

## **A Study of Academic Scientists' Roles and Works in Managing Problems Associated with a Natural Disaster and Related Industrial Hazards: A View from a Non-Governmental Organization's Perspective**

**Walaiporn Mooksuwan**

### **Introduction**

Japan has developed industries for hundreds of years. From such industrial development, it has suffered serious negative impacts, among them the Four Big Pollution Diseases. The first case involved the Kumamoto-Minamata Disease officially discovered to have afflicted patients in 1956. This disease was caused by exposure to food containing methyl mercury released by the Chisso acetaldehyde plant into the sea. The second case was the Niigata-Minamata disease discovered in 1965, a result of the wastewater discharge containing methyl mercury from the Showa Denko plant in Niigata prefecture. The third case was the Ital-Ital disease which occurred around 1955, caused by polluted water coming from a mine of Mitsui Mining and Smelting in Toyama prefecture. The fourth case was Yokkaichi Asthma, which began to appear between 1957 and 1960. This was caused by air pollution from the Yokkaichi Industrial Complex.

At present, it might appear that Japan has controlled such serious industrial pollution; but Japan, in fact, is now facing a more complex pollution problem derived from the explosion of TEPCO's Fukushima nuclear power plant after a giant earthquake and tsunami hit Japan on 11 March 2011.

There is now an interesting question awaiting an answer—how will scientists solve these problems? Academic scientists are always expected to rightfully and fairly deal with problems because society holds the view that scientists are knowledgeable about the management of industrial pollution, the environment and health; and are independent of the state and private organizations. With that in mind I conducted a study of the role of academic scientists of Japan in solving the Minamata disease case and the

nuclear crisis in Fukushima. The methods used were literature review of relevant documents, site visits, and interviews.

### **Results**

#### **1. The Minamata disease incident**

##### **Background**

A hundred and five years ago, Minamata City welcomed its first chemical factory; and so began happy stories as well as stories of hardship experienced by its residents.

The Shin Nitchitsu (Chisso) Company started its business by operating a hydroelectric power station in the Kagoshima Prefecture. At that time, the power station experienced overcapacity that resulted in surplus power. To make use of this, the company thought of establishing a new factory. The initial plan was to construct it in Izumi City in Kagoshima Prefecture but this plan was changed after the mayor of Minamata Municipality invited the group to construct the factory at Minamata City in Kumamoto Prefecture so as to spur the city's economy. Minamata City additionally proposed to establish a deep seaport and to put up electricity posts for this reciprocal exchange with Chisso Company. For this reason, Minamata City became the industrial site of Chisso Company in 1908<sup>1</sup> (George 2001; Open Research Center for Minamata Study 2007). The arrival of Chisso was credited with the rapid economic growth and the expansion of the city. As Chisso dominated the economy of Minamata City, the city went under the influence of Chisso (Foundation Minamata Disease Center Soshisha).

Chisso continually expanded its industrial area. In 1932 it began to produce acetaldehyde within the new factory in Minamata city (Foundation

Minamata Disease Center Soshisha) This was how the suffering of Minamata residents originated, even as it gained from the economic boom. Chisso discharged wastewater contaminated with methyl mercury as a by-product of acetaldehyde production directly to Minamata Bay. During that period, Japan had started World War II. Chisso was one of the big chemical companies involved in producing essentials for the War, including bombs, chemical substances, and others. After the war ended in 1945, the Chisso factory at Minamata appeared to have been relatively damaged by the bombing. Given its advanced technologies, Chisso dramatically recovered (George 2001). At that time, Chisso hastened its production of various products including acetaldehyde. This led to a corresponding increase in methyl mercury released to the ocean.

In 1949 the unusual phenomenon occurred in the bay, resulting in the death of shellfishes, fishes, and birds. In 1954, the large number of cats suffering from the dancing cat fever enormously increased (Foundation Minamata Disease Centre Soshisha year). In addition, on 1 May 1956, Dr. Hosokawa Hajime, the director of the Chisso company hospital, reported that there were patients suffering from a strange disease that was later called the Minamata disease (Open Research Center for Minamata Study 2007). This marked the official discovery of Minamata disease; although in 1953, the disease had already occurred (Open Research Center for Minamata Study 2007; Mazazumi 2004).

#### **The role of scientists in identifying the causes of Minamata disease**

The official discovery of patients suffering from Minamata became the starting point of an epic of finding the scientific evidence. The arduous investigation took up considerable time, especially because Chisso had a strong influence both on the local and national levels as it took the lead in the recovery of Japan's economy after the war.

In order to identify the causes of this new disease, Kumamoto Prefecture formed the Strange Disease

Countermeasures committee comprising of the doctor's association, the municipal hospital, the Chisso company hospital and the public health office of Kumamoto Prefecture (Mazazumi 2004).

The study conducted by the municipality, prefecture, and Japanese government released its results on 1 December 1956. Fifty-two patients were officially reported as having contracted the disease of which number 17 passed away. The researchers recommended conducting further studies in the laboratory to examine the causes of the disease. Due to such advice, the subsequent study mainly conducted in laboratory, while no further field surveying to find more patients was conducted. The Minister of Health and Welfare appointed the Food Hygiene Investigation Committee and the Minamata Food Poisoning Subcommittee composed of researchers from the medical school of Kumamoto University to lead the study. This committee was abolished in end 1959, with the Ministry of Health and Welfare explaining that it did not have enough funds to support the study any longer. Later on, the researchers from Kumamoto University received a research grant from the Health Institution of the United States to carry on the study on Minamata disease. American friends working at the institution helped in its conduct (George 2001).

The investigation on the causes of the disease proceeded intensively. The researchers strove to prove their assumption. They worked without any assistance from the Chisso company. Besides, the Chisso company tried to confute the presumption and the study outcome of the committee, where possible. For example, the company did not reveal the laboratory results of the tests conducted by Hosokawa Hajime. Moreover, the company employed researchers from Tokyo to neutralize the findings by proposing different theories. In addition, The Minamata Disease General Investigation and Research Liaison Council was established under the umbrella of the Economic Planning Agency. This committee was comprised of ten members, six of them from Tokyo University, two from Kumamoto, one from Kyushu and

the other from the National Hygiene Laboratory. Furthermore, the company also nominated the Japan Medical Association to set up the Minamata Disease Research Consultation Group composed of seven members, all of whom were from universities located in Tokyo. This committee

was likely to be influenced by the Japan Chemical Industry Association, set up to oppose the findings from Kumamoto which indicated that methyl mercury was the cause of Minamata disease (George 2001). The proposition and confutation are summarized in Table 1.

**Table 1:** The summary of some propositions and confutations

<b>Research group/ individuals/reports and the date of presentation of the findings</b>	<b>The theories used and the findings</b>	<b>The theories used to oppose the findings and the arguments</b>	<b>Name of opponents and the date the findings were presented</b>
Research group formed by the ministry of Health and Welfare Kumamoto University January 25, 1957	The disease was probably caused by heavy metal in fish and shellfish.	The disease must have been caused by pesticides and fertilizers washed to the sea by a typhoon in 1953.	Mayor Hashimoto April 1957
Mastoid Shinichi, head of scientists assembled by MHW and Yamaguchi Masayoshi, chief of Public Health Bureau July 1958	“Waste from the Shin Nitchitsu factory pollutes the sludge of the bay and harbor; and fish, shellfish, and migratory fish become poisonous due to a substance identical in type to a chemical poison in the waste.”	The Ministry of Health and Welfare’s study dismissed the selenium, thallium and manganese theories. No proof yet that the disease was seasonal. It speculated that the cause was probably “a complex organic poison”.	Shin Nitchitsu issued monthly pamphlet in 1958-1959
Takeuchi Tadao of Kumamoto university March 1959	Published an article showing the similarities between the symptom of Minamata disease and organic mercury poisoning. The factory used inorganic mercury in producing vinyl chloride and acetaldehyde. Researchers still could not explain how the inorganic mercury could become organic but presumed that this happened in seawater or in the fish.	The organic mercury theory is not only fraught with the same problems as the manganese, selenium, and thallium theories. In addition, looking at it from the point of view of scientific common sense, it is based on assumptions and contradicts the facts. At this stage, it would be premature to immediately conclude that organic mercury is the cause of Minamata disease. Even linking it to the Minamata factory’s waste would be jumping to conclusions.	Nishida Eiichi, plant manager August 5, 1959
Dr. Hosokawa, head of Shin Nitchitsu’s hospital June 1959	Cat experiment #400: started on July 21, fed cat with food to which was added wastewater from the acetic acid plant. On October 7, cat suffered from Minamata disease. Mercury was found in the organs of the cat.	The factory manager and the head of the research department ordered him to halt all experiments with factory waste.	

<p>Food Hygiene Investigation Committee interim report submitted to the Ministry of Health and Welfare (the committee was disbanded on the day the ministry received the report) November 12, 1959</p>	<p>Minamata disease, which results from the consumption of large quantities of fish and shellfish from Minamata Bay and the surrounding areas, is caused by food poisoning that mainly attacks the central nervous system. The main cause is an organic mercury compound.</p>	<p>“If only the wastewater issue had been dealt with before it became a big problem, not by a hick university like Kumamoto University Medical School but by scholars from the center, who were true authorities.”</p>	<p>The industry journal <i>Mizu</i> (water) December 1959</p>
<p>Leonard Kurland, National institute of Health, USA December 8, 1959</p>	<p>Contributed articles to newspapers supporting the Kumamoto University conclusion that organic mercury was the causative substance of Minamata disease. Discovered methyl mercury in seafood samples from Minamata.</p>	<ul style="list-style-type: none"> <li>• Funded many researches to support the amine theory</li> <li>• Amine theory (Minamata disease was caused by poisonous amines that were produced when fish rotted.)</li> <li>• The cat fed with soup made from spoiled fish went mad, like the cat with Minamata disease. It seemed likely the causative agent was some source of amine in the fish.</li> </ul>	<ul style="list-style-type: none"> <li>• Minamata Disease General Investigation and Research Liaison Council (directed by Economic Planning Agency 1960</li> <li>• Kiyoura Raisaku of Tokyo University April 1960</li> <li>• Tokita Kikuji, a pharmacologist at Toho University supported by Kiyoura Raisaku, MITI, Shin Nitchitsu, The JCIA and Tamiya Takeo, head of Japan Medical Association) 1961</li> </ul>

Despite the evidence presented on the cause of Minamata disease, Chisso company continued to deny its responsibility. Among the findings from the committee nominated by the Minister of Health and Welfare, was that the cause of Minamata disease was the organic mercury, which was the contaminant in the wastewater released into Minamata Bay. In addition, the experiment testing by Dr. Hosokawa Hajime showed that the disease was caused by contaminated wastewater. The Japanese government never accepted this

finding until September 1968. The federal government has acknowledged it since then. The government declared that the Minamata disease in Kumamoto Prefecture was caused by methyl mercury produced by the acetaldehyde acetic acid facility of the Chisso factory in Manamata City. Nevertheless, the declaration was issued after the Chisso company stopped producing acetaldehyde in May 1968 (Open Research Center for Minamata Study 2007).

### **The role of scientists vis-à-vis Minamata disease patients**

Minamata disease was first officially discovered in 1956. The victims manifested severe symptoms including a narrowing of their field of vision, sensory disorder, ataxia, speech disorder, hearing disorder, walking disorder, tremor, and mild psychiatric disorder. Dr. Masazumi Harada saw babies with Minamata symptoms upon birth. He conducted the research in 1961 to 1962, verifying that those babies got methyl mercury from their pregnant mothers through the umbilical cord which is connected to the placenta. This was a discovery for the medical field because previously, it was believed that toxic substances from the mother could not be passed on to the fetus (Masazumi 2004).

On September 31, 2012, the government officially recognized 2,273 victims. Among them, 1,782 victims resided in Kumamoto Prefecture while 491 victims resided in Kagoshima Prefecture.<sup>2</sup> Large numbers of victims who should have received the compensation came but government specified the criteria for diagnosing Minamata disease to be those identified as symptoms when the disease was initially discovered. Those criteria were too strict because at the initial stage of the discovery of the disease, no such research had thoroughly and comprehensively been undertaken. The research conducted was likely to pay attention on the victims who had severe symptoms and there were but a few of them compared to the victims as a whole. Thus, the victims had to bring the suit to a court for justice, with support from Dr. Harada who was an expert and had undertaken the research on Minamata when the problem first presented itself. He assisted the patients' group as an important expert witness but while the outcome of the lawsuit was beneficial to the victims, the federal government, local government and Chisso company to evade responsibility. They abided by the traditional investigation and only provided the victims with health assistance. Considering the size of the health budget, this was far less than the compensation cost for recognized patients.

In 2004 the federal and local governments of Kumamoto Prefecture were pronounced guilty of not taking preventive actions to halt the outbreak of Minamata disease (Open Research Center for Minamata Study 2007). Moreover, the Supreme Court ruled that a person with a certain condition should be officially recognized as a Minamata disease victim even if the condition did not meet the 1977 criteria. Even so, the government had not revised the criteria. Instead, the government had the Diet enact the 2009 Special Law on relief measures that provided health assistance to the victims (Editor 2012.) However, to get the support, the victims had to submit their application by the deadline which was indefinitely closed in July 2012. That was the final assistance given with applicants numbering 65,151.2 The assistance was extended on the condition that the applicants would withdraw the accusation and not file a lawsuit again in the future.

Fifty-six years after the discovery of Minamata disease, the federal and local governments have never undertaken research to determine the entire number of assumed victims so it could help them through their suffering. Although there were other research teams trying to discover the entire number of assumed victims, they could not get through this. Up until now, the number of all victims remains unclear. However, the estimated number of victims may reach 200,000 patients (Maruyama 1996).

## **2. The Fukushima Nuclear Crisis**

### **The Disasters**

On 11 March 2011, Japan experienced an earthquake that measured 9.0 on the Richter scale as well as an enormous tsunami. These disasters which came at such great cost led to the loss of more than 17,000 lives (Hongo, 2012). It is possible that the worst impacts are yet to be realized. Explosions at the nuclear power plant of Tokyo Electric Power Company (TEPCO) in Fukushima caused problems that continue to the present. Radioactive substances released have contaminated

air, soil, water, and agricultural products. People who live within a 30-kilometer radius of the nuclear power plant have been suffering. Radioactive-contaminated environment and food currently confront Japan.

### **The investigation on the causes of explosion at the Fukushima Nuclear Power Plant Station**

After the explosion at the Fukushima Nuclear Power Plant Station, four committees were set up to investigate the cause of the explosion.

The first, the Independent Investigation Committee on the Accident (ICANPS) was appointed by the Japan government on 7 June 2011. Most of its 10 members were experts from educational institutions. The committee aimed to make policy proposals on measures to prevent the further spread of the damage caused by the accident and a recurrence of similar accidents in the future, by conducting a multifaceted investigation in an open and neutral manner. Accountable to the Japanese public, the committee's task was to determine the causes of the accident at the Fukushima Dai-ichi and Dai-ni Nuclear Power Stations (Wikipedia 2012).

The second committee, called the Nuclear Accident Independent Investigation Commission (NAIIC), was appointed by the Japan Diet on 7 October 2011. Also comprised of 10 members, its crucial aim was to investigate the background and cause of the Fukushima Dai-ichi nuclear disaster and provide suggestions including the "re-examination of an optimal administrative organization" for nuclear safety regulation based on its investigation of the accident (Wikipedia 2012). The third committee, the Fukushima Nuclear Accident Investigation Committee, was nominated by the Tokyo Electric Power Company. The fourth committee, the Independent Investigation Commission (RJIF), was appointed by Rebuild Japan Initiative Foundation. This committee was an independent committee from civil society.

The executive summary investigated by the Fukushima Nuclear Accident Independent Investigation Commission was made public on 5 July 2012. This report asserted, "The TEPCO Fukushima Nuclear Power Plant accident was the result of collusion among the government, the regulators, and TEPCO, and the lack of governance by said parties. They effectively betrayed the nation's right to be safe from nuclear accidents. Therefore, we conclude that the accident was clearly 'manmade.' We believe that the root causes were the organizational and regulatory systems that supported faulty rationales for decisions and actions, rather than issues relating to the competency of any specific individual" (The National Diet of Japan 2012).

### **The safety regulations in the nuclear power plant**

The regulation that provided for maximizing safety in the nuclear power plant was the most necessary and important. This is because radioactivity emanating from the production process poses dangers to human lives and the environment. Therefore, the prevention of accidents is strictly necessary. Before the 11 March 2011 incident, the institution responsible for the regulatory policy on the nuclear power plant was the Nuclear Safety Commission (NSC) under the control of Prime Minister's Cabinet Office. The commission consisted of five members, the secretariat office, and the advisory board. The operating institution was the Nuclear and Industrial Safety Agency (NISA), under the control of the Ministry of Economy, Trade and Industry (METI). Furthermore, it was involved with other institutions including the Ministry of Education, Culture, Sports, Science and Technology. These institutions were responsible for testing and conducting relevant research.

After the March 11 incident, the Nuclear Accident Independent Investigation Commission (NAIIC) indicated that the root causes of the incident was the diminished governance in regulation.

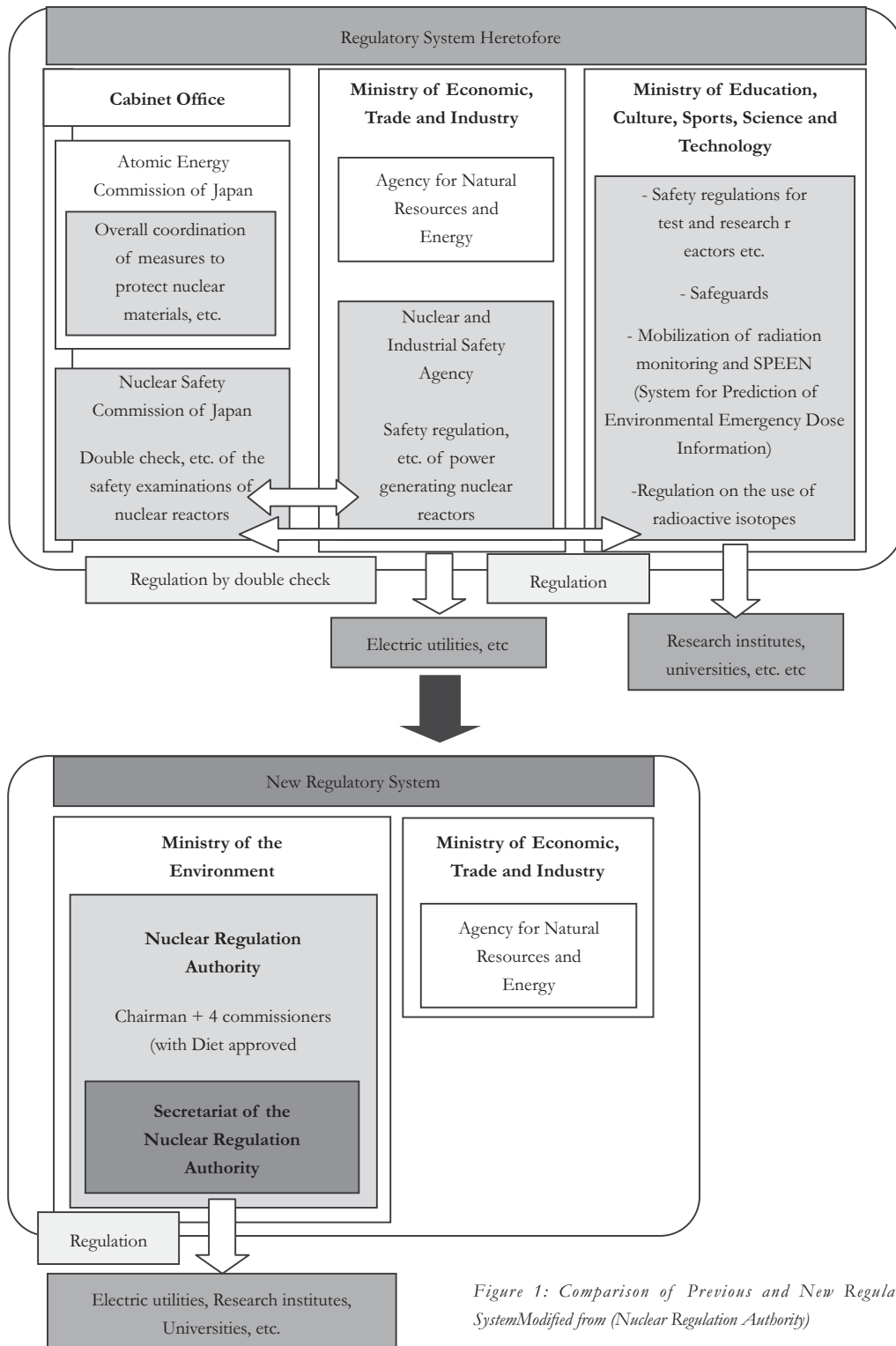


Figure 1: Comparison of Previous and New Regulatory System Modified from (Nuclear Regulation Authority)



The commission suggested that the regulatory institution needed to be reformed (Nuclear Safety Commission). Due to the public outcry, the Japan government enacted the law and reformed the regulatory structure on the use of the nuclear power plant. The previous and the new regulatory systems are presented in figure 1 (The National Diet of Japan 2012).

In June 2012, the new regulatory law was promulgated to set up the new nuclear power plant regulatory institution called the Nuclear Regulation Authority (NRA), managed by the Ministry of Environment. The previous organization which was called the Nuclear Safety Commission (NSC) and was subject to METI was removed. This reformation aimed to solve the problems regarding the conflict of interest between organizations. The regulatory institution and the promotion institution were in the same ministry. The new law vested independence and authority in decision-making in the committees composed of five members similar to the NSC. The staff and resources of NISA were transferred to the secretariat office of NRA to perform their tasks for the new institution. The change involved simply entailed the transferring of tasks from one ministry to another. This change has made many parties concerned about the effectiveness regulating the nuclear power plants. It might be merely cosmetic.

**The social structure impeding legitimacy in regulating the nuclear power business sector.**

Harutoshi Funabashi (2012) addressed the idea of relationships called “Nuclear Complex”. It was a crucial part that caused the regulation of the nuclear power business sector a failure. The reason was that it obstructed hearings from all other aspects and ignored the warnings of others. The characteristics of the Nuclear Complex are presented in Figure 2.

It could be asserted that the Nuclear Complex was the network for strengthening the influence of the nuclear power plant business. It was

constructed through the consolidation of patronizing relationships between the nuclear power plant industry and other associated institutions, including the promoting institutions, the regulatory institutions, the political parties at the local and national levels, educational institutions, media, and communities supporting nuclear plants. The relationship has occurred through the financial support extended in various forms: donations, funds, and research grants. Consequently, people from these institutions became the representatives of involved sectors responsible for regulating the nuclear power plant. For example, experts working in the universities who were associated with the nuclear industry became the representatives in any alliance in relation to giving advice or formulating policy, regulation, and recommendations for the regulatory institutions. Another example would be politicians who received a donation from energy industry and became members of parliament. In addition, the staffs between NISA and nuclear power plants were regularly alternated. This was one of the causes leading to the occurrence of patronage relationships. This kind of relationship resulted in regulatory ineffectiveness, lessening the strict rules and regulations for the power plant. This also included ignorance of the warnings or opinions from those people who were concerned but were out of the relationship. (Pritchard 2011; Fukue 2011). For instance, the warning from Dr. Katsuhiko Ishibashi, a seismologist and professor of Kobe University, suggested rethinking the fault line issue; however, this advice was never seriously considered (Pritchard 2011). Furthermore, the creators of Safety Guidelines for the nuclear power plant, comprising of the committees and most of the experts working within the committees had a good relationship with nuclear power plants. For this reason, the accident prevention measures for nuclear power plant set by the committee was not strict enough. (Matsutani 2011). These were all the root causes of the explosion in March 2011.



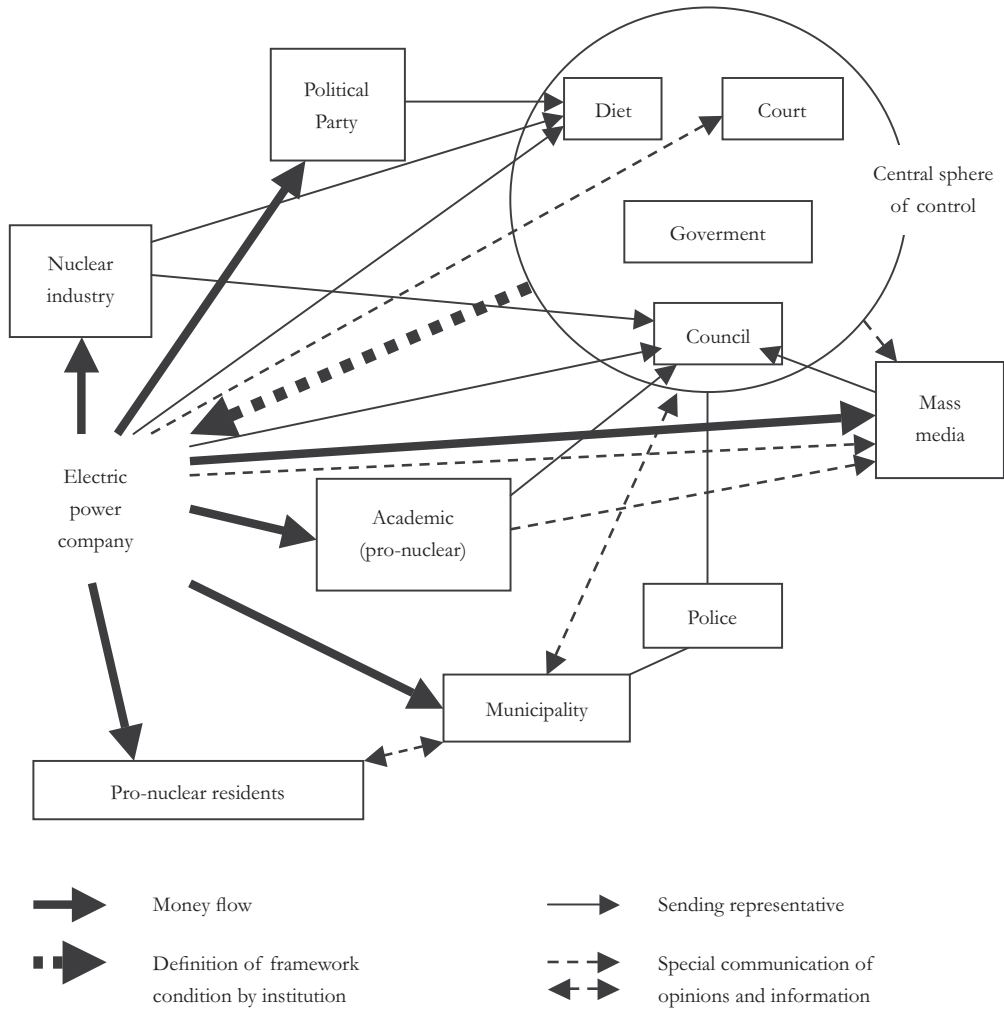


Figure 2: Nuclear Complex Modified from (Funabasbi 2012)

### Lesson learned from the Minamata and the Fukushima incidents

The Minamata case occurred 55 years before the Fukushima accident. At the time of the Minamata case, scientists had no knowledge of the Minamata disease and its cause. On the other hand, by the time of the Fukushima accident, scientists had knowledge of the nuclear technology and earthquake forecasting, and knew about the potential hazards that existed. Therefore, the implementation of preventive measures was the important thing that could have prevented the accident.

Despite having such knowledge, scientists failed to prevent the occurrence of the Fukushima incident. In the Minamata case, they failed to contain the impact of the disease. Scientists in Kumamoto exerted much effort to find the cause of the Minamata disease, and finally concluded that the disease may be caused by eating fish and shellfish contaminated with heavy metals; but the local and central governments ignored this information. Besides, industry was trying to obfuscate the conclusion by introducing other theories developed by the central scientists. In the Fukushima case, NISA and NSC's lessening of the preventive measures, while ignoring the decline of nuclear specialists outside the network, caused the explosion.

What lie behind the failure of preventing the occurrence of two incidents are similar, that is the economic influence of the industrial world which blocks the real participation of other sectors including the academic sector.

The mistakes in the prevention of accidents at the Fukushima nuclear power plant can happen to any sector. People involved in the supervision should learn about this error and commit to do their duty with fidelity. They should be open to comments and suggestions in the decision-making process especially with regard to public safety.

### Conclusion

#### The factors affecting the role of scientists

The incidents in the chemical factory in Minamata and the Fukushima Nuclear Power Plant resulted from policy at the national level to which the Japanese government gave such importance and push. These two enterprises had a strong influence on Japan's economy, leading to enormous inequality in the economic and social statuses of stakeholders as well as in knowledge construction. It became more difficult for scientists to perform their tasks amidst the inequality in social status. These situations substantially supported the fact that science became a tool to establish legitimacy for those who needed it by cooperating with scientists. Although some scientists were admired by the society for being moral, there were those who struggled before surrendering to particular conditions that made them decide to leave truth and justice behind.

These two incidents in Minamata and Fukushima indicated that the factors influential in the scientists' role were from both the level of individuals and organizations or head of organizations to which the scientists belonged.

At the individual level, the attitudes and concepts of scientists toward the incidents were responsible for their works and comments. It was explicit in the case of the nuclear power plant. Many of the scientists accepted the potential risk attendant to the dispersion of radioactivity at the intensive level. This was because they agreed that the nuclear power plant had the most worth for Japan. On the other hand, there were many scientists who felt uncertain about the plant's safety.

At the level of organization or head of organization, apart from scientists' perspectives, organizations and heads of organizations had an influence on the role of scientists as well. For

example, Dr. Hosokawa Hajime, the director of Chisso Hospital, discovered that the wastewater from the acetaldehyde factory caused the Minamata disease three years after officially establishing the existence of Minamata disease patients. However, Chisso company concealed his report; therefore, to a certain degree, Hosokawa had to keep quiet about his discovery nearly all his life. Furthermore, it was explicit that the donors who provided funding for both the private and public sectors had an influence on those organizations. This ultimately affected the role of scientists. The good thing was that the Chisso company provided funds for the scientists from Tokyo University to conduct research that would disprove the theory or research outcome of the research team from Kumamoto University. Another example involved the enormous donation from the nuclear power plant industry to Tokyo University. Many nuclear experts from Tokyo University had played their role in supporting the nuclear industry in various ways, including being part of the NSC committees, creating the safety guideline, and being part of the TEPCO executives.

### Recommendations

1. Convey the lessons of the past to scientists, both seniors and juniors alike. This will serve as a reminder of the impact derived from their not adhering to their duties.
2. Establish a counterbalance mechanism in the decision making process. The involvement of the public is one of the strategies which can be applied as such mechanism in the decision making process. The public can truly be involved when they can access related information. As such, policy makers and citizens should encourage the disclosure of relevant information to the public.
3. Promote diversity of scientists involved and public participation. Increasing the diversity of scientists who will do research on particular issues, as well as increasing public hearings, exchanging information, and distributing the outcome to the public may also provide other alternative approaches to promote scientific works that will be beneficial to all stakeholders equally.

### NOTES

<sup>1</sup>Sadami Maruyama. Lecture to participants of “Minamata Studies for young researchers 2012” Seminar held by Open Research Center for Minamata Studies during Sep 6 – 9, 2012.

<sup>2</sup>Exhibition at Minamata Disease Municipal Museum. 2013.

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