata disease.

In response to the presentation of the hypothesis of organic mercury poisoning, We requested Chisso to stop the discharge in 1959, but it was not realized. In those days, we patients have been placed in fixes for physical, mental, and economic points. Therefore, we were obliged to make an agreement with Chisso about a gift of money in token of their sympathy on December 30 of the year. With this opportunity, Minamata disease died from the memory of the public medically and socially, and in the district the disease remained recognized as being infectious. Because of this misunderstanding, it still remains difficult for the patients to marry. When the people who were born and brought up in Minamata are asked about the birth place, some of them hesitate to say, “I am from Minamata”. We would like to become an example of the person who can say his/her birth place without apology.

*Tsuginori Hamamoto was born in 1935. At present, he talks his own experiences as a family of professional reciters at exhibits of Minamata Disease Municipal Museum with the hope that Minamata disease will be understood by many people.

5. The name of the disease, Minamata disease

Since the cause of Minamata disease was unknown in those days when it was discovered, the disease was called “kibyō (strange disease)” among the people of the district. Therefore, the Minamata City Government also tentatively used the name, “the Minamata Strange Disease Countermeasures Commission”, and so on, and the Prefectural Government and the Government called the disease officially “central nervous disease of unknown cause developing in the Minamata District” or “so-called kibyō (strange disease)”. In the mass media, the term, “Minamata kibyō”, was generally used in the beginning of the outbreak.

In the Kumamoto University Research Group as well, Prof. Katsuki suggested to call the disease “Minamata disease” because it was too nonmedical to call the disease “kibyō (strange disease)” for any

length of time. These institutions including the governments reached an agreement on this point that “Minamata disease” would be most appropriate.

The term, “Minamata disease”, was used for the first time by Prof. Takeuchi in an article submitted to a scientific journal, which was entitled “A pathological study of Minamata disease (central nervous disease of unknown cause in the Minamata District) (2nd Report)” [Kumamoto Igakkai Zasshi (Journal of the Kumamoto Medical Society) vol. 31, Supplement No. 1, June, 1957]. In the article, the name, “Minamata disease” was used after giving notice that “the disease will be called Minamata disease tentatively by the time when a toxic factor is confirmed.

In newspapers, all newspaper publishing companies have come to call the disease “Minamata disease” since August 1958 when new incidence was reported after the silence of about 1.5 years.

In 1959 the organic mercury hypothesis was reported by the Kumamoto University Research Group, but the causative agent for Minamata disease was not officially confirmed until 1968 when the Government’s unified views were led. During the period, Minamata disease was widely reported not only in overseas literature on medical sciences but also abroad as the affair of environmental pollution. Thus, the name, “Minamata disease”, became widely used.

[Comments] The research on commission, which involved environmental pollution, etc., sponsored by the Ministry of Health and Welfare was conducted in March 1970 for the purpose of enforcing the (old) Law Concerning the Relief of Pollution-Related Health Damage. In the research article “A study of the range and so on of diseases under the influence of environmental pollution”, the name, Minamata disease, was concluded “to be valid for being adopted as the name of disease included in the Cabinet order”, on the basis of the fact that the name has already been widely used internationally. In the research, Minamata disease was defined as “a disease of the nervous system resulting from the oral intake of organic mercury accumulated in fishes and shellfishes”; the disease is not merely induced by the aerial, oral, or percutaneous intake of organic mercury, but “includes a factor for environmental pollution in the process of the accumulation in fishes and shellfishes and the ingestion of them”.

As for the entity of Minamata disease, which became known on a nationwide scale, the people still erroneously understood; the disease was regarded as endemic, infectious, or hereditary. The citizens of Minamata considered that the name, “Minamata disease”, hurted the city image to lead not only to damages to the products and tourist development in Minamata but also to discrimination in marriage and employment opportunities. In 1973, the Municipal Office as well as the Chamber of Commerce and Industry and the Tourist Association carried on a drive to change the name of the disease.

<Column> *What is Minamata disease?*

“Minamata disease” is methylmercury poisoning that developed as a result of the oral ingestion of the fishes and shellfishes contaminated with methylmercury compound, which was discharged into environments through industrial activities and accumulated in fishes and shellfishes via the mechanism of biological concentration.

Since the source of the generation of the causative agent and the route of invasion into human body are very specific, research groups on commission, which included environmental pollution investigation, etc., sponsored by the Ministry of Health and Welfare have used this term in a special sense, unlike merely methylmercury poisoning, on the basis of the concept that “the disease includes a factor for environmental pollution in the process of the accumulation in fishes and shellfishes and ingestion of them”. The cases due to direct exposure to causative agents, such as vocational diseases in agricultural chemical plants using the methylmercury compound, and the case in Republic of Iraq, in which a number of people ate seed wheat plants disinfected with organic mercurial agricultural chemicals and died, are included in the category of methylmercury poisoning but not called “Minamata disease”. In gold refining, on the other hand, metal

mercury is mixed with gold dust to produce amalgam, and the mercury is evaporated by heating. This method poisoning due to exposure of workers to mercurial vapor becomes a big issue. This matter is quite different from Minamata disease. However, inorganic mercury is discharged into rivers and contaminated the soil and rivers by scattering the air. After methylation in the environment, the compounds are accumulated in fishes and shellfishes and then increase the mercury level in human hairs. Such facts are being confirmed in various countries all over the world. In the Amazonian area particularly, the hair mercury level (approximately 90% of the level is methylmercury) exceeded 50 ppm, and some people complained of nervous symptoms. If such nervous symptoms were confirmed to have been induced by methylmercury poisoning, these people may manifest symptoms medically similar to those of Minamata disease, though the condition of the area is different from that for the outbreak of Minamata disease, in which the methylmercury compound was directly discharged into the environment.

<Column> *Factors related the hypothesis of methylmercury*

With regard to methylmercury poisoning that observed in 4 workers of a seed disinfection plant in England, D. Hunter, R. Bomford, and D. Russell made a detailed clinical report in 1940 (Quart. J. Med., vol. 9). One of them (Case No. 4) died 15 years after the onset, and examined by autopsy. The Kumamoto University Research Group noticed that the symptoms of Minamata disease closely resemble those of organic mercury poisoning, owing to description of details of the pathological findings in an article by Hunter and Russell (J. Neurol. Neurosurg. Psychiat., vol. 17, 1954).

Prof. Takeuchi obtained "A Compendium of Pathological Anatomy" [vol. 13 (2), edited by F. Henke and O. Lubarsch] published in 1958, and found that the pathological findings on the brain of a patient with methylmercury poisoning, which were observed by Hunter et al. and described by A. Pentschew in the item of mercury poisoning, were extremely similar to those in Minamata disease patients. Prof. Takeuchi was convinced that Minamata disease is methylmercury poisoning, asked the Dept. of Public Health to analyze mercury in the fishes and shellfishes caught in Minamata Bay.

Asst. Prof. Tokuomi noticed that alkyl mercury was given, as a toxic substance inducing concentric constriction of visual field and ataxia, at the beginning of a book by Von Oettingen, "Poisoning" (published in 1954), which Tokuomi obtained in April 1957. He obtained two pieces of literature by Hunter et al., which were cited in the book, and assessed them. In those days there were many severe cases and the symptoms were so serious that these conditions were not necessarily consistent with the description by Hunter et al. The possibility of expensive mercury being abandoned in large quantities was also considered low. Therefore, these phenomena did not reach the hypothesis of alkyl mercury. Thereafter, however, Tokuomi encountered at least 34 patients, and found that the main symptoms and signs are consistent with those reported by Hunter et al. Thus, he confirmed that Minamata disease is organic mercury poisoning.

The relationship between Minamata disease and organic mercury was first described in an academic journal by McAlpine, a neurologist in England, and Shukuro Araki (Dept. of Internal Medicine, Kyushu University School of Medicine). McAlpine has come to Prof. Kuheita Miyagawa of Kumamoto University School of Medicine (Dept. Neuropsychiatry) in order to investigate multiple sclerosis. In February 1958, McAlpine visited Minamata with Araki to examine Minamata disease patients, and introduced Minamata disease in Lancet (published in September, 1958). On this occasion, introducing a thallium hypothesis, which was advocated by Prof. Miyagawa as a study in Japan in those days, he suggested for the first time the possibility of organic mercury being a causative agent for the disease from the clinical features.

In September 1958, Kurland, the Director of the Epidemiology Division of National Institutes of Health (NIH) in the U.S., and his co-workers visited Minamata in order to investigate the cause of Minamata disease, and examined patients. They brought back the fishes/shellfishes Bay, the mud, and the seawater of Minamata for analysis. He detected a large amount of mercury in the samples which he brought back from Minamata. As a result, he strongly supported the hypothesis postrated by the Kumamoto University

Research Group in 1959. The support from such an overseas authoritative investigator has encouraged the Kumamoto University Research Group, which has been exposed to various counterarguments in those days. Furthermore, NIH came to support thereafter the research by Kumamoto University School of Medicine from the aspect of research funds as well.