Solid Waste Management in the Pacific
The Nine Countries Covered by J-PRISM II

INTRODUCTION

Solid waste management (SWM) in the island countries of the Pacific region is difficult due to the unique geographical conditions, such as small land areas and small populations, and isolation and remoteness from major recycling markets. It is also difficult to secure final disposal sites due to the traditional land ownership system and other social factors. In addition, urbanization and the modernization of lifestyles have led to a significant increase in the variety and volume of waste, making the need for appropriate SWM a common issue for island countries in the Pacific region.

SWM comprises technical systems for undertaking waste storage and discharge, collection and transportation, weight reduction, recycling, and final disposal. This document presents the technical systems for SWM implemented mainly in the capitals of the nine countries covered by the Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries, Phase 2 (J-PRISM II), which the Japan International Cooperation Agency (JICA) has been implementing since 2017. The nine countries are Palau, the Federated States of Micronesia, the Marshall Islands, Fiji, Papua New Guinea, the Solomon Islands, Vanuatu, Samoa, and Tonga.

WASTE GENERATED AND COMPOSITION

Municipal solid waste is a general term for waste generated by ordinary households, stores, offices, schools, public institutions, etc. The amount of municipal solid waste generated is calculated by the sum of the products of the number of generation sources and the waste generation rate.

The generation rate of municipal solid waste per capita is obtained by dividing the total amount generated as calculated above by the population. The generation rate of municipal solid waste is generally 1 kg per person per day, although this varies from country to country, and household waste accounts for around 60% of this. The difference between municipal solid waste generated and household waste generated can be regarded as the amount of business waste generated. The table below shows the generation rates of municipal solid waste (MSW) and household waste (HHW) for each country obtained from the Waste Amount and Composition Survey (WACS) carried out in the Pacific region.

Waste generation rates for each country

PICs	Representative cities/islands	(g/person/day)	
		MSW	HHW
Palau	Koror	1,335	673
Micronesia	Yap	1,292	834
	Chuuk	916	582
	Pohnpei	1,151	743
	Kosrae	1,128	773
Marshall	Majuro	1,413	868
PNG	Port Moresby	672	381
Solomon	Honiara	860	310
Vanuatu	Port Vila	1,070	910
Fiji	Lautoka*	1.147	476
Tonga	Vava'u**	1,210	503
Samoa	Upolu	1,060	387

Source: From WACS conducted by J-PRISM II in 2017 (PNG, Solomon, and Fiji are taken from the Waste Management Master Plan)
* Due to the lack of Suva data, Lautoka values were used.
** Results of the WACS survey conducted by J-PRISM in 2012.

In all countries, the composition of municipal waste is dominated by organic waste, such as kitchen waste, plants, and trees, accounting for 34% to 67%. This is followed by paper (including cardboard), plastics (including PET), and metals and glass, all of which are so-called recyclable waste, but their proportions vary from country to country.

DISCHARGE, COLLECTION, AND TRANSPORT OF WASTE

In order to minimize the impact of waste on the living

Waste composition for each country (weight ratio)

PICs	Palau	Micronesia	Marshall	PNG	Solomon	Vanuatu	Fiji*	Tonga	Samoa
Survey year	2015	2017	2017	2014	2011	2018	2008	2012	2017
Organic waste	55%	35%	34%	40%	49%	62%	68%	49%	43%
Paper/cardboard	6%	10%	21%	23%	17%	5%	13%	6%	18%
Plastics	8%	16%	16%	12%	17%	19%	8%	13%	11%
Metals	5%	8%	10%	15%	8%	8%	3%	13%	8%
Glassware	6%	2%	3%	6%	1%	2%	2%	6%	4%
Textiles	2%	4%	5%	3%	2%	2%	2%	3%	3%
Others	18%	26%	12%	2%	6%	1%	6%	10%	15%

Source: From WACS conducted by J-PRISM and J-PRISM II.
* For Fiji, values are from WACS conducted in Lautoka.
Note: Except in Micronesia, Fiji, and Samoa, glassware includes pottery.

environment, it is essential that it is properly stored and discharged at the source. Waste discharged in accordance with the collection rules is collected by the collection services provided by the public administration and transported to the final disposal site.

Waste is discharged individually or collectively. The former entails putting waste into plastic bags, wheelie bins, or drums, and placing these at the side of the road, or putting it on elevated stands to prevent street dogs and other animals from devouring it. The latter—collective discharging of waste—entails putting waste directly into areas designated by the community or municipality, or in large containers called skip bins.

Collection services are provided directly by local governments, outsourced to private companies, or a combination of the two. In some cases, the collection service is provided directly by the local government, such as in Chuuk, Pohnpei, and Kosrae in the Federated States of Micronesia, and in Ebeye in the Marshall Islands, and Samoa, while in other cases, it is provided by a government corporation, such as in Majuro in the Marshall Islands and Tonga. In addition, in PNG and Samoa, the government outsources collection services to private contractors. In some areas, such as Port Vila City in Vanuatu, the city has introduced a prepaid garbage bag system and provides collection services directly.

Compactor trucks and dump trucks are the most widely used equipment for collection owned by local governments. Although much of this equipment has been provided through development assistance, the municipalities are unable to provide a regular collection service because they do not have sufficient equipment maintenance systems to deal with breakdowns.

The most common methods of collection are curb collection, door-to-door collection, and stationary collection. In many countries in the Pacific region, garbage is placed on an elevated stand to prevent wild dogs and pigs from devouring it. Although this makes the collection process a little laborious, it is widely used because it prevents the litter from being scattered.

In residential areas, the most common collection frequency is once a week, but in some cities, it is two or three times a week. In the city center, daily collection is common, and the waste of large generators is collected as needed by individually contracted collectors. In Samoa, bulky waste is collected every three months.

On the islands of the Pacific region, where settlements are scattered, improving the efficiency of collection is a challenge. On the island of Upolu in Samoa, a private contractor has begun to install GPS on its collection vehicles to digitize collection routes and map them for efficiency. Port Moresby in PNG has also begun to consider the use of GPS to map and optimize collection routes to villages and illegal settlements.

WASTE REDUCTION AND RECYCLING

The small size of island countries and traditional land tenure systems make it very difficult to secure disposal sites. Therefore, the reduction of solid waste is an important issue.

As the composition of the above-mentioned waste shows, about half of the solid waste in the region is organic waste. Many countries also use kitchen waste to feed livestock due to the presence of pig farming. In Lautoka, Fiji, composting of market waste has been ongoing since

Waste collection systems in the Pacific Island Countries

PICs	Representative cities/ islands	Discharge method	Implementation system	Collection system	Service frequency
Palau	Koror	Drum, elevated stand	Direct operation by state government	Door to door	Once a week
Micronesia	Yap (10 municipalities)	Drum, skip bin	Private outsourcing (households with contracts only)	Door to door	Once a week (only some municipalities)
	Chuuk	Elevated stand	Direct operation by state government	Stationary & Door to door	Once a week
	Pohnpei (6 municipalities)	Drum, others	Direct operation by municipalities	Curbside	Once a week (3 municipalities); on request (2 municipalities); no regular collection (1 municipality)
	Kosrae (4 municipalities)	Unified container (skip bin)	Direct operation by state government	Curbside	Once a week
Marshall	Majuro	Wheelie bin	Direct operation by government corporation (MAWC)	Pay-for-service operation	Once a week
	Ebeye	Wheelie bin	Direct operation by local government (KALGOV)	Stationary	Once a week
PNG	Port Moresby	Skip bin, drum, wheelie bin, plastic bag	Private outsourcing	Curbside	Twice a week
Solomon	Honiara (10 zones)	Drum, skip bin, wheelie bin, plastic bag	Direct operation by city (6 zones); Private Waste Operators (PWOs; 4 zones)	Stationary	Once a week
Vanuatu	Port Vila (5 wards + peri-urban area)	Plastic bag	Direct operation by PVCC; PWOs	Door to door; curbside; stationary	2-3 times a week
Fiji	Suva (4 wards + extended boundary)	Plastic bag, skip bin	Direct operation	Curbside	Once a week (suburbs) 3 times a week (council area)
Tonga	Tongatapu	Plastic bag, drum, skip bin, wheelie bin	Direct operation by WAL (households & commercial); PWOs (Commercial)	Curbside; stationary; door to door	Once a week (households); daily (central area); on request (commercial)
Samoa	Upolu (14 zones)	Plastic bag, wheelie bin	Private outsourcing (4 contractors)	Stationary & door to door (partial)	Daily (central area); twice a week (non- central areas); every 3 months (bulky waste)

Source: J-PRISM II documents

2009. Many municipalities in Fiji are also promoting the composting of household waste by subsidizing half the cost of compost bins. Such recycling of organic waste is expected to become more widespread as it contributes to weight reduction and also reduces the deterioration of leachate quality, and methane gas production, resulting from anaerobic decomposition at disposal sites.

Efforts to recycle recyclable waste can be summarized in the table on the following page. In the Micronesian region as a whole, the introduction of container deposit schemes for recycling of beverage containers is well underway, and has already brought about a significant improvement in the collection of recyclable waste, with the beverage container collection rate reaching 90% in some cases. It is therefore expected to spread to other areas in the future.

In the Federated States of Micronesia, the Marshall Islands, and other countries, it has been reported that some

Recycling initiatives in Pacific Island Countries

PICs	Representative cities/islands	Recycling initiatives	Organic waste	Metals	Paper	Plastics	Glassware	Others
Palau	Koror	Beverage container recovery rate via CDS is about 90%. End of life vehicles (ELV) are dismantled and resources are sorted by type by private sector. Glass is c3rushed into construction materials.	✓	✓	✓	✓	✓	✓
Micronesia	Yap (10 municipalities)	CDS is well operated and functioning.		✓		✓	✓	✓
	Chuuk	CDS used be operated but is currently not functioning; CDS was being rebuilt as of 2020						
	Pohnpei (6 municipalities)	Strengthening the operation of CDS by using the private sector.		✓				
	Kosrae (4 municipalities)	CDS is well operated and functioning. Beverage container recovery rate is 90%.		✓		✓	✓	✓
Marshall	Majuro	MAWC is the only recycling operator. CDS is operated and functioning. The MAWC also buys used lead-acid batteries, which are then sold to Marshalls Energy Company.	✓	✓		✓	✓	✓
PNG	Port Moresby	Metals & plastic recycling; PET plastic reuse; beer bottle recycling		✓		✓	✓	
Solomon	Honiara (10 zones)	Small-scale composting; metals recycling; beer bottle collection system	✓	✓		✓	✓	
Vanuatu	Port Villa (5 wards + peri-urban area)	Trial market and household waste composting; recyclable waste collection by one recycling company (CDS is being introduced); beer bottle collection system; recycling association		✓			✓	✓
Fiji	Suva (4 wards + extended boundary)	Market waste composting; home composting; scrap metals, plastics, etc. are exported; waste paper is recycled; beer bottle collection system; battery & waste oils recycling	✓	✓	✓	✓	✓	✓
Tonga	Tongatapu	Food residues fed to livestock; one recyclables collector; waste oil & used lead-acid batteries exported; glass is crushed into construction materials	✓	✓	✓		✓	
Samoa	Upolu (14 zones)	Food residues fed to livestock; returnable bottles for popular beverages; scrap metals are collected and exported; recycling association	✓	✓		✓	✓	

of the collected beverage containers, except for aluminum cans and other recyclable waste, have been kept in storage because no export destination could be found. One of the main reasons for this situation is that, even if recyclable materials are collected and consolidated, the high cost of transporting them to remote international markets puts them at a disadvantage in price competition, making it impossible to export them on a commercial basis. Another factor is that local markets for recycled products are extremely small due to the limited economic scale of PICs, which means that the recycling industry in the region is limited or non-existent. In Fiji, for example, recycling of waste paper and scrap metal is undertaken, but only on a small scale.

It was against this backdrop that, on March 20, 2018, the Secretariat of the Pacific Regional Environment Programme (SPREP) signed a Memorandum of Understanding (the Moana Taka Partnership) with China Navigation Company (CNCo; headquartered in Singapore), a company wholly owned by Swire Group [1]. This will see CNCo's vessels transport recyclable waste containers from Pacific island ports to appropriate ports in the Asia Pacific free of charge, which is expected to promote sustainable recycling activities in the region, as it will boost price competitiveness in the international recycling market.

Furthermore, JICA and PRIF (Pacific Region Infrastructure Facility) [2] are considering and supporting the establishment of a sustainable recycling system in combination with Moana Taka for more efficient collection, accumulation, and transportation of recyclable waste in the region.

FINAL DISPOSAL OF WASTE

In order to reduce the volume of waste for final dis-

Landfill methods for solid waste

Landfill method	Features
Open dumps	Waste is piled up in wetlands and other infrequently used land. The waste gradually decomposes, but the pile of waste expands rapidly as large amounts of plastic and other non-degradable waste are brought in or mixed in. The sanitary environment in the vicinity deteriorates significantly, and spontaneous ignition occurs due to fermentation and combined heat.
Controlled dumps	This method involves excavating land with relatively low risk of groundwater contamination, such as impermeable layers, and dumping the waste. Landfill waste is moved, shaped, and compacted by heavy machinery, and this is a widespread method of disposing of small-scale, non-toxic waste.
Engineered dumps	Landfill waste is covered with a thin layer of soil daily as a measure to prevent flies and other pests from swarming. Ventilation pipes are installed to vent the gases generated from under the soil cover. Leachate often percolates into the underground or seeps to the surroundings and causes problems.
Sanitary landfills (Anaerobic)	An impermeable liner and a leachate collection pipe are installed at the bottom of the landfill, and the leachate is received by the recovery pit, aerated in an oxide pond, etc., and returned to the landfill for use in decomposing organic matter in the waste (closed system). Alternatively, the leachate is drained into the sewer and treated at a sewage treatment facility. This is also called anaerobic landfill because leachate occurs under anaerobic conditions. This landfill method is the mainstream method around the world, but the treatment cost increases because leachate containing a large amount of BOD/COD components and ammoniacal nitrogen continues to be generated for a long period of time.
Fukuoka-Method landfills (Semi-aerobic)	This is the standard method in Japan, which was put to practical use in Fukuoka in 1975. The leachate is collected in a drainage pipe, and air flows into the pipe by natural convection caused by the heat of fermentation of the waste. This aeration effect causes aerobic biodegradation and a rapid decrease in BOD of the leachate. However, the operation and maintenance costs are high because the semi-aerobic conditions cannot be maintained without constant air flow through the leachate collection pipe.

posal, waste collected through collection systems should undergo intermediate treatment. In the PICs, with the exception of Palau, where an intermediate treatment system has been introduced, there is no systematic intermediate treatment, and most of the municipal waste collected is delivered to final disposal sites and sent to landfill.

The table below summarizes the landfill methods for solid waste in the PICs. Before the early 2000s, most landfills in the Oceania region were so-called open dumps[3]. As the capitals and state capitals of each country are densely populated economic centers, and environmental problems caused by waste have become more apparent, their final disposal sites have been developed earlier than in regional cities, with the support of international organizations, and countries such as Japan and Australia.

In Fiji, the Lami Landfill site was known as Mini Smoky Mountain due to the regularity of fires, and the Baruni Landfill site in Port Moresby, PNG, was in a similar state. In Apia, Samoa, and Tongatapu, Tonga, it was common practice to collect and burn garbage in the villages.

To remedy this situation, in Fiji, the EU constructed a sanitary landfill site at Naboro in 2005 as a final disposal site for the solid waste of four municipalities in the metropolitan area. In Tonga, Australia and the Asian Development Bank built the Tapuhia sanitary landfill in 2007, and provided equipment for the landfill as well. In addition, JICA has improved the following landfills as semi-aerobic landfill sites by introducing the Fukuoka Method: Tafaigata Landfill in Samoa (2002); the M-Dock Landfill in Palau (2012); the Colonia Landfill (Yap, 2014), the Tofol Landfill (Kosrae, 2009), and the Dekehtik Landfill (Pohnpei, 1997) in the Federated States of Micronesia; the Bouffa Landfill site in Vanuatu (2009); and the Ranadi Landfill site in the Solomon Islands (2015). In PNG, under the technical guidance of JICA, the National Capital District Commission (NCDC) improved the Baruni Landfill site as a semi-aerobic landfill site with its own funds in 2015, and also acquired the surrounding land for future expansion.

The table below provides an overview of the 13 final disposal sites located in the capitals and state capitals of the nine countries covered by J-PRISM II as of 2019.

Facilities to control leachate and landfill gas have been developed at these landfills, which is a dramatic improvement over conventional open dumping. However, due to inadequate funding for the operation and maintenance of the landfills, and the turnover of workers, some of the fa-

Overview of final disposal sites in the capitals and state capitals of nine Pacific countries

PICs	Representative cities/islands	Name of disposal site	Area	Operation	Target population	Disposal amount (tons/year)	Landfill method
Palau	Koror	M-Dock	5.2 ha	Direct operation	11,754	10,000	Sanitary landfill Semi-aerobic (2012)
	Aimeliik	National DS	6.0 ha	Direct operation	16,629	Starts operation in 2021	Semi-aerobic (2021)
Micronesia	Yap (10 municipalities)	Colonia	0.84 ha	Private outsourcing	11,377	2,000	Semi-aerobic (2014)
	Chuuk	Marine dumpsite	0.2 ha	Direct operation	13,850	2,700	Controlled dump
	Pohnpei (6 municipalities)	Dekehtik	4 ha	Outsourcing	36,196	8,300	Semi-aerobic (1997) Cell-2 (2018-)
	Kosrae (4 municipalities)	Tofol	0.6 ha	Direct operation	6,616	1,500	Semi-aerobic (2009)
Marshall	Majuro	Batkan	1.6 ha	Outsourcing	27,797	12,700	Controlled dump
	Ebeye		1.6 ha	Direct operation	11,408	4,088	Controlled dump
PNG	Port Moresby	Baruni	35.67 ha	Outsourcing	473,368	110,000	Semi-aerobic (2018-)
Solomon	Honiara (10 zones)	Ranadi	4 ha	Direct operation	82,485	25,000	Semi-aerobic (2015) Controlled dump (2020)
Vanuatu	Port Villa (5 wards + peri-urban area)	Bouffa	48 ha	Direct operation	50,944	16,500	Sanitary landfill (2009) Controlled dump (2020)
Fiji	Suva + 3 municipalities	Naboro	15 ha	Outsourcing	342,594	96,000	Sanitary landfill (2005)
Tonga	Tongatapu	Tapuhia	6 ha	Direct operation	74,611	19,000	Sanitary landfill (2007) Controlled dump (2020)
Samoa	Upolu (14 zones)	Tafaigata	6.2 ha	Direct operation (outsourcing field work)	151,364	16,000	Semi-aerobic (2002) Controlled dump (2020)

cilities have not been kept functional and are in a state of controlled dumping.

The semi-aerobic landfill at the Baruni disposal site in PNG has been in operation since 2017, but landfill operations are carried out by a contractor under the management of NCDC. The construction and maintenance of the infrastructure in the Baruni disposal site, including roads and drains, is outsourced to a different contractor. The Baruni landfill is currently receiving about 300 tons of solid waste per day and is operating in good condition.

On the other hand, the Bunat landfill site in Lautoka, Fiji's second largest city, had been a 20-ha site where waste was dumped in the mangroves for many years. In 2010, with JICA's technical assistance, a periphery bank was constructed to prevent the uncontrolled expansion of the landfill, and the site was divided into six landfill sections to spread the waste thinly and promote aerobic decomposition. This has reduced the deterioration of water quality and the generation of landfill gas due to anaerobic decomposition, thereby minimizing the burden on the surrounding environment. This landfill method was devised due to the lack of availability of soil covering materials in the neighborhood, but since it is inexpensive, the city has been able to conduct appropriate landfill management on a sustainable basis. However, it is desirable to monitor the environmental impact quantitatively; for example, by testing the water quality of the fire prevention canal installed in the site.

The remaining capacity at the Ranadi disposal site in Solomon is tight and there is an urgent need to develop a new disposal site. The Greater Honiara Urban Development Strategy and Action Plan, which includes the surrounding area, was prepared in 2017, and includes a reference to a regional disposal site. Because of land constraints in Honiara, securing land for a disposal site is an issue that cannot be solved independently, so a long-term solution

involving the surrounding area is desirable.

In Palau, a new national final disposal site will be built with Japanese grant aid and will be operational from 2021. The disposal site is equipped with all the necessary facilities for landfill operation, including a rainwater drainage control pond, leachate collection pipes and treatment pond, an administration building and weighbridge, and a heavy equipment garage.

RECOMMENDATIONS FOR THE IMPROVEMENT OF SWM IN THE ISLAND COUNTRIES OF THE PACIFIC REGION

1. Quantitative assessment of municipal solid waste management (MSWM)

In order to establish a sound MSWM system, it is necessary to understand the quantity and composition of waste and to quantitatively evaluate the flow of waste from generation to final disposal.

The amount of waste generated and its composition can be estimated by periodically conducting waste amount and composition surveys (in line with the national census conducted every five or ten years), and using population and economic data obtained from the census to estimate the total amount of waste generated and the amount generated by item.

Install a weighbridge at the final disposal site, accumulate data on daily collection and final disposal, and create a waste flow together with the amount of waste generated as estimated above. By analyzing this waste flow, individual issues in the discharge, collection and transportation, and final disposal systems can be quantitatively clarified. This makes it possible to set targets for improvement of the MSWM system and to quantitatively monitor the progress in implementing the plan. The repeated implementation of these procedures will ensure the continuation of proper urban waste management in a sustainable and progressive manner.

2. Selecting the optimal technical system

As described in the next section, the funds for MSWM in the target countries are not sufficient. As a result, the equipment and facilities introduced with support from other countries and international organizations cannot be maintained, and in some cases, the expected results have not been obtained. With regard to operation of final disposal sites in particular, there is strong demand for standards of landfill that allow for more advanced treatment, but the maintenance and management costs of roads, leachate treatment, rainwater collection systems, and landfill gas ventilation pipes are high. If these facilities are not maintained properly, the landfill will eventually become an open dump.

It is important to build technical systems that are sustainable in light of the human resources, equipment, materials, and funds that can be provided at the present time.

3. Securing financial resources for the operation of a sound MSWM system

A sound MSWM system is completed when the discharge, collection and transportation, recycling, and treatment and disposal systems are properly implemented and comprehensively combined. The table on the following page shows the waste management cost per ton calculated from data on waste management expenditure and final disposal volume for 2015 to 2018 collected during J-PRISM II.

The World Bank has summarized the operating costs of these systems by income groups, classified by GNI per capita, as shown in the second table on the following page.

As can be seen from these tables, the target countries except Palau are included in the lower-middle to upper-middle income range, but their waste management costs, including collection and disposal costs, are less than the unit cost of collection at the global level, except for Yap and Pohnpei in the Federated States of Micronesia, Port Moresby in PNG, and Upolu Island in Samoa. Due to inadequate financial resources for waste management, the equipment and facilities that have been improved with the support of international organizations and foreign countries have not been adequately maintained. The result is that the expected improvements have not been achieved.

It goes without saying that adequate funding is essential to make the technical systems described here work as expected.

Some of the J-PRISM II target countries are working to secure financial resources for SWM by introducing prepaid garbage bags, imposing an environmental tax on travelers, and generating surplus funds from a CDS in order to enforce the polluter-pays principle. It is hoped that the countries of the Pacific region will share the results of these efforts and secure sufficient financial resources to sustain and develop the technical systems necessary for MSWM.

Unit cost of SWM in each city

PICs	Representative cities/islands	MSWM* cost (USD/ton)	Collection (USD/ton)	Landfill (USD/ton)	Income level**
Palau	Koror	213	187	26	High income
Micronesia	Yap (10 municipalities)	35			Lower-middle
	Chuuk	16			
	Pohnpei (6 municipalities)	33			
	Kosrae (4 municipalities)	27			
Marshall	Majuro	71			Upper-middle
PNG	Port Moresby	44	29	8	Lower-middle
Solomon	Honiara (10 zones)	11			Lower-middle
Vanuatu	Port Villa (5 wards + peri-urban area)	19	14	6	Lower-middle
Fiji	Suva (4 wards + extended boundary)	16	9	3	Upper-middle
Tonga	Tongatapu	28	22	6	Upper-middle
Samoa	Upolu (14 zones)	62	41	7	Upper-middle

Source: Compiled by the author from SWM cost and final disposal volume data collected by J-PRISM II.
* MSWM: Municipal Solid Waste Management
** Income level:The World Bank's Classification of Countries by Income
(https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups)

Unit cost of waste disposal by income level(USD/ton)

Income level / Waste disposal	Low-income countries (USD 1,035 or less)	Lower-middle-income countries (USD 1,036 to USD 4,045)	Upper-middle-income countries (USD 4,046 to USD 12,535)	High income countries (USD 12,536 or more)
Collection and transfer	20–50	30–75	50–100	90–200
Controlled landfill to sanitary landfill	10–20	15–40	20–65	40–100
Open dumping	2–8	3–10	NA	NA
Recycling	0–25	5–30	5–50	30–80
Composting	5–30	10–40	20–75	35–90

Source: World Bank Solid Waste Community of Practice and Climate and Clean Air Coalition.

4. Capacity development of waste management workers

J-PRISM II has been supporting the improvement of waste management in the Pacific region since 2011, and has been focusing on strengthening the capacity of people involved in MSWM as well as enhancing facilities and equipment. However, in some municipalities, human resources have been replaced and knowledge, skills, and experience in MSWM have not been transferred, making it difficult to effect sustainable improvements.

Since MSWM in island countries is unique and the necessary knowledge, skills, and experience are developed over time, it is extremely important to establish a system that allows the personnel involved in the project to remain involved in MSWM for a long time.

*1 An international group of companies headquartered in Hong Kong, with a range of businesses including shipping, air transport, trading, and real estate.

*2 PRIF is a donor coordination framework covering 13 countries in the Pacific region. It aims to improve the quality of financial and technical cooperation in the Pacific region's infrastructure sector and to enhance the effectiveness and efficiency of aid. JICA is the member from Japan.

*3 Waste brought to these disposal sites is simply discarded through dumping in the open, causing piles of waste.

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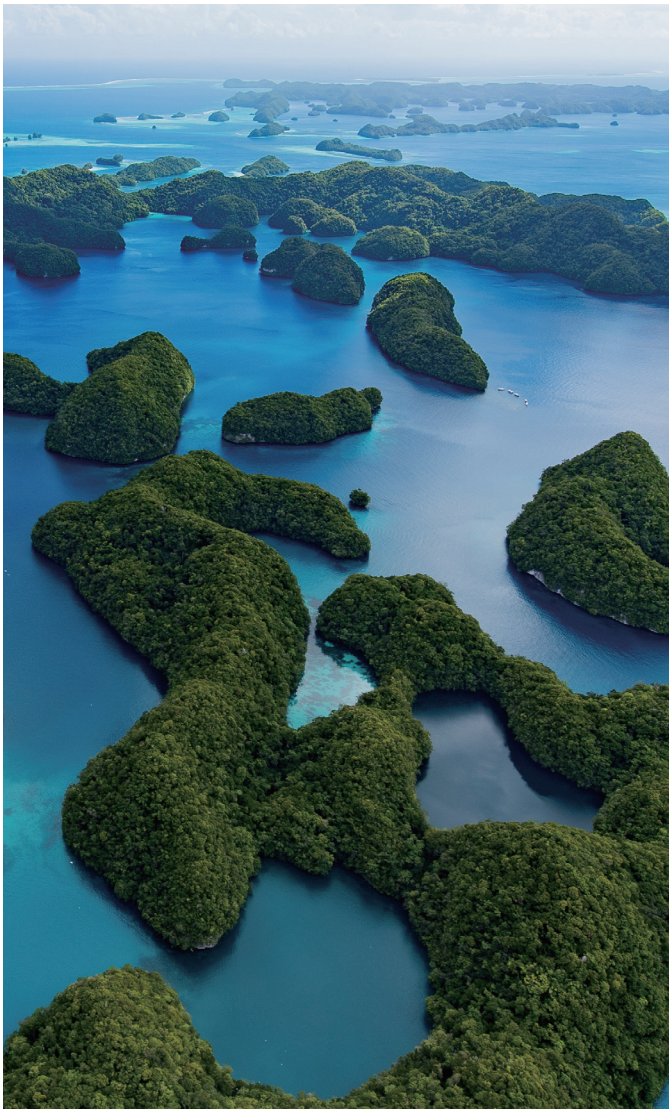

Contact Us:

J-PRISM II Project Office

Office: c/o P.O. Box 240, Secretariat of the Pacific Regional Environment Programme (SPREP), Apia, Samoa

Telephone: (685) 21929 (ext. 324),

Website: https://www.sprep.org/j-prism-2/home