Topic 5. Modern Trend of Waste Management

Contents

1 Main Issues of Waste Management in Japan

Japan has been tackling waste management issues for a long time, with the principle aim of improving the sanitary living environment of the country's residents. During this process, various challenges were confronted and efforts have been exerted to overcome them, such as pollution problems.

These waste management challenges have become more pronounced with the high economic growth the country has experienced and include; illegal dumping; hazardous wastes such as mercury and PCBs which are contained in various products, and asbestos which has been widely used as a convenient construction material; dioxins which are generated from incineration facilities that play an important role in prolonging the lifespans of landfill sites and improving sanitary conditions; and disaster waste generated in large quantities when earthquakes or floods occur. Efforts are continuously being made to improve waste management systems by changing conventional insights.

It may be very useful for government officials and managers engaged in waste management in developing countries to learn about the continuous efforts of Japan in this sector in order to find ways to solve issues that they are currently facing or to prevent or control issues that may occur in the future.

Topic 5 will provide information about specific waste management issues that Japan is continuously working on and countermeasures that have been adopted to address them.

At the same time, this topic will introduce global trends and the efforts of Japan to deal with the global issue of marine plastic wastes which needs to be urgently addressed.

2 Illegal Dumping

In the management of waste, illegal dumping is a critical issue that that is of concern to many countries around the world including developing countries. This section will introduce the necessary countermeasures together with the challenges of implementing them, by reviewing past cases of large-scale illegal dumping in Japan and the current status of illegal dumping countermeasures.

2.1 Cases in the Past

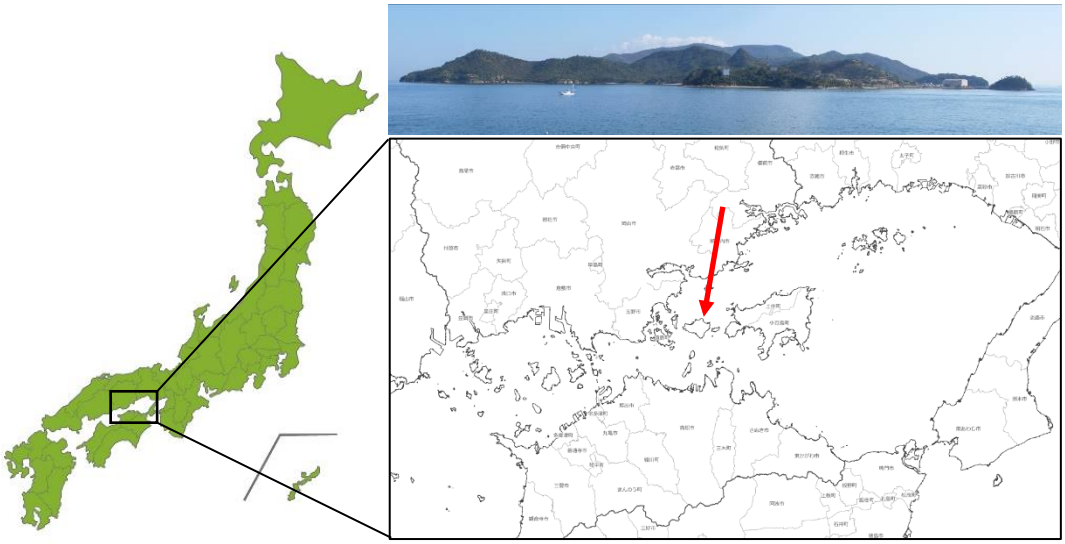
In managing waste, illegal dumping is strictly forbidden in Japan and the law prescribes penalties will be described in this section. However, in the process of industrial development, illegal dumping occurs repeatedly, and it is extremely difficult to discover and control it in a timely manner. The specific conditions of two cases of large-scale illegal waste dumping that occurred in Japan in the past are introduced hereafter, together with the challenges encountered, activities implemented, and other related information.

(1) Illegal Industrial Waste Dumping Case in Teshima, Kagawa Prefecture

The illegal dumping of industrial waste in Teshima, Kagawa Prefecture in the 1990s is one of the largest cases of illegal dumping that occurred in Japan.

Triggered by this case, responses to illegal dumping in Japan became stricter and government officials and citizens have since been cooperating to establish a system to prevent illegal dumping.

The Seto Inland Sea is one of the most representative closed water bodies in the world and is located in the southwestern part of Japan, surrounded by western Honshu, Shikoku, and Kyushu. Teshima island of Kagawa Prefecture is located in the northeastern part of the Seto Inland Sea and was once an island blessed with rich nature. The current population (as of 2021) is about 780 and depopulation is continuing. Teshima is mainly dependent on primary industries such as agriculture, forestry and fisheries, and is located somewhat away from the centers of secondary and tertiary industries.



Source: GSI "Geographical Survey Institute Map," https://maps.gsi.go.jp (accessed January 20, 2022) (lower right of map)
Yachiyo Engineering Co., Ltd.（upper right of Photo）

Figure 5-1 Location of Teshima

Table 5-1 describes the background of illegal industrial waste dumping case in Teshima.

Table 5-1 Background of Illegal Industrial Waste Dumping Case in Teshima

Year	Kagawa Prefecture (Municipality)	Residents	Business Operator
1965			Began mass excavation of sand at Mizugaura, located in the northern part of Teshima.
1975		Campaign against the construction of a landfill for hazardous industrial waste.	Applied to the prefecture for a permit to engage in industrial waste treatment business handling hazardous industrial wastes, etc.
1977	The prefecture expressed its policy to permit the project implementation with conditions on the type and amount of industrial waste.	Filed a lawsuit demanding an injunction against the construction of the landfill.	Applied for a permit with a revised business description: "Vermicular (worm) farming using wood waste, food sludge, and other industrial wastes."
1978	The prefecture permitted the industrial waste treatment business.		
1978 ～ 1989	During this period, the prefecture conducted on-site inspections, but failed to certify the waste types and failed to issue cautions and warnings to the business operator.	Residents began suffering from asthma and other health problems as a result of open burning of waste.	The business operator continued to bring in large quantities of shredder dust and industrial waste for burning in the field and other activities.
1990	After the police exposed the wrongdoing of the business operator, the prefecture conducted a fact-finding investigation and revoked the business license.		The business was exposed by the Hyogo Prefectural Police and effectively discontinued.

Year	Kagawa Prefecture (Municipality)	Residents	Business Operator
1993	The prefecture ordered the business operator to take measures to prevent environmental pollution based on the results of on-site inspections that had been conducted since 1992.	Based on the *Act on the Settlement of Environmental Pollution Disputes,* an application for arbitration was filed by 438 Teshima residents against the prefecture, business operator, and industrial waste generators.	Did not carry out the action order.
1994	The prefecture charged the business operator with violating the order. At the 4th meeting of the arbitration committee, a plan was presented to consider the removal of waste and other materials and the cost of environmental preservation.		
1995			Received a summary order from the court to pay a fine of JPY 500,000.
1996		Residents applied to the government for pollution arbitration.	
1997	The prefecture considered environmental preservation measures without making any changes to the current status of the waste at the disposal site, but based on the request of the arbitration committee and financial support from the government, the prefecture decided to base the decision on intermediate treatment such as melting, and an interim agreement was concluded with the residents.		
1999	The prefecture received the final report of the technical study committee established in response to the interim agreement, and the method of intermediate treatment was established. The prefecture proposed that the waste be treated on Naoshima Island.		
2000	The mayor of Naoshima Town expressed his acceptance, and the arbitration was concluded.		

From around 1965, a business operator who owned the land started to collect a large amount of earth and sand at Mizugaura, located in the northern part of Teshima, and in 1975 construction of an industrial hazardous waste disposal facility was planned on the site, however the residents organized a large opposition movement and the project came to a standstill.

The business operator applied for a business license stating they would “cultivate earthworms utilizing industrial waste of wood chips, food waste, etc.” and Kagawa Prefecture approved the business license in 1978.

However, the operator soon started to illegally dump industrial wastes not covered in the license in the site, such as waste oil, paper mill sludge, shredder dust, and ragger ropes and burn them in the open area. Due to this illegal disposal of industrial waste, local residents started to suffer from health hazards such as asthma. However, the Kagawa Prefecture government did not monitor the situation adequately and virtually left it unattended, resulting in increased environmental pollution and health hazards.

The Hyogo Prefectural Police cracked down on the company on suspicion of “illegal dumping of industrial waste under the false pretense of cultivating earthworms” in November 1990.

From November 1993, when the residents of the island filed for pollution arbitration, discussions were continuously held between Kagawa Prefecture and the residents under the mediation of the arbitration committee. Starting with a 150-day protest in front of the Kagawa Prefectural Government Office, the residents organized “grassroots activities” such as a protest caravan to Ginza, an upscale shopping area in Tokyo, round-table talks at 100 locations in Kagawa Prefecture seeking understanding and support, and others.

In July 1997, an interim agreement was reached between Kagawa Prefecture and the residents. After that, the Kagawa Prefectural Teshima Waste Treatment Technology Review Committee, which was established based on this agreement, discussed suitable technical methods for treating the waste in Teshima that was mixed with harmful substances, without incurring technical or environmental/safety problems.

Source: GSI "Geographical Survey Institute Map" https://maps.gsi.go.jp (accessed January 20, 2022)

Figure 5-2 Location of Illegal Dumping Site

During the detailed discussion for constructing the treatment facility, various challenges, such as necessary site for locating the facility, securing operational resources of electricity/water/fuel, residences for laborers, and carry-in routes were identified and a decision was reached to negotiate with neighboring NaoshimaTown located west of Teshima in order to address those challenges. In the interim agreement reached in 1997, the possibility of taking environmental preservation measures at the disposal site without changing the current situation of the waste was considered, but it was finally decided to adopt melting and other intermediate treatment methods as the basic approach in order to preserve the environment around the disposal site and resolve the problem as soon as possible. Naoshima Town put forward four conditions during the negotiations; (1) The intermediate treatment facility should not be a source of secondary pollution, (2) The facility should contribute to revitalization of Naoshima Town, (3) Measures should be taken to prevent harmful rumors and the like, and (4) Agreement of the townspeople of Naoshima Town should be secured. Furthermore, the local fishery cooperative expressed concerns about safety of ships navigation and the tarnishing of the brand of local fishery products due to harmful rumors and called for suitable responses to those concerns.

In response to those conditions, Kagawa Prefecture proceeded with detailed studies and proposed the construction of an intermediate treatment facility on the premises of a private company in Naoshima Town. The related people jointly and sincerely worked together to provide detailed explanations to local residents to obtain their understanding for the intermediate treatment facility construction and operation. As a result of these successful efforts, in March 2000 Naoshima Town accepted the proposal. Furthermore, in May of the same year the final terms of arbitration were

presented by the arbitration committee. Kagawa Prefecture confirmed that the terms met the conditions for providing the required waste treatment and management and made a comprehensive decision to accept the arbitration.

Based on this agreement, the work to restore the site to its original state started in 2000 with public funding and removal and treatment of the industrial waste was completed in July 2019. The total amount of waste treated was reportedly over 900,000 tons. Furthermore, regarding groundwater, the expert meeting held in July 2019 confirmed that the effluent standards were achieved in the entire landfill site.

Photo 5-1 Polluted Situation in Teshima

Photo 5-2 Campaign by the Residents

Source: Material for Teshima Residents' Council of Countermeasure for Waste Treatment (Photo 5-1 taken in 1990, Photo 5-2 taken in 1996)

While implementing the project of restoring the site to its original state (the restoration project), Kagawa Prefecture made ensuring safety and environmental conservation their top priorities in order to prevent harmful rumors and made efforts to gain the trust of the local fishery cooperative in Naoshima Town by holding periodical meetings. Furthermore, a fund was established to support any measures that may become necessary to deal with harmful rumors that would affect the livelihoods of fishermen and others, but the fund was not utilized because, fortunately there were no harmful rumors. In total the more than JPY 80 billion spent for the restoration project, was basically paid by Kagawa Prefecture under the financial support of the Ministry of the Environment. To prevent a recurrence of similar cases, Kagawa Prefecture established “the Kagawa Prefecture industrial waste illegal treatment prevention liaison council” composed of the prefecture, prefectural police, central government, municipalities, and others intending to strengthen the surveillance system for illegal dumping and others and has been conducting scheduled air surveillance activities, and information exchange between the relevant people. The prefecture has also engaged security companies to conduct patrols at night and during holidays, set up a “waste emergency call” system utilizing telephone message recorders and facsimile, and established an Environmental Management Office in the public health and welfare offices of four areas in Kagawa Prefecture to conduct on-site inspection for approved companies, respond to reports, and take other measures. Concerning surveillance of illegal dumping,

the prefecture has also called for cooperation from private organizations for the purpose of early detection of illegal dumping. Specifically, in 2004, an agreement with Shikoku Electric Power Co., Inc. to provide information on illegal dumping was concluded and similar agreements with four new private organizations were concluded in 2017. The commercial vehicles used for private organizations (about 5,400 vehicles in total) are affixed with the "Monitoring Illegal Dumping" stickers created by the prefecture and meetings with persons in charge of private organizations are held regularly to exchange information and encourage the provision of information on illegal dumping.

Through this case, Kagawa Prefecture learned the following lessons:

- The prefecture should take a firm stand on compliance with laws and regulations.
- The prefecture should prepare the necessary response emphasizing what is actually being done and not taking notices from the central government and others superficially.
- The prefecture should take a thorough hands-on approach.
- The prefecture should respond as an organization.
- The prefecture should work on prevention before occurrence, early detection, and early response to illegal dumping.
- The prefecture should promote the reduction of waste and increased recycling.

In order to put these lessons into practice, Kagawa Prefecture is ensuring that the prefectural personnel have sufficient knowledge and understanding of the Teshima case through opportunities of personnel training.

At the national level, taking the occurrence of this incident as an opportunity, the central government worked to strengthen both the legal system to control illegal dumping and partnership with persons concerned, as outlined in the countermeasures described in section 2.2.

Photo 5-3 General View of Teshima (November 2021)

Photo 5-4 Bird's Eye View of the Illegal Dumping Site (November 2021)

Photo 5-5 Illegal Dumping Site (November 2021)

Photo 5-6 Illegal Dumping Site (November 2021)

Source: Yachiyo Engineering Co., Ltd.

(2) Illegal Industrial Waste Dumping Case at the Border Between Aomori Prefecture and Iwate Prefecture

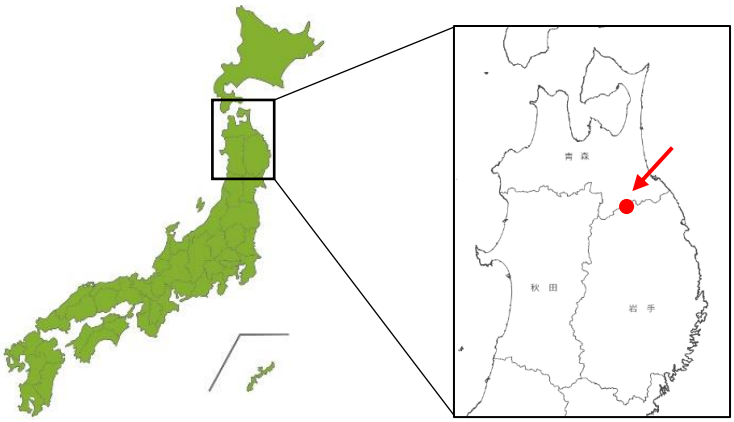
This case occurred at the border between Aomori Prefecture and Iwate Prefecture in the 1990s, during the same period as the illegal industrial waste dumping case in Teshima, Kagawa Prefecture. The illegal dumping site straddled the two prefectures, and both prefectures cooperated in conducting a joint investigation by their respective prefectural police departments. This is a case where two prefectures worked together in investigating the problem and cooperated in taking measures to resolve the issue.

In developing countries, there is the possibility similar situations may occur where illegal dumping sites is located between two or more administrative regions or authorities, and this case study may serve as a good reference. The history of this case provides important insights into how related officials and parties in two prefectural governments successfully collaborated to smoothly investigate and take necessary actions to remedy the situation.

In 1995, as the amount of waste continued to increase in Japan, there was an urgent need to develop countermeasures to mitigate against environmental problems such as dioxins, and at the time it was difficult to construct new treatment facilities. Under these circumstances, a large amount of 790,000 m^3 of incinerated ash, sludge, waste oil, and other industrial waste was dumped illegally by multiple private companies on a vast 27-hectare land straddling Takko Town, Aomori Prefecture, and Ninohe City, Iwate Prefecture, in the Tohoku region. Most of the dumped industrial waste was transported from the capital area.

The case came to light when Ninohe Public Health Center conducted on-site inspection and collection of reports based on information provided by the Iwate prefecture's Agricultural Policy Planning Department. Illegal waste dumping was suspected and the results of investigation and surveillance activities conducted over a period of time were reported to the Iwate Prefectural Police. After that, based on information provided by residents and former employees, the Iwate and Aomori

Prefectural Police departments set up a joint investigation headquarters and conducted a compulsory investigation on suspicion of violating the *Waste Management Act*, which revealed the details of the illegal dumping and led to the arrest of the suspects involved in May 2000. The two private companies responsible for the illegal dumping were fined JPY 30 million in total with prison sentences and the companies closed. Since 2000, the two prefectures have successively issued orders to the polluters responsible for the illegal dumping to remove the waste. However, from 2002 the two prefectures decided to jointly conduct the waste removal by proxy since the polluters were not expected to take any major action in this regard. Furthermore, since 2001, the two prefectures conducted an investigation of the actual state of pollution, a monitoring survey for the surrounding environment, a soil investigation, as well as other surveys. In 2002, a joint study committee meeting was held by both prefectures with the attendance of others, where the policy to restore the site to its original state (site restoration) was discussed.



Source: GSI "Geographical Survey Institute Map" https://maps.gsi.go.jp (accessed January 20, 2022)

Figure 5-3 Location

In 2003, the "Council for Promotion of Measures for Prefecture Border Dumping Site Restoration to Original State" was established, which included representatives from the two prefectures, as well as academic experts and residents. The Council held repeated discussions and determined that the highest priority of the site restoration policy was the prevention of adverse environmental impacts on the Mabechi-gawa river system and the removal of all the waste and polluted soil.

In 2004, with the approval of the Minister of the Environment the council drew up the restoration site project execution plan, and the actual removal works commenced from December 2004.

Along with the removal work, the necessary measures for reutilizing the site after restoration were considered. The Council drew up the "Environmental regeneration plan for the illegal dumping site at the border between Aomori Prefecture and Iwate Prefecture" in 2010. The environmental regeneration plan aimed to pass on to the next generations the restored site as a valuable asset that had been realized through the restoration project, as well as the experiences gained from the project, and to convey a

strong message that such an illegal dump site should never be allowed to happen again. The restored site was planned to host nature regeneration projects such as trees planting and facilities where environmental education would be conducted for local residents.

In Aomori Prefecture, waste and polluted soil were all removed on December 19, 2013. It was decided that the polluted groundwater that would remain at the site after completion of the waste removal would be actively pumped and treated and that the site restoration project would be completed by 2022.

Photo 5-7 Overview of Illegal Dumping (2000)

Photo 5-8 Situation of Illegal Dumping (2012)

Source: Labor Union of Iwate Prefecture Website "Representative Report's Current situation of illegal dumping of industrial waste on the border between Iwate and Aomori prefectures" https://www.pref.aomori.lg.jp/soshiki/kankyo/hozen/archive-syashinkan.html (accessed December 13, 2021)

2.2 Current Status of Measures

In Japan, various measures have been taken against illegal dumping, such as enactment of necessary laws, strengthening cooperation between the central government and municipalities, strengthening the surveillance system, improving the reporting system, and others and, as a result, the number of newly detected illegal dumping sites has greatly decreased compared with the respective numbers during the peak period of the late 1990s.

(1) Organization

In order to prevent illegal dumping, the Ministry of the Environment is actively engaged in strengthening surveillance activities in cooperation with prefectures and providing them with advice through dispatching specialists familiar with relevant laws, regulations, and others. The close cooperation between the Ministry of the Environment and the prefectures has made it possible to both prevent the emergence of large-scale illegal dumping sites through early detection and prevent their expansion through early response. In addition, the Ministry of the Environment has established a financial support system to cover the costs of measures taken by prefectures and municipalities to facilitate the conservation of the living environment caused by illegal dumping.

(2) Legal System

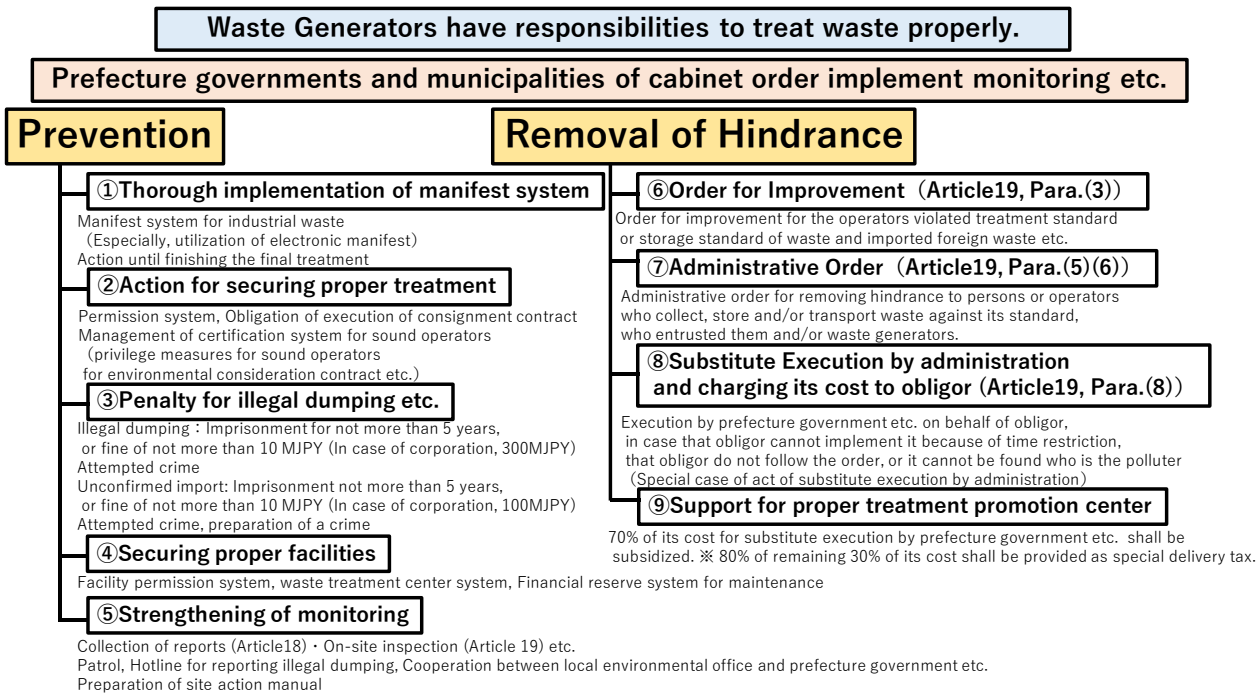
Revisions to the Waste Management Act were enacted in 1997 and 2000 to address the large-scale illegal dumping activities that grew in the 1990s, and introduce stronger measures to prohibit the inappropriate disposal of waste.

The details of the revisions to the act are discussed in this section in order to understand the legal system necessary to prevent illegal dumping.

The 1997 and 2000 revisions to the *Waste Management Act* have strengthened measures against improper disposal of industrial waste, while ensuring that waste generators are responsible for the proper disposal of their waste.

Specifically, it includes strengthening of the manifest system, strengthening of remedial action orders (expansion of eligible persons), strengthening of requirements for permission to establish waste management companies and facilities, strengthening of disqualification requirements, imposition of heavier penalties, and the establishment of a fund, in addition to others.

The system diagram of measures against illegal dumping cases in Japan is shown in Figure 5-4.



Source: Ministry of the Environment "Study Group Document on Prevention of Disasters Caused by Embankments (Response to Illegal Dumping Cases under the Waste Management and Public Cleansing Law)" (2021)

Figure 5-4 System Diagram against Illegal Dumping

When the *Waste Management Act* was enacted, the penalty for improper disposal (illegal dumping) was a fine of up to JPY 50,000. The penalties for illegal dumping have been strengthened as various cases of illegal dumping were discovered. Currently, the maximum term of imprisonment is five years, the maximum fine is JPY 10 million, both imprisonment and a fine may be imposed, and a fine of up to JPY 300 million may be imposed on a corporation if the violation is committed in the course of the corporation's business. In addition, the amendment to the law in 2003 made attempted illegal dumping also punishable (attempted illegal dumping), and the amendment to the law in 2004 made the collection or transport of waste for the purpose of illegal dumping also punishable (crime of preparing to commit an offense).

Table 5-2 shows the changes in penalties for illegal dumping.

Table 5-2 Changes in Penalties for Illegal Dumping

Penalties (Illegal Dumping) Revised Year	Penalties
1970 (*Waste Management Act* enacted)	A fine not exceeding JPY 50,000
1976	Up to 6 months imprisonment or a fine of up to JPY 300,000
1991	Up to 6 months imprisonment or a fine of up to JPY 500,000
1997	Up to 3 years imprisonment or a fine of up to JPY 10 million (JPY 100 million for corporations)
2000	Up to 5 years imprisonment or a fine of up to JPY 10 million (JPY 100 million for corporations)
2003	Attempted illegal dumping
2004	Penalties enhanced. Deliberate crime (imprisonment for not more than 3 years or a fine of not more than JPY 3 million) established.
2010	Tougher penalties. Maximum corporate fine increased to JPY 300 million.

Source: Japan Environmental Sanitation Center “Waste Technical Manager Training Course Textbook” (2019)

(3) Activities by the Central Government, Municipalities and Residents

At the national level, an annual survey of the status of inappropriate disposal cases of industrial waste is conducted and the results are published. Inter-municipal cooperation in waste management is expanding. Continuous monitoring and inter-municipal cooperation are essential for preventing illegal dumping.

In addition to the efforts described in “(1) Organization”, the Ministry of the Environment, with the cooperation of prefectures and municipalities annually investigates and publishes the status of newly detected illegal dumping sites nationwide, the number of illegal dumping cases as of the end of the fiscal year, and other related data with the aim of using this information as basic materials for policy formulation related to measures against illegal dumping of industrial waste.

Inter-municipal cooperation is also spreading as a countermeasure against illegal dumping of

industrial waste. For example, in November 2000, at the call of the Tokyo Metropolitan Government, the "Wide Area Liaison Council for the Prevention of Improper Disposal of Industrial Waste" (commonly referred to as "Industrial Waste Scrum 21") was established. After that, 16 local governments joined, and now the council consists of 37 local governments in 12 prefectures (including Tokyo Metropolis) and 25 cities (ordinance-designated cities and core cities).

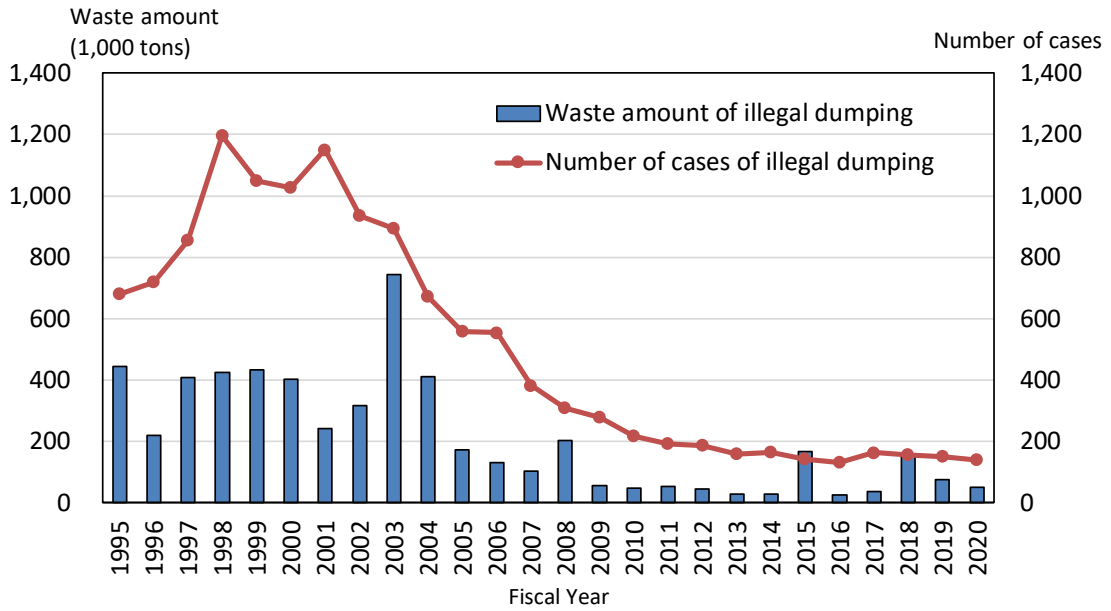
In addition, several local governments have established their own unique measures. Aomori Prefecture has setup a "Construction material waste reception completion report system", Chiba Prefecture has setup a "night-time ban on carrying waste into and out of its disposal sites" and defined "clarification of the obligations of land owners, etc. related to illegal dumping", and Niigata Prefecture has a "Monitoring by unmanned aerial vehicles (UAVs)", Fukuoka Prefecture has "visualization of monitoring (mapping system)", and Fukuoka City has "reward system for reporting illegal dumping".

Residents are required to be aware that "illegal dumping is unacceptable" and to have sufficient concern to report any illegal dumping they may encounter to the police and local governments.

2.3 Challenges and Considerations for Taking Measures

Concerning illegal dumping, it is important to foster the social recognition that "illegal dumping is a crime" and continue to communicate related information to the public and businesses.

Figure 5-5 shows that the number of cases of illegal dumping of waste, especially industrial waste, is decreasing every year since 1998 when it reached its peak. Japan aims to eradicate illegal dumping by properly and continuously employing various measures, as described above against illegal dumping.



Source: Ministry of the Environment "Survey results of illegal dumping, etc. (FY2020)" (2022)

Figure 5-5 Transition of Number and Amount of Newly Discovered Cases of Illegal dumping

In situations where the responsible party for illegal disposal, the polluter is not in a position to remove the illegal waste dumped and restore the site, then the related prefectural government will by proxy, either directly, or engage a third party to, remove the waste and restore the site. The costs for waste removal and restoration should be borne by the polluter. However, when it is difficult to force the polluter to cover the costs for any reason, then the related prefecture can obtain financial support from a fund established jointly by the government and industries. But unfortunately, in recent years there has been a growing challenge to maintain the fund as the share shouldered by the industries has been annually decreasing.

With regard to this, the study group meeting in 2020 adopted a policy to expand cooperation from the industry sector, and currently support is being sought from various enterprises and organizations.

Concerning illegal dumping, it is important is to foster social recognition that illegal dumping is a crime, and to continue communication of related information to the public and businesses. In the past there have been cases of illegal dumping where early detection prevented them from expanding, and therefore it is essential for local governments to collect information on illegal dumping cases and act firmly and swiftly in cooperation with the police against pernicious operators.

Fostering consciousness about beautifying towns among people, business operators, and administrations is important to avoid having an unclean city where “waste attracts waste”. In that respect, it is necessary to continue activities such as cleanup events and the like, and encourage residents to participate.

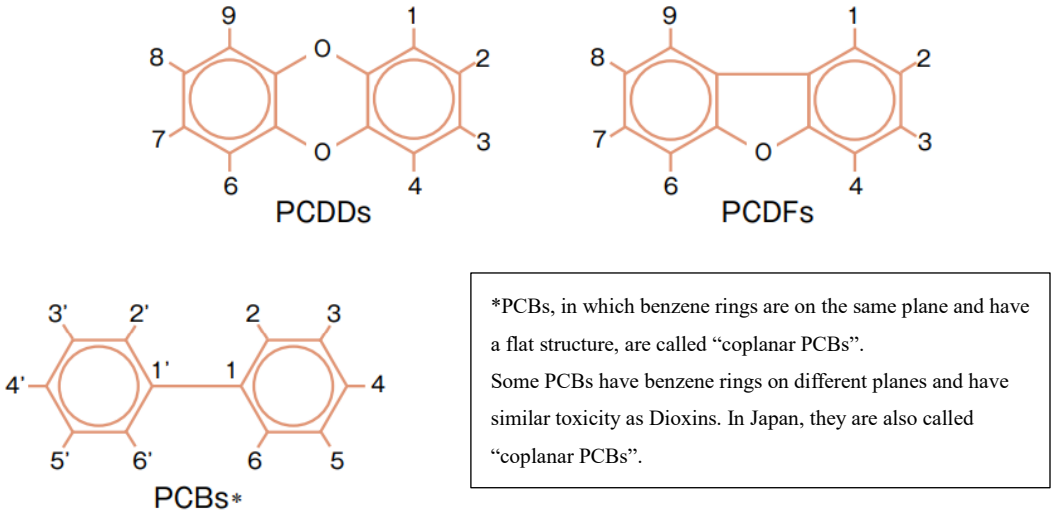
3 Dioxins Problem

Dioxins are substances that are unintentionally generated during the combustion of materials, and there are many types of facilities that may generate them. They hardly decompose in the environment and are likely to accumulate in an organism. There are many uncertainties about the extents of chronic toxicity in an organism. However, there are particular concerns on the effects of dioxins on the next generation including reproductive effects, and further research is necessary. With regard to waste management, concerns were raised in the past about dioxins emitted to the atmosphere during waste incineration and strenuous efforts have been exerted to develop the required technologies needed to solve this problem. This section presents the current status and issues related to the countermeasures against dioxins employed in Japan, countermeasures that will be required in the future, and matters to be considered when implementing the countermeasures.

3.1 What are Dioxins

Dioxins are generic term for Polychlorinated dibenzo-p-dioxins (PCDDs) and Polychlorinated dibenzofurans (PCDFs). Although the substances that show toxicity like dioxins such as coplanar-polychlorinated biphenyl (coplanar PCB) are called dioxin-like compounds, dioxins in this document refer not only to PCDDs and PCDFs but also coplanar PCB in accordance with the definition in *Act on Special Measures concerning Countermeasures against Dioxins* enacted in 1999.

Dioxins have basically a structure where two benzene rings are combined with oxygen and chlorine is attached there, as shown Figure 5-6. There are 75 types of PCDD, 135 types of PCDF, and dozens of types of coplanar PCB since the shape varies depending on the number of attached chlorine and where they are attached, and only 29 types of them are regarded as toxic.



*PCBs, in which benzene rings are on the same plane and have a flat structure, are called “coplanar PCBs”.
Some PCBs have benzene rings on different planes and have similar toxicity as Dioxins. In Japan, they are also called “coplanar PCBs”.

Source: Brochure shared with related ministries “Dioxins” (2012)

Figure 5-6 Molecular Structure of Dioxins

3.2 Measures Taken against Dioxins in Japan

In Japan, there were reports about the effect of dioxins on the human body, and in 1999 the Dioxins Measures Promotion Basic Policy and the *Act on Special Measures concerning Countermeasures against Dioxins* were established. As a result of implementing the measures defined in the policy and act, the environmental standards have been satisfied at most of the measurement points for atmosphere, water quality, and others.

In the 1970s, reports that dioxins were having an adverse effect on the environment were being seriously discussed worldwide, and damage reports were issued one after another. In Japan, emission of dioxins to the environment became notable from the 1960s to the 1980s and the main cause was considered to be the use of agricultural chemicals that contain highly concentrated dioxins (pentachlorophenol, chloronitrofen). The effect of dioxins on environmental contamination began to be widely reported by the media in 1980s, and various researches and investigations covering different topics including dioxins effects on the human body were conducted. In the 1990s, the effects of dioxins on breast milk and contamination of food including vegetables and other foodstuffs were reported, which led to prompt the need for urgent measures to be taken. During this period, although the usage of agricultural chemicals which were causing the emission of dioxins ceased, the emission of dioxins from operation of incinerators gradually became more conspicuous. For this reason, based on the Dioxins Measures Promotion Basic Policy and the *Act on Special Measures concerning Countermeasures against Dioxins* formulated in 1999 with the aim of preventing environmental pollution caused by dioxins, the central government, municipalities, business operators, and citizens worked to implement various pollution prevention measures. As a result, the total amount of emission of dioxins to the environment was reduced by 90% at the end of 2002 compared with 1997. With regard to atmosphere, water quality, and others, the environmental concentration steadily decreased and the environmental standards have been satisfied at most of the measurement points. Furthermore, with regard to sediments and soil, pollution control measures and others are currently implemented individually for each identified contaminated location.

3.3 Current Status of Measures

(1) Organization

The central government agency responsible for enforcing the *Act on Special Measures concerning Countermeasures against Dioxins* is the Ministry of the Environment, and the ministry's structure is stipulated in the Order for Organization of Ministry of the Environment. The "Environmental Management Bureau" of the ministry is mainly responsible for enforcing that act.

Furthermore, each municipality conducts periodical measurements of dioxins in the air. As an

example, for Tokyo the "Environmental Improvement Division" and the "Natural Environment Division" in the Bureau of Environment are in charge of air monitoring, and the monitoring results are publicized in their web site.

(2) Legal System

With regard to dioxins, the *Order for Enforcement of the Waste Management Act* was revised in 1997 and regulatory standards for gas emissions at waste incineration plants were established. Furthermore, the *Act on Special Measures concerning Countermeasures against Dioxins* was established in July 12, 1999, and based on which regulations for gas emissions as well as those for wastewater, soot and dust, incinerated ash, and others at waste incineration plants began to be applied. Furthermore, "the Dioxins Measures Promotion Basic Policy" was formulated at the meeting of cabinet members in charge of dioxins measures held on March 30, 1999 (and revised on September 28, 1999), and the entire government has been deeply committed to both implementing and facilitating implementation of various measures for drastically lowering the emission amounts of dioxins.

The environmental standards concerning air pollution, water pollution, and soil pollution were stipulated in the Ministry of the Environment Notification No. 68 in December 1999 and were applied from January 2000. Table 5-3 shows the outline of the environmental standards.

Table 5-3 Outline of Environmental Standards

Medium	Standard value	Measuring method
Air	0.6pg-TEQ/m^3 or less	Method of measuring a sample collected with the air sampler where the sampling tube with attached polyurethane foam is attached to the subsequent part of the filter paper with high-resolution gas chromatography-mass spectrometer
Water quality	1pg-TEQ/L or less	Method specified in Japanese Industrial Standard K0312
Sediment at the bottom of water	150pg-TEQ/g or less	Method of measuring the dioxins in the sediment at the bottom of water obtained by the Soxhlet extraction method with high-resolution gas chromatography-mass spectrometer
Soil	1,000pg-TEQ/g or less	Method of measuring dioxins in the soil obtained by the Soxhlet extraction method with high-resolution gas chromatography-mass spectrometer

Source: Ministry of the Environment "The environmental standards related to air pollution, water pollution (including pollution of bottom material of bottom of water), and soil pollution" ((Notified in 1999, amended in 2009))

(3) Activities by the Central Government and Municipalities

In Japan the "Plan for reducing the amount of dioxins emitted in relation with business activities in Japan" was formulated and is under implementation. The first plan was formulated in September 2000, followed by the second plan in June 2005, and the third plan in August 2012. Based on these plans long-term efforts are being taken to reduce risks of dioxins considering their characteristic such as low

degradability and accumulating property.

The second plan also reflected the contents of the “Stockholm Convention on Persistent Organic Pollutants” that became effective in May 2004.

The reduction target set in the first plan was 90% by the end of 2002 compared with 1997, but an actual reduction of 95% was achieved. Similarly, the reduction target set in the second plan of 15% by 2010, compared with 2003 was surpassed by the achieved reduction rate of 59%. This was achieved through the serious efforts jointly made by the private and public sectors. It should be noted that in the third plan, the target amount was set but the target year was not specified.

Furthermore, guidelines for emission reduction measures for dioxins related with waste treatment were drawn up in 1990 and revised in 1997. Dioxins emitted from waste incineration plants are said to be generated by incomplete combustion and synthesized by catalytic action on the surface of dust when the gas temperature reaches about 300°C in flue gas treatment facilities. For this reason, the guidelines call for the following measures to be taken at incineration facilities to ensure proper combustion management: (1) ensure continuous operation of the facility for as long as possible, (2) maintain the combustion temperature at 800°C or higher (850°C or higher is desirable), (3) install gas cooling facilities, exhaust gas treatment facilities and devices, etc. Based on these guidelines, each municipality is considering utilization and expansion of inter-municipal facilities in waste treatment, and installing and operating full continuous type incineration plants that meet the criteria of the guidelines.

3.4 Challenges and Considerations for Taking Measures

Dioxins require long-term risk management, and it is important for all the parties concerned to continue to work together and take the necessary countermeasures.

Research on the health effects of dioxins has progressed and, at present there are concerns about the possible effects on reproduction, the brain, and the immune system even at minute amounts, rather than carcinogenicity and lethal toxicity that were major problems in the past. Since such effects are considered to be most dangerous for fetuses, infants, and toddlers, their exposure to dioxins may have a bad effect on the next generation. Furthermore, it is necessary to continue paying close attention to effects by similar compounds such as brominated dioxins and the risk for people who eat a lot of fish. The World Health Organization (WHO) recently started a review of toxicity equivalency factor, and it is possible that in the future they will start a review of the tolerable daily intake. For this reason, it is necessary to take a long-term approach regarding issues related to dioxins, such as paying close attention to trends in domestic and international risk assessments and taking proactive measures based on those trends.

Although the amount of emission of dioxins has been drastically reduced, since dioxins are

substances that are unintentionally generated during the combustion of materials, there is a possibility that unidentified generation sources or new generation sources will be discovered in the future. For this reason, related parties in Japan are steadily implementing current countermeasures, such as monitoring the source of emissions, grasping the total amount of emissions, monitoring the state of environmental contamination, thoroughly implementing countermeasures at high-concentration contaminated points, and smoothly dismantling obsolete incinerators. Emissions need to be managed over the long term so that at least current emissions levels are not exceeded. Additionally, it is necessary to proactively develop pollution prevention measures in future through the progress of scientific knowledge and reflection of that progress in countermeasures while observing the latest trends in risk assessment such as efforts for reviewing the tolerable daily intake.

As mentioned earlier, with regard to issues of dioxins, long-term risk management is necessary and it is required that the central government, municipalities, business operators, and citizens should continue to jointly take measures against dioxins pollution.

4 Hazardous Waste

Waste generated by industries, businesses, and our daily life contains hazardous waste that is difficult to treat. For the purpose of this section, mercury, PCB, and asbestos have been selected as major hazardous wastes to be discussed; an overview of their properties and toxicity is presented, together with current countermeasures in Japan, and past cases of pollution caused by these wastes. Through the description of actual cases, the necessary measures and the challenges for their implementation are also introduced.

4.1 Mercury

Mercury has an effect on living organisms, which is a disorder due to “corrosive action of inorganic mercury compounds” and “uptake of methyl mercury”. Minamata disease is widely known as the most famous disorder that has occurred in Japan from mercury pollution. Globally, research was conducted by the United Nations in 2000s and the Minamata Convention went into effect in 2017. Japan ratified this convention and is engaged in developing and applying the countermeasures.

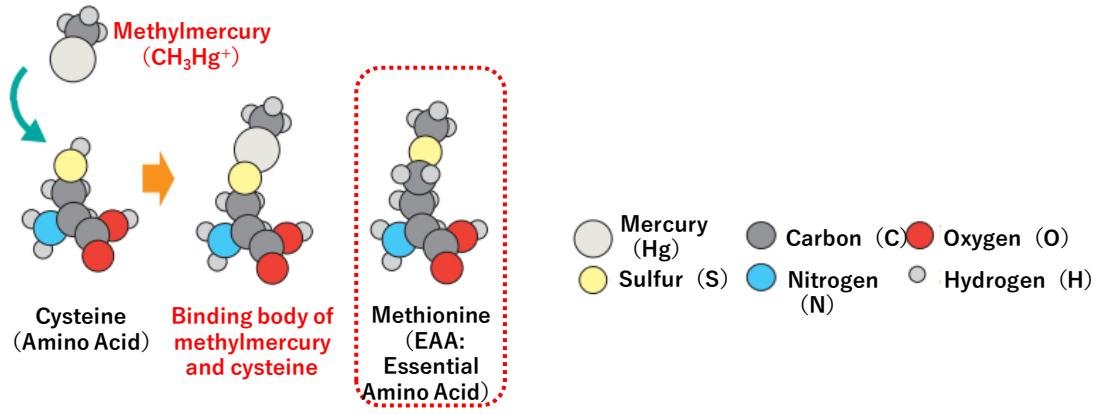
In addition to learning about the mechanisms by which mercury affects human bodies, the need for countermeasures and issues in their implementation will be presented in this section by learning about Minamata disease cases and countermeasures in Japan.

In Japan, "Guidelines for Mercury Waste" have been established to explain the considerations on the handling of mercury waste, and its collection, transportation, and disposal.

Mercury is the only metallic element that is liquid under both normal temperature and pressure, and as shown in Figure 5-7, mercury in the environment can be largely divided into 3 chemical forms; metallic mercury, inorganic mercury compound, and organic mercury compound (mainly methyl mercury).

Mercury is believed to affect living organisms mainly through two mechanisms. One is the corrosive action of inorganic mercury compounds. This is caused by the mercury ions of inorganic mercury compound, which have an effect of inflaming cells when they come in contact with either the inner or outer surfaces of living organisms. Therefore, if taken orally, they cause disorders in the kidneys.

The second mechanism is the disorder caused by an uptake of methyl mercury, which caused the Minamata disease. Methyl mercury combines with “cysteine”, which is amino acid, and a highly toxic combined-body is generated. Since the structure of this combined-body is similar to that of “methionine”, which is a necessary amino acid, it is synthesized as partial protein in the body’s process for absorbing and transporting necessary amino acids, and inhibits the normal functions of the protein.



Source: Ministry of the Environment "A wonder story of Mercury (version 2)" (2021)

Figure 5-7 Conjugating of Methylmercury and Cysteine

Regarding exposure to mercury, in addition to its chemical form, the amount taken into the body and how it is absorbed and metabolized are important.

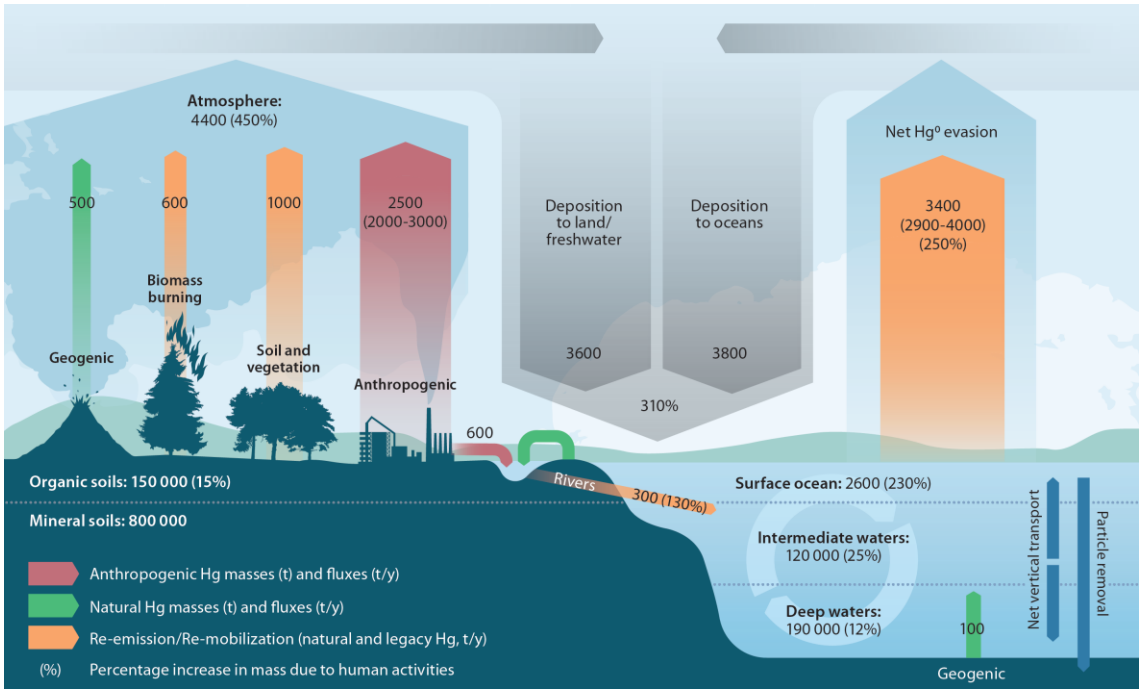
Metallic mercury exerts little action on organisms, and, if accidentally swallowed, it is considered not to cause serious effect because it is usually excreted as is, with little absorption from the digestive tract. However, if it becomes mercury vapor, it is absorbed in higher efficiency than the gas exchange function of the lungs and circulates in the body carried by the blood stream. Furthermore, it passes through the protective barrier, referred to as the blood-brain barrier and reaches the central nerve including the brain. After entering the brain, if metallic mercury becomes mercury ions by the metabolism of the organism, expression of the disorder occurs according to each region due to the corrosive action of inorganic mercury compounds mentioned earlier.

Methyl mercury is mainly taken orally from food and is absorbed at a high efficiency through the digestive tract. Although methyl mercury is also gradually oxidized and excreted, since part of it is mistaken for amino acid and transported and creeps into protein, a disorder due to mercury occurs according to each region and the level of denaturalization.

With regard to inorganic mercury compounds, since the toxicity is different depending on their chemical stability, the action on organisms is also different. Since mercuric sulfide is low in aqueous solubility and is the safest chemical form of mercury, stabilizing treatment into sulfureting mercury in advance might be required in the final disposal of waste mercury. When inorganic mercury compounds are discharged into the aquatic environment, they may be methylated by bacterial metabolism under anaerobic conditions to form methylmercury, which is highly toxic. Special attention should be paid to the disposal of wastes containing mercury, even inorganic mercury compounds, because high concentrations may accumulate in large fish through the food chain in the natural world.

With regard to global action, the United Nations Environment Programme (UNEP) started research activities concerning global mercury pollution in 2001 and issued the report titled "Global Mercury

Assessment" in 2002 summarizing the effects on people and the contamination status. The report was then revised several times and the 2018 version is the latest revision (as of 2021). The actual state of global mercury cycle described in this report is shown in Figure 5-8. The report states that it is crucial to reduce artificial discharge of mercury to reduce the amount of mercury circulating in the environment in the future.



Source: UNEP "Global Mercury Assessment 2018" (2018)

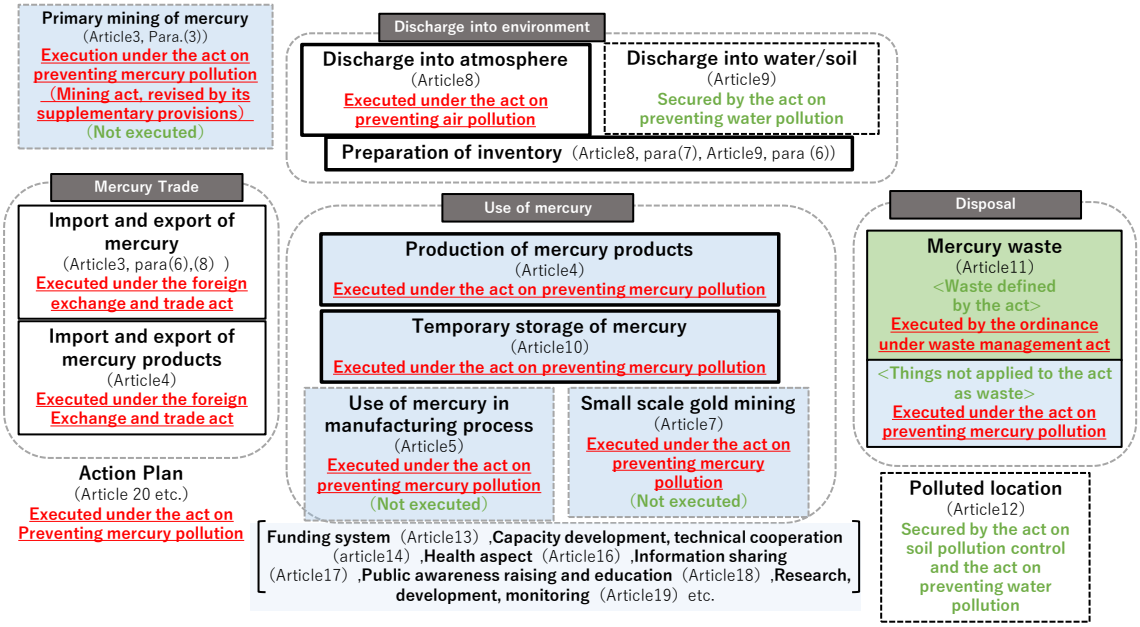
Figure 5-8 Global Circulation of Mercury

"The Minamata Convention on Mercury" (hereinafter referred to as "Minamata Convention"), which was adopted at the diplomatic conference in October 2013 and is influenced by the aforementioned UNEP report, aims to recognize mercury, which has potential for long-range environmental transport, circularity/persistency in the environment, and bio-accumulation potential, as a chemical substance that causes a global concern for the protection of health and environment of people from artificial discharge and emission of mercury. Table 5-4 shows the chronology until Minamata Convention went into effect, and Figure 5-9 shows the configuration of Minamata Convention and relation to collateral measures.

Table 5-4 Chronology until Minamata Convention Went into Effect

Period	Event
October 2013	"Diplomatic Conference for the Minamata Convention on Mercury" was held in Minamata, Kumamoto Prefecture. "Minamata Convention on Mercury" was adopted unanimously.
2015	Towards ratification of the convention, enactment of *Act on Preventing Environmental Pollution of Mercury (Mercury Pollution Prevention Act)*, revision of *Air Pollution Control Act* and Order for Enforcement of the Waste Management Act, etc.
February 2016	Japan ratified the convention.
May 2017	The number of signatory countries reached 50, which is a requirement for the convention to go into effect.
August 16, 2017	The convention went into effect.

Source: Ministry of the Environment "Revision of the Order for Enforcement of the *Waste Management Act* (for proper management of mercury waste)" (2017)



Source: Ministry of the Environment "Revision of the Order for Enforcement of the *Waste Management Act* (for proper management of mercury waste)" (2017)

Figure 5-9 Configuration of Minamata Convention and Relation to Collateral Measures

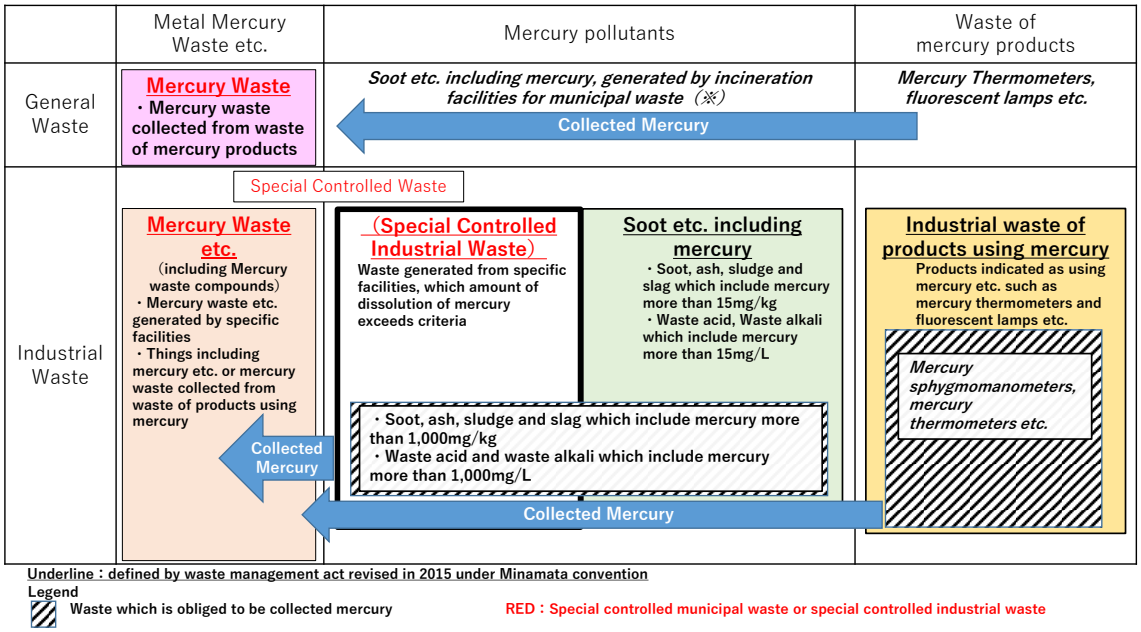
The Ministry of the Environment has drawn up guidelines for ensuring the appropriate treatment of mercury waste and the latest version as of now (year 2022) is the 3rd version published in March 2021. The background and the goals are extracted from the guidelines as below:

As an activity for achieving the goal of the convention, Minamata Convention Article 11 (mercury waste) requests signatory countries to take appropriate measures so that mercury waste should be managed in a way appropriate for the environment, and the Order for Enforcement of the Waste Management Act was revised based on the treatment of mercury waste appropriate for the

environment shown in “Mercury waste measures in future based on Minamata Convention on Mercury” submitted by the Central Environment Council in February 2015. The guidelines were created for the purpose of ensuring appropriate treatment for mercury waste by specifically describing new considerations for treatment, collection, transportation, disposal, or others of mercury waste based mainly on the revised order for enforcement.

Source: Ministry of the Environment “Guidelines for Mercury Waste, Version 3” (2021)

In addition, the classification of mercury waste in the guidelines is shown in Figure 5-10.



*: Soot discharged from incineration facilities for municipal waste with treatment capacity of more than 5 tons per day is regarded as “Special controlled municipal waste”.

Source: Ministry of the Environment “Guidelines for Mercury Waste” (2021)

Figure 5-10 Classification of Mercury Waste

Metallic mercury waste, etc.

Waste metallic mercury, etc. is waste that was originally mercury or chemical compounds of mercury, and is designated either as “waste mercury, etc.” under specially controlled industrial waste, or “waste mercury”, under specially controlled municipal waste. When disposing or recycling of “waste mercury”, or landfilling of “waste mercury, etc.”, the waste must be sulfurized and solidified as specified in the “Standards on solidification, etc. of waste containing metals, etc.” notified by the Environment Agency (currently the Ministry of the Environment). Furthermore, disposal of “waste mercury, etc.” and other treated materials are prohibited in landfills developed on reclaimed land in the sea, and if the result of the elution test, specified as assay method does not satisfy the landfill criteria described in Table 5-5, the waste must be disposed in a sealed-type landfill site. On the other

hand, if the criteria are satisfied, the waste can be disposed at a controlled final landfill site after taking additional measures, such as constructing a container structure where the waste is contained and rainwater entry is prevented from coming into contact with it.

Table 5-5 Landfill Criteria

Target	Contents
Alkyl mercury compound	Alkyl mercury compound is not detected
Mercury or chemical compound of mercury	0.005 mg or less of mercury per 1 liter

Source: Ministry of the Environment "Guidelines for Mercury Waste, Version 3" (2021)

Mercury-contaminated Matter

Mercury-contaminated matter is matter that was contaminated with mercury or chemical compounds of mercury and has become waste. Mercury-contaminated matter is defined in the guidelines as follows:

- Specially controlled industrial waste or specially controlled municipal waste
- Soot and dust, ash, sludge, waste acid, waste alkali, slag, paper waste, wood waste, waste textile, and others that contain mercury or chemical compounds of mercury
- Soot and dust, ash, sludge, waste acid, waste alkali, and slag that are industrial waste but are not specially controlled industrial waste and contain mercury or chemical compounds of mercury whose concentration is more than a certain value are regarded as "soot and dust and others that contain mercury"

When conducting disposal or recycling of "soot and dust and others that contain mercury", it is required to take necessary measures in order to prevent scatter of mercury or chemical compounds of mercury. Furthermore, when conducting landfill disposal of "soot and dust and others that contain mercury" that are one of soot and duct, ash, or sludge and do not satisfy the landfill decision criteria, it is required to treat them in advance so that they satisfy the landfill criteria or conduct cement solidification in a specified method. If "soot and dust and others that contain mercury" or those that have been treated satisfy the landfill criteria, they can be disposed of at a controlled final landfill site.

Mercury-using-product Waste

Mercury-using-product waste is waste that was original a mercury-using product, for example, fluorescent tubes, mercury-containing dry cell batteries, mercury thermometers, etc. Manufacturers or importers of mercury-using products are obligated to make efforts to provide information such as notices about usage of mercury and others in mercury-using products they produce or import so that consumers can properly separate and discharge a mercury-using product when the product becomes waste. When disposing or recycling mercury-using-product industrial waste, it is required to take

necessary measures in order to prevent scatter of mercury or chemical compounds of mercury. Before disposing mercury-using-product industrial waste at the landfill, the waste should be treated, such as insolubilization. It is prohibited to dispose of mercury-using-product industrial waste at an inert landfill site.

In Japan, mercury waste from municipal solid waste became a problem in the early 1980s, and municipalities began to implement separate collection of dry cell batteries and fluorescent lamps. Many municipalities separate and collect mercury-containing wastes such as batteries and fluorescent lamps from other waste as noncombustible and hazardous wastes. After collecting the mercury-containing wastes, the mercury is recovered through inter-municipal treatment (through the inter-municipal treatment route designated by the government) or consignment to private companies by each municipality.

Column: Minamata Disease

Minamata disease is a toxic nervous disease that occurred among residents who routinely ate much seafood - such as fish, shrimps, crabs, and shellfish that absorbed methylmercury compounds discharged by a chemical factory producing acetaldehyde into the sea and rivers, directly from gills and the digestive tract or had them in the body accumulated with a high concentration through the food chain.

The disease occurred along the coast of Yatsushiro Sea centering on the surrounding area of Minamata Bay and was treated at first as a nervous disease of unknown cause. The first patient was reported in May 1956, and 52 patients were identified by the end of that year.

Furthermore, the patients with the same symptoms were identified along the Aganogawa river in Niigata Prefecture in May 1965, and 26 patients were identified in July 1965.

A variety of symptoms occur in patients of Minamata disease clinically, but the main symptoms are sensory disorder of the distal portion of the extremities, cerebellar ataxia, central ocular motility disorder, and central deafness. Furthermore, fetal Minamata disease has also been confirmed as a result of mothers being exposed to methylmercury during pregnancy.

Minamata disease is a typical byproduct of pollution where contaminated substances, which are generated incidentally by industrial activities that bring a life of affluence, eroded human bodies through the environment. The certification and compensation for patients of Minamata disease are being continued by the central government and the municipalities even now.

4.2 PCB

In Japan, although PCB was used for various uses in the past, at present orders were issued for discontinuing production, collection, and prohibition of importation. Collected PCB is treated by the Japan Environmental Storage & Safety Corporation (JESCO).

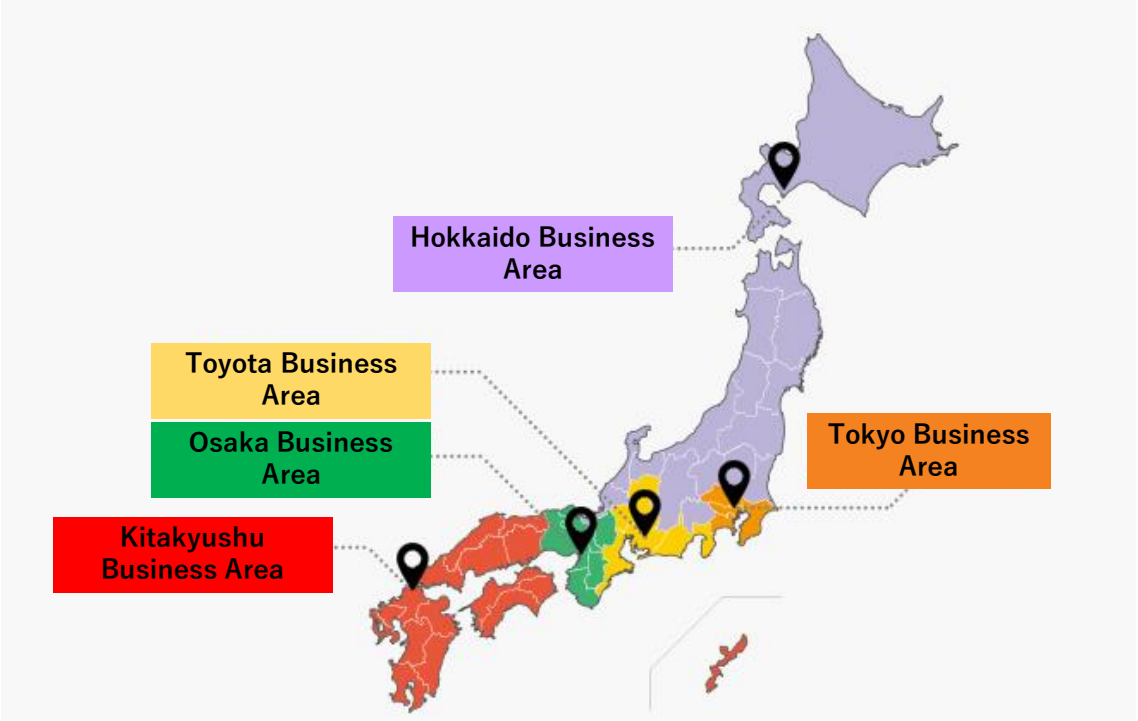
This section introduces the harmful characteristics of PCB and the measures taken against PCB in Japan to underline to developing countries the importance of taking similar measures.

PCB (Poly Chlorinated Biphenyl) is the abbreviation of poly chlorinated biphenyl and is a chemical substance made artificially. Since PCB has chemically stable characteristics such as difficulty to dissolve in water, high boiling point, difficulty to decompose by heat, incombustibility, and excellent electrical insulation, it was used for various purposes such as insulating oil for electric equipment used on daily basis, heat medium for heat exchanger, no-carbon paper, and others.

Typical electric equipment that used PCB included transformers, capacitors, and stabilizers. Transformers and capacitors containing PCB were used as equipment in such as old factories and buildings and stabilizers were used for fluorescent light component in old factories and schools amongst others.

Since PCB is easily dissolved in fat, it is reported that chronic intake results in gradual accumulation in the body and causes various symptoms. In the 1960s, PCB became a popular media topic triggered by the Kanemi Oil Poisoning Incident in 1968 (refer to the Column: Kanemi Oil Poisoning Incident) promoting the government to take countermeasures. Based on the administrative guidance issued by the Ministry of International Trade and Industry in 1972, orders were issued for production discontinuation, collection and others, and at present importation is prohibited.

For 30 years after the discontinuation of PCB production, attempts were made to construct a treatment facility under a private sector initiative but it was not possible to reach a decision on siting the facility because of difficulty in gaining surrounding residents approval. Because of the prolonged storage of the collected PCB waste there were increased concerns of potential loss or leakage occurrences which would result in environmental pollution. In order to deal with this situation, the *Act on Special Measures concerning Promotion of Proper Treatment of PCB Wastes* (*PCB Special Measures Law*) was promulgated on June 22, 2001 and came into force on July 15 of the same year for the purpose of promoting secure and appropriate treatment. Furthermore, the *Act on Japan Environmental Safety Corporation* came into force in 2003, and based on this act, the Japan Environmental Storage & Safety Corporation (JESCO) was established as a wholly owned subsidiary of the central government. Through this company, treatment facilities were developed at 5 locations in Japan, as shown in Figure 5-11 and operation of the Kita Kyushu treatment facility commenced in 2004.



Source: Ministry of the Environment Website "Information website for early treatment of poly chlorinated biphenyl (PCB)"
http://pcb-soukishori.env.go.jp/about/pcb.html (accessed February 1, 2022)

Figure 5-11 Locations of Region-based PCB Waste Treatment Facilities Established by JESCO

Business operators who are storing PCB waste are obligated to both notify on the status of storage and disposal every year, and dispose of the waste within the period prescribed in the Cabinet Order. This period was initially stipulated to be until July 2016, but in light of the fact that a large amount of electrical equipment was found to be contaminated with minute amounts of PCBs, and that JESCO's disposal was behind schedule, in December 2012, the Cabinet Order was amended to extend the period to the end of March 2027.

Furthermore, the *PCB Special Measures Law* was revised in 2016. The outline of the revision was as follows:

(a) Cabinet decision on the PCB waste treatment basic plan

In order for all the concerned government bodies to implement the plan together, the PCB waste treatment basic plan will be established by cabinet decision.

(b) Disposal of high concentration PCB waste is made mandatory.

It is mandatory for storage business operators to dispose of the waste with high concentration of PCB before the due date of planned treatment completion, and an improvement order can be issued for the violation of this obligation. Penalties are imposed on violation of order.

(c) Strengthening of authority for collection of reports and on-site inspections

Strengthen the authority of prefectural governments and municipalities to collect reports

from business operators and conduct on-site inspections regarding high-concentration PCB wastes for which no notifications had been issued, and which would be in violation of the *PCB Special Measures Law*.

(d) Execution by proxy for disposal of high concentration PCB waste

If the storage business operator is unknown or not in a position to dispose of the PCB waste stored, prefectures and municipalities will be able to carry out proxy execution related to the disposal of high-concentration PCB waste.

Table 5-6 Events Related to PCB Waste

Month and Year	Event
1954	Domestic production of PCB started.
1968	The Kanemi Oil Poisoning Incident occurred.
1972	Due to administrative guidance by the Ministry of International Trade and Industry, production discontinuation/collection and others were ordered.
1973	Electrical Insulator Treatment Association started attempts for siting of a treatment facility.
2001	*Act on Special Measures concerning Promotion of Proper Treatment of PCB Wastes* was enacted.
	Japan Environment Corporation Law was revised - PCB treatment project was added as one operation of this corporation that was engaged in the business of construction and transfer of pollution control facilities and others.
2003	Act on Japan Environmental Safety Corporation was enacted.
2004	Japan Environmental Safety Corporation (currently JESCO) was established.
2011	A study committee concerning promotion of proper treatment of PCB waste was held.
2012	The study committee report on the promotion of proper treatment of PCB waste "Promotion of Proper Treatment of PCB Waste in Future" was compiled.
	The period prescribed in the Cabinet Order referred to in the *PCB Special Measures Law* was postponed to March 31, 2027.
October - November 2013	The local governments related to the JESCO treatment facilities were requested to study the revision of the PCB waste treatment basic plan.
May 2014	The revision (draft) of the basic plan was agreed to at the study committee concerning promotion of proper treatment of PCB waste.
May 2016	*PCB Waste Special Measures Law* was revised.
July 2016	The PCB waste treatment basic plan was revised.
December 2019	The PCB waste treatment basic plan was revised.

Source: Ministry of the Environment Website "Poly chlorinated biphenyl (PCB) early treatment information site" http://pcb-soukishori.env.go.jp/about/background.html (accessed February 1, 2022)

Furthermore, on the global scene, international activities calling for regulation of PCB waste were growing as cases of the expansion of pollution from some areas where PCBs were used to areas where PCBs were not used at all, were being reported. As a result of these activities, the Stockholm

Convention on Persistent Organic Pollutants (POPs Convention) went into effect in May 2004.

The POPs Convention calls for abolishing the use of PCBs by 2025 and the proper management of PCB waste by 2028. Japan ratified this convention in August 2002.

Column: Kanemi Oil Poisoning Incident

The Kanemi oil poisoning incident is a food-poisoning incident caused by rice oil (rice bran oil) produced by a private company, which occurred across a wide area centered in western Japan in 1968.

The incident occurred because PCB was used as heat medium, and polychlorinated dibenzofuran (PCDF) which is a type of dioxins, and others were mixed into the product during the deodorization process in the production process of rice oil.

Patients showed various symptoms such as cutaneous symptoms including pustule and pigmentation, nervous symptoms, joint symptoms, respiratory symptoms, anemia, and bone deformity, which often became serious. Improvement in symptoms took a long time, and, for example, the symptoms of one patient still persist even after the passing of 50 years. Effects on fertility of women and on newborn babies were also reported.

Since 1969, victims who suffered health problems have filed a series of class action lawsuits against the relevant private company and the central government seeking compensation for damages, but it took a long time before the judgement was finalized in 2015. Discussions about relief for the victims is still continuing.

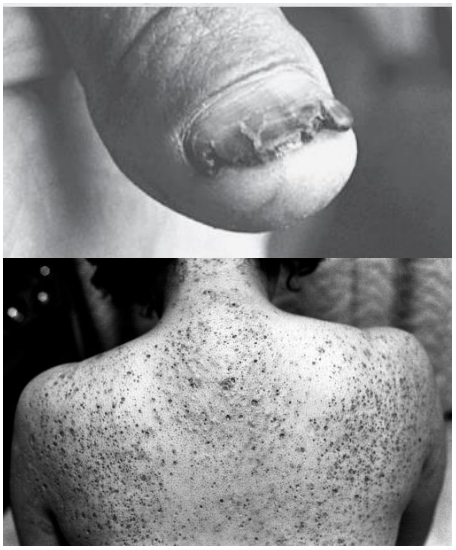


Photo 5-9 Health Hazard Caused by Kanemi Oil Poisoning

Source: Yukiaki Kawano

Photo 5-10 Class-Action Lawsuit by Sufferers of Kanemi Oil Poisoning

4.3 Asbestos

Asbestos that is taken into the human body and remains there causes diseases such as lung fibrosis, lung cancer, and malignant mesothelioma. Its use is regulated in Japan and at present is not imported into the country.

In some developing countries, asbestos is not properly regulated, and many people do not understand its harmfulness. In this section the necessity for countermeasures is shown by understanding the actual condition of asbestos' harmfulness and the damage it inflicts over a long period of time.

Asbestos is "sekimen" in Japanese, and it is a natural ore, which is made when serpentinite and amphibole are transformed and become fibrous. Asbestos is the generic name of inorganic fibrous mineral. Asbestos is fine and the diameter (chrysotile 0.02 to 0.08 μm, crocidolite 0.04 to 0.15 μm, amosite 0.06 to 0.35 μm) is thinner than that of human hair (40 to 100 μm). It consists of extremely fine fiber that cannot be seen by the naked eye. Therefore, when scattered, it is apt to be suspended in the air and is easily inhaled into the lungs and deposited in the alveoli of the lung.

Part of inhaled asbestos is mixed into phlegm as a foreign substance and is discharged out of the body, but other part remains long in the tissue of the lungs since asbestos fibers are tough and stable. Asbestos that remains in the body sometimes causes diseases such as lung fibrosis, lung cancer, and malignant mesothelioma. Finer and longer asbestos fibers are considered to be more harmful. It is thought that the reason is that macrophages, a kind of leucocyte, try to remove the asbestos fibers that remain in the lungs, but long fibers are difficult to remove and can remain in the body for long periods. Furthermore, carcinogenicity differs depending on the type of asbestos and the carcinogenicity of amphibole (crocidolite and amosite) is considered to be higher than that of chrysotile.

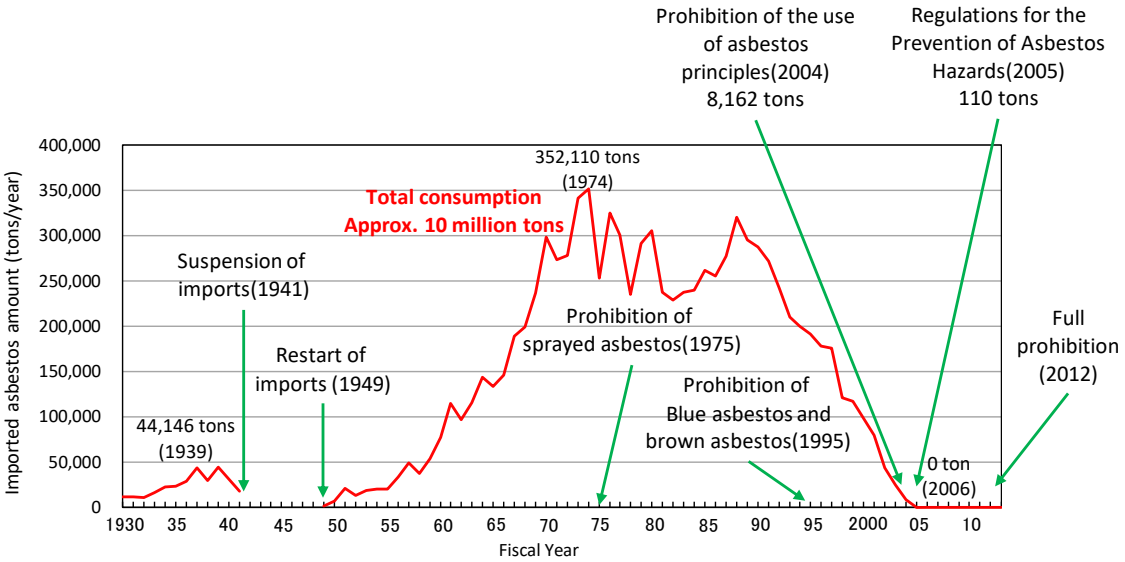
Source: Environmental Restoration and Conservation Agency (ERCA) Website
https://www.erca.go.jp/asbestos/what/whats/whatAsbestos.html (accessed February 1, 2022)

Figure 5-12 Types of Asbestos and their Degree of Carcinogenicity

A correlation is recognized between the amount of inhaled asbestos and the occurrence of diseases such as mesothelioma and lung cancer, but what amount of asbestos needs to be inhaled and how long it needs to be inhaled for the occurrence of mesothelioma are not clear.

In Japan, importation of asbestos started in the 1890s and, although it was temporarily stopped during the Second World War, importation was immediately resumed after the war. The imported amount peaked in the 1970s and more than 300,000 ton of asbestos was imported almost annually during that decade. At that time, asbestos was utilized as a lagging material or a heat insulating material in the construction of buildings and structures, slate material, brake lining, soundproof material, as well as other uses.

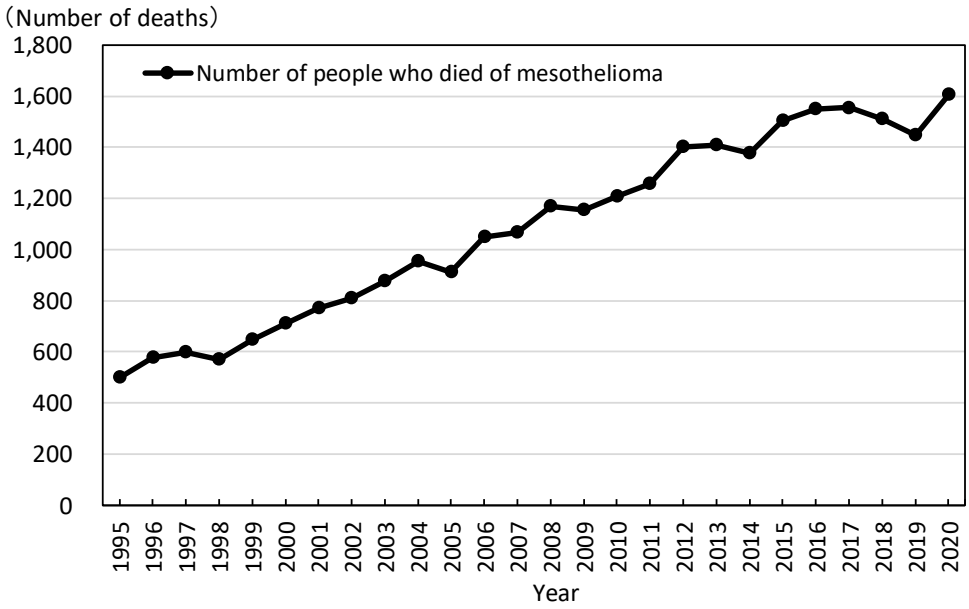
After that, since effects on health and others were pointed out and the use was regulated, the amounts imported sharply decreased and at present no asbestos is imported. Afterwards, its use was regulated due to the increasing awareness of its effects on health, and imports decreased sharply. Presently asbestos is no longer imported.



Source: Environmental Restoration and Conservation Agency Website (ERCA) "Asbestos and its health hazard" (2021)

Figure 5-13 Transition of Import Amount of Asbestos and History of Regulation

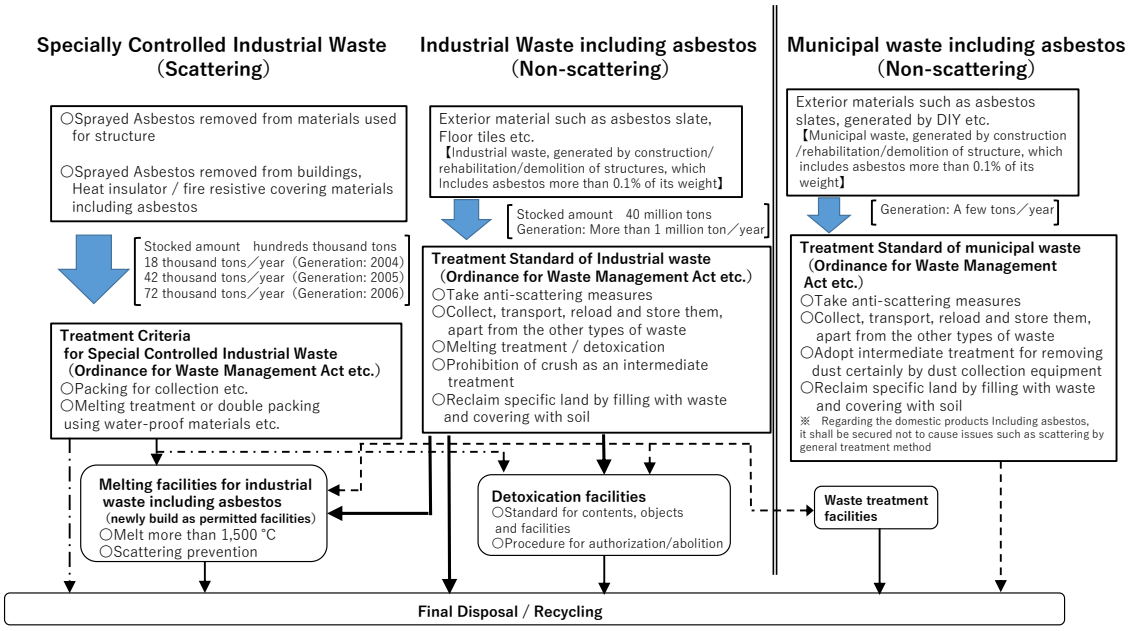
On the other hand, as shown in Figure 5-14, the number of patients with mesothelioma, which is said to be an illness caused by asbestos, continues to increase year by year. According to population survey reports released by the Ministry of Health, Labor and Welfare, the number of patients increased rapidly since the 2000s, which coincides with the latent period (about 40 years on average) after the 1960s when the amount of imported asbestos had increased. The number of people who died of mesothelioma in 2020 reached 1,605, which is more than three times as many as 1995.



Source: Ministry of Health, Labour and Welfare "Prepared based on the data listed in 'Transition of estimated number of people who died of mesothelioma in prefectures from 1995 to 2020'" (2021)

Figure 5-14 Transition of Number of People who Died of Mesothelioma in Japan

Waste that contains asbestos can be largely divided into "waste asbestos and others", "asbestos-containing industrial waste", and "asbestos-containing municipal waste" and is required to be treated appropriately in accordance with the law. The current regulations related to asbestos-containing waste in Japan are shown in Figure 5-15.



Source: Ministry of the Environment "Management Guideline for Waste including Asbestos (ver.3)" (2021)

Figure 5-15 Current Regulation of Waste Including Asbestos in Japan

The types of waste containing asbestos and their disposal methods are defined according to their characteristics as shown in Figure 5-16.

Sprayed asbestos and asbestos heat-retention (thermal insulation) material are friable asbestos that can be easily dispersed into the air and must be disposed of as specially controlled industrial waste (hazardous waste) as defined in the *Waste Management Act*. Specifically, the business operator is required to take temporary measures such as spraying the waste with water to prevent dispersal of asbestos until it is transported, and then solidify the waste or stabilize it with chemicals in advance and double pack it with water-resistant materials to prevent it from dispersing into the atmosphere. The waste must be landfilled at a controlled landfill site. If the waste is melted or detoxified as specially controlled industrial waste and loses its properties, it can be landfilled in an inert landfill site.

On the other hand, asbestos fiber board are non-scattering asbestos waste that is not easily dispersed into the atmosphere when it becomes waste. It can be collected and transported as industrial waste that is not specially controlled industrial waste, and can be disposed in an inert landfill site if anti-scattering measures are taken at a certain location.

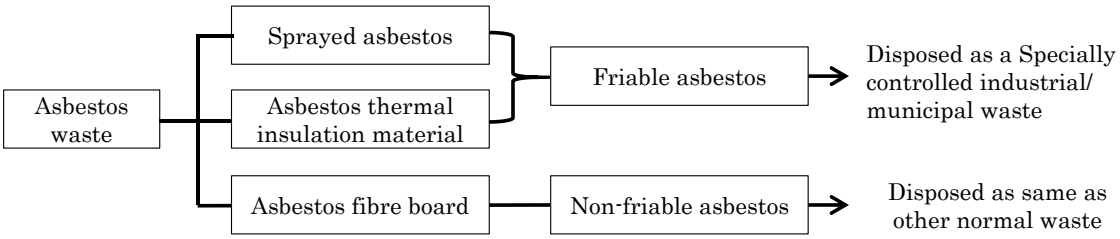


Figure 5-16 Types of Asbestos Wastes and Respective Disposal Methods

5 Disaster Waste

Due to its location, geography, geology, climate, and other natural conditions, Japan frequently experiences typhoons, severe rainstorms, earthquakes, and other natural disasters. The percentage of global disasters that Japan accounts for is 20.8% of earthquakes with a magnitude over 6, and the percentage of disaster damage costs is 18.3%. As Japan accounts for only 0.25% of the world's land area, these figures are very high.

When a disaster occurs, vast quantities of waste are immediately generated and they must be speedily disposed of to help the residents recover.

If disaster waste is left unattended, it not only interferes with the residents' daily lives, but can also cause various problems such as sanitary issues due to its decomposition, and safety issues due to burning, etc. However, it is difficult to sort the waste generated by disasters and in many cases, it is difficult to treat it as well.

This section introduces the disaster waste measures practiced in Japan and their related issues. The measures that each country should consider, the potential challenges in implementing these measures, and the current state of international cooperation regarding disaster waste are discussed as well.

5.1 Changes in the System

Disaster waste measures are positioned as part of Japan's national resilience policies, and the Disaster Waste Countermeasure Guidelines were established in 2014.

Japan revised the disaster waste management system each time the country experienced a major disaster. It is important to have a flexible system and continuously improve upon it as the situation demands.

Based on the lessons learned from the Ise Bay Typhoon of 1959, the *Disaster Countermeasure Basic Act* was enacted in the same year and has been revised several times since then. The purpose of the act is to protect the lives, health, and property of the citizens from disasters and thereby contribute to maintaining social order and assuring public welfare.

In 2011 Japan was struck by the Great East Japan Earthquake, and once more the lessons learned in that disaster led to the establishment of the *Basic Act to Strengthen National Resilience to Contribute to Disaster Prevention and Alleviation to Achieve Strong and Flexible Citizens' Lives* (hereinafter referred to as the *Basic Act to Strengthen National Resilience*) established in 2013, and activities have since been carried out based on the concepts of this act.

Based on these laws, the Basic Plan to Strengthen National Resilience was established in June 2014, and "situations to be avoided" was defined as "situations in which recovery and reconstruction are delayed due to stagnation in the treatment of the vast quantities of waste produced by disasters". Therefore, countermeasures for disaster waste were included as part of the policies to strengthen national resilience.

Furthermore, the Waste Treatment Facilities Improvement Plan that was revised in 2013 clearly includes “strengthening of disaster countermeasures”. In March 2014, the Disaster Waste Countermeasure Guidelines was developed.

5.2 Current Situation of Disaster Waste Management

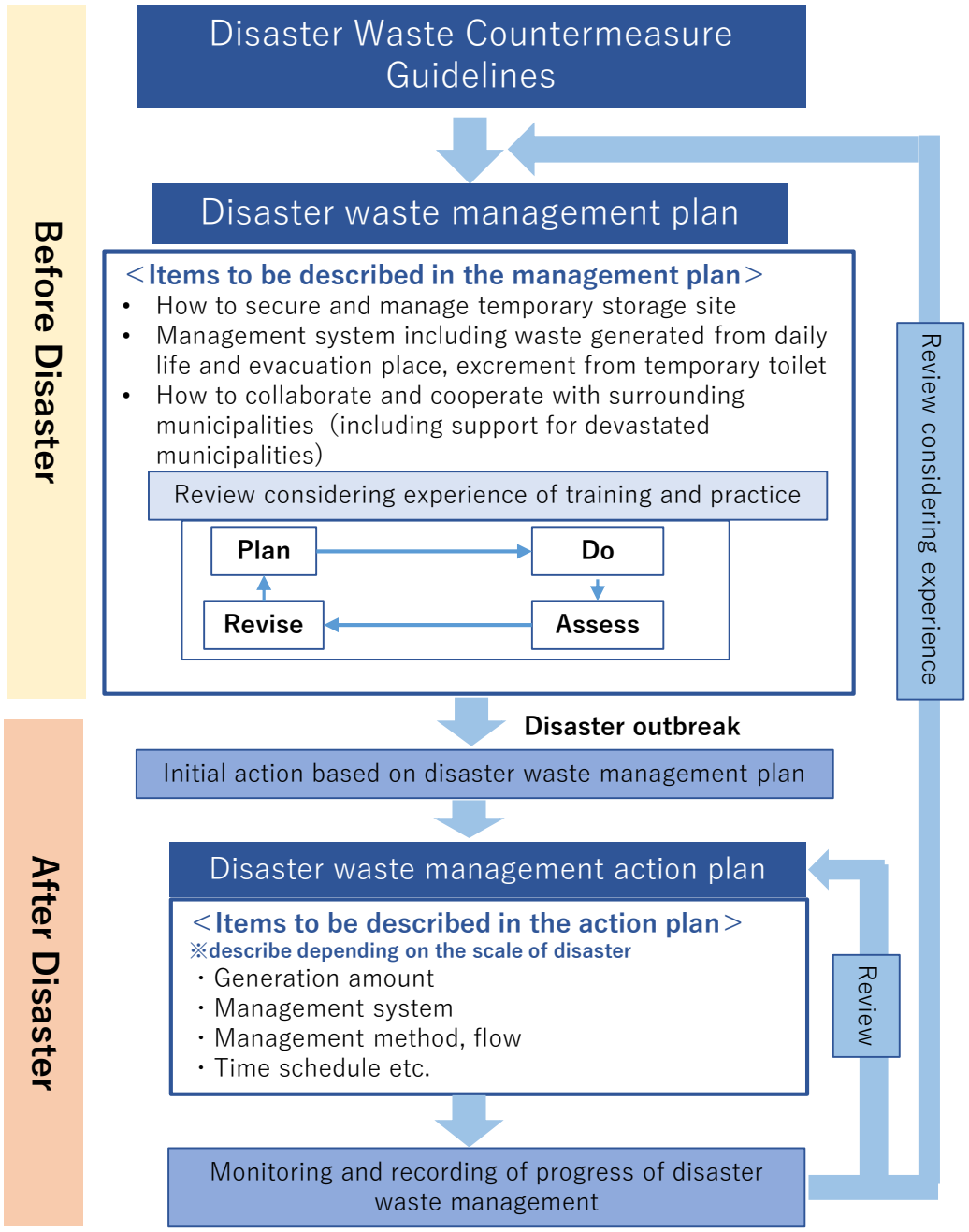
(1) Organization

Countermeasures for disaster waste must be considered separately; countermeasures for normal times before a disaster strikes and those needed after the disaster has struck. It is important that the related organizations make efforts to establish working relationships under normal conditions so they can smoothly work together during disasters and their aftermath.

The Disaster Waste Countermeasure Guidelines (Revised Edition) developed by the Ministry of the Environment states that disaster waste systems must be prepared during normal conditions.

The guidelines state that the prefectures must assist their various municipalities to formulate and review their disaster waste management plans according to the respective conditions of each municipality after sufficiently considering the Waste Treatment Facilities Improvement Plan (2013), the aforementioned guidelines, and action guidelines. The prefectural governments and municipalities need to ensure that the formulated plans are consistent with regional disaster plans and other disaster related guidelines and that the plans are based on the *Disaster Countermeasure Basic Act*. Additionally, during emergency situations, the prefectures must proactively communicate and adjust actions with the related groups and organizations while quickly creating implementation plans for the management of disaster waste. At the same time, they must also cooperate with the related groups and organizations to manage the progress of overall treatment within their jurisdictions.

The municipalities must make sure that their local disaster prevention plans and other disaster related guidelines and plans made under prefectural disaster waste treatment plans and the *Disaster Countermeasure Basic Act* are consistent with the national Waste Treatment Facilities Improvement Plan (2013), the aforementioned guidelines, and action guidelines. At the same time, the municipalities must include the measures related to disaster waste countermeasures made in preparation for disasters in their municipal waste treatment plans according to their local situations. The municipalities must also formulate disaster waste treatment plans in preparation for disasters and review them as appropriate. Furthermore, during disasters, the municipalities need to quickly assess the degree of damages according to the disaster waste treatment plan, prepare disaster waste management implementation plans, and based on the plans manage the disaster waste.



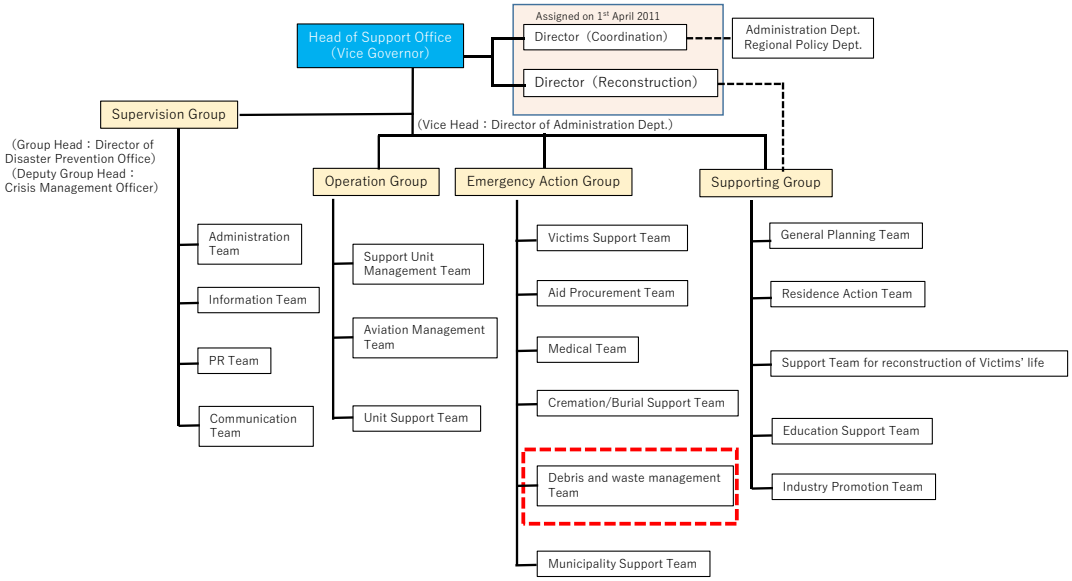
Source: Ministry of the Environment “Disaster Waste Countermeasure Guidelines (revised edition)” (2018)

Figure 5-17 Relation between Disaster Waste Management Plan and its Action Plan

Column: Example of a Disaster Waste Management System

The following is an example of a disaster waste management system in Iwate Prefecture during the Great East Japan Earthquake of 2011. Iwate Prefecture was one of the hardest hit prefectures by the Great East Japan Earthquake and subsequent tsunami, with a total of 5,794 people killed or missing. This example is included as an attachment to the Disaster Waste Countermeasure Guidelines (Revised Edition).

Management of disaster waste in Iwate Prefecture was handled by the Resources and Environment Promotion Section of the Environment and Life Department as part of the prefecture's Disaster Countermeasures Headquarters. Immediately after the disaster, it helped with the related office functions for the municipalities. Initially, the prefecture's Disaster Countermeasure Headquarters was using a team system for handling the support and recovery work of municipalities under a larger framework. However, because the work was so diversified, it reviewed the system on March 25, 2011. The individual work was assigned to various teams and the Debris and Waste Countermeasures Team was set up. After that, to execute the vast amount of work in a suitable manner and provide technical assistance to the municipalities, it acquired civil engineering related manpower and clerical personnel with detailed knowledge about contract work and waste treatment laws from both inside and outside the department. However, the acquired manpower and personnel were still insufficient. Through the Ministry of the Environment, it received temporary human resources from other local governments who were knowledgeable about waste management work to reinforce its organization. On April 1, 2012, it was renamed the Waste Special Countermeasures Office, Environment and Life Department. Additionally, as human resources assistance from the central government, the Iwate Prefecture Support Team of the Local Disaster Countermeasures Headquarters of the Ministry of the Environment was assigned at the prefectural capital on June 3, 2011.

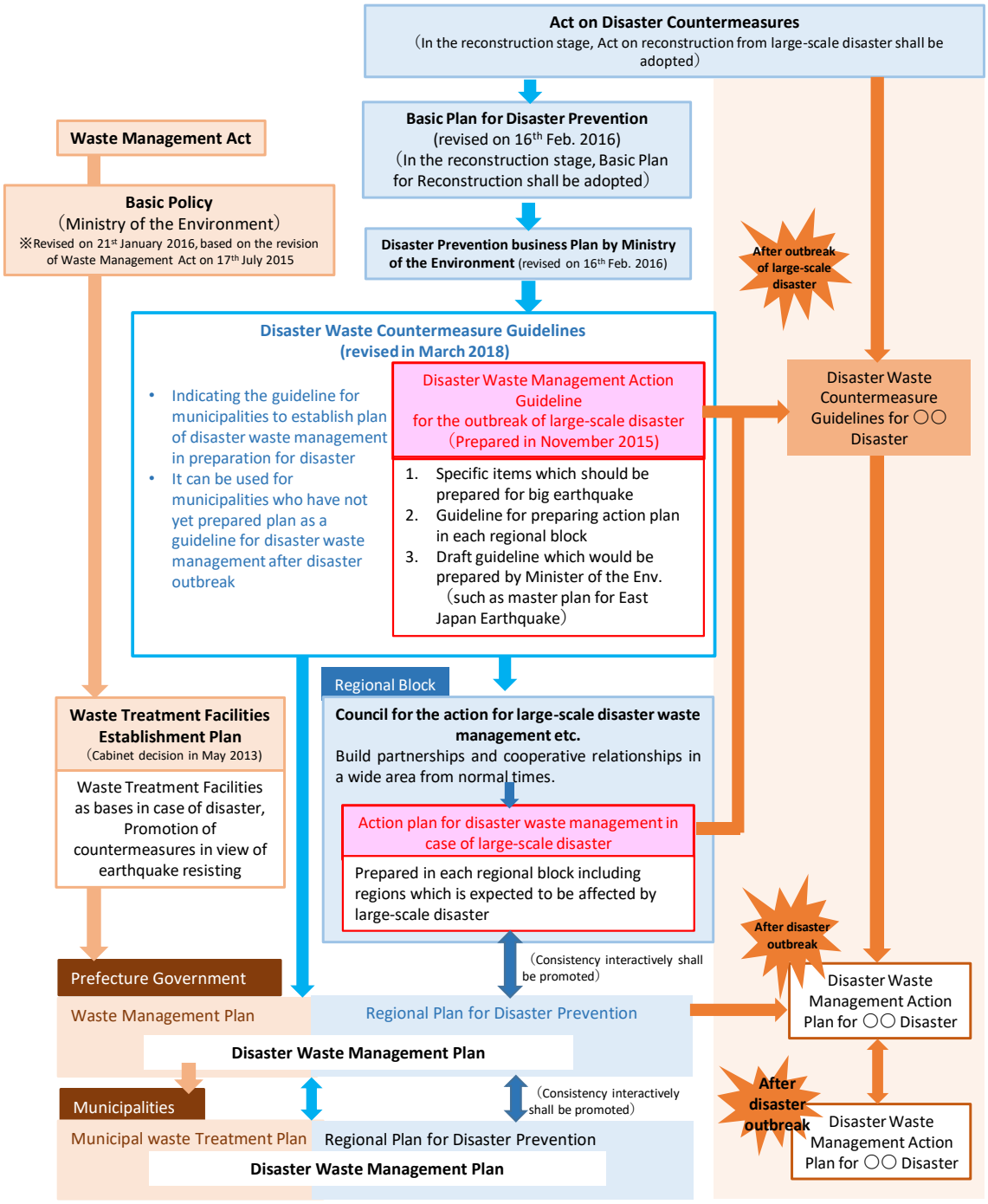


Source: Ministry of the Environment "Disaster Waste Management Guideline (revised)" (2018)

Figure 5-18 Structure of Supporting Office in Iwate Prefecture

(2) Legal System

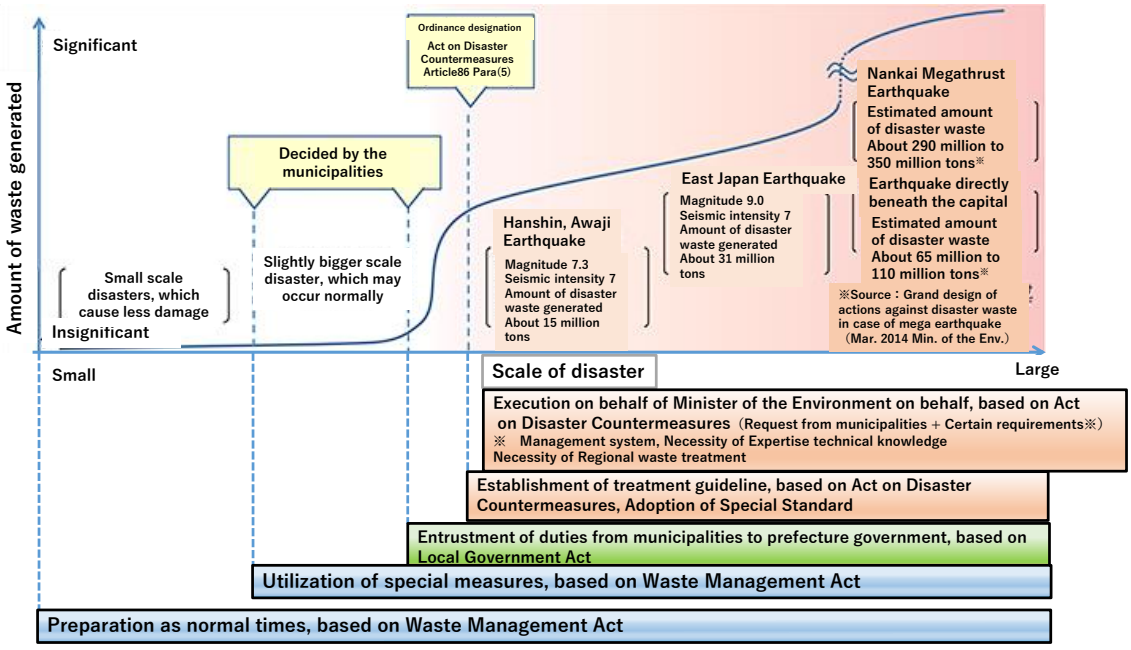
As described earlier, the "Basic Plan to Strengthen National Resilience" established in 2014 based on the *Disaster Countermeasure Basic Act* and the *Basic Act to Strengthen National Resilience* has positioned disaster waste countermeasures as part of the national resilience strengthening policy, and this is the legal foundation for the current disaster waste countermeasures practiced in Japan.



Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (revised edition)" (2018)

Figure 5-19 Laws and Institutions Related to Disaster Waste Management in Japan

As shown in Figure 5-20, the scale of the disaster and the measures to be applied in Japan's disaster waste management are based on the size of the disaster according to the amount of waste generated.



Source: Ministry of the Environment website (Disaster Waste Management Information) "Outline of the *Act for Partial Revision of the Waste Disposal and Public Cleansing Act* and the *Disaster Countermeasures Basic Act*" (Viewed on February 15, 2022)

Figure 5-20 Scale of Disasters and Related Countermeasures Applied in Japan

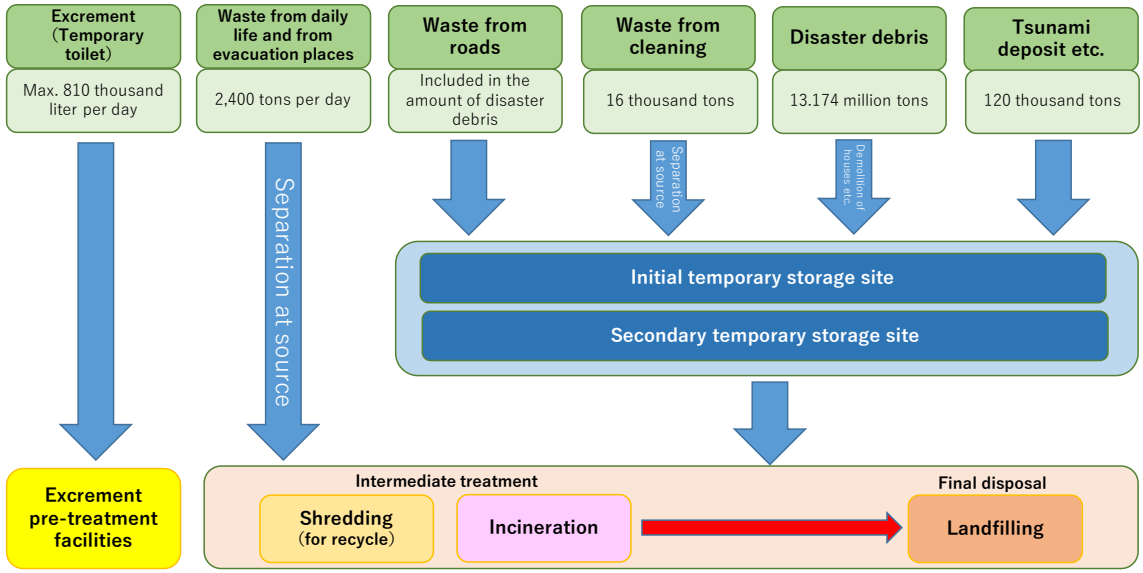
Article 9, Clause 3, Item 3 of the *Waste Management Act* stipulates, "Special exceptions for the establishment of municipal waste treatment facilities related to disasters". However, many local governments have not established the necessary ordinances required for these special exceptions.

As a result, the Ministry of the Environment created the "Ordinance Formulation Examples for Local Governments regarding the Special Exception Measures for Disaster Waste Treatment according to Article 9, Clause 3, Item 3 of the *Waste Management Act*, and is promoting the enactment of the necessary ordinances by the local governments.

(3) Treatment Flow

In Japan, in accordance with the Disaster Waste Countermeasure Guidelines, the municipalities are obliged to prepare a treatment flow for disaster waste.

The Ministry of the Environment's Disaster Waste Countermeasure Guidelines (Revised Edition) describes the basic flow of disaster waste management after a disaster has occurred. In principle, disaster waste is managed according to the descriptions in the guidelines. Furthermore, regarding the treatment flow for disaster waste, the guidelines state that "Local governments shall create a process flow for the methods and quantities of sorting, intermediate treatment, final disposal, and recycling based on the disaster waste treatment guidelines, the quantity of waste, and treatment capacity". Figure 5-21 shows the disaster waste treatment flow of Yokohama city, which is the biggest city in Kanagawa prefecture, next to Tokyo, and has a population of about 3.8 million people.



Source: Yokohama City "Disaster Waste Management Plan in Yokohama City" (2018)

Figure 5-21 Disaster Waste Treatment Flow in Yokohama City

The following is an overview of the basic flow of disaster waste management that is described in the guidelines.

System Development and Support

- The local government must make efforts to understand the scope of the disaster and create a system to manage the waste while considering the roles of other departments and the aid from other agencies.
- The central government and the respective local government must confirm the scope of the disaster, and provide assistance according to the needs while coordinating their mutual actions as best as possible.

Disaster Waste Management

- Depending on the amount of disaster waste produced, the local government will arrange locations for temporary waste dumping sites.
- The local government will consider methods for the collection and removal of disaster waste, and notify the residents of those methods together with sorting methods.
- Disaster waste is sorted, removed/collected from the disaster sites, transported to the temporary waste dump site, and sorted for storage. Additionally, sorting of collected waste is promoted and accepted at the temporary waste dump sites. Handling of disaster waste from destroyed homes and the like will go into full swing after disaster damage certificates are issued to the related victims.
- Hazardous waste and dangerous items will be given collection priority after safety has been assured.
- From the point of view of preventing the deterioration of public hygiene, perishable waste will be given collection priority.
- Disaster waste that is accepted at temporary waste dump sites will be shredded and separated according to how it will be processed or treated, shipped out, and then go to intermediate treatment, recycling, or final disposal.
- To prevent secondary disasters during treatment, environmental countermeasures, monitoring, and fire countermeasures will be implemented.
- In order to implement this plan, there must be an understanding of the amount of each waste category based on the disaster information and treatment results. A process flow must be made that designates the treatment and disposal sites by category and this must be included in an action plan.

Treatment of Household Waste, Evacuation Center Waste, and Human Waste from Temporary Toilets

- The local government must confirm the damage conditions of the treatment facilities and secure the treatment functions.
- The local government must consider the collection methods for household waste, evacuation center waste, and human waste from temporary toilets, etc., and notify these to the residents.
- The local government must know where household waste, evacuation center waste, and human waste from temporary toilets and the like are being generated, and collect, and deliver them to treatment facilities.

Source: Ministry of the Environment “Disaster Waste Countermeasure Guidelines (Revised Edition)” (2018)

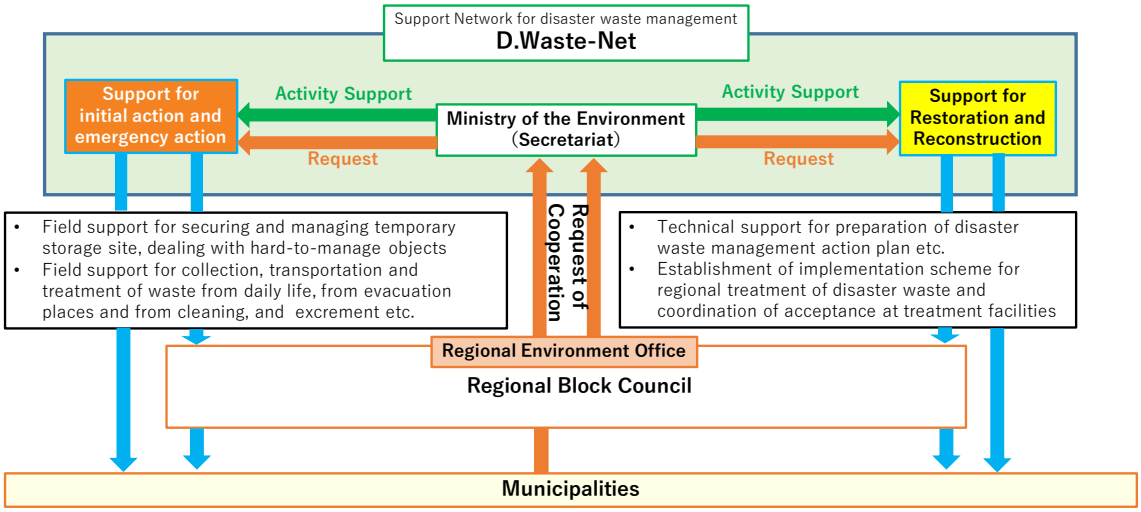
(4) Measures Taken by the Central Government and Municipalities

In Japan, the Ministry of the Environment has developed the D.Waste-Net system to provide aid during disasters. Persons from the government, industry, and academia took part in developing this system. D.Waste-Net also archives the management of waste from past disasters and makes the information available to the public. It is important that related persons work together and past experiences in disaster waste management are archived.

The Ministry of the Environment is at the center of national level disaster waste countermeasures in Japan. Specifically, the ministry formulates legislation, basic plans, and guidelines as described earlier in this section. The ministry also monitors the efforts by the various local governments, makes suggestions as necessary, and at the same time, it archives information about waste from past disasters and makes it available to the public through its "Disaster Waste Countermeasures Site".

The Ministry of the Environment also operates the Disaster Waste Treatment Assistance Network (D.Waste-Net: http://kouikishori.env.go.jp/en/d_waste_net/) as a secretariat to support disaster waste management implemented by local governments. Numerous research and specialized organizations, as well as municipal waste related organizations, are members of D.Waste-Net.

Figure 5-22 shows how D.Waste-Net provides support during disasters.



Source: Ministry of the Environment Website (Disaster Waste Management Information) "D.Waste-Net" http://kouikishori.env.go.jp/action/d_waste_net/ (accessed February 1, 2022)

Figure 5-22 Supporting Structure of D.Waste-Net

Table 5-7 shows the functions and roles of D.Waste-Net during normal times and during disasters.

Table 5-7 Functions and Roles of D.Waste-Net

Normal times	
Assist local governments in making disaster waste management plans, etc., and assistance for development of human resources, disaster training, etc.	
Passes down records, verifications, and knowledge about various actions related to disaster waste countermeasures.	
Maintenance and improvement of disaster response through meetings and exchange of information between D.Waste-Net members.	
Initial response during disasters	
Research and specialized organizations	Dispatching specialists and engineers to local governments where disasters occur; constructing treatment systems; notifying others about how to eliminate and sort household waste and cleaned-up waste; securing and operating primary temporary waste dump sites according to the initial estimates of cleaned-up waste; stench and pest countermeasures; local support for difficult-to-treat waste items; etc.
Municipal waste related organizations	Dispatching waste collection vehicles and workers to local governments hit by disasters; collecting and transporting household waste, human waste; evacuation center waste, and cleaned-up waste; providing local support about treatment; etc. (Includes cooperation with volunteers depending on the circumstances.)
Recovery and reconstruction actions - mid- to long-term measures	
Research and specialized organizations	Estimating information about disaster conditions and disaster waste quantities; making disaster waste management execution plans; technical support to local governments hit by disasters in the form of securing secondary waste dump sites, and intermediate treatment and final disposal sites.
Waste treatment related organizations; Construction related organizations; transport related organizations	Management of disaster waste treatment systems; making implementation plans for wide-range treatment of disaster waste; adjusting the reception at treatment facilities; etc.

Source: Ministry of the Environment Website (Disaster Waste Management Information) "D.Waste-Net" http://kouikishori.env.go.jp/action/d_waste_net/ (accessed February 1, 2022)

The National Institute for Environmental Studies has made a disaster waste information platform on the Internet where it makes the following information available: disaster archives; progress reports by local governments on their management plans; examples of human resources development; emergency response reports; etc.

At the local government level, prefectures and municipalities are preparing disaster waste management plans according to the central government guidelines, but the progress varies among local governments.

5.3 Treatment Technology

The transport, storage, and treatment of disaster waste must be conducted more carefully when compared with regular waste treatment. Additionally, there are difficult aspects, so some unique technologies have been adopted. In this section the main considerations and technologies concerning disaster waste treatment in Japan are introduced.

(1) Collection and Transport

The Disaster Waste Countermeasure Guidelines highlights the importance of carefully considering the following aspects related to the collection and transport of disaster waste.

○ During disasters, there are instances when the amounts of waste will overwhelm the collection system, especially immediately after the disaster. In such cases, perishable waste, hazardous waste, and dangerous items should be given priority for collection and transport.

- Consider securing fuel, consumables such as tires, and measures to take when vehicles break down so that collection and transport of disaster waste are assured.
- Be aware of weather conditions and evacuate collection and transport vehicles before a disaster strikes.
- Study flooding hazard maps and consider possible transportation routes after a disaster.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

Regular dump trucks and waste collection trucks (compactors and waste container trucks) are used for actual collection and transport, but liquid transport trucks may be used depending on the type of waste.

(2) Storage Facilities

During normal times before disasters occur it is important to select suitable temporary waste dump site candidates, for efficient waste management during disasters. When selecting temporary storage sites in developing countries, it is necessary to consider effectiveness of the sites.

Temporary storage sites for disaster waste should generally be located within a distance where residents can transport disaster waste on their own, and it is expected that it may take several years to manage the stored waste. For example, it may be appropriate in some cases to temporarily store the waste next to the disposal site and set up a sorting yard next to it. The impact of long-term storage on residents in the vicinity should be fully considered. Consideration should also be given to the accessibility of large vehicles for transportation, and whether or not the site is close to the activity base of emergency response personnel or to a planned site for temporary housing.

If large quantities of disaster waste are generated during a disaster and the residents collect the disaster waste without any plans, this can cause unsanitary environmental conditions, such as odor, and also safety issues, such as the possibility of fires erupting in the collected disaster waste.

Therefore, it is important that local authorities select suitable temporary waste dump sites during normal times, before disasters strike. Efficient disaster waste processing during disasters is possible if suitable temporary waste dump sites are designated. The Disaster Waste Countermeasure Guidelines explain aspects related to temporary waste dump sites; how the sites will be used, calculation method to determine the required dumping area, and criteria for selecting the candidate sites. The following is an overview.

○ Local governments shall designate temporary waste dump site candidates during normal times and for that purpose they must consider the usage of these sites before designating them.
- Temporary waste dump sites can be divided into temporary waste dump sites for the temporary storage of waste (at which waste may also be separated) and temporary waste dump sites mainly used for the shredding and sorting of disaster waste.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

Table 5-8 Examples for Utilization of Temporary Waste Dump Sites

Use	Description
Temporary waste dump sites	✓ Temporary waste dump sites for the emergency removal of disaster waste that is blocking roads, etc. ✓ Temporary waste dump sites to which residents deliver waste.
Shredding work areas	✓ Areas where temporary shredders and treatment work (sorting, separation, etc.) can be conducted.
Storage areas	✓ Areas where delivered disaster waste exceeds available intermediate treatment capacity can be stored. ✓ Areas where waste that exceeds the landfill operation capacity and/or the available capacity to transport the waste to the landfill, can be stored. ✓ Temporary sites where concrete blocks, tsunami debris, and other reconstruction materials can be stored until they are transported to where they will be used. ✓ Temporary storage for incinerator ash, hazardous waste, etc. (including dangerous items) ✓ Storage sites for recycled items that have accumulated because there is more than needed. However, this does not include sites that only store items for recycling.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

Calculating the Area Needed for Temporary Waste Dump Sites

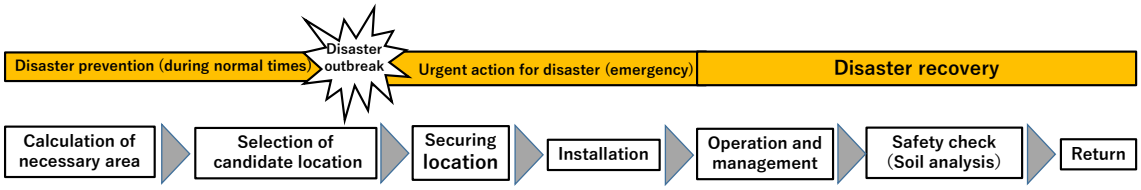
○ Local governments should calculate the necessary area of temporary waste dump sites according to the estimated scale of disasters.

○ Because stacking too much disaster waste can lead to fires, the necessary area should be calculated by keeping the height of the waste to 5 meters or less. Moreover, distance should be kept between stacks of waste to prevent the spreading of fire and for firefighting activities so that immediate action can be taken if a fire should start.

Selecting Temporary Waste Dump Site Candidates

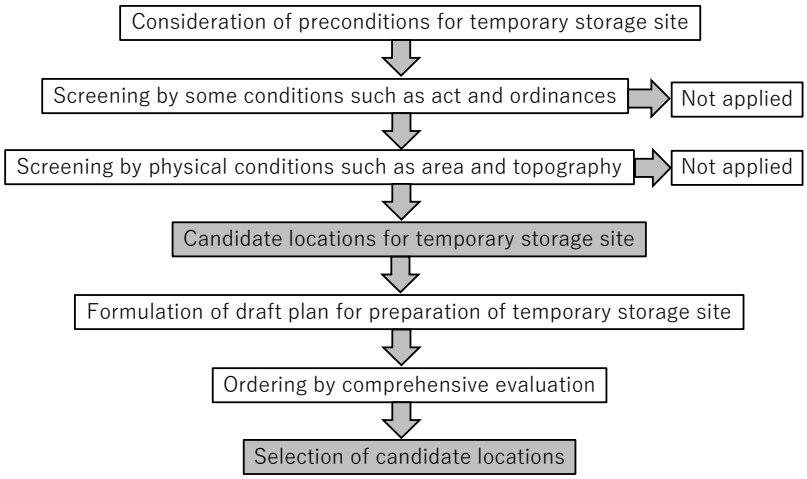
○ Temporary waste dump site candidates must be selected with the understanding that evacuation centers and emergency temporary housing will have priority for open space during disasters. When selecting candidate sites, decisions should be made after consulting with local residents as necessary.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)



Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

Figure 5-23 Flow for Selection of Temporary Storage Site (Example)



Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

Figure 5-24 Condition for Selection of Temporary Storage Sites

(3) Treatment, Recycling and Disposal

Considering treatment and recycling of disaster waste after a disaster occurs, efforts should be made to separate and sort the waste as much as possible. However, it is best to be flexible and operate according to the actual circumstances of each location.

After disaster waste is temporarily stored at the aforementioned temporary waste dump sites, they are transported to treatment facilities. The Disaster Waste Countermeasure Guidelines describe the precautions regarding treatment facilities for disaster waste. The following is an overview.

○ Even during emergency situations, waste should be separated as much as possible when considering future treatment and recycling.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

Table 5-9 describes the treatment methods and precautions for each type of waste during emergencies.

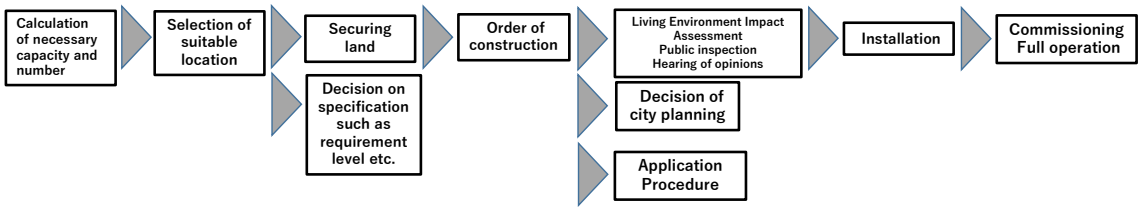
Table 5-9 Treatment Methods and Precautions for Each Type of Waste during Emergencies (Excerpts)

Type	Precautions
Automobiles, ships, etc.	Automobiles and ships that obstruct movement are transported to temporary waste dump sites. Because they may be damaged when they are being transported and there are legal suit risks, the intentions of owners should be confirmed.
	When handling vehicles with high voltage batteries, such as electric and hybrid vehicles, the workers should use insulated protective gear (masks, protective glasses, insulated gloves, etc.), high voltage lines should be cut, and other safety measures taken during transport because of the danger of electrocution.
Batteries	Be careful of electrocution, and use insulated gear, such as cloth or rubber work gloves and long rubber boots.
	If there is a danger of electrocution, do not carelessly come into contact with the battery, and follow the instructions of an electrical technician and a specialist from the manufacturer.
Perishable waste	Perishable waste, such as fisheries waste and food waste, should be treated first starting with items that were not frozen.
Removal of destroyed homes, etc.	For buildings that still maintain some of their structure on their plots, the basic principle is to confirm the wishes of owners or other interested parties. However, if the concerned parties cannot be contacted and there is the danger of further damage, then a land and house inspector should be consulted and if the damaged building has no value, then it should be removed (and dismantled if necessary). In such cases, the state of the building should be recorded in photographs, etc.
	Any valuables, such as precious metals and the like, and items with sentimental value for the owners, such as mortuary tablets and photo albums, should be stored in a temporary or separate location until they can be returned. When the owners of the property cannot be identified, they should be handled according to the *Lost Goods Act*. All items other than the above should be removed and discarded.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

○ Consider the specifications of the necessary temporary treatment facilities based on the estimated quantity and quality of the disaster waste.
○ If it is difficult to treat the disaster waste at municipal shredding facilities, then the installation of temporary shredding machines (portable or fixed) should be considered according to the quantity of disaster waste that needs to be handled.
○ When there are large quantities of mixed disaster waste, either mechanical separation or manual sorting must be considered.
○ The local government that experienced the disaster must consider the need for temporary incinerators depending on the quantity of disaster waste that requires treatment, the treatment period, and the necessary costs.
○ If the local government that experienced the disaster decides that temporary incinerators are necessary, then they must consider the treatment capacities and the number of incinerators necessary for efficient treatment after considering the necessary costs.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)



Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

Figure 5-25 Example of Installation Procedure for Temporary Incinerator, etc.

○ When dismantling and removing temporary incinerators, the applicable laws must be followed, the dismantling and removal methods should be considered after consulting with a Labor Standards Supervision Office and related parties.
○ Because temporary incinerators themselves might be polluted with dioxins and other harmful substances, the surrounding environments must be monitored for dioxins and other toxic matter before, during, and after dismantling and removal.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

Table 5-10 shows the treatment methods and precautions for each type of waste during disaster recovery and reconstruction.

Table 5-10 Treatment Methods and Precautions for Each Type of Waste for Disaster Recovery and Reconstruction (Excerpts)

Type	Precautions
Mixed waste	The removal of hazardous waste and dangerous items from mixed waste should be given priority. Then, the mixed waste should be treated in stages. First, recyclable wood scraps, concrete debris, and metal scraps should be removed. After separating any soil or sand with trommel screens, the mixed waste should be shredded to a uniform size, sorted (magnetic sorting, specific gravity sorting, manual sorting, etc.).
Wood scraps	In treating wood scraps, it is important to first use a trommel screen to remove any soil or sand. If any soil is attached to the wood scraps, they might not be recyclable and have to be disposed of. When incinerating wood scraps with soil attached or moist wood scraps, the heat generation (calories) of incinerators falls, so that addition of combustion improvers or heavy fuel oil may be necessary to maintain the treatment standard (800°C or higher).
Concrete debris	Sort the debris and crush it if necessary so it can be recycled. In order to facilitate recycling, it might be necessary to confirm the safety of the concrete debris by conducting physical characteristics tests, such as strength tests, and environmental safety tests.
Home appliances	After a disaster, products that come under the *Small Home Appliance Recycling Act* (televisions, refrigerators, air conditioners, washing machines) should be separated from other waste and recovered. In general, they are returned to the manufacturer and recycled according to the *Small Home Appliance Recycling Act*. In this case, the handling fees that the local governments pay to the manufacturers are covered by government aid. In the case of the Great East Japan Earthquake, products subject to the *Small Home Appliance Recycling Act* that were significantly deformed by the tsunami, etc. were shredded and incinerated.
	When processing refrigerators and freezers, any food or drink inside them must be removed before treatment to thoroughly separate any kitchen waste.
	Refrigerators and other appliances that use freon gas must be thoroughly separated and stored for recovery of the freon gas.
Tires	Tires can be recycled as fuel by shredding them into chips. Precautions must be taken for fire and the like when processing.
Plasterboard, slate panels, and other construction material	Items that contain asbestos must be appropriately processed and disposed of. Items that do not use asbestos are recycled.
	Determine the treatment method by checking the year the construction material was made and whether it has any marking indicating the use of asbestos.
	For some destroyed construction materials, it will be hard to determine if they are plasterboard. The material that cannot be identified should not be mixed with other waste and it should be stored separately or other measures should be taken.
Asbestos	Destroyed homes should be checked for asbestos before they are removed (or before they are dismantled if necessary). If asbestos is discovered, it should be removed appropriately so that it is not mixed with other disaster waste, and it should be disposed of in a suitable manner for waste asbestos or waste containing asbestos.

Type	Precautions
	In principle, waste asbestos should not be delivered to temporary waste dump sites.
	If items that might contain asbestos are found in the disaster waste stored in a temporary waste dump site, they should be analyzed for confirmation.
	During destroyed home removal (and dismantling if necessary) and shredding work at temporary waste dump sites, workers should wear suitable masks and water should be sprinkled to prevent exposure to asbestos.
Fishing nets	Because fishing nets have weights using lead and other metals, they must be separated beforehand. Fishing nets are either incinerated or put in landfills. However, there are cases in which lead is used in the fishnet wires. So, if fishnets are incinerated, the main ash, fly ash, and slags are analyzed for their lead content and monitoring must be continued during the process.
Fishing gear	Because fishing gear is difficult to shred, the gear from some areas hit by the Great East Japan Earthquake were manually shredded and incinerated.
Fertilizer, feed, etc.	If fertilizer or feed is exposed to water, then the producers should be asked to process and dispose of it.
Marine waste	After the Great East Japan Earthquake, marine waste was treated according to the "Treatment Guidelines for Disaster Waste that Went Out to Sea during the Great East Japan Earthquake" (November 2011). If a large-scale disaster occurs, the involved parties should follow the government's policy.
PCB waste	PCB waste should not be treated by the local governments, but should be transferred to the PCB storing enterprises.
	When removing a destroyed home which had used or stored PCBs or when PCB equipment is discovered during removal, it should be separated from other waste and stored.
	Transformers, capacitors, and other equipment for which it cannot be determined if PCBs are used should be separated as if they are PCB waste.
Batteries	Beware of electrocution, and use insulated gear, such as cloth or rubber work gloves and long rubber boots.
	Follow the instructions of an electrical technician and a specialist from the manufacturer.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

○ In order for local governments to dispose of disaster waste that cannot be recycled or incinerated, it is important for them to secure landfill sites. If landfill sites cannot be secured, then the waste must be handled as part of a wide-area (or inter-municipal) treatment system. If any landfill sites have been secured as part of an agreement, then procedures must be taken to start transportation.
○ If a landfill site has not been secured, economic measures and methods should be used to secure sites to which disaster waste can be transported.

Source: Ministry of the Environment "Disaster Waste Countermeasure Guidelines (Revised Edition)" (2018)

5.4 Challenges and Considerations for Taking Measures

It is difficult to get people to focus on disaster waste countermeasures during normal times but if the measures are not sufficient, then the living environment and sanitation of the disaster areas will be adversely affected, and these could become obstacles to recovery and reconstruction. Therefore, the

local governments must take the lead to prepare so that they can take quick and suitable actions, especially in the early stages when a disaster occurs. It is also necessary to inform residents of the suitable actions to take during normal times so they can take suitable action, such as sorting and transporting waste, during the confusion of a disaster without having to wait for instructions from the authorities.

To those ends, local governments should make disaster waste treatment plans and conduct disaster training during normal times. They should also consider situations in which local treatment is difficult and cooperate with other local governments and related organizations. To promote these activities, the central government is currently making guidelines and manuals for local governments and revising the systems. Although over 60% of local governments have formulated disaster waste treatment plans as of 2021, the current challenge is improving this figure. Another challenge for the future is to improve the practicality of plans so that waste can be processed according to the plans during disasters, and so that each local government can take suitable actions according to their plans during disasters.

With regard to actions after a disaster occurs, a system of subsidies from central government for the management of disaster waste by local governments has been established through legislation. This assures the implementation of disaster waste treatment by local governments and is an important foundation for their promotion.

5.5 Japan's International Cooperation

As an example of Japan's international cooperation related to disaster waste, the debris treatment support provided to Nepal after the major earthquake that struck that country in 2015 and the creation of the "Asia-Pacific Disaster Waste Management Guidelines" are introduced in this section.

From April to May 2015, earthquakes of a maximum magnitude of 7.8 struck the municipality of Gorkha which is about 77 km northwest of the capital city of Kathmandu. Over 50,000 homes were destroyed and there were over 8,000 casualties. In response, the Japanese government, through the Japan International Cooperation Agency (JICA) dispatched an international emergency relief team and provided about JPY 25 million of emergency relief supplies (tents, blankets, etc.) as humanitarian support for the victims. In addition, based on requests from the government of Nepal and the United Nations Environment Programme (UNEP), the Ministry of the Environment provided technical support for formulating disaster waste treatment plans centered on the recycling of the bricks from the buildings destroyed in Nepal.

Source: JICA "Build Back Better-Supporting Nepal for Earthquake Recovery" (2017)

Figure 5-26 Brochure for Introducing the Project for Supporting Nepal for Earthquake Recovery, Prepared by JICA

At the G7 Toyama Environment Ministers' Summit in May 2016, the "Toyama Material Cycle Framework" was adopted for the field of disaster waste management. The G7 countries agreed to provide support for nations and regions in the Asia-Pacific region that experienced natural disasters.

Based on this agreement, from fiscal 2017, the Ministry of the Environment examined the natural disasters occurring around the world, centering on the Asia-Pacific region, and the treatment of disaster waste, then it organized the issues and lessons learned. Based on the Japanese know-how on disaster waste countermeasures and the needs of other countries that were identified through the aforementioned study, in October 2018 the Ministry of the Environment created the "Asia-Pacific Disaster Waste Management Guidelines" to describe the points necessary to accurately, smoothly, and quickly process disaster waste.

The guidelines consist of a broad overview of disasters and disaster waste in the Asia-Pacific region, then describe the necessary disaster waste countermeasures and disaster waste management policies. Information on how to take countermeasures against disaster waste, what kind of institution is necessary for disaster waste management and the preparations that should be taken during normal times are identified.

Source: Ministry of the Environment "Disaster Management Guideline for Asia and the Pacific (Japan Society of Material Cycles and Waste Management)" (2018 English ver.), (2019 Indonesian ver.)

Figure 5-27 Front cover of Disaster Waste Management Guidelines for Asia and the Pacific

The English, Indonesian, Thai, and Nepalese versions of the guidelines were published and made available on the Ministry of the Environment's Disaster Waste Management Information Site[1] and the Japan Society of Material Cycles and Waste Management website[2] for free download.

The guidelines assert the importance of making plans before disasters strike. It asserts that thorough discussions and considerations by the related parties are necessary in order to formulate plans that are realistic and practical. The guidelines especially emphasize that during the initial period immediately after a disaster strikes, there must be specific instructions, including the selection of temporary waste dump sites. Additionally, the guidelines note that after the plans are formulated, it is important that the plan contents are shared among all parties involved and regularly reviewed.

In addition to the above, Japan's Ministry of the Environment believes that suitable waste treatment in normal times is important to protect the environment from the scattering and discharge of waste. Therefore, the ministry is conducting in-person and online training courses for persons in charge of waste management in other countries that are related to Japan's policies and legislation for waste management and help them gain a better understanding of the waste treatment technology in Japan. At the same time, the Ministry of the Environment is conducting courses and human resource

1 http://kouikishori.env.go.jp/action/international_organizations_cooperation/

2 https://jsmcwm.or.jp/international/?page_id=2187

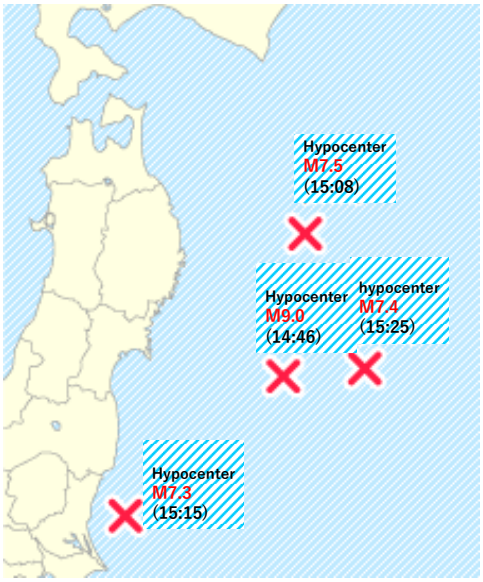
development training so that people in the interested countries can learn the knowledge necessary for introducing waste treatment facilities.

5.6 Cases in the Past

The combination of the earthquake and tsunami caused by the Great East Japan Earthquake in 2011 created approximately 2,000 tons of disaster waste. Due to the cooperation among the various organizations and their quick responses, this waste was treated according to plan by 2014.

An overview of the management of the disaster waste generated from the Great East Japan Earthquake that struck in March 2011 is introduced below as an example of disaster waste management in Japan. It should be noted that the Ministry of the Environment has its "Disaster Waste Treatment Archives" at its Disaster Waste Countermeasures Information Site with records about recent disaster waste cases that are available to the public.

In March 2011, an earthquake with a maximum magnitude of 9.0 struck off the Sanriku coast. This earthquake caused unprecedented human and material damage of 19,630 dead, 2,569 missing, and 6,230 injured. The tsunami that resulted from this earthquake increased the damage.



Source: Ministry of the Environment Website (Disaster Waste Management Information)
http://kouikishori.env.go.jp/archive/h23_shinsai/damage_situation/
(accessed February 23, 2022)

Figure 5-28 Hypocenters of the Great East Japan Earthquake

A vast quantity of disaster waste resulted from the earthquake and tsunami. A gross tonnage of about 20 million tons of disaster waste was generated in 239 municipalities in 13 prefectures. In addition, a gross tonnage of about 11,000 tons of tsunami deposits was confirmed in 36 municipalities in six prefectures.

After the Great East Japan Earthquake struck, the prime minister headed the Emergency Disaster Countermeasures Headquarters that was established under the *Disaster Countermeasures Basic Act*. Additionally, the Deputy Minister of the Cabinet Office headed the Local Countermeasures Headquarters located at the capital of Miyagi Prefecture, and Local Government Contact Offices were installed in the capitals of Iwate and Fukushima Prefectures.

Immediately after the earthquake, the Ministry of the Environment established its own Emergency Disaster Countermeasures Headquarters with the Minister of the Environment at the head. In addition, it installed its Ministry of the Environment Local Countermeasures Headquarters at the Tohoku

Region Environment Office located in Sendai City, and it dispatched Ministry of the Environment employees to the capitals of Iwate, Miyagi, and Fukushima Prefectures. Furthermore, the Ministry of the Environment established the Disaster Waste Countermeasures Special Headquarters under the Ministry of the Environment's Emergency Disaster Countermeasures Headquarters for the coordination of disaster waste treatment for the entire region.

This earthquake caused considerable damage to both movable and immovable properties and the tsunami carried much of the properties to distant locations creating vast quantities of movable and immovable properties with unknown owners. The handling of the ownerships of these properties was an emergent and important issue in treatment of the disaster waste, so the related government ministries held the Review Meeting regarding the Legal Problems related to the Treatment of Disaster Waste. On March 25, the prefectures were notified of the "Guidelines related to the Removal of the Homes Destroyed in the Tohoku Region's Pacific Coast Earthquake".

In May of the same year, the "Treatment Guidelines (Master Plan) for Disaster Waste related to the Great East Japan Earthquake" was created and disaster waste management was to be implemented on the basis of these guidelines.

At the local government level, the three most affected prefectures - Iwate, Miyagi, and Fukushima - established the Disaster Waste Treatment Countermeasures Council made up of persons from the central government's local departments, prefectures, municipalities, and related organizations to comprehend the quantity and quality of the disaster waste, consider systems to process it, clarify the different roles, and formulate and manage the treatment plans. The Council formulated the Disaster Waste Treatment Execution Plan as a concrete treatment plan that was based on the central government's guidelines.

The basic policy in the central government's guidelines was follows: (1) Roughly sort the waste where it was generated, then deliver it to temporary waste dump sites to reduce the amount of mixed waste as much as possible. Also, separate the combustible, non-combustible, and recyclables at the temporary waste dump sites and process in suitable ways to reduce costs and the quantity requiring final disposal. (2) Create treatment process flows by type of waste and using these as a basis, recycle as much as possible. At the same time, the guidelines mentioned the need for more wide-ranged, or inter-municipal treatment.

Based on these guidelines, an overview of the treatment plans made by Iwate and Miyagi Prefectures is shown in Table 5-11. Of the three prefectures most seriously damaged by the earthquake, a separate *Special Measures Act* was enacted for Fukushima Prefecture due to the effects of the environmental pollution caused by the radioactive materials from the damage to the nuclear power plants. The *Special Measures Act* designated the central government to treat the disaster waste in the evacuated areas of the prefecture so that Fukushima Prefecture did not make its own plans.

Table 5-11 Overview of the Disaster Waste Treatment Plans in Iwate and Miyagi Prefectures

Prefecture	Contents of the treatment plan
Iwate	The initial plan estimates based on the number of houses destroyed were 3.98 million tons of disaster waste, 1.85 million tons of tsunami deposits for a total of 5.83 million tons.
	The prefecture was assigned comprehensive authority to handle the administrative matters for the 12 coastal municipalities that suffered the greatest damage and treatment was conducted jointly with specific measures taken by the individual municipalities.
	The cement plants in the prefecture were positioned as central treatment facilities and the existing waste treatment facilities, including private facilities, were utilized to the maximum.
	Two temporary incinerators (195 ton/day) and secondary temporary waste dump sites with shredding and separating facilities for each district (9 locations) were established. After maximizing treatment within the prefecture, any excess was sent to wide-area treatment facilities.
Miyagi	The initial estimates based on the number of destroyed houses and excluding tsunami deposits was approximately 15.5 to 18.2 million tons of waste.
	Excluding Sendai City and Rifu Town which had their unique treatment facilities, the prefecture was assigned comprehensive authority to handle the administrative matters for the 13 coastal municipalities, and it divided the prefecture into four blocks.
	In the four blocks and Sendai City, the prefecture installed a total of 29 temporary incinerators (total capacity about 4,600 ton/day), nine secondary temporary waste dump sites, three delivery stations, and 12 shredding and sorting facilities.
	In order to decrease the quantity headed to landfills, treatment in the prefecture was maximized by means such as solidifying incinerator ash into pellets for recycling, and only any excess was sent to wide-area treatment facilities.

Source: Ministry of the Environment Website (Disaster Waste Countermeasures Information Site) "Disaster Waste Disposal Details" http://kouikishori.env.go.jp/archive/h23_shinsai/implementation/contents/ (accessed February 23, 2022)

As a result of these countermeasures, as of the target date of the end of March 2014, disaster waste treatment was completed in 231 municipalities in 12 prefectures (excluding Fukushima Prefecture) so the target was mostly met.

Photo 5-11 Conditions of Temporary Storage Site (Ishinomaki City, November 2012)

Source: Ministry of the Environment Website (Disaster Waste Management Information) "Before and after completion of temporary waste dumps" http://kouikishori.env.go.jp/archive/h23_shinsai/photo/ba/ (accessed January 29, 2022)

Photo 5-12 Temporary Incinerator (Koizumi Region, May 2013)

Source: Ministry of the Environment Website (Disaster Waste Management Information) "Kesennuma City, Miyagi Photo Archive" http://kouikishori.env.go.jp/archive/h23_shinsai/photo/area_miyagi_kesennuma.html (accessed January 29, 2022)

6 Marine Plastic Waste Issue

Recently, the marine plastic waste issue has been reported through various media outlets and is increasingly attracting attention globally. This section describes the global situation of the marine plastic waste issue, the approach taken by Japan on this issue, and the countermeasures to be taken by each country through the current situation of international cooperation relating to the marine plastic waste issue.

6.1 Global Situation

Since having been reported in the World Economic Forum in 2016, the marine plastic waste issue has become a global issue that needs to be addressed, and the 2018 Charlevoix G7 Summit Communique was formulated making the global approach more active. This issue is being addressed by the private sector also, mainly among the global enterprises.

Since the introduction of plastic products around the 1950s, their applications have expanded due to the ease of processing and stable non-corrosive characteristics, and the gross production amount so far is said to exceed 8.3 billion tons. Of this, 6.3 billion tons are disposed of as waste, much of which is landfilled or dumped in the ocean. Recently, large amounts of plastics were found from the stomachs of dead seabirds and whales in various regions around the world. A video showing a scene in which a plastic straw was removed from the nose of a turtle was aired in the media and this image galvanized global attention to the marine plastic waste issue. The issue of marine plastic waste is now being addressed as a global scale.

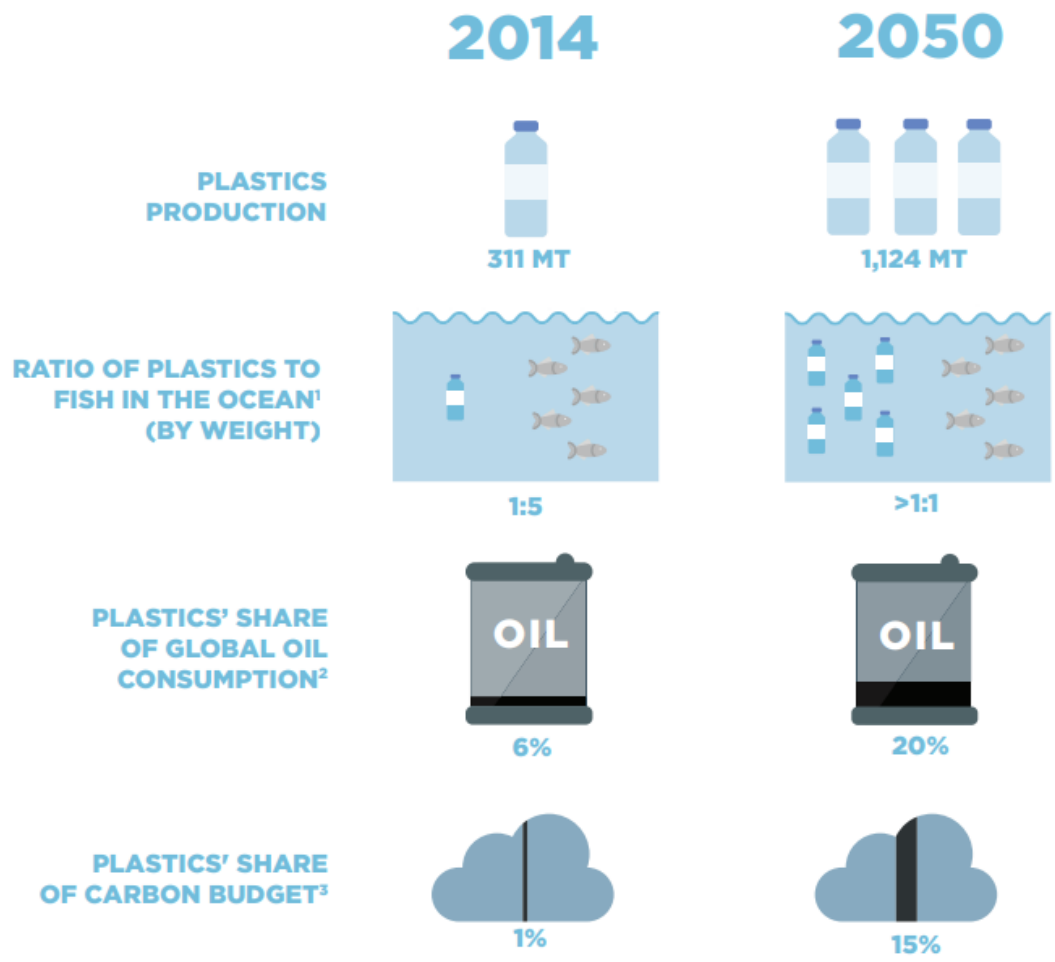
According to the report[3] of the World Economic Forum in January 2016, 90% or more of plastics are not recycled and at least 8 million tons of plastics, mainly plastic containers and packaging materials, flow out to oceans annually. In one estimate marine plastic waste is inflicting damage on the marine ecosystem, fishing industry, and tourism of about 13 billion dollars annually. In addition, the impact of the plastic pollution is concerning in terms of not only the health of marine organisms but also the health of human beings as microplastics - plastics with a diameter of 5 mm or less - are ingested into human bodies through the food chain.

[3] World Economic Forum “The New Plastics Economy - Rethinking the future of plastics” https://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf

Photo 5-13 Plastic Waste on the Beach

Photo 5-14 Sea Turtle and Plastics

Source: DigArt "Plastic bottles and waste washed up on a beach by the incoming tide, covering the entire beach at Umkomaas in KZN, South Africa" (Photo 5-13), Willyam Bradberry "Water Environmental Pollution Problem Underwater animal Sea turtle eating Plastic" (Photo 5-14)



Source: World Economic Forum "The New Plastics Economy - Rethinking the future of plastics" (2016)

Figure 5-29 Expected Increase of Plastics under BAU Scenario

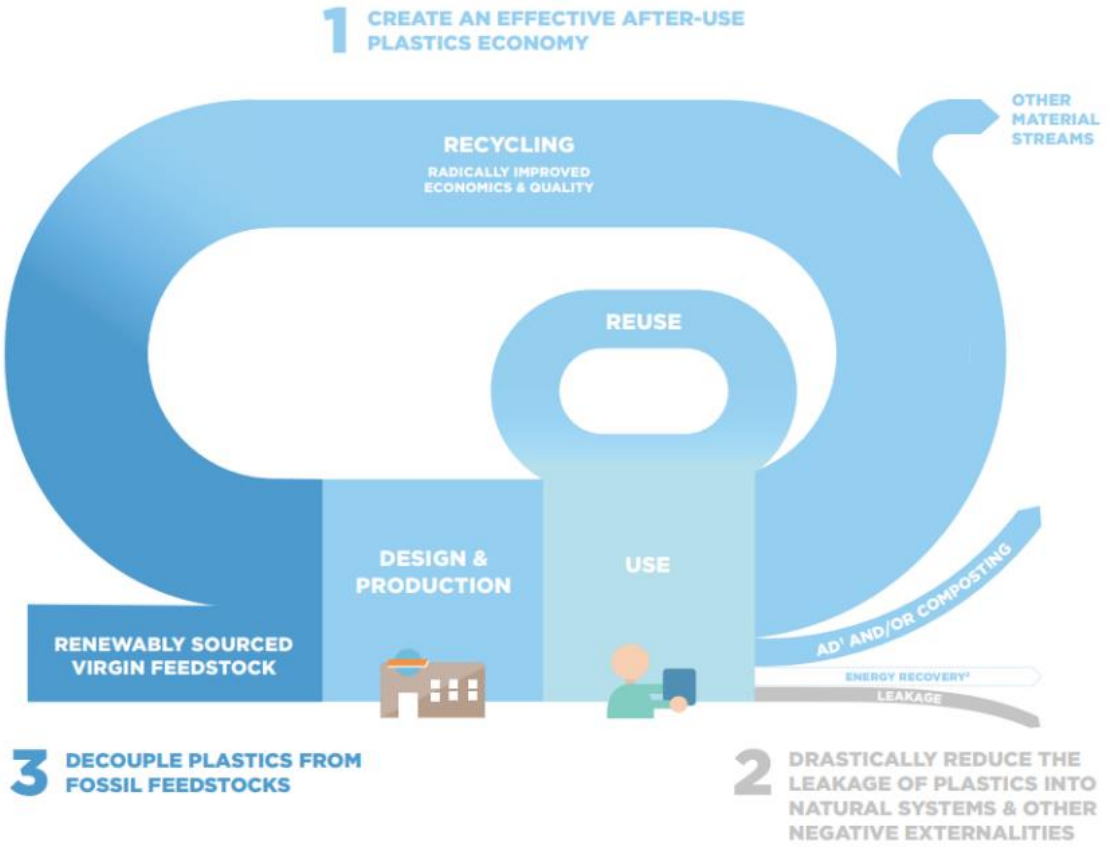
Figure 5-29 was included in the report titled "New Plastics Economy", that was presented by the World Economic Forum in 2016. This report indicates that the amount of plastic waste generated

annually was 0.3 billion tons in 2014 and the amount is expected to increase to 1.1 billion tons annually by 2050, which is equal to the weight of all the fishes in all of the oceans.

Governments and businesses across the world are accelerating their efforts to address this plastic pollution on a global scale. A group of seven advanced countries (G7: France, USA, UK, Germany, Japan, Italy, and Canada) reconfirmed the actions on the marine plastic waste in the Declaration of the Japan G7 2016 Ise-Shima Summit. In the Italy G7 Bologna Environment Ministers' Meeting in 2017, the concerns regarding the marine plastic waste issue and the microplastics issue were expressed and the members reconfirmed further promotion of the accord of science-based indicators and methods for monitoring and assessment and the innovative reduction of disposable plastics and microplastics to avoid the outflow of plastic waste to the marine environment.

In the Charlevoix G7 Summit that was held in Canada in 2018, the Communique, "Charlevoix Blueprint for Healthy Oceans, Seas, and Resilient Communities" was adopted with the recognition of the urgency of the threats towards the ecosystem as well as the commitment to shift to the more resource efficient and sustainable plastic management approach. In addition, Canada, France, Germany, Italy, and UK, and the EU leaders signed "The Ocean Plastics Character", for the cooperation of the private sector and Governments to recycle or reuse 50% of plastic packaging by 2030 and recover all the plastics by 2040.

In the private sector, the efforts are progressing mainly among the global companies. Coca-Cola Company declared "Zero Waste Initiative" in 2018, where all the plastic bottles and empty cans are collected across the world and recycled by 2030. At the same time, the company tackled adaptation of 100% recyclable packaging materials under the "World Without Waste" program and developed the World's first 100% plant-based plastic bottles in 2015. Pepsi-Cola Company also committed, in October, 2018, to an increase of the recycled material ratio for plastic container production to 25% by 2025, and in particular, for plastic bottles, an increase up to 33%. In the Davos Forum in January 2019, plastic waste was addressed as the main theme and P&G and Pepsi-Cola announced their efforts for sales and distribution of the products that use glass and stainless containers to be reusable for up to 100 times. While the marine plastic waste is gathering more attention in this way and the urgency for handling the issue is being cried out, the 4th United Nations Environmental Assembly (UNEA4) was held in Nairobi, Kenya from March 11 to March 15, 2019. With this international momentum, the issue of marine plastic waste was taken as the main agenda. In UNEA4, in addition to the ministerial declaration titled "Innovation Solutions for Environmental Challenges and Sustainable Consumption and Production" that includes remarks on marine plastic waste, a total of 23 resolutions were adopted, including the resolution relating to "Marine Plastic Waste and Microplastics" based on the joint proposal by Japan, Norway, and Sri Lanka and the resolution relating to the "Innovative Pathway to Achieve Sustainable Consumption and Production".



Source: World Economic Forum "The New Plastics Economy - Rethinking the future of plastics" (2016)

Figure 5-30 New Plastics Economy which the World Should Aim for

6.2 Current Situation in Japan

At the G20 Osaka Summit in 2019, Japan called on all countries to be involved in the "Osaka Blue Ocean Vision", and the "MARINE Initiative" was launched in August 2021 to support global measures. This initiative supports developing countries to promote marine waste collection and innovation.

Strongly encouraged by this international momentum, Japan is also promoting countermeasures to combat plastic pollution.

The Ministry of the Environment has continuously conducted surveys and published the results on marine debris, including drifted and adrift litter and marine bed litter, since 2006, in consideration of their impacts on the environment, including the degradation of coastal functions and ecosystems, hindrance to safe vessel navigation, damage to the fishing industry, and secondary disasters caused by drifting medical waste, as well as the damage to the seashore scenery. According to the FY2020 report, most of the microplastics observed in the sea area are polyethylene and polypropylene, and the particle size varies depending on the location of the observation. In addition, based on the results

of these surveys, a “Study Group on Understanding the Actual Condition of Marine Litter and Effective and Efficient Marine Litter Recovery” has been convened and experts are now studying the issue.

At the G20 Osaka Summit that was held in Osaka on June 28, 2019, as the chair country Japan promoted “Osaka Blue Ocean Vision” to each country as a universal global vision. The aim is to completely eliminate extra pollution caused by marine plastic waste by 2050 through the comprehensive approach to life cycle including the reduction of the outflow of plastic waste caused by poor management. This is to be achieved by the improvement of waste management and innovative solutions that are achieved while recognizing the important role of plastics in the society.

In this Summit, Japan also announced the country’s intention to support capacity building and infrastructure development relating to waste management in developing countries. To achieve this objective, the Japanese Government established the “Marine Initiative” to support effective global countermeasures for marine plastic waste, by focusing on (1) waste management, (2) recovery of marine waste, (3) innovation, and (4) capacity enhancement. The Japanese Government supports capacity enhancement of developing countries to promote waste management, recovery of marine waste, and innovation through the following specific policies under this initiative.

Table 5-12 Specific Policies to be Implemented Under the Marine Initiative

Policy	Specific content
International cooperation including bilateral ODA and support via international organizations	Provide a variety of support factors including the support through ODA and international organizations to developing countries through bilateral and multilateral cooperation for the introduction of high-quality environmental infrastructures and related human resource development. Such infrastructures include (1) Capacity building and institution building for waste management and 3R promotion including waste legislation and separation and collection systems (2) Formulation of an action plan by each country relating to marine waste (3) Waste treatment facilities including recycling facilities and waste power generation facilities.
	Globally, train 10,000 waste management personnel by 2025
	Provide ASEAN countries with support based on the "ASEAN + 3 Marine Plastics Debris Cooperative Action Initiative" towards improvement of awareness of non-governmental entities including communities, citizens, and business sectors and formulation of an action plan by each country for marine waste, proper waste management including waste power generation infrastructure, and capacity building relating to 3R.
	Provide support to the South-East Asian region for the monitoring of marine plastic waste and develop human resources.
Promote International development activities by Japanese companies, NGOs, and communities	Promote international development activities by Japanese companies, NGOs, and local public bodies through the development of international businesses associated with industries and collaboration with NGOs and local public bodies for the export of infrastructure such as waste treatment related facilities and support of innovations and technology introduction relating to substitutes for plastics and recycling technology.
	Promote international cooperation by the industrial sector such as support for improvement of plastic waste management in the emerging Asian countries through the Japan Initiative for Marine Environment (JaIME) that was established by the chemical industry group of Japan and the prevention of dispersion and outflow of pellets based on the Memorandum of Cooperation of the industry related to Japan-China plastic processing.
Demonstrating/sharing of best practices	Demonstrate and share best practices (experience, knowledge and technology) in the approaches by the Japanese public and private sectors relating to the waste management and collection of marine waste through the related international conferences (United Nations Marine Conference, Regional 3R Forum in Asia and Pacific) and initiatives.
	Promote the sharing of knowledge relating to countermeasures for marine plastic waste to ASEAN countries through the establishment of "Marine Plastic Waste Knowledge Center".

Source: Ministry of Foreign Affairs Website "MARINE Initiative toward Realization of the Ocean Blue Vision" https://www.mofa.go.jp/mofaj/ic/ge/page25_001919.html (accessed February 17, 2021)

(1) Organization

In June 1989, two directors from the Ministry of the Environment, one responsible for the ministry bureau[4] in charge of proper waste treatment, environmental regeneration and resources recycling and the other heading the section[5] charged with marine environment at the ministry's Bureau of Environment Management, recommended the establishment of systems for marine plastic waste treatment in each prefecture. A notice of this recommendation regarding the development of a management system for drifting waste was issued to the directors responsible for municipal waste management and coastal debris countermeasures of each prefecture. Under this notification, the prefectures were requested to examine the need to develop a system for treatment of drifting waste, which is collected through the collaboration of municipalities and fishery industry organizations within the jurisdiction of each prefecture, as well as for circulation of the information to the municipalities within the respective prefecture's jurisdiction, in order to address the conservation of the marine environment and conservation of the living environment. The central government also requested the municipalities to proactively examine the treatment of drifting waste including the utilization of treatment facilities available to the municipalities. Associated with this request, the central government also requested that prefectures and municipalities work together, participate in the coastal debris countermeasures promotion council, and coordinate between the prefecture regional plan and the waste treatment plan.

At the same time, the Notification, "Regarding the promotion of collection and disposal of drifting waste" was issued from the Fisheries Agency to the Fisheries Departments of Prefectures and the National Federation of Fisheries Cooperatives, and the Japanese Fisheries Association.

In addition, based on the regulation, *Coastal Debris Treatment Promotion Law*, that is described later in this section, the Coastal Debris Disposal Promotion Meeting (Article 30, Paragraph 1) and the Coastal Debris Countermeasure Meeting (Article 30, Paragraph 2) are held regularly. These meetings are utilized for liaison and coordination for the promotion of comprehensive, effective, and efficient coastal debris countermeasures by the related administration organizations and also to reflect on advice of the experts relating to coastal debris.

[4] Ministry of the Environment, Environmental Reclamation and Resource Recycling Bureau, Waste Proper Management Division

[5] Ministry of the Environment, Marine Environment Office, Water Environment Division, Water and Air Environment Bureau

(2) Legal System

In Japan, marine environment conservation and marine plastic waste countermeasures are implemented based on the *Coastal Debris Treatment Promotion Law* and "Plastic Resource Recycling Strategy".

The legal system regulating the marine plastic pollution countermeasures in Japan is based on the *Law Concerning Promotion of Good Landscape and Environment on the Coast to Protect Beautiful and Rich Nature and Disposal of Coastal Debris Related to Conservation of Marine Environment* (hereafter referred to as the *Coastal Debris Treatment Promotion Law*) which was enacted in July 2009. This law was partially amended in June 2018 and renamed the *Law Concerning Promotion of Good Landscape and Environment on the Coast to Protect Beautiful and Rich Nature and Disposal of Coastal Debris Related to Conservation of Marine Environment*.

In accordance with this law, the basic policies were approved by the Cabinet Meeting in March 2010 and as a result of the amendment of the law, the change was approved by the Cabinet in May 2019.

This law applies the following as the basic principles for conservation of good coastal landscape environment and the marine environment: (1) Conservation and regeneration of comprehensive marine environment, (2) Clarification of responsibilities and promotion of smooth waste treatment, (3) Effective control of the generation of coastal debris by 3R promotion, etc., (4) Conservation of marine environment (including microplastics countermeasures), (5) Ensuring appropriate role sharing and collaboration among the diverse bodies, and (6) Promotion of international cooperation.

In addition, based on the 4th Fundamental Plan for Establishing a Sound Material-Cycle Society that was approved by the Cabinet in June, 2018, the Plastic Resource Recycling Strategy was established in 2019. This strategy promotes infrastructure improvements and includes (1) reduction of plastic waste, (2) promotion of recycling (3) promotion of utilization of recycled materials and bioplastics, (4) countermeasures to prevent marine plastic waste, (5) promotion of international development, and (6) technology development, collaboration, and cooperation. Therefore, the central government has adopted the reduction in discharge of plastic waste as a national policy.

In May 2015, "Marine Plastic Waste Countermeasure Action Plan" was formulated at the "Ministerial Meeting on Marine Plastic Waste Countermeasure Action Plan". In the plan, specific countermeasures have been outlined and promoted, various guidelines relating to marine plastic waste are provided, and their utilization is recommended. The main guidelines are listed in Table 5-13.

Table 5-13 List of Various Guidelines Related to Marine Plastic Waste

Title	Intended organization	Purpose/target	Expected utilization method
Guidelines for surveying the actual conditions of scattered waste	Survey bodies/operators that conduct surveys based on orders received from municipalities or local environmental research centers	Checking the actual conditions of the waste scattered over land areas, riverbanks, and riverbeds	Use for long-term monitoring of sites where scattered waste countermeasures are under implementation, setting targets and course of actions, verification of effects of measures taken, and effects of countermeasures
Collection of reference materials for surveying river waste		Checking the actual condition of floating waste through rivers from land areas to sea areas (in principle, 25mm or more in length)	Check the actual condition of river waste and obtain long-term assessment indicators of the targets and course of actions of the countermeasures, indicators of specific measures, and specific countermeasures that were taken.
Guidelines for surveying river microplastics		Checking the actual condition of microplastics in river water within the microplastics flowing out from land areas to sea areas	Promotion of countermeasures for microplastic generation sources through collaboration between municipalities and related organizations and residents based on the survey results.
Guidelines for surveying drifting waste composition		Checking continuously the actual conditions of the drifting waste amount and composition over a long term and changes of these conditions over time.	Obtaining the targets and course of actions of drifting waste countermeasures, indicators of specific countermeasures, and indicators of long-term assessment of the countermeasures that were taken
Guide for creating regional plan based on the *Coastal Debris Disposal Promotion Law*	Prefectures	Formulation or change of the regional plan based on the Coastal Debris Disposal Promotion Law	Comprehensive and effective promotion of countermeasures for costal debris in respective regions
Casebook of measures to control the generation of marine debris	Municipalities, NPOs, and self-governing associations	Effective implementation of marine waste generation control measures	Promotion of control of new marine waste and its collection

Source: Ministry of the Environment Website "About Various Survey Guidelines for Marine Plastic Waste" http://www.env.go.jp/water/marine_litter/post_118.html (accessed February 20, 2021)

(3) Treatment Flow

With regard to marine plastic waste that has drifted ashore, the *Coastal Debris Treatment Promotion Law* stipulates that the responsibility for the treatment of that waste lies with the administrator of the beach where the waste has drifted ashore. At the same time, beach occupants who are not coast administrators are obliged to make efforts to clean up the waste. Municipalities are also required to cooperate with coastal administrators.

On the other hand, when it is clear that much of the coastal debris has flowed from areas of other prefectures, the governor of the prefecture where the waste has flowed in may request the governors of those prefectures where the waste flowed from to dispose of the coastal debris, as well as other related actions. According to the regulation, when a problem in the environmental conservation in the region is identified due to debris from overseas, the Minister of Foreign Affairs is to take the appropriate action.

The collected marine plastic waste is appropriately treated as municipal waste at the treatment facility of the municipality within which the coast is located, however, the treatment may vary depending on the municipality.

(4) Approaches Taken by the Japanese Government and Municipalities

The Japanese Government established the Marine Plastic Waste Countermeasure Action Plan in May, 2019 for the implementation of marine plastic waste countermeasures. The Government, municipalities, and related organizations are implementing the countermeasures based on this Action Plan. The Action Plan is outlined in Table 5-14.

Table 5-14 List of Various Guidelines Relating to Marine Plastic Waste

Purpose	Main organizations in charge of the countermeasures at the Government level
Thorough collection and proper treatment and disposal by the waste management system, etc.	• Containers, packaging, and products (land area) Ministry of the Environment and Ministry of Agriculture, Forestry, and Fisheries • Plastic products used in sea areas such as fishing equipment Ministry of the Environment, Ministry of Agriculture, Forestry, and Fisheries, Ministry of Land, Infrastructure, Transport and Tourism
Prevention of littering, illegal dumping, and unintentional outflow to the ocean	• Containers, packaging, and products (land area) Ministry of the Environment, The National Police Agency, Japan Coast Guard, and Ministry of Internal Affairs and Communications, Ministry of Land, Infrastructure, Transport and Tourism, Ministry of Agriculture, Forestry, and Fisheries, and Ministry of Economy, Trade, and Industry • Plastic products used in sea areas such as fishing equipment Ministry of Agriculture, Forestry, and Fisheries, and Japan Coast Guard
Collection of litter and illegally dumped waste	Ministry of the Environment、Ministry of Land, Infrastructure, Transport and Tourism, Ministry of Education, Culture, Sports, Science and Technology, and Japan Coast Guard
Collection of plastic waste that has flowed into the ocean	Ministry of the Environment, Ministry of Agriculture, Forestry, and Fisheries, and Ministry of Land, Infrastructure, Transport and Tourism
Innovation such as development and conversion of alternative materials	Ministry of Economy, Trade, and Industry, Ministry of the Environment, Ministry of Agriculture, Forestry, and Fisheries, and Ministry of Education, Culture, Sports, Science and Technology
Collaboration of related parties for promotion of the approaches	Ministry of the Environment, Ministry of Agriculture, Forestry, and Fisheries, Ministry of Economy, Trade, and Industry, Consumer Affairs Agency, Ministry of Education, Culture, Sports, Science and Technology, Cabinet Office, and Ministry of Land, Infrastructure, Transport and Tourism
International contribution to promote measures in developing countries	Ministry of Foreign Affairs, Ministry of the Environment, Ministry of Economy, Trade, and Industry
Understanding the actual situation and accumulating scientific knowledge	Ministry of the Environment, Japan Meteorological Agency, Ministry of Agriculture, Forestry, and Fisheries, and Ministry of Education, Culture, Sports, Science and Technology

Source: Ministry of the Environment Website “About Marin Plastic Waste Countermeasure Action Plan” (2019)

6.3 Monitoring

In this Action Plan, indicators are set to effectively implement the activities and check the progress each year. Table 5-15 shows the indicators and monitoring organizations.

Table 5-15 Indicators and Implementation Organizations

Indicator	Implementation organization
Amount of plastic waste properly treated domestically	Ministry of the Environment
Amount of plastic waste littered, illegally-dumped, and scattered that is collected from land areas	Ministry of the Environment
Amount of marine plastic waste collected	Ministry of the Environment
Production capacity and utilization amount of alternative materials (biodegradable plastics, paper, and so on)	Ministry of the Environment and Ministry of Economy, Trade, and Industry
Amount of "properly treated waste" that is increasing through international cooperation	Ministry of Foreign Affairs and Ministry of the Environment

Source: Ministry of the Environment Website "About Marine Plastic Waste Countermeasure Action Plan" (2019)

6.4 Challenges and Considerations

The marine plastic waste countermeasures that were established in 2019 according to the Action Plan are currently being implemented. It is important to maintain flexibility in revising the countermeasures when required according to the situation.

Countermeasures to prevent marine plastic waste in Japan have just commenced, and it is expected that they will be actively promoted in the future, along with countermeasures to manage coastal debris that have been under implementation for some time.

Basically, the countermeasures are implemented according to the contents of the Action Plan that was established in 2019. However, this Plan also needs to be reviewed regularly through deliberations among the concerned parties and surveys and monitoring of the actual conditions.

In Japan, by formulating the "Plastic Resource Recycling Strategy" in 2019, controlling of plastic waste generation itself is progressing through the reduction of the use of one-way plastic, promotion of recycling, and so on.

It is expected that such efforts will gain momentum within the society and lead to solutions of the marine plastic waste issues.

6.5 Japan's International Cooperation

In terms of countermeasures to prevent marine plastic waste, it is important for the world as a whole, including developing countries, to promote efforts to curb the outflow of plastic waste into the ocean. Accordingly, the Japanese Government is promoting effective support for developing countries through the "MARINE Initiative" and other programs mentioned earlier. Examples of surveys and technical cooperation activities recently implemented by JICA are provided in Table 5-16.

Table 5-16 Examples of International Cooperation by Japan Relating to Marine Plastic Waste Countermeasures

Project name	Period	Target region/country
The Project for formation of a center of excellence for marine plastic pollution studies in the Southeast Asian seas	2019 to 2024	South East Asia region
Information collection and confirmation survey on the understanding of the actual conditions of marine plastic waste and utilization of Japanese technologies associated with resource recycling	2019 to 2020	Global
Information collection and confirmation survey on marine plastic issues in the Caribbean region	2020	Caribbean region
Information collection and confirmation survey on the marine waste monitoring and waste power generation towards the sound-material-cycle society of Thailand	2020 to 2021	Thailand
Adviser for marine plastic waste countermeasures in the Caribbean region	2021 to 2023	Jamaica and other countries, Caribbean region

The basic policy of the "Marine Initiative" is to disseminate the knowledge of marine plastic waste countermeasures to ASEAN countries through the establishment of "Marine Plastic Waste Knowledge Center".