

2.2 Historical Retrospection of Air Pollution in Japan

The following classifies the history of air pollution in Japan into three stages; the first starting from the industrialization of Japan by the Meiji government and lasting up to the end of the Pacific War; the second extends from the industrial restoration to the environmental crisis; and the third stage indicates the time period following thereafter.

2.2.1 Air Pollution, the First Stage

(1) Development of Industrialization and the Occurrence of Air Pollution ^{1) 2)}

The industrialization policies of the Meiji government were supported by the potential technology of the Edo period and led to its rapid progression. For example, the popularization of western-style buildings and plans for the additional building of docks for the Yokosuka Iron Works, founded in the last days of the Edo period, led to a forecast of an increase in the demand for cement. This led the government to plan to shift over to domestic production of cement. In May 1875, the former Ministry of Industry's Fukagawa Seisakuryo succeeded in putting into operation a wet method cement kiln. However, it resulted in amassed complaints from citizens due to scattered dust.

After the end of the Edo period, Takatoh Oshima began the operation of a blast furnace which used charcoal in Kamaishi, this became the foundation for Japan's steel manufacturing industry. This also led to the founding of Yawata Steel Mill in 1911. Kamaishi and Yawata became a steel producing cities and eventually began to experience air pollution. At Besshi Coppermine, a refinery was moved to Niihama around 1882 and western refinery methods were adopted. These events also took place at Ashio, leading the historical disputes between the copper industry and farmers, which had erupted due to exhaust gas emitted from the refineries, to repeat themselves. Other industries also began to modernize and prosper, resulting in more emphasis to be placed on air pollution. As in the case of the reclamation done by Soichiro Asano and others along the coastal areas of Tsurumi and Kawasaki in Kanagawa Prefecture in the 1900's, Japan's industrialization was characterized by coastal industrial areas built on reclamations. By the time of the first World War the main stage was set for the initial phase of air pollution in Japan's four major industrial areas, Hanshin, Keihin, Chukyo, and Kita Kyushu.

(2) Local Air Pollution Disputes ^{1) 2)}

Long term disputes over agricultural damage caused by refinery exhaust gas became prominent. Disputes over local pollution caused by new factories became frequent. A typical example of the aforementioned is the case of the Besshi Copper Mine dispute. A private railway was completed to travel between Mount Besshi and Niihama. As the amount of copper production increased, damage to rice paddies materialized in four such as Niihama in 1893. Eventually farmers began to hold demonstration seeking the halt or relocation of the refinery. Negotiations were held between the refinery and farmers but in the following year, 1894, damage to the wheat harvest recurred disputes. In 1905, the refinery was completely moved to an uninhabited island, Shisaka Island, 18 km off the shores of Niihama in the Inland Sea. However, after the refinery began full-scale operations on the island, damages to wheat and rice harvests resulted in agreements which was entered into regulating such items as and the payment of

compensation to farmers the quantity of copper production. And these battles during 47 years come to close due to the production of sulfuric acid from dilute sulfur dioxide in exhaust gas adopting Petersen process in 1929, and the operation of the desulfurization plant for exhaust gas using ammonia in 1937. Also, in the latter case, there were such issues as claims from farmers regarding hydrogen chloride problems caused by the start of the manufacture of monosodium glutamate by the Suzuki Seiyaku company in 1900's Zushi, Kanagawa Prefecture, and the dust issue in Fukagawa caused by the aforementioned cement plant. Because the outbreak of west-south war between political faction in Japan led to tight financial situation, Meiji Government sold the cement factory at Fukagawa operating by Ministry of Industry to Soichiro Asano in 1877. The dust dispersion problem caused by this cement factory operated by Soichiro Asano surfaced as a result of adaptation of rotary kiln imported from U.S.. A relocated petition of factory by citizens of Fukagawa area was approved in 1908. Thus in 1918, Asano Cement has imported the electric dust collector from U.S. investigated by Professor Cottrel and succeeded to retract citizen's petition who recognized the device's effectiveness. However, this did not stop the uprising by citizens opposing plans for the construction of a factory in Daishi Kawahara-village, Tachibana-county, Kanagawa Prefecture. The Asano Cement Kawasaki factory which began operations in 1917 in the village of Tajima in Tachibana-county, also faced repeated long dispute until 1930, immediately following the start of its operations.

(3) Regional Scale Air Pollution ⁽¹⁾⁽²⁾

Industrial cities were posed by the problem of long range air pollution, resulting in the scale of the problem to extend beyond the realms of mere local disputes. Initially, the first time the smoke and soot problem arose in Osaka was during 1883-1884. Osaka Prefecture passed laws cracking down on industrial smoke and soot due to coal combustion. Also, in 1888, smoke and soot emitted by Osaka Electric K.K caused the prefectural government to pass an order "banning the construction of smoke releasing factories within city limits". Osaka prefectural assembly proposed to the governor to control smoke and soot, and in 1910, the prefectural police ordered all public baths to install smoke consuming devices. During the same year, a research group on the prevention of soot and smoke was established with the prefectural governor as its chairman. Osaka City requested funds in 1912 in order to take measures against the smoke and soot emitted from the city-run thermal power plant. Following this, there were continued complaints from mass media were heard against the factory's soot and smoke. However this was to no avail. The prefectural governor sought advice from its research group on the prevention of soot and smoke and also from the Osaka Chamber of Commerce in order to develop countermeasures, but the research group became defunct in 1917. The smoke and soot problem in Osaka intensified during the First World War. This issue also began to be taken up in Tokyo. In 1924, the Association on Fuel expressed the necessity for smoke prevention for the sake of the city's appearance, the health of its citizens and in order to prevent squandering fuel. This led the Ministry of Home Affairs to issue an ordinance, in December 1924, to regulate soot and smoke emissions in six major cities. In 1922, the Osaka City Institute of Public Health (currently the Osaka City Institute of Public Health and Environmental Science) began a study on regional scale air pollution. In 1932, the Osaka prefectural government issued an order stating regulations on the prevention of soot and smoke emission. It banned the black smoke emission exceeding a level 3 on the Ringelman's charts over 6 minutes per 1 hour. Similar measures were instituted in 1933 in Kyoto and in 1935 in Hyogo Prefecture. In the Tokyo metropolitan area, local battles related

to factories began early on. In 1927, the Tokyo City Research Laboratory of Public Health began a large-scale study on regional scale air pollution. There are only a few examples of older records concerning the air pollution in the Keihin Industrial Area. Of these, the following reports were found. In 1916, damage to the area's vegetation was observed due to pollutants released from the Hodogaya Soda factory. In 1918, Yokohama (Gyoyu) Fish Oil K.K. was cited for problems concerning soot, smoke, and offensive odor. In 1919, Nihon Hiryo (Japan Fertilizer) K.K. was responsible for releasing offensive odors into the air. In 1922, Yokohama Chemical, Nippon Chemical, and Dai-Nippon Artificial Fertilizer were the cause of damages due to toxic gases. Vegetation in the Kawasaki area was affected in 1929 because of Tokyo Electric K.K. In 1938, NKK Corp.'s operation of a Thomas converter resulted in the emission of iron oxide fumes into the air. In 1935, the Tokyo Prefecture created an outline of guidelines on the prevention of soot and smoke. Beginning in 1937, Kanagawa prefecture implemented policies after deciding on provisions for a "committee on the prevention of soot and smoke". During the same year, the Kanagawa Prefectural Assembly took up the issue of air pollution. In 1940, the Kawasaki City submitted a written opinion to the Governor of Kanagawa and the Minister of Home Affairs, documenting claims by citizens who suffered from the soot and smoke released by the Keihin Industrial Area, in particular symptoms such as adverse effects on the health and hygiene of school children and growth deficiencies in infants. In Kyushu Area, from the latter half of the Meiji era (1868-1911) industries in the area began to develop based on the use of coal as a fuel source. Yawata Steel Mill was the main force behind the prosperity of the Kita-Kyushu Industrial Area. The Omuta Industrial Area, where the problem of air pollution had existed even prior to the Second World War reached its peak of prosperity due to the Miike coalfield.

(4) Trends in Air Pollution Survey and Research ¹⁾²⁾

Regional scale air pollution surveys instituted early on, were launched in 1922 under the guidance of Kujyuro Fujiwara. These were performed over the long-term by the Osaka City Institute of Public Health and were reported in a summary stating the institute's results.

The following is a famous passage taken from an institute report released in 1927. "The rampant black smoke which swept the skies has not only become the utmost characteristic of our fair city, Osaka, but also has become our biggest dilemma. The enormous damage sustained by the city's citizens from the soot and smoke... it must be said that such matters as the creation of policies for the prevention of soot and smoke are of the utmost urgent mission. At our institute, this was the first step in research to remedy this matter. Beginning a few years ago, we have been performing measurements, taken at various locations throughout the city, for such things as the volume of falling soot and the quantity of airborne soot and dust. However, for those projects which were completed or started after the completion of our report for the previous fiscal year, if we were to provide a general outline it would be somewhat in the following manner..." Yoshiaki Takeda of Osaka Medical College, did research the air pollution in Osaka City from January through November 1928. During this period, he reported that the average monthly concentration of carbon dioxide (CO₂) in atmosphere was 315-450 ppm, while the average concentration of sulfur dioxide (SO₂) over a 24 hour period was 0.0075~0.368 ppm. These figures were reported to increase during the winter months.

Full-scale research was launched in the Tokyo metropolitan area when the Tokyo City Research Laboratory of

Public Health began to take measurements for CO₂, SO₂, airborne dust, and dust fall. In the Tokyo City Institute of Public Health's first report, Kunitaro Arimoto wrote the following passage. "Accompanying the increase in population and the development of industry, it is a clearly known fact that the city's air is continually becoming polluted. The chimneys which stand like the trees of a thick forest, exude billowing soot and smoke which covers the sky. Of course, while on one hand this is an unmistakable evidence as to how our city is flourishing, when looking at it from the standpoint of the health of the citizens, it must be said that this a matter of great concern... When giving consideration to the origin of the soot and smoke, it is evident that this method is an incomplete combustion of fuel. Included in the soot and smoke that is emitted are large amounts of combustible materials such as soot and tar. It goes without saying that this is a huge loss of fuel...". This report covered surveys which were performed from May 1927 to March 1928, again from May 1934 to April 1935, then again from 1939 to 1941. In addition, Yasuo Miyake made an analysis of the minor quantities of air and rain water he took at the central meteorological observatory and weather station beginning from 1935.

2.2.2 Air Pollution, the Second Stage ^{1) 2)}

(1) Facing the Issue of Air Pollution during the period of Industrial Restoration

By the end of 1945 NKK Corp. had halted operations of its blast furnace and open-hearth furnaces in the Keihin Industrial Area. However, right after the end of the Second World War, the company reopened a portion of its pipe manufacturing plants, cokes oven, chemical plant, and steel sheeting factories. In 1946 NKK put into operation 3 of its open-hearth furnaces. In October 1945, Nippon Oil Co., Ltd's Yokohama oil refinery disposed of its paraffin based oil and by May 1946 began to take in crude oil. With this, the restoration of Japan's industry which was destroyed during the war in the Second World War. The main energy source at this time was domestic coal. People once again began to suffer from the dust fall, especially those living in and around industrial areas. In particular, in Ube City, Yamaguchi Prefecture, during the first half of 1940's, it was indicated that the problem of dust fall caused by the combustion of low-grade coal, which was being used to accomplish industrial restoration, needed to be resolved. Furthermore, Japan's steel mills were at blame for the emission of densely red iron oxide fumes from its open-hearth furnaces, steel converters, and electric furnaces adopting oxygen-blowing steel refining technology. This worsened the problem of gray skies for those living in the city. Fallout of dust and soot around the factory, soiled laundry hung out to dry, caused corrosion of daily utensils, and decreased the chances of a clear sight of the area's panorama. The shades of colors in paintings drawn by children living in the cities of Kawasaki and Amasaki were much more dismal in comparison to drawings done by the children living in residential areas. This was attributed to the effects of the soot and smoke. There was noticeable withering of vegetation. Also there was a noted effect on the health of the area's residents. During this period, in Yokohama, the officers and men of the US occupational forces and their family fell ill to a respiratory disease known as "Yokohama asthma". Air pollution was pinpointed as the cause. The fear of the effects of air pollution on human health became a reality.

(2) Enactment of Pollution Control Ordinances and Struggles of Local Governments ^{1) 2) 3)}

Around 1950, the complaints about industrial pollution increased. Civil action against air pollution damage

gained momentum. Local governments were made to face these numerous petitions. In order to deal with this, Tokyo metropolitan area enacted pollution control ordinances in 1949, Osaka prefecture in 1950, and Kanagawa Prefecture 1951. However, during the enactment process for these ordinances, opinions were voiced that if the Department of Health drafted such ordinances, it would be a "harsh blow to industry". In opposition to this was the opinion that should ordinances be drafted by the Department of Economy, they would be "in favor of industry". Also, while opinions were in favor of the general principles backing the ordinances proposed by economic groups such as the Chamber of Commerce, they still supported factories. Some of these issues went so far as to deny the occurrence of environmental pollution, resulting in the rise of a dilemma between social welfare and whether to uphold factories. Local administrations dealing with environmental pollution were constantly handling complaints. The lack of effective measures led to the increased severity of air pollution. In December 1952, about 4,000 excess deaths were reported in London as a result of an air pollution disaster. However, this problem was not widely recognized until much later. In December 1960 the Kawasaki Chamber of Commerce called for the formation of the "Kawasaki Committee on the Prevention of Soot and Smoke". The conversion to heavy oil as an industrial fuel source led to a deterioration in the balance of trade. The worsening international balance of payments led government to reconsider its stance and contemplate a switch back to coal as a fuel source. This gave rise to civil action which sought for industrial circles to rectify air pollution. However, the government found that factories, which had invested heavily in order to make the conversion from coal to heavyoil, were not understanding of its policy. Petitions opposing the policy caused the government to withdraw its plans, instead implementing rulings which placed restrictions on the installation of heavyoil firing boilers. At the time, the conversion to heavyoil, which opposed the government's plans to save the coal industry, was thought also to be valuable to the creation of policy to counter air pollution and led to the Kawasaki Chamber of Commerce to form a committee in conjunction with labor unions, townships, women's clubs, and local assembly. However, this was actually a signal of a switch over from soot and smoke pollution to sulfur dioxide pollution.

(3) Establishment of Soot and Smoke Emission Regional Law

Full-scale surveys began to take place during the decade from 1945 to 1955. These surveys were performed by local governments which aimed to create legislation which would give them the authority to pass regulations on air pollution. As a result of this, it was found that the main cause of air pollution was fuel combustion performed at factories and enterprises. It proved that pollution was behind the internationally grim occurrence of damage, such as health disorders¹⁾. Furthermore, the national government, who had failed to address this issue itself, leaving the responsibility of creating industrial pollution measures up to local governments, became the focus of public inquisition. More opinions were voiced in favor of full participation by the government in the area of environmental pollution. In March 1954, the Ministry of Health and Welfare requested advice from the Japan Public Health Association in regards to permissible allowance of pollutants concentration in exhaust gas and atmosphere. In November of 1955, the association submitted a report to the minister stating that "the emission of black smoke from the source should not exceed 6 minutes every hour" etc.. In August 1955, an outline was created for drafting legislation in regard to the prevention of industrial pollution by Ministry of Health and Welfare. But, the Ministry of International Trade and Industry (MITI) criticized this proposal and in September of the same year

fabricated its own outline for legislation governing the prevention of pollution in line with the activation of an industry. The Ministry of Health and Welfare's proposal emphasized the preservation of the environment and took consideration of specified areas under the jurisdiction of the ministry itself and of that of the local government. In contrast to this, MITI's proposal aimed at a resolution to ensuing disputes and the development of industry but did not take into consideration any specified areas under its jurisdiction. The Ministry of Health and Welfare's proposal was heavily criticized by economic groups. It also faced opposition from the Ministry of Transport and MITI. So, the Ministry of Health and Welfare stopped legislation works. In 1959, MITI began legislation for air pollution control asserting that the legislation has to emphasize not only public health but also development of industry. And MITI started drafting legislation in cooperation with Ministry and Welfare. Modifications were made in combination with MITI and in March 1962, joint legislation was submitted to the 40th Diet.

In May 1962, Soot and Smoke Emission regulation Law was established⁴⁾. There was ample criticism of the unreliable government who was slow in dealing with the pollution problem due to long deliberations and also of MITI who attempted to conceal the legislative efforts of the Ministry of Health and Welfare. The government, which opted for regulations against soot and smoke as opposed to the creation of a law for the prevention of air pollution, was attacked for its shallow recognition of the issue. After emphasizing the necessity for regulations on toxic gases and automobile exhaust gas, attention was turned to the problem of why electrical and gas companies were exempt from these regulations. There was a request that authority be conferred to large metropolitan cities. There was also forceful dialogue on the need of governmental financial aid in an interpellation at the Diet⁵⁾. The House of Representatives ① requested that, when needed, in the future, the government should consider making the repayment period for funds, lent to small and medium sized firms to promote their growth, work more in favor of small businesses. Also the government should work to expand its provision of financing and other supplemental aid programs. All of this would be in order to promote the maintenance of such things as soot and smoke treatment facilities for factories and enterprises. ② stated that the government should heavily promote technical research and refer a resolution for the establishment of related measures, in order to deal with environmental pollution such as exhaust gas, noise pollution, vibrations, and offensive odors from cars in the future⁴⁾. In a summary of the law, there are stipulations for specifying regions by a ministerial ordinance where soot and smoke emissions are to be regulated and facilities subject to said laws. Furthermore, the Minister of Health and Welfare and the minister of International Trade and Industry can define the standards for regulations for each region. They can see that the law is enforced. The governor of the prefecture can establish a reporting system for new or refurbished facilities subject to the said laws as a concrete method for setting up regulations in order to control these set standards. He can also establish measures to deal with accidents or emergencies. Also defined in the law are provisions for out-of-court settlements where the governor acts as mediator in situations where a dispute over air pollution may arise. There are also provisions set for giving financial aid for necessary revisions or corrections to facilities which emit soot and smoke into the atmosphere⁴⁾⁵⁾. In particular, in Article 1 it states that, "By taking such measures as the appropriate treatment of soot and smoke being emitted due to business activities being performed at factories or enterprises, in addition to preventing danger caused by air pollution for the sake of the public's health, it is possible to plan for harmony between the preservation of our living environment and the development of industry..." Article 2 focuses on the following point, "Emission Standard is defined as the allowable limit of soot and smoke content contained in

the exhaust gas which is emitted in atmosphere from soot and smoke emitting facility.” Under this law, exemptions are made for electrical power plant and gas works. This brought about much debate on the issue. However, the most momentous fact regarding this law was the exceptionally tremendous speed at which it was passed, in regards to date of implementation, reporting system, method of measurement, emergency measures, and emissions standards. While this law contained many problems within it, it is deeply significant in the fact that it formed the fundamental framework for our today’s air pollution regulations. It made concrete the “new social order” which was necessary for the environmental pollution measures which were expressed by Naohiko Harada ⁶⁾ of University of Tokyo. Also it can be assumed that the formation of this law posed many difficulties for the Ministries of Health and Welfare and International Trade and Industry as it exceeded the concepts of traditional governmental legal theory. When considering the emission standards that were released on July 12, 1963 from a technical standpoint, in regards to soot and dust, it called for the use of high-performance dust collectors on such facilities as pulverized coal firing boilers, steel converters, open-hearth furnaces, coal-continuous burning limestone kiln, cement kiln, and electric furnace etc.. It also allowed for the use of heavy oil combustion for sulfur oxides (SO_x). For this reason, this law was effective in the prevention of soot and dust. However, in regards to SO_x the law was said to be full of loopholes ⁷⁾. When considering the fact that Japan imported crude produced in the Middle East in order to expand industry, it should have been noted that sulfur dioxide (SO₂) would become a critical problem in the plight of air pollution.

(4) Establishment of the Basic Law for Environmental Pollution Control and Air Pollution Control Law

Policies created for the sake of higher economic growth only helped to accelerate the air pollution problem. Japan encountered with the tragedy of watching air pollution spread, maligning an even wide span of the country. In 1967, the government established the Basic Law for Environmental Pollution Control which was a basic stance on environmental pollution. As it regulated environmental quality standards, it invited debate from all around. Furthermore, the government repealed soot and smoke emission regulating law in 1968. In its place, the Air Pollution Control Law enacted and automobile exhaust gas standards were implemented. Emission standard for amounts of sulfur oxides (K-value regulation), for regulating sulfur dioxide (SO₂) in atmosphere, was put into action. The increase of effective stack height was also put into effect ⁸⁾. Local governments made full use of administrative organizations dealing with environmental pollution. From around 1968, local governments established their institute of environmental research and study. Administrative organizations were set up but the key problem was technology for preventing pollution. Technologies used in dust collectors had developed to some extent. However, the necessary technology for the direct desulfurization of heavy oil was only put into operation as of October 1967, at Idemitsu Kosan Co. Ltd. ⁹⁾. Chiba oil refinery, Professors Keiichi Murakami and Shoichiro Hori from Tohoku University expounded on the idea of using a plentiful quantity of limestone which is an inherent resources for alkaline in solving the problem of sulfur dioxide (SO₂). They explained the superiority of the limestone gypsum method, which stabilizes sulfur as gypsum and began development of the method in 1955. The two professors succeeded in creating and putting into operation a pilot plant at the Tokyo Industrial Research Institute. After obtaining a patent (Japan Patent Office No. 2152091) ⁹⁾, based on this, in 1960, Mitsubishi Heavy Industries, Ltd. put into operation a 62,500 mn³/h prototype unit at NKK Corp.’s Koyasu factory ⁹⁾. However, the Ministry

of International Trade and Industry furthered development of a dry process to compete with the wet limestone gypsum flue gas desulfurization process.

The limestone gypsum method eventually did become the mainstream in flue gas desulfurization. There were doubts about the government's policy which persisted on the use of a dry method. The economy continued to expand its growth, while industrial development was pursued throughout the nation. The characteristic of this era, was the posing problem of air pollution. A typical example is that of Yokkaichi City. This case is hard to leave out when talking about the problem of air pollution which Japan faces, as it tells of a growing number of patients, gale pollution, regulation on total emissions, environmental pollution court cases, and compensation for damage to the health of citizens. Also the development of the industrial area around Negishi Bay gave birth to the "Yokohama type" agreement on environmental pollution control.

(5) Post War Air Pollution Research ¹⁾

In 1956, Sapporo began to focus on its air pollution problems which were being caused by coal heaters. Professor Abe of Hokkaido University was asked to survey the problem. The survey began in December 1955. Samplings of dust fall were taken at 6 locations using a funnel and container and measured. The sulfate ion (SO_4^{2-}) and chloride ion (Cl^-) in dust and soot have been analyzed.

In Tokyo, from November 1954, Isao Saito and his associates at the Tokyo Metropolitan Research Institute of Public Health used a wide mouthed bottle in order to measure the dust fall at 26 locations throughout Tokyo. This survey measured the amount of solids, ignition loss, ash content, radioactivity for soot fallout, atmospheric concentration of suspended particles, and carbon dioxide. A detailed analysis of the soot and dust was performed once every three month.

Kawasaki City also implemented a similar survey taking samples of dust fall at 16 places starting from June 1956. Yokohama began its survey from August 1956, taking samples at 15 locations.

In May 1957, Kanagawa Prefecture assembled a committee for the establishment of technological measures for dealing with the prevention of air pollution in the Keihin Industrial Area (headed by Professor Tetsuzo Kitagawa of Yokohama National University). The activities of the committee studied the measurement methods, dust fall, suspended dust and soot, changes in concentration of sulfur dioxide, regional dispersion, meteorological effects, health and hygiene, and techniques for prevention.

Osaka City Research Institute of Public Health, which has the longest history of measuring dust fall, has been continually conducting measurements since before the Second World War in the Osaka area. During the early stages of post-war Japan, air pollution research in Osaka City expanded, and from around 1955 measurements for the volume of dust fall, and concentration of sulfur dioxide and suspended dust and soot were started.

The commencement of research on air pollution in Kobe began at a relatively early stage. From 1958 to 1959, results were already obtained the area distribution of dust fall. The iron content within the dust fall was analyzed, measurements of sulfur dioxide concentration in atmosphere were carried out, and testing was done to determine health effects.

The Mayor of Ube consigned dust and soot survey work to Assistant Professor Yoshikatsu Nose of Yamaguchi Medical College. Measurements of dust fall began in October 1949. This research took into consideration the

consequences on human health. The survey was performed in conjunction with Yamaguchi University Professor Yukata Kamioka and done systematically, with proposals made suggesting the use of technological measures.

In Fukuoka prefecture, in post-war Japan, an air pollution survey party was established between the 5 cities of Kita Kyushu and from June 1959, a survey and research was begun.

Takeo Suzuki and his associates at the National Institute of Public Health created a prototype for the tape air sampler. From December 29, 1954, on the 7th floor of the institute, they began continuous measurement of the concentration of suspended dust and soot in the atmosphere. Likewise, the Japan Society for Occupational Health (current name) made a meteorological study by taking measurements of the sulfur dioxide concentration in the atmosphere at seven locations within the vicinity of Tokyo from January 18-24, 1955. Kiyoshi Kawamura of the Meteorological Research Institute took measurements of the ozone (O₃) concentration in the atmosphere in Tokyo from October to November 1950. This research was taken over by Yasuo Miyake and his associates from the same institute, and data obtained from the period of January 1951 to September 1952 was reported on. Furthermore, Miyake and his associates took measurements of the ozone levels (O₃), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂) concentration in atmosphere from December 1957 to March 1959.

Research for the improvement of fuel combustion was encouraged for the aim of creating more efficient uses of fuel and preventing air pollution. Heat management inspections were implemented at specified heat management factories. In addition research was promoted in the fields of flue gas desulfurization technologies and dust collector.

Air pollution gradually became the focus of researchers. Eight of Japan's representative air pollution researchers invited people to become founders for a new organization. About 80 people gave their approval to the project and on December 19, 1959, the Japan Society of Air Pollution (currently the Japan Society for Atmospheric Environment) was established at the National Institute of Public Health.

2.2.3 Air Pollution, the Third Stage

(1) An Outbreak of an Environmental Crisis

In 1970, the media began to heavily attack the delay in improvement of environmental pollution. On May 21, 1970, a high concentration of lead was found in the blood of those who took a public health examination held near an intersection in Ushigome, Yanagi-cho, Tokyo. This was used as an opportunity to take measures to reduce the amount of lead additive found in gasoline. Also, the occurrence of health injuries due to photochemical smog became more prevalent. This led to the recognition that this was an important topic which needed to be resolved and measures targeting regulation of nitrogen oxides (NO_x) and hydrocarbons became the issues at hand. However, the only improvements seen were to the fallout of soot and dust and carbon monoxide (CO). There was not even the slightest sign of a decline in the sulfur dioxide (SO₂) concentration in the atmosphere. Emergency measures to curb the sulfur dioxide levels in various areas were done recurrently. There were some areas where high levels of sulfur dioxide concentration, 0.7 ppm per hour, were found in the atmosphere. Focus was placed on automobile exhaust gas, and it became a critical issue how to deal with this new problem. It was unsure as to how to deal with this new problem. Pressure from the mass media and the nation's citizens grew stronger, placing the country in a true environmental crisis.

(2) Establishing the Diet's "Pollution Session" -Dealing with the Environmental Crisis ⁽¹⁰⁾⁽¹¹⁾

In May 1970, the House of councilors special committee on environmental pollution decided, the "issue of environmental pollution". The proposal called for the national government to "consider the items set forth and plan for the further promotion of environmental pollution measures". The items set forth and emphasized in the proposal were as follows: (1) along with the strengthened administration of the conference on Environmental Pollution Control for the sake of the comprehensive and cooperative promotion of environmental pollution measures, to ensure, without any regret, such matters as the use of functions which would allow for the comprehensive or general adjustment or correction of related matters, and (2) to devise further budgetary, financial, and tax measures, plus other necessary measures for the planning of the Improvement of the maintenance of facilities used in the prevention of environmental pollution. In July of the same year, there was strengthened centralization of the information system for environmental pollution. With the prime minister acting as chief, the headquarters on environmental pollution control was established on July 31, 1970 to provide a comprehensive means for creating and dealing with environmental pollution measures. Following this, a similar groundwork was done on the prefectural level, with prefecture governors heading their own regional headquarters for environmental pollution control. The administration's recognition of the pollution problem spread nationwide. At this point, governmental departments began to endorse such things as, promoting the establishment of environment quality standards, approval of plans for preventing environment pollution, partial revision of Basic Law for Environmental Pollution Control, Air Pollution Control Law, Road Traffic Law, and the Law for the Prevention of Pollution of the Sea by Oil, clarification of responsibilities of the enterprises, reform of laws related to water quality regulation, and the establishment of pollution offense law. It recognized the fact that it was not carrying a problem which would be easily dealt with. On November 25, 1970, the 64th Diet (Pollution Session) was held. Prior to holding of this session, on September 21, 1970, then Prime Minister Eisaku Sato spoke at a public hearing related to the national government, expressing the ideology of "there is no growth without well-being". This remark, along with the Prime Minister Sato's opening remark of his general policy speech at the Diet "...This Diet session, I have submitted a proposal for the revision of the Basic Law for Environmental Pollution Control, from the standpoint of putting the lives of our citizens first...", was very impressive. The 14 proposed laws that were submitted in the draft of the environmental pollution control law that was introduced to the Diet was passed with only a single segment having been revised. The 14 laws included are as follows: legislative bill to revise a portion of the Public Nuisance Counter measures Basic Law, legislative bill to revise a segment of the Road Traffic Law, legislative bill for partial revision of the Noise Control Law, legislative bill for Waste Disposal Law, legislative bill for revision to part of the Sewage Water Law, legislative bill regarding the Law Concerning Entrepreneur's Bearing of the Cost of the Public Pollution Control Works, legislative bill for the Law relating to the Prevention of Marine Pollution and Maritime Disaster, legislative bill relating to penalization for environmental pollution crimes which inflict on the health of individuals, legislative bill revising a portion of the Agricultural Chemicals Regulation Law, legislative bill regarding such matters as the prevention of pollution to soil used for agricultural purposes, legislative bill for Water Pollution Control Law, legislative bill for reform of a segment of the Air Pollution Control Law, legislative bill to revise a section of the Natural Parks Law, and lastly, a legislative bill to revise part of the Poisonous and Deleterious

Substances Control Law. A partial revision to the Air Pollution Control Law led to the removal of the article on reconciliation from the original draft. The idea of "preventive medicine" in areas not inflicted with eminent levels of air pollution led to the abolishment of regulations which designated certain areas due to their heavy pollution levels. Also, hazardous materials and specified toxic substances were added to the list of dust and soot controlled subjects. Other matter such as nitrogen oxides, cadmium, and lead were made controlled subjects. Furthermore, regulations and measures were devised for the dust made during mechanical crushing and transportation. Controls placed on automobile exhaust were widened, and regulations on hydrocarbons and nitrogen oxides were instituted. The emission standards for the dust and soot were strengthened. Stricter prefectural standard for hydrogen fluoride and chloride emission were implemented. Reduction of fuel sulfur due to fuel regulations placed on such things as building heaters in densely populated areas of a city. Regulations were also adopted which helped in strengthening emergency measures. Reforms were made to laws which had allowed for exemptions to electric thermal plants and gas works. Prefectural governors, in fact, became able to control air pollution measures such as those for thermal power plants etc.. This revision provided for the promotion of the enactment of laws for avoiding environmental crises. However, there existed many technical problems. In particular, regarding photochemical smog, there were many issues at hand such as phenomenon analysis, and prevention of the emission of nitrogen oxides and hydrocarbons.

(3) Establishment of the Environment Agency ¹⁰⁾

In July of 1971, the Environment Agency was established as a way for the government to centralize its administrative planning of environmental pollution issues. The framework and significance of this was stated in a report on legislative bills relating to environmental pollution, such as the draft for revisions to the Basic Law for Environmental Pollution Control, submitted on November 19, 1970, by the Central Council for Environmental Pollution Control. It stated that "In order to deal with the wide and diversified range of environmental pollution issues, and from a standpoint based on the future further development of economic and social conditions, while planning a mutually harmonious affiliation, it is believed that not only is the maintenance of various institutions necessary, but a broad scope of promotion of all measures is also needed. Therefore, along with the execution of research into the problem of centralizing several administrative organizations, we look to the government to further establish and promote comprehensive policies". And as if referring to this opinion, the Headquarter for Environmental Pollution Control, which had succeeded in building a basic framework for environmental pollution control, held an extraordinary organization in which it recognized the need to centralize the regulatory functions, which were dispersed among several ministries, into one permanent institution, in order to strengthen its control over environmental pollution ¹⁰⁾.

(4) Environment Agency and Air Conservation Measures

The establishment and the revision of environmental quality standards, introduction of regulation of total emission for sulfur oxides and nitrogen oxides, will and hesitation on hydrocarbons emission regulation, auto exhaust gas emissions regulations, promotion of improvements to fuel, good relationships with local governments, and promotion of research for the air pollution have been noticed as activities of Environment Agency. This process

led to issues which were filled with dilemmas such as adjustment and discord with other ministries, dealing with the system for Pollution-related Health Damage Compensation and civil action, debate with industrial circles related to regulations and adaptations with the local governments who were at the brunt of civil disputes.

Following the establishment of the Air Quality Bureau, with the assistance of local governments, a system was established to measure total air pollution emissions nationwide. Also, in regard to offensive odors, standards were set and with the aid of the National Institute for Environmental Study, research was performed on the structure of the creation of oxidants. Responsibility for a survey investigating the effects of complex air pollution on the health of human beings done by the Ministry of Health and Welfare and the national air monitoring network were taken over by the agency. Local governments were notified of emergency measures and a system to provide aid for setting up facilities was put into operation. The agency supervised the creation of a regulations manual on total emissions, a manual on air pollution continuous monitoring system, and guidelines governing the methods of measurement for air pollutants. It surveyed technology for controlling air pollution and established air quality standards. Several times, focus was placed on stationary emission sources in order to strengthen both the standards regulating the emissions of nitrogen oxides and automobile exhaust gas emissions regulations. Decisions on plans for preventing environmental pollution control, Environmental Pollution Control Service Corporation, and the Pollution-related Health Damage Compensation system all became important issues in the fight to preserve air quality. Environmental impact assessment and pollution-related damage compensation prevention system were also impressive. In order to deal with the energy crisis which began in 1978, a conversion from liquid fuel to solid fuel was promoted. Focus was placed on only those items which threatened to reverse the trend of accomplishing the preservation of air quality. The Environment Agency played a significant role in avoiding an environmental crisis. During this time, such matters as the future establishment of the Environment Basic Law, global environmental issues, and contributions to the international environment helped to gain further recognition of the agency's necessity.

(5) Local Government Response to Environmental Crisis

Prefectures, ordinance-designated cities set up their own administrative organizations. The area monitoring for air pollution and the number of controlled substances targeted for measuring were increased. Plans were made for the strengthening of the functions performed by environmental pollution study and research institutions. With this, the local environmental administrations were completed. The government, who sought for caution in regards to strict standard for sulfur oxides, was ignored. There were those local governments who enforced total emission regulations through ordinances and legal outlines. This trend was also illustrated in the regulations of the total emissions of nitrogen oxides. Regulations of total emissions for sulfur oxides as defined under the Air Pollution Control Law were implemented throughout various regions. Regulations stipulated under the same law for controlling total nitrogen oxide emissions were implemented in Tokyo metropolitan, Kanagawa, and Osaka prefecture. In 1971, in the Kanto region, complaints arose concerning eye and skin irritation due to rain. This raised to the problem of polluted rainwater. Research on acid rain was performed mainly by local government level. Local governments settled on local environmental measurement plan and made efforts to promote environmental monitoring system and to enlarge environmental research organizations. The local governments fulfilled their role

as the source for knowledge on local environmental technology. Its contribution to the elusion of an environmental crisis was remarkable.

(6) Response by the Ministry of International Trade and Industry and Industrial Circles

Focus was turned to the training of engineers and development of pollution control facilities by the Ministry of International Trade and Industry (MITI) and Industrial circles and the system for pollution control managers. There is need to make special note of the completion of the dust collection technology for converter in steel mills and thermal electric plants. Desulfurization plants for free gas became popular. Currently there are some 2,000 units in operation around Japan. Japan, along with the US and Germany are one of the world's leading nations which possess Desulfurization plants for free gas. Furthermore the adaptation of desulfurized heavy oil and the conversion to natural gas for fuel, contributed to the dramatic decrease in sulfur dioxide concentrations in atmosphere. After the energy crisis of 1978, energy saving techniques spread and enabled for the planning of streamlined fuel combustion. Industrial circles, in order to deal with the impending regulations on nitrogen oxide emissions, established low NOx combustion and exhaust denitration technologies. Also there were a spread in the use of hydrocarbon recovery technology.

Promotional measures by the car industry in order to deal with auto emissions regulations covering such as problems as waste incinerators and facilities which emitted foul odors, were given positive evaluations. However, large-scale land development and air pollution such as the Negishi Bay development and agreement on environmental pollution control, Project of Oogi-sima, Keiyo industrial area and air quality preservation, and Yokkaichi and the ensuing court litigation, are still unforgettable.

(7) Furthering Research on Air Pollution

Monitoring techniques and research institutions on the occurrence of air pollution were advanced and research was also performed on the long transport of air pollutants. There was more activity in diverse research and technology which enabled the prediction of air pollution was developed. These factors contributed to regulation of total emission of sulfur oxides and nitrogen oxides and helped to establish the environmental assessment system. Research into stench and foul odors was also promoted. Also, the development of technology in the area of preventing air pollution was exceptional. Local institutes researching environmental pollution, the National Institute for Environmental Study, National Institute for Resource and Environment, and the Training Institute for Environmental Pollution Control functioned, helping to establish a research system. The environmental research institutes furnish grants to such nations as Thailand, China, Indonesia, and Chile.

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