Preliminary Survey Report on Large/Bulky Waste Management in the Pacific Island Countries

June 2004

Global Environment Department
Japan International Cooperation Agency (JICA)

Preface

Waste is considered a critical and urgent issue in the Pacific Island Countries (Independent State of Samoa, Republic of Fiji, Republic of Palau, and Republic of the Marshall Islands), as it is a problem that is getting worse at an alarming speed. Although progress has been seen in the area of municipal waste, thanks to the wide array of improvement measures that have been formulated and implemented, many waste-related problems still remain unsolved.

In this region especially, bulky solid waste such as used cars and home appliances, is expected to increase greatly in the future. In view of this situation, we conducted a survey in these countries with the objectives of finding out the current state of impact such large/bulky waste has on society and the environment, formulating measures to properly treat and dispose of waste at the forecasted volumes, and recommending laws and regulations to facilitate their implementation.

We hope this report will be fully utilized and will contribute to improving solid waste management in these countries.

We would like to extend our deepest gratitude to the related organizations in and out of Japan for their cooperation in this survey and we would appreciate your continued support in the future.

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List of **Abbreviations**

3Rs	Reduce, Reuse, Recycle
CEO	Chief Executive Officer
EQPD	Environmental Quality Protection Department
EU	European Union
FEA	Fiji Electricity Authority
EPA	Environmental Protection Agency
EPR	Extensive Producers Responsibility
FJD	Fiji Dollar
GSVAT	Goods and Service Value Added Tax
JOCV	Japan Overseas Cooperation Volunteers
MNREM	Ministry of Natural Resources, Environment and Meteorology
OERC	Office of Environmental Response and Coordination
PUMA	The New Planning and Urban Management Agency for Apia and Samoa
RMI	Republic of the Marshall Islands
RoHS	Restriction of the use of certain hazardous substances in electrical and electronic equipment
SPREP	Pacific Regional Environment Programme
SV	Senior Volunteer
SWM	Solid Waste Management
USD	United States Dollar
USP	University of South Pacific
VAT	Value Added Tax
WEEE	Waste Electrical and Electronic Equipment
WST	Western Samoa Tara

Exchange Rates Used

1 FJD (Fiji Dollar) = 67 yen
1 USD (US Dollar) = 110 yen
1 WST (Western Samoa Tara) = 41 yen

Chapter 1 Introduction

1.1 Scope of the Survey

1.1.1 Background

The seriousness of waste problems in Pacific Small Island Countries is rapidly increasing and has lead people to understand the importance of executing proper waste management and urgently taking proper actions. Various initiatives aimed at solving problems concerning municipal waste have been taken and progress made, however, there are still many problems caused by other wastes which have yet to be addressed.

This survey, therefore, focuses on those large/bulky waste problems of which improvements have not been initiated. The survey will forecast the negative social and environmental impacts on islands by large wastes such as vehicles and appliances, which are predicted to increase in number. Taking the trend of these problems and the peculiar socio-economic conditions in Pacific Small Island Countries into account, practical improvement measures will be proposed including both non-technical and technical issues executable in island countries.

In these countries, various industrial products such as food and daily goods have been brought in from surrounding countries, and, after their consumption, eventually result in accumulated waste. This begins to have a considerable impact on the countries' vital tourism industries, as well as the public health of residents, which cannot be ignored.

The importation of (used) cars and large home appliances, especially, has increased drastically due to their convenience. But when they are no longer usable, they become difficult wastes to dispose of, posing a great burden on the society. While developed countries, including Japan, have started recycling by way of producers' responsibility, in these island nations with smaller-scale societies, it is a challenge to actualize recycling efforts.

Japan pledged cooperation in the field of waste management at the Japan-Pacific Islands Forum (PIF) Summit Meeting held in May 2003. At the meeting, the South Pacific Regional Environment Programme (SPREP), an international organization for the South Pacific region, has made recommendations on the formulation of a regional master plan for solid waste treatment, and the Japanese government committed to cooperate in waste management measures in line with the regional plan.

1.1.2 Objectives

i. Investigate the current state of large/bulky waste disposal and waste disposal measures, taking into consideration the geographic and social characteristics of the target countries; understand the issues; and forecast future trends.

ii. Recommend methods of large/bulky waste management (to reduce, recycle, transport, and dispose of waste), and identify issues in each recommendation.

1.1.3 Survey Contents

i. Discuss with SPREP, the regional international organization in Samoa, the issues of the survey and its policy.

ii. Discuss with the targeted survey countries' related ministries and agencies what measures are being taken regarding the waste in question.

iii. Collect, investigate, and analyze information pertaining to the status of and issues in the treatment and disposal of the waste in question in the targeted survey countries.

iv. Recommend methods to treat, recycle, and dispose of the waste in question in the Pacific Small Island Countries and identify and analyze issues in each method.

v. Collect and analyze existing statistical materials on the waste in question in the targeted survey countries, conduct future forecasts, and evaluate the waste's impact on the economy, the environment and society.

vi. Summarize the overall findings, study measures for tackling the waste in question in the Pacific Small Island Countries, and analyze the feasibility of such measures.

1.1.4 Survey Policy

Conduct a survey on the following three subjects, make recommendations, and summarize the survey results in a report.

i. Investigate the state of large/bulky waste in representative countries in the region.

ii. Recommend options in treating and disposing of waste that are appropriate for the Pacific Island Countries.

iii. Recommend policies and mechanisms for handling large/bulky waste.

1.2 Survey Schedule

a. Survey Team Members

Name	Responsibility	Company
Akira Doi	Consideration for the environment and society, policies, and institutions	Kokusai Kogyo Co., Ltd.
Keiji Matsuoka	Waste management/treatment, disposal, and recycling	NJS Co., Ltd.

b. Field Survey Schedule

Survey Period: From April 11 till May 8, 2004

Date		Activities
4/11	Sun	Depart from Narita (18:15 NZ090)
4/12	Mon	Arrive at Oakland (07:45), Depart from Oakland (19:30 PH856), Arrive at Apia (00:10), Easter Monday holiday
4/13	Tue	10:00 Courtesy call at JICA Samoa Office 14:00 Meeting with SPREP
4/14	Wed	Survey of Tafaigata Landfill Site, survey of non-ferrous metals and iron collection traders, survey of the number of registered automobiles at automobile inspection facility, survey of import quantity at the customs office, and inspection of 3 large/bulky waste disposal sites
4/15	Thu	Survey the eastern half of Upolu Island 16:00 Courtesy call on the CEO of the Ministry of Natural Resources, Environment and Meteorology (NREM)
4/16	Fri	Morning: Survey of home appliances repair shops and Samoa Polytechnics 16:00 Present report to JICA Samoa Office
4/17	Sat	Depart from Apia (03:50 FJ252)
4/18	Sun	Arrive at Nadi (04:50), Transit to Suva
4/19	Mon	10:30 Courtesy call at JICA Fiji Office 11:30 Courtesy call at Japanese Embassy in Fiji 14:30 Meeting with the Department of Environment
4/20	Tue	9:00 Pacific Centre for Environment and Sustainable Development Dep. USP 14:00 EU Delegation of the European Commission for the Pacific 15:00 Meeting with Maleli Naiova, Sinclair Knight Merz (Fiji) Ltd. 16: 00 Fiji Electrical Authority

4/21	Wed	9:00 Inspect related facilities (Construction of the Naboro disposal site, Lami disposal site) 14:00 Attend seminar on discarded home appliances at the University of the South Pacific
4/22	Thu	9:00 Dialog with returnee researcher Mr. Timothy Young at the Ministry of Health 11:00 Meeting with a returnee researcher of Samoa PUMA 14:00 After meeting with Suva City PHI, visit the end-of-life car disposal site
4/23	Fri	8:00 Meeting with Steven Iddings, WHO 9:00 Present report to JICA Fiji Office Afternoon: Survey of scrap iron recycling plant and disposal site in Ba City, survey of disposal sites and disused automobile traders in Lautoka city Depart from Nadi (22:30FJ820), Arrive at Honolulu (08:30), Depart from Honolulu (13:45 CO001)
4/24	Sat	Arrive at Guam (17:25), Depart from Guam (18:55 CO953), Arrive at Koror (21:00)
4/25	Sun	Organize collected information
4/26	Mon	9:00 Meeting with Tanaka (Expert and Economic Policy Adviser) and other members at JICA Palau Office 10:00 Meeting with returnee researchers Afternoon: Inspect the M-Dock disposal site of the Koror State, scrap traders, automobile repair shops, home appliances repair shops, and Airai State disposal site
4/27	Tue	10:00 Meeting with the management of EQPB (Environmental Quality Protection Board) of the Ministry of Finance, Meeting with the Vice Minister of the Ministry of Finance 13:30 Meeting at JICA Palau Office 15:00 Report to Japan's Charge d'affaires in Palau
4/28	Wed	Depart from Koror (01:45 CO954), Arrive at Guam (04:45), Depart from Guam (08:20 CO956), Arrive at Majuro (19:05) 20:00 Meeting with Charge d'affaires Ikeda
4/29	Thu	10:00 Discussion with the Environmental Protection Agency 13:30 Discussion with the Ministry of Public Works 15:00 Discussion with the Office of Environmental Policy Coordination 16:00 Discussion with the Majuro Atoll local government
4/30	Fri	Field survey of the Majuro Atoll
5/1	Sat	Inspect related facilities, organize collected information materials
5/2	Sun	Compile survey report
5/3	Mon	10:00 Visit and inspect Pacific International, Inc. 11:00 Courtesy call at the Ministry of Foreign Affairs 11:30 Collect data at Internal Revenue Service 11:45 Investigate number of cars registered at the Majuro Police Department 13:00 Exchange opinions with Shimizu, JOCV member (civil engineering) 15:00 Exchange opinions with Fukuda, JOVC member (environmental education) 18:00 Meeting with Charge d'affaires Ikeda
5/4	Tue	9:00 Discussion with the Minister of Public Works 10:00 Visit Japanese construction company in the Marshall Islands
5/5	Wed	15:30 Present report to JOCV Marshall Islands Office Depart from Majuro (19:55 CO956), Arrive at Honolulu (02:35),

		Depart from Honolulu (20:40 PH363)
5/6	Thu	Arrive at Apia (01:05) 9:30 - 12:00 Visit scrap traders with Shida SV and exchange information on the current state of municipal waste management 15:00 Present survey report to SPREP 16:00 Present report to JICA Samoa Office
5/7	Fri	Depart from Apia (01:45 NZ061)
5/8	Sat	Arrive at Oakland (05:00), Depart from Oakland (08:30 NZ099), Arrive at Narita (16:30)

c. Field Survey Route

As shown in Figure 1-1.

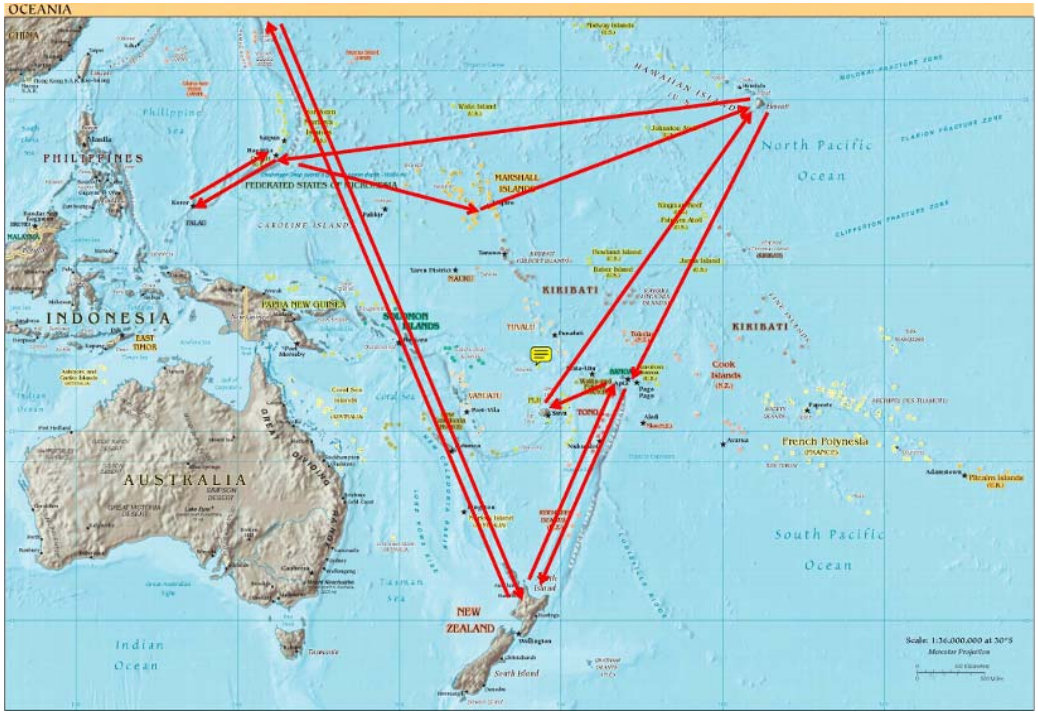


Figure 1-1 Field survey route

Chapter 2 Current State of the Independent State of Samoa

2.1 Geography and Society

The Independent State of Samoa (hereinafter referred to as "Samoa") is situated in the South Pacific. It consists of islands with mountain ranges, the highest of which exceeds 1,800 m. The average annual temperature is 27.5 Celsius and the humidity is extremely high with an annual rainfall of approximately 2,900 mm. While the tropical climate creates a high demand for refrigerators and air-conditioners, the salt content in the strong ocean wind that blows throughout the year creates a harsh environment for both vehicles and home appliances.

Samoa has an area of 2,935 km^2 and a population of 177,000, with most of the people living along the coast. Samoans of ethnic Polynesian descent account for over 90% of the population. The population grew at an extremely slow rate of 1.0% annually between 1991 and 2001, and then in 2003, according to an estimate in the CIA Fact Book, the population growth rate changed to a downward trend of –0.27%. In terms of age composition, 41% of the population is between the age of 0 and 14, 56% is between 15 and 64, and 4% is over 64 years old. The percentage of the population under 14 years old is extremely high because many adults immigrate to countries such as New Zealand, Australia, and the USA, due to the lack of job opportunities in Samoa. Also, the fact that part of the school education is taught in English and that many Samoans are proficient in English makes it easy for them to move to such countries. This "brain drain" has become a barrier to improving the capacity of the Samoan civil workforce.

Samoans live on four islands—the two big islands of Upolu and Savaii, and two smaller islands with less than 1,000 residents each. Among the population of 177,000, 70% live on Upolu Island, and among them, about 35,000 live in the island's capital city Apia. Besides Apia, no other place in Samoa with population over 10,000 is urbanized. Therefore, the waste problem is mostly confined to Apia and its vicinity, and Salelologa, the center of Savaii Island.

The per capita GNP is 1,271 USD (Samoa Central Bank, 1999). About 60% of the labor force is engaged in traditional agriculture, growing copra, taro, etc. In terms of industry, only a beer factory and a Japanese auto-parts assembly plant exist. Because the scale of these industries is small, the volume of industrial waste is also small. All vehicles and home appliances are obviously imported and there is neither technology nor industrial infrastructure to recycle the waste into raw materials.

Tourism is one of the few income sources. However, the tourist industry remains lackluster with few visitors on account of the flourishing tourism industries in nearby countries such as New Caledonia and Fiji, and the difficult routes of access to Samoa from other countries. As a result, there is not much waste resulting from tourism.

Due to the miniscule market size, difficult access to overseas markets, and other barriers, Samoa's trade balance is constantly in the red, forcing it to rely on loans and assistance from other countries.

Over 70% of the population has annual income below 10,000 WST (410,000 yen), withthe annual salary of a government employee at 3,000~5,000 WST (120,000~210,000 yen). Meanwhile, because the island nation incurs high freight costs, even the living allowance of a Japan Overseas Cooperation Volunteer (JOCV) is set at a higher level of 370 USD per month. The electricity cost is 1.8 WST/unit, so that the electricity bill for many families in Apia amounts to 100~200 WST (4,100~8,200 yen), exerting a great burden on the family budget.

A noteworthy source of income is remittances and gifts, including automobiles, often sent during the Christmas season and for other ceremonial occasions such as weddings and funerals, by relatives living overseas. Therefore, despite low per capita GNP and a relatively high cost of living, the actual living standards seem high, and are reflected by the ownership of vehicles and

home appliances.

In 1983, only the capital city of Apia and its vicinity had an electricity supply. Today, over 95% of households have access to electricity. This drastic increase in the availability of electricity is the main cause of rapid diffusion of home appliances. The start of television broadcasting in 1993 also drastically boosted television ownership.

Since 1995, the tariff was lowered twice by a tremendous amount. Therefore, despite the introduction of a 12.5% Goods and Service Value Added Tax (GSVAT), consumers still enjoy a substantial decrease in actual prices. This also accounts for the diffusion of automobiles and home appliances. The customs duty is expected to further decrease in the future, which presents a potential cause for further increases in the ownership of automobiles and home appliances.

2.2 State of Solid Waste Management

2.2.1 Non-technical Systems

a. Self-governing System

The organizational framework of solid waste management (SWM) must be understood in the context of Samoa's regional self-governing system. Samoa has a traditional self-governing system called the *Matai system,* with a chieftain called *Matai* who oversees the self-governance of multiple family units, and where *Matai* conferences are held at a national level. Since the Matai system is still functioning in full force outside Apia, there are no local governments in Samoa. Therefore, the central government is not only responsible for making policy decisions and formulating laws but also governing the capital, Apia, where the *Matai* system has weakened, and providing administrative services to the entire country. The fact that the central government also plays the role of implementation agency is very different from the systems in other countries.

b. Organizational Structure for SWM

The Ministry of Natural Resources, Environment and Meteorology (MNREM) is in charge of SWM, and formulates policies and related laws and regulations. The New Planning and Urban Management Agency for Apia and Samoa (PUMA), a section of the MNREM, provides SWM services and environmental education.

PUMA carries out waste collection services in the islands of Upolu and Savaii. The Upolu Island is divided into six collection zones and part of Savaii Island is divided into two collection zones. Public bidding is used to select a private contractor for each collection zone to carry out waste collection. At present, all eight collection zones have different contractors and each uses its own equipment to carry out waste collection in the designated zone.

This private consignment system started in 2002. The contract period is for two years, and the total contract cost for the two years is paid in installments on a monthly basis.

PUMA directly manages the only waste disposal facility on Upolu Island, the Tafaigata landfill site. The staff assigned to the facility's administration office records the number of vehicles carrying waste into the facility and PUMA reports the data to the Finance Bureau. Based on the data, the Finance Bureau collects waste disposal fees from private operators who bring waste directly to the disposal site. Preparations are currently under way to transfer management of the final disposal site to a private contractor.

Most of the SWM operation has been consigned to private contractors. This is in line with the policy of the Government of Samoa to expand consignment of all government functions to private sector. In Samoa, it is very common for adults to immigrate overseas so that human resources development often results in more transfers overseas, making it very difficult to maintain personnel and improve capacity within the organization. Therefore, the basic policy of consigning to private contractors, which will require fewer administrative personnel on the part of the government, also applies to Samoa's SWM operation.

c. Financial System

There is no need for a household to pay for waste collection, so the Government's only waste-related revenue is the waste disposal fee that private operators pay when they bring waste directly to the waste disposal site. This fee is treated as annual revenue of the Ministry of Finance, rather than being allocated to the budget for waste administration. For this reason, waste administration is financed completely by tax money.

The waste collection cost necessary for Upolu and Savaii is 650,000 WST (26,650,000 yen) for two years. This amount is the total of contract fees paid to eight private contractors. Assuming that PUMA collects 60 tons of domestic waste daily in the two islands, each ton incurs a relatively low cost of about 600 yen. Including the owning cost of equipment, the contract amount is estimated to be at a price below cost.

The final disposal expense is the personnel cost for the six staff assigned to the disposal site. The equipment for landfill, such as a wheel loader and a bulldozer, are rented from private companies whenever necessary. However, between January 2003 and April 2004, after the construction to improve the Tafaigata landfill site was completed, the MNREM did not pay any rental fees. The consignment fee for private contractors to undertake the operation of the disposal facility for two years is budgeted at 200,000 WST (8,200,000 yen) for the fiscal year 2004. Based on existing data, assuming that the total amount of waste brought to the Tafaigata landfill site, including industrial waste, is 90 tons per day, the cost per ton is 127 yen; an incredibly low figure.

d. Capacity to Undertake SWM

From an institutional perspective, the concentration of all powers for policy-making, oversight, and implementation in the MNREM may make it difficult to monitor progress in the implementation. However, with capable leadership in place, such an organizational system can expedite decision-making and implementation, making it an ideal system for a small nation.

PUMA assigns two staff members to Upolu and one to Savaii for waste operation. There is also one more member, who is currently pursuing studies at the graduate school of the University of the South Pacific (USP) in Fiji. There are PUMA members who have attended SWM seminars at SPREP, and they are equipped with the basic knowledge of SWM. Together with these members, PUMA staff is carrying out SWM works under the supervision of senior volunteers from Japan assigned to waste operation. Although these members are in charge of the islands' overall SWM works, they lack the necessary transportation means to carry out duties, making it difficult to supervise the contractors and to carry out environmental education activities.

As it stands now, the basic organizational structure and the collection and disposal systems, which are the two most important structures in SWM, have been established. The environment for upgrading capacity in SWM is finally in place.

The current extremely simple organizational structure is appropriate for Samoa, a country with small population and the constraint of not having enough public employees. Although the system is functioning well, the personnel do not have enough knowledge and technology, making it necessary to further assist Samoa in developing human resources and strengthening implementation capacity.

2.2.2 Technical System

a. Solid Waste Discharge Amount

Samoa does not have any truck scales. Therefore, the amount of waste collected is calculated by converting the number of trucks recorded carrying waste into the disposal facility into weight. Because we could not verify whether the conversion factor was correct or not, we could not completely trust the data. Therefore, we used multiple data to estimate the waste amount.

All the waste collected in Upolu Island is brought to the Tafaigata landfill site. According to PUMA's data, 2,746 tons was brought to the site in December 2003, with general waste

accounting for 850 tons. Because of Christmas, December is the month with the highest waste amount; however, according to the PUMA staff, because there were times when no one was present to record the number of trucks, and disposal fees are determined and collected according to this data, the recorded data and the estimated amount are on the low side.

Table 2-1 shows the collection amount of general waste estimated based on the collection capacity. Derived from the number of collection trucks and the average number of trips, the estimated waste collection amount of Apia city alone is about 40 tons/day. Because waste collected from rural districts has little kitchen waste (most of the kitchen waste seems to have been treated by the residents themselves on site) and consists mostly of non-biodegradable waste such as plastics, and because the collectors can only make one trip a day due to the long transportation distance, the waste collection amount is low, estimated at approximately 10 tons/day. Therefore, the solid waste produced by Upolu Island as a whole is estimated at 50 tons/day. Because there is no waste collection on Sundays, the waste discharge amount is approximately 1,285 tons/month.

Thus, the waste discharge amount is estimated to be in the range of 850 tons/month to 1,285 tons/month. We used the higher figure of 1,285 tons/month to estimate the waste discharge rate.

Table 2-1 Estimated Waste Discharge Amounts

Area	Estimated amount of waste collected (Sundays excluded)	Estimated amount of waste collected	Population	Waste Discharge Rate
Apia area	40 tons/day	34.3 tons/day	40,000	0.858 kg/person/day
Areas on Upolu Island other than Apia and its vicinity	10 tons/day	8.6 tons/day	85,000	0.101 kg/person/day
Entire Upolu Island	50 tons/day	42.9 tons/day	125,000	0.343 kg/person/day

The waste discharge rate on Upolu Island is estimated to be 0.343 kg/person/day, which is quite similar to the value of 0.3 kg/person/day estimated by Amano, a Japanese SWM expert who was assigned to SPREP. The unit-waste generation measured by Sinclair Knight Merz in 1999 was 0.98 kg/person/day. This value is similar to the 0.858/kg/person/day value we estimated for the Apia area, which is close to the level of developed countries.

What these data mean is that waste reduction efforts can, and must, have a real impact in the Apia area and that it is also important to make such efforts in other areas as well to prevent the amount of waste from increasing.

According to PUMA's data on the amount of waste brought into the disposal site, 31% is general waste (from households and stores), 36% is waste consisting mainly of paper from the island's largest factory, funded by the Japanese company Yazaki Corporation (which manufactures mainly electrical components for automobiles), 18% is sludge from septic tanks, and 10% is waste from landscape trimmings carried out by the Department of Agriculture, bringing the total to 95%. Thus, if the volume of general waste is about 1,285 tons/month, the overall waste volume is estimated to be approximately 4,150 tons/month. Although we are not sure how accurate the PUMA data can be, they seem to be on the right track. The data indicated that the waste amount discharged by Yazaki Corporation exceeds the amount of general waste produced by the entire Upolu Island. This shows that the reduction of industrial and business waste has a higher priority than the reduction of general waste.

b. Reduce, Reuse, and Recycle (3Rs)

A deposit system for bottles[1] is in place, levying 30 sene (12 yen) for big bottles and 20 sene for

[1] For example, when beverages are bought in bottles, these bottles' ownership belongs to the manufacture and the one who purchased pays deposit for the bottle. On returning the bottle, the deposit paid would be returned. With this kind of incentive system, reuse of bottles would be encouraged.

small bottles as deposit. For this reason, most families collect the bottles and exchange them for cash. The deposit system results in a very high reuse rate and prevents their disposal.

Senior volunteers from Japan assigned to PUMA are taking the lead in promoting the use of compost for treating kitchen waste.

Because many families raise piglets, it is still very popular today to feed kitchen waste to pigs.

c. Collection and Transportation

As shown in Photo 2-1, it is most common to put general waste on a stand set up at the roadside to prevent dogs and other animals from scattering the garbage. The offices and stores in the capital city of Apia use plastic containers like the one shown in Photo 2-2.

The garbage is not sorted. Collection is carried out twice a day in the capital city of Apia and twice a week in areas outside of Apia.

Photo 2-1 Stand to put general waste on

Photo 2-2 Waste container at a fire station

Private companies contracted by PUMA use their own collection trucks to collect waste. There are three compactor collection trucks, two of which are used for waste collection in Apia. In addition, eight dump trucks are used for collecting waste in Apia. Because Apia is about 6 km from the Tafaigata landfill site, the compactor trucks make four trips a day and the dump trucks make two trips a day. Based on the number of trucks and number of trips, the waste collected from Apia alone is estimated to be 40 tons/day.

On Upolu Island, areas that are farthest away from the disposal site have a transportation distance of about 40 km. Since there is no waste transfer point and the road conditions are unsatisfactory in some places, many areas are limited to only one trip a day. We found waste in plastic bags placed at garbage stands, like the one shown in Photo 2-1, in Aleipata, which is the farthest away from Apia at the southeast corner of Upolu Island, indicating that there is waste collection service in the area.

Waste from residences, small stores, and offices are collected by the regular waste collection service. Business waste and industrial waste from large factories and stores are brought directly to the disposal site by the waste generators themselves in their own trucks. Disposal fees are charged based on the disposal volume.

Bulky home appliances are collected twice a year at the same time as other bulky wastes. The first large/bulky waste collection took place between April 5 and April 24, 2004. Photos 2-3 and 2-4 show discarded home appliances in the city of Apia and the truck carrying them into the Tafaigata landfill site, respectively.

Photo 2-3 Discarded refrigerators

Photo 2-4 Large/bulky waste being transported

d. Final Disposal

The Tafaigata landfill site, in the suburb of Apia, is the final disposal point for waste collected from all over the Upolu Island. As it happens, there is neither a processing nor treatment facility.

The Tafaigata landfill site occupies an area of approximately 40 ha, and in January 2003 with the assistance of a JICA SWM expert assigned to SPREP by JICA, 2.5-ha of this land was developed as the landfill site with a leachate treatment pond, as shown in photos 2-5 and 2-6. Besides solid waste, industrial waste and sludge from septic tanks are also disposed of here in the landfill. Large/bulky waste is disposed of in the excavated area at one corner of the landfill site, as shown in Photo 2-7. The huge volume of waste resulting from trimmings at the parks is brought to another area of the site, piled up, and made into compost using the windrow method, as shown in Photo 2-8.

Photo 2-5 Tafaigata landfill site

Photo 2-6 Leachate treatment pond at Tafaigata landfill site

Photo 2-7 Disposal of large/bulky waste

Photo 2-8 Waste from trimmings is made into compost using the windrow method

The sanitary landfill site is divided into six lots using embankments. Landfill operation is carried out from the highest lot downward. Photo 2-5 shows the second lot from the top, which shows the amount filled in about three months in 2004. Large/bulky waste brought in by dump trucks or compactor trucks is disposed of in the landfill, which is carried out using heavy equipment such as a rented wheel loader to spread the waste evenly on the ground, compress the surface, disperse cover soil (which is inadequate and only carried out partially), and to pile up and turn over trimmings waste.

2.3 State of Large/Bulky Waste Management

2.3.1 Collection System

There is no system for collecting end-of-life vehicles.

End-of life home appliances are collected free of charge twice a year at the time of bulky waste collections.

2.3.2 End-of-life Vehicles

a. Number of Vehicles Registered and Number of Vehicles Imported

Samoa's car inspection system requires annual inspection. Table 2-2 gives a breakdown of vehicles that were inspected during the year between 2002 and 2003. Of the vehicles, 92% are used on Upolu Island and 82% of these are Japanese cars. Because it was in 2002 that the jurisdiction of vehicle inspection was transferred from the Police to the Ministry of Labor, Transportation, and Facilities/Transport Management, we were unable to obtain data from before that year.

In Samoa, automobiles drive on the right side of the road, and currently, the import of vehicles with a right-side driver's seat is prohibited. At present, 15% of the vehicles still have right-side steering; and trucks with right or left-side steering are similar in number. This shows that a considerable number of used vehicles, especially trucks, were imported directly from countries where the driver sits on the right side, such as in Japan, Australia, New Zealand, etc. Table 2-2 includes heavy equipment such as cranes, excavators, etc., though few in number.

Table 2-2 Number of Vehicles Passed Inspection (2002 – 2003)

Breakdown	Upolu Island		Savaii Island		Nationwide	
Unit	Number	%	Number	%	Number	%
Total	10,133	100	834	100	10,967	100
Japanese car %	8,339	82.3	-	-	-	-
Bus	225	2.2	34	4.1	259	2.4
Taxi	1,047	10.3	67	8.0	1,114	10.2
Truck	443	4.4	71	8.5	514	4.7
Light truck	310	3.1	31	3.7	341	3.1
Van	1,152	11.4	40	4.8	1,192	10.9
Pickup truck	2,720	26.8	180	21.6	2,900	26.4
Passenger car	2,598	25.6	236	28.3	2,834	25.8
Motorcycle	22	0.2	17	2.0	39	0.4
Others	1,616	15.9	158	18.9	1,774	16.2

Table 2-3 shows the number of imported vehicles that went through customs. Although the customs office does not record the new and used vehicles separately, according to the staff at customs, new vehicles account for about 20% of the total. The data in the table shows that the units imported are on the rise in recent years. Until recent years, many of the used cars imported were about ten years old. Today, the import of used vehicles over five years old is prohibited.

Table 2-3 Number of Vehicles Imported

Year	2001	2002	2003
No. of vehicles imported	1,291	1,390	1,653
Japanese car percentage	65%	70%	73%

These tables show that approximately 11,000 vehicles are operated now on the islands and Japanese cars account for over 80%. In 2003, approximately 1,600 vehicles were imported and Japanese cars account for about 73%.

b. Estimated Number of Discarded Vehicles

According to Table 2-4, in addition to the vehicles that have passed inspection, 204 other units have either failed inspection or are unaccounted for. These vehicles are thought to have been discarded.

Table 2-4 Total Number of Vehicles in Samoa

Item	Number of units
Total number of vehicles passing inspection	10,967
Number of vehicles failing inspection	130
Unaccounted	74
Total	11,171

Including customs duty (20% of CIF price) and GSVAT (12.5%), automobiles are very expensive. A ten-year old, well-maintained used vehicle costs about 1 million yen, and it isn't easy to buy one. According to senior volunteer Endo who is assigned to the Samoa Polytechnics as an instructor for automobile repair, because automobiles are valuable assets to the islanders, it is common for people to import vehicles that are almost up to the five-year limit (many are gifts from relatives overseas) and use them on average for another ten years with repeated repairs.

Based on the above information, we can assume the following: a) the imported vehicles will be used an average of ten years and the currently registered vehicles will be gradually phased out; b) at present, there are 23,000 families in Samoa (2001 Census of Population and Housing), and because many people move overseas, the current condition of minimal population growth will continue; and c) the number of vehicles imported will peak in five fiscal years from 2003, reaching 2000 units annually, and thus the number of registered vehicles will peak at 20,000. The trend in the number of registered vehicles, imported vehicles, and discarded vehicles based on these assumptions are as shown in Figures 2-1 and 2-2. When the number of imported vehicles and the number of registered vehicles become steady, the number of imported vehicles will eventually be almost equal to the number of vehicles to be discarded. From the current number of less than 200 units, the number of discarded vehicles will increase drastically.

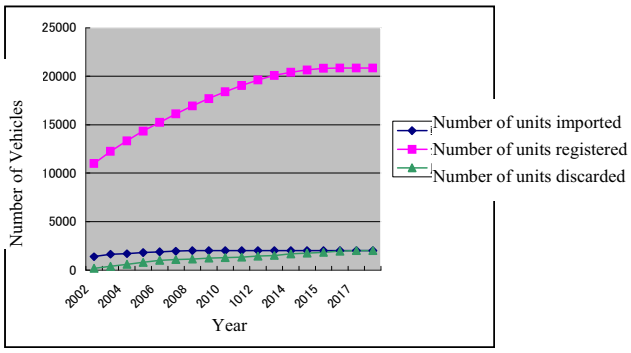


Figure 2-1 Secular Changes in the Number of Vehicles Imported, Registered, and Discarded

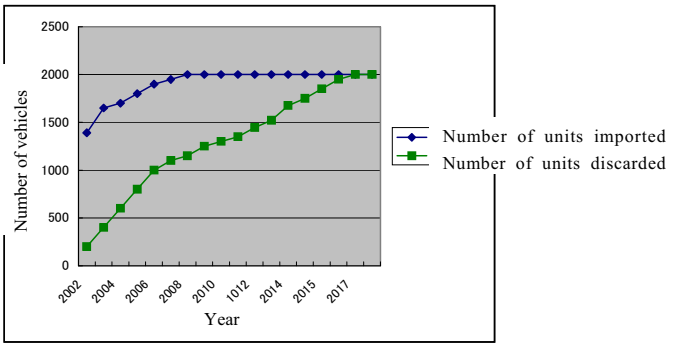


Figure 2-2 Secular Changes in the Number of Vehicles Imported and Discarded

c. State of Automobile Disposal

We interviewed many people and drove about 100 km but did not find any illegally discarded vehicles either on public or private land. End-of-life vehicles are either left at a repair shop or garage, (there are some abandoned vehicles but most are left there waiting for the retrieval of car parts and components), or in the yard of a private residence. Photos 2-9 and 2-10 show vehicles left at a repair shop and photos 2-11 and 2-12 show vehicles left in the yard of a private home.

We drove through the eastern side of Upolu Island to find out the number of discarded cars, and found fewer than 100 units. From this, we can estimate that the total number of discarded vehicles in the country is about 200–300 units.

The MNREM requested us to include heavy construction equipment, such as discarded bulldozers, in the large/bulky waste targeted in this survey. Such equipment includes, for example, one shown in Photo 2-13, which was left on private land and the landowner had filed a complaint; and another shown in Photo 2-14, a gravel collecting machine left in the sea. We have, however, decided not to include them in our survey, because these machines are owned by the Ministry of Public Works and Transportation, and the responsibility for these machines is clear.

Photo 2-9 Vehicle discarded at a repair shop

Photo 2-10 Vehicle discarded at a repair shop

Photo 2-11 Vehicle discarded in the yard

Photo 2-12 Vehicle discarded in the yard of an uninhabited house

Photo 2-13 Heavy equipment discarded on private land

Photo 2-14 Heavy equipment discarded in the water

2.3.3 End-of Life Large Home Appliances

Ownership of Bulky Home Appliances and Number of Imported Units

Table 2-5 shows the ownership of home appliances in Samoan families.

Table 2-5 Ownership of Home Appliances

Item	Usable	No longer usable
Television	14,443	1,160
Refrigerator/freezer	12,118	795
Radio	20,434	340
Video	9,804	1,026
Computer	1,217	105
Telephone	5,189	337
Cell phone	1,945	154

Source: 2001 Census of Population and Housing, AusAID

According to an official at the MNREM, Samoans consider home appliances in the following priorities: (1) radio, (2) television, and (3) refrigerator. Table 2-5 generally confirms this trend.

Since the purchase of televisions in Samoa started and increased drastically after TV broadcasting began in 1993, many televisions are approaching their time for replacement.

Table 2-6 is the record of bulky home appliances going through customs. According to the data, only 30 – 90 refrigerator/freezer units went through customs annually. These numbers are extremely questionable given the ownership of refrigerators/freezers at 12,000 units. We conducted interviews at two retail stores and found the two stores alone sold 400 units annually. We concluded, therefore, that the data from customs are not reliable.

Not too many families own computers, but because computers are used at a large number of government agencies and business offices, we need to obtain further data. Furthermore, while the diffusion rate of microwave ovens is still low, electric ovens have been in use for a long time. The customs record shows that the total number of microwave and electric ovens exceeds the number of refrigerators, freezers, and washing machines combined.

Table 2-6 Numbers of Home Appliances Imported and Owned

Category	Import Statistics*1			Ownership*2	
Item	2001	2002	2003	Usable	Unusable
Television	124	76	89	14,443	1,160
Refrigerator	42	13	13	12,118	795
Freezer	49	13	19		
Washing machine	54	41	35		
Microwave oven	31	20	36		
Electric oven	7	5	9		
Air-conditioner	4	8	12		
Total	311	176	213		

*1: Ministry of Revenue

*2: 2001 Census of Population and Housing, AusAID

a. Forecast of Large Home Appliances to be Discarded

Table 2-7 shows an estimate of the ownership of bulky home appliances, including televisions, refrigerators, freezers, washing machines, computers, air-conditioners, electric ovens, and microwave ovens, in 2003 and in the future (2013).

Table 2-7 Estimated Ownership of Bulky Home Appliances at Present and in the Future

Year	2003			2013		
No. of households	23,000			24,000		
Item	Ownership (%)	Owned	Discarded	Ownership (%)	Owned	Discarded
Television	65	14,950	748	80	19,200	1,920
Refrigerator/Freezer	55	12,650	633	80	19,200	1,920
Washing machine	40	9,200	460	80	19,200	1,920
Electric oven /Microwave	40	9,200	460	60	14,400	1,440
Air-conditioner	10	2,300	115	20	4,800	480
Computer	10	2,300	115	20	4,800	480
Total		50,600	2,530		81,600	8,160

For the 2003 estimate in Table 2-7, the television, refrigerator, and freezer categories use more or less the same figures as in Table 2-5. The diffusion rate of washing machines is estimated to have reached 40% due to their rapid rise in popularity as water services improve. Considering the high import quantities of electric ovens and microwave ovens recorded, their diffusion is estimated to be at the same level as washing machines. The ownership rate of air-conditioners is estimated to be low as electricity is very expensive in Samoa and air-conditioners do not work well in traditional Samoan-style houses without walls (known as fales). Deriving from Table 2-5, we assume that the ownership rate of computers is the same in offices as in households and we set it at 10% of the number of households. The future ownership rates of these appliances are estimated based on the current data and interviews conducted. The frequent power outages, sudden surges in power voltage, and extremely high humidity in Samoa together create a very unfavorable condition for home appliances. As shown in Table 2-5, 8% of television sets were already out of order in 2001. Although quite a number of used refrigerators and freezers were imported and put in use by fully repairing them, due to the low number of new refrigerators and freezers, their service life before disposal will be short. Therefore, the quantity of home appliances to be discarded is estimated with an assumption that the service life of those appliances is 10 years after the commencement of their use in Samoa.

Taking into consideration that Samoa is in a stage in which home appliances are becoming rapidly more popular, we calculated the annual rate of disposal at 5% of the current ownership and 10% in the future.

To Samoans, home appliances are as valuable as automobiles. When the appliances fail, Samoans will not easily discard them but try to repair them for further use. As shown in photos 2-15 and 2-16, the customers bring the appliances to repair shops. The shops repair the appliances that can be repaired and bring the ones they cannot repair to the Tafaigata landfill site. The repair shop in Photo 2-15 reports about 200 units of appliances it cannot repair each year and the shop in Photo 2-16 reports about 40 units, which they dispose of. According to the PUMA staff, four repair shops near Apia are similar to the one in Photo 2-15. We multiply 240 units by 2, which totals about 500 units of waste disposed of by these repair shops each year. This figure is substantially different from the number of disposal in Table 2-7. From Table 2-5, we can assume that there is a trend of keeping many of the unusable appliances at homes. Because PUMA has started the collection of home appliances free of charge, it is possible that the disposal volume of end-of-life home appliances that were formerly kept at home will increase drastically in the future.

Photo 2-15Medium-size repair shop for home appliances

Photo 2-16 Small-size repair shop for medium-size home appliances

2.4 Conditions Related to Countermeasures

a. Repair Technology

a.1 Repair of Automobiles

Since over 20 years ago, JICA has been providing assistance in automobile repair technology. Even today, JICA is dispatching senior volunteers to Samoa Polytechnics to teach repair technology. In addition to having over 10 graduates from Polytechnics each year, there are also graduates from technical schools, totaling over 30 graduates. Even taking into account the high number of Samoans immigrating to developed countries, there should still be a large number of technicians left in Samoa.

Although there are no large-scale repair shops, it was confirmed that Apia has five shops with several technicians and the eastern part of the island has one shop. In addition, there are also many individuals operating out of their garage to do the repairs. These facts show that Samoa has a certain level of automobile repair technology, which contributes to the reduction of large/bulky waste. This is largely attributable to the technological assistance that JICA has provided in automobile repair technology over the years.

However, compared to the condition of Fiji's automobile repair industry, Samoa's automobile sales market is still in its nascent stage and the system for supplying automobile parts and components is not well established.

a.2 Repair of Home Appliances

In terms of the technologies for repairing home appliances, Samoa Polytechnics offers courses in motors, compressors, etc., as well as courses on television. Each year, approximately 10 and 20 people graduate from these courses, respectively. Because televisions have started using

many packaged electronic components, such as IC, it has become increasingly difficult to obtain some components or to exchange the packaged components in Samoa. Consequently, it is planned that some television repair courses will shift their focus to computer repair technology.

The towns' repair shops do quite a thorough job in repairing appliances that include motors and coolant, right down to the repair of the coolant pipes, such as refrigerators, washing machines, and air-conditioners.. These repair shops help lengthen the service life of home appliances as well as reduce waste. This is also largely attributable to JICA's technological assistance to Samoa Polytechnics over the years.

However, electronic technology has made great strides in recent years, and many parts have become a black box, making the repair of home appliances increasingly difficult. In other words, although Samoa has the old technology to repair home appliances, with new electronic technology making inroads into home appliances, it will become more difficult to lengthen the service life of appliances through repair.

b. State of Recycling

The West End Co., Ltd. collected approximately 190 tons of non-ferrous metal scrap (aluminum, stainless steel, copper, etc.) in 2003 and exported it to Singapore. According to the company, although it is possible to collect and export iron scrap to Indonesia, the undertaking is not profitable enough. In American Samoa, the company also exports compressed used cars using government subsidy. However, due to the suspension of this subsidy, the export has stopped.

The Greenland Construction Company exports only iron scrap parts having a large bulk density that have been discarded by utility companies by loading this iron scrap into small containers.

Some automobile tires have been used as curb dividers or planters, but these methods of usage only account for a small portion of the scrap tires.

c. Measures for the Handling of Hazardous Substances Resulting from the Treatment and Disposal of Large/Bulky Waste

The fact that batteries are discarded everywhere implies that there is almost no awareness of the hazardous substances that result from the disposal of automobiles and bulky home appliances.

2.5 Evaluation

2.5.1 Evaluation of the Overall SWM Issues

There is hardly any garbage scattered around town and almost no waste-related health and hygiene problems exist. This means that the current waste discharge and storage system is appropriate for the society and has the support of the residents, and that the collection system is functioning properly. Because Samoans are taught about cleaning at home throughout childhood, they have a high awareness of the environment and hygiene. As for the final disposal, the condition of Tafaigata landfill site, the only disposal site on Upolu island, is satisfactory, because it has been upgraded to minimize environment impact. We did not have the chance to inspect the disposal site on Savaii Island, however, because the landfill amount is small and the condition should not be serious.

It is only recently that the main components of waste operation, such as the organization and various systems of collection and final disposal, have come into place. The improved condition is attributable to the contributions made by JICA, which is not only dispatching experts to SPREP, which is headquartered in Samoa, and senior volunteers from Japan to PUMA to supervise the waste operation, but is also providing financial aid. Accordingly, Samoa has just embarked on a systematic urban waste management program and the operation still lacks stability and reliability, with weaknesses visible everywhere. But the time is finally ripe for Samoa to build up its management capacity so that the waste operation can take root. Because

hazardous waste and other issues remain unsolved, donors must continue to provide technological assistance in the future to help improve management capability.

2.5.2 Evaluation of the Large/Bulky Waste

a. Illegal Dumping

Illegal dumping is a typical social problem related to large/bulky waste. However, throughout our survey period, we have not seen any illegal dumping of discarded automobiles or home appliances. They were all placed on private land with the permission of the landowners. Due to the small quantity, the large/bulky waste did not pose any problem. In particular, since a collection system for end-of life home appliances is now in place, it is believed that illegal dumping will not occur at present or in the near future. There is also little likelihood of illegal dumping by repair shops because operators of such shops transport their waste home appliances to the Tafaigata landfill site for disposal.

Although there is still no collection system for end-of-life automobiles, families have enough land at their home to house retired cars. For this reason, it is believed that there will not be any social problem caused by the illegal dumping of unwanted automobiles in the next few years.

b. Environmental Pollution

Used home appliances brought to the Tafaigata landfill site are buried after private recycling operators retrieve the non-ferrous metal scrap. Because they are disposed of in the landfill, there is no problem with scenery and sanitation at present. However, as no measures have been taken to tackle the hazardous substances contained in the discarded automobiles and electric waste, there is the possibility of soil contamination.

As the ownership of automobiles and home appliances rises, the number of automobiles and home appliances to be disposed of will also increase tremendously. When the ownership rate reaches a point of saturation, the disposal amount will be at a similar quantity as the imported amount. Consequently, problems related to the financial insolvency inherent in the current electric waste collection system, the land issues of the landfill site, and the difficulty in keeping end-of-life vehicles at homes are expected to become prominent, making large/bulky waste treatment a serious challenge. Although there is currently no problem with large/bulky waste treatment, the increase in end-of-life automobiles and home appliances will bring the issues to the forefront. Therefore, it is urgent to formulate measures for tackling large/bulky waste in the future.

c. Priority in Large/Bulky Waste-related Problems

Because the discharge rate of municipal waste in the capital and its vicinity is rapidly increasing, there is greater need for reducing the quantity and volume of such waste in order to extend the life of the disposal site. Therefore, it is expected that the increase in large/bulky waste will be a large burden in terms of the final disposal capacity. In addition, given the increasing burden of cost resulting from the collection of large/bulky waste and the problem of hazardous substances treatment caused by large/bulky waste, implementing measures to tackle these large/bulky waste issues should be the next priority in the SWM.

Chapter 3 Current State of the Republic of Fiji

3.1 Geography and Society

The Republic of Fiji (hereinafter referred to as "Fiji") is situated in the South Pacific Ocean. It is an island nation of mountain ranges with elevations over 1,300 m. The temperature is 18 – 28 degrees Celsius and the annual rainfall is approximately 3,000 mm. Due to the tropical climate, there is a high demand for refrigerators and air-conditioners. As the sea breeze is very strong throughout the year, the environment for automobiles and home appliances is very harsh.

The land area is 18,270 km^2 and the population is approximately 870,000 (2003 estimate). The population density of 48 persons/km^2 is low, and since the inland is not developed, most of the people live along the coast. The 2003 estimate of population growth is quite stable, showing an increase of 1.41% per year. The population density, however, especially in cities such as the capital city of Suva, is increasing rapidly.

Fiji is made up of 332 islands. Among them, about 110 islands are inhabited. Over 70% of the population lives on the largest island, Viti Levu, and approximately 50% of the population lives in the capital city of Suva and its vicinity. Other than Suva, Lautoka is the only city with a population over 10,000 people. Racially, Fiji is made up of 51% Fiji natives, 44% Indians, and 5% people of other races.

The per capita GNP is 2,627 USD (2002), which is quite high among the island nations of Oceania, and the purchasing power is relatively high. Tourism, sugar, and fabric are the three main industries, and other notable industries such as wood chip, minerals, and fisheries. Manufacturing includes a beer factory, a reinforced-steel manufacturing plant, iron works, and others. In that sense, the technological infrastructure necessary for the recycling of discarded automobiles and home appliances is in place, to some extent.

Electricity supply was available to an estimated 70% of the population in 2003, with an increase of approximately 5% a year currently. Thus, home appliances are also expected to increase from now on. However, because the gap between the rich and the poor in Fiji is larger than in other island nations, the high percentage of poor population has put a constraint on the rate of home appliance ownership.

The land system in Fiji is difficult for foreigners to comprehend, and it has a large impact on development and environmental protection. The land is divided into three types (Table 3-1): Freehold Land is private land; State Land, owned by the government, is in the process of being returned to the former landowners; and Native Land, owned by Fiji clan members, and for which the Native Land Commission manages the land ledger. The Native Land cannot be bought or sold, but it is possible to lease the land from the National Land Trust Board. It is, however, extremely difficult in reality, because there is no clearly defined process. As a result, even though many sites have a suitable natural environment and the land use conditions for a disposal site, it has become increasingly difficult to secure usable land, especially with the return of State Land to former landowners.

Table 3-1 Land Types in Fiji

Land Type	Area (km^2)	Percentage (%)
Native land	15,036.6	82.4
Freehold land	1,490.8	8.2
State land (Crown land)	1,726.1	9.4
Total	18,253.5	100.0

3.2 State of SWM

3.2.1 Non-technical Systems

a. Self-governing System

The territory is classified as follows by population size and degree of urbanization:

City Councils	2 (Suva and Lautoka)
Town Councils	12
Local Authorities	16

City Councils and Town Councils operate by their own revenue sources, while local authorities are under the direct control of the central government because they do not have their own revenue sources. The population of the 16 Local Authorities accounts for about 50% of the country's total population.

Apart from the laws of the country, many self-governing Fijian Villages at various localities still govern with strict adherence to Fiji's traditional rules. So even when a Fijian Village is located within the jurisdiction of a City Council, neither the central government nor the City Council can govern it. In reality, a Fijian Village is an entity outside the control of any legal jurisdiction. Residents of a Fijian Village do not pay any taxes, but in order to handle their waste output, the City Council provides waste collection service by furnishing them with a large waste container.

b. Organizational Structure for SWM

The Central Board of Health is the policy-making agency for SWM. The Chief Executive Officer (CEO) of the Ministry of Health is the Chairman of the Board. Board members include the CEOs of all local authorities and related ministries. SWM administration is substantially under the jurisdiction of the Ministry of Health, which chairs the Central Board of Health.

The Environmental Health Unit within the Ministry of Health handles waste matters as part of its health and hygiene functions. It administers SWM operation in accordance with the adopted policies. The Environmental Health Unit has 103 staff members, who are under the supervision of the Chief Health Inspector. The country is divided into four districts, namely the central, northern, eastern, and western districts, with a district office set up in each. The staff members are assigned to these districts and each office is headed by a Deputy Health Inspector.

City Councils and Town Councils use their own financial resources to conduct SWM operations. The Ministry of Health offers consulting services to these local authorities.

The Ministry of Health allocates the budget for health and hygiene to local authorities and the Ministry's district offices use the allocated funds to carry out activities. Only three out of the 16 local authorities provide regular waste collection services. The FY 2004 budget allocated 8,000 FJD (536,000 yen) to the waste operations of local authorities; specifically, 1,000 FJD for each of the three local authorities that have regular waste collection services and the remaining 5,000 FJD are shared among the other 13 local authorities. The Chief Health Inspector said that this budget amount is extremely limited.

The Ministry of the Environment draws up the necessary rules and regulations and conducts surveys and environmental impact assessments (EIA). EIA mainly targets land development, and the Ministry of the Environment strictly enforces EIA for development activities in order to protect the attractive environment, an essential resource for the Fiji's tourist industry abound with western land developers. In addition, the Ministry of the Environment is the responsible agency on the Fiji side for the construction of the Naboro Landfill, which has been developed in collaboration with the European Union.

The SWM systems established at the council level differ with each local authority. In the capital city of Suva, the city collects residential waste directly and has commissioned ten private contractors to clean roads and carry out pruning. As for non-residential waste, waste dischargers

either bring in waste directly or commission private contractors to do the collection.

c. Financial System

Suva does not levy any fees for the collection of residential waste, because it is included in the property tax. The only revenue from waste operation is the fee levied on non-residential waste brought in directly by the generators. The fee is allocated to the city's general revenue.

d. Capacity to Undertake SWM

The Ministry of Health is the agency in charge of waste management. It makes policy decisions, establishes the legal framework, and provides technological support to local authorities. In reality, however, the Ministry of Health has neither the sufficient human resources, both in terms of quantity and quality, nor the budget to give technological support to local authorities for SWM.

The Ministry of the Environment, which is responsible for providing supervision, only has approximately ten officers, excepting the staff members who are hired on a per-project basis. Among the thirty some ministries and agencies, the Ministry of the Environment is low ranking, making it difficult for it to vigorously conduct activities.

The local authority is the entity that actually carries out waste collection activities. The capital city of Suva seems to have a well-coordinated collection schedule and residents only put out waste for collection on the scheduled collection dates. The fact that the city keeps to its collection schedule properly and has educated its residents to follow the schedule shows that the management ability of the local authority in Suva is quite high. On the other hand, the management capacity of local authorities in other areas seems weak.

In theory, the responsibilities of SWM are divided among the Ministry of Health, the Ministry of the Environment, and local authorities as the implementation bodies. However, due to difficulty in coordination and collaboration among the various organizations, and the limited capacity of organizations in a small nation, the overall implementation capacity is not high.

On another front, for waste issues there are also social considerations involved, such as the Fijian Village system and race issues, making the implementation of SWM operation more difficult.

3.2.2 Technical System

a. Solid Waste Discharge Amount

As shown in Table 3-2, the 1999 record shows that the solid waste discharge amount of Suva City is approximately 48,000 tons/year and general (domestic) waste accounts for 41%. Currently, the city's population is approximately 100,000. Thus, the waste discharge rate of domestic waste is about 0.54 kg/person per day and of all waste 1.31 kg/person per day.

Table 3-2 Suva City's Estimated Waste Discharge Amount (1999)

Item	General	Green	Market	Industry	Mixed	Total
Volume (1000 tons/year)	19.76	9.36	1.82	12.85	4.00	47.79
Percentage (%)	41.3	19.6	3.8	26.9	8.4	100.0

Source: Information presented by participants in the 2003 Okinawa seminar

According to the waste amount survey conducted by SPREP in Suva in 1994, the waste discharge rate of domestic waste was 0.7 kg/person/day, which is higher than the figure today. It is possible that the survey included other types of waste in addition to domestic waste.

Table 3-3 shows the waste discharge amount of six western cities in 2002 and the composition of the municipal waste.

Table 3-3 Waste Discharge Amounts and the Composition of Western Cities (2002)

City	Serviced Population	Annual collection Amount	Percentage of municipal waste	Generation Rate	Composition (%)	
	person	ton/year	%	(kg/person/day)	Organic	Paper
Ba Town	16,000	1,053	90	0.18	71	8
Lautoka City	45,000	11,202	67	0.68	68	15
Nadib Town	20,000	2730 – 2290	80	0.37 – 0.61		
Ra Town	3,255	1,188	80	1.00		
Sigatoka Town	3,500	1,872	52	1.46	57	12
Tavua Town	5,000	934	80	0.51		

Source: Solid Waste Management and Recycling in The Fiji Islands, JICA

b. 3Rs

Beer bottles are actively reused thanks to the application of a deposit system. Coca Cola also has a for-value collection system for its PET bottles and transports them to Australia, but it is not actively being pursued. Paper, such as cardboards and newspaper, non-ferrous metals, glass, and cloth are also collected. Hog raisers also collect food waste from markets. Other waste reduction measures are carried out, such as encouraging families to use compost and limiting the free-of-charge annual collection of trimming waste to 2 m^3, etc. Thanks to these efforts, the waste collection amount has been reduced from 23,600 tons/year in 1998 to 15,400 tons/year in 2002.

c. Collection and Transportation

Suva and the surrounding city areas are divided into districts with either twice or three times weekly waste collection. Residents put their garbage in bags and place them along the roadside for collection. The fact that garbage bags are put out in the morning on the collection day, as shown in Photo 3-1, shows that garbage collection is being carried out according to schedule and that residents follow the rule properly. In Suva, compactor trucks are used to collect garbage placed along the roadside, as shown in Photo 3-2. To collect the waste of large-volume waste generators, such as businesses, skipper trucks (Photo 3-3) are used and they transport waste to the Lami landfill site.

Photo 3-1 Residential waste

Photo 3-2 Suva City's compactor truck

Photo 3-3 Skipper truck

Suva City has five large-size 9 m^3 compactor trucks (three were donated by Japan). Suva City consigns road cleaning as well as waste transportation to ten private contractors. The collection of yard trimmings from households is also included in the agreement. Bulky waste, such as unwanted home appliances and furniture, is collected three times a year and transported to the disposal site.

Waste collection is being carried out by two City Councils, 12 Town Councils, and three Local Authorities. In the case of City Councils and Town Councils, because the Councils are the implementation bodies themselves, each Council uses its own method to collect waste, which includes either direct operation by the district office, or consignment with private contractors. Generators of business waste hire waste transport operators directly to bring the waste to the disposal site.

All of the existing landfill sites use the open dump method or controlled tipping method, but not the sanitary landfill method. The Lami landfill site used by Suva and the landfill site in Lautoka have security facilities including fences and gates. Bulldozers are used steadily to compress and spread the waste evenly. These two sites can, therefore, be classified as the controlled tipping type[2]. Nothing much is being done at other sites, and they are in an open dump condition.

Bulky waste, including home appliances, is collected by the City or Town Council and is disposed of at landfill sites.

As shown in Table 3-4, Fiji's urban population is slightly less than 400,000. The national population with waste collection services is estimated also at about this level. Based on the number of persons in an urban household, the total number of households in the nation of Fiji was calculated to be approximately 175,000 (Table 3-4).

Table 3-4 Population and Number of Households in Fiji Cities (2002)

Category		Number of households	Population	Person/household
Cities	Central and East	47,105	227,941	4.84
	North	8,768	38,885	4.43
	West	27,770	127,039	4.57
	Total	83,643	393,865	4.71
National		175,427	826,261	4.71

Source: Statistic Authority Home Page

[2] A landfill method that controls the landfill surface by laying and leveling waste.

d. Final Disposal

There is no transfer station or processing and treatment facility in any of the cities or towns. The following describes the condition of the landfill sites we inspected.

d.1 Lami Landfill Site

Most of the solid waste, including general waste, from the city of Suva and its three neighboring towns is disposed of at the Lami landfill site. The facility is located at an estuary in the town of Lami, which is to the west of Suva. It has been used for some fifty years, since around 1945. The site has an area of approximately 5 ha, 2 to 3 ha of which have waste piled up as high as 15 m. The unsightly scene is visible even from the roads. Because Suva and its neighboring towns have a total population of over 200,000, the Lami landfill site, which accommodates all their waste, is estimated to receive a total disposal amount of over 100,000 tons a year.

Photo 3-4 and Photo 3-5 show the landfill from the side of the road; most of the slopes have already been covered by grass. Photo 3-6 shows the current landfill operation. Photo 3-7 shows a discarded vehicle and a refrigerator.

The European Union has agreed to provide funds from the European Union Development Fund for construction work to close the Lami landfill site. When the new Naboro landfill site starts operation, the work to close down the Lami landfill will begin.

Photo 3-4 Lami landfill site seen from the main road

Photo 3-5 The area where landfill has been completed

Photo 3-6 Current landfill area

Photo 3-7 Discarded vehicle and refrigerator

d.2 Naboro Sanitary Landfill Site

In the huge 100 ha Naboro forest 16 km to the west of Suva, a new landfill site is being developed with EU assistance. It is intended to replace the Lami landfill site to serve Suva and its neighboring three townships. As the first phase of the development project, a landfill area of 20 ha, which has a capacity of 1.8 million m^3, is under construction. It was scheduled for completion in July, 2004, and would begin operation immediately. The landfill site is expected to have the capacity to accept waste for twenty years. The funding is from the 8th European Development Fund (Financing Agreement Number 6473/FIJ). About 50% of the 8.5 million euro has been allocated to this project. As a condition of this funding, EU presses the participating local authorities to upgrade efficiency and to adopt a fee-collection system.

The Naboro landfill site is located along the trunk road that connects Suva and Nadi (Photo 3-8). The landfill area is to the north on the far side of the mountain. The area can be accessed by a road that branches off from the trunk road for 300 m around the mountain. The landfill site cannot be seen from the road or from any residential areas; it is only visible to the neighboring Naboro prison. Leachate is drained into a nearby river, which flows about 500 m to the ocean, and no facility in-between uses the underground water. Since it is very unlikely that there will be any serious problem with scenery or water contamination, the site is ideal as a landfill site from an environmental point of view. One point of concern is, due to a mountain stream with a big catchment area flowing through the landfill area, the disposal facility is constructed with a large box culvert (Photo 3-9) buried underground. During heavy rains, big trees and debris may block the entrance to the box culvert and dam up the water inside, making it difficult to maintain and control the box culvert. In Japan, there is a tendency to try to avoid building underground drains in a landfill site.

Photo 3-8 Entrance to the Naboro landfill site, administration building, garage, etc.
The area in the foreground is saved as the site for a recycling facility.

Photo 3-9 Box culvert in the landfill area

Photo 3-10 Landfill site

A German company named Hydroplan designs and oversees construction of the Naboro landfill site, and an Australian company, Downer, executes the work. The type of contract for this construction is a bill of quantities contract. Since the budget has an upper limit of approximately 4 million euro, when there is an unexpected need for construction that is not included in the contract price, the units of construction for other parts have to be reduced to make up for the additional construction. In this project, for instance, because of the unexpected need for the costly drilling and removal of 8,000 m^3 of rocks, which was not included in the contract, the laying of impermeable sheets had to be drastically reduced. The leachate treatment pond was also made into a tiny pond without any treatment facility or construction work. For the recycling facility, the contract only covered preparation of the site, but not construction of the facility. The access road was built with a completely different specification at a location different from that shown in the design plan. In the end, frequent changes in the design plan have rendered it impossible to know the layout of the disposal facility until the construction is complete.

Although impermeable sheets have not been laid, the original drilling ground is made up of layers of impermeable clay. In addition, an embankment of clay as thick as 60 cm is laid on top. There is, however, no evidence that the embankment has been properly constructed or maintained.

The Naboro landfill site is planned to be operated and managed by a private company. The condition is that the operator has to be a joint venture between a local company and an experienced company of a developed country. Bidding for the management of the landfill site took place in mid-April, 2004, and three joint-venture companies submitted their bids. The bidding used a proposal approach, which should include a leachate treatment plan and a recycling plan.

What is most important for a landfill site is how it is operated, maintained, and managed, rather than how the site is constructed. The EU has devoted great efforts to reviewing the implementation method in detail. As shown in Figure 3-1, a quite complex structure for the operation and management of the site is being planned, including the participation of local authorities who bring in the waste. The necessary legal framework is also being put in place. In the course of our survey, however, we found that only a limited number of related people had sufficient knowledge of the site's structure and the management system of this project.

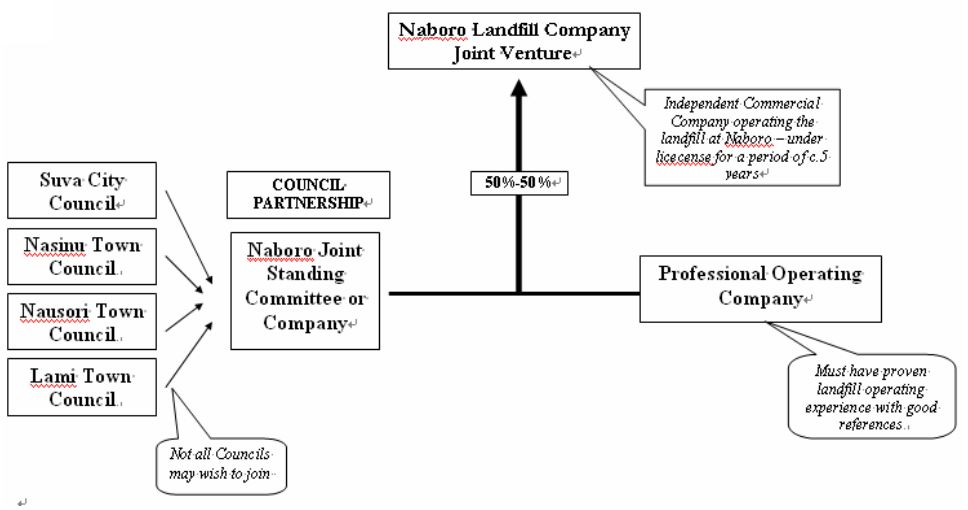


Figure 3-1 Organizational Plan for the Operation of Naboro Landfill Site

d.3 Lautoka City Landfill Site

The Lautoka landfill site in a forest along the eastern seacoast of Lautoka City is a huge site with an area of 50 ha (Photo 3-11). It is located at a convenient location about 2 km from the city. Although no houses are in the neighborhood, there are about ten houses along the road to the landfill site. At the site, bulldozers spread and even out the waste but no cover soil is used. The fact that there are gates to deter intruders and signs are present indicating the number of landfill areas shows that the facility is managed to a certain extent. About ten waste pickers were seen collecting waste that can be exchanged for cash. Bulky home appliances are also collected in the same way as Suva City and are disposed of as shown in Photo 3-12.

Photo 3-11 Lautoka City disposal facility

Photo 3-12 Discarded bulky home appliances

d.4 Ba City Landfill Site

The Ba City landfill site is relatively close to the town, situated at about 5 km from the town center. There is, however, a winding unpaved 2 km farm road leading to the site's entrance, and it takes considerable time to get to the facility. The landfill site started operation in 1994. As shown in Photo 3-13, waste is dumped into the valley. Although heavy machinery is used from time to time, the practice is close to open dumping. Although the scattering of waste makes the scenery unsightly, the disposal volume is low at about 10 tons/day. The waste is thinly spread and there are favorable aerobic conditions so that it is believed almost no water leakage has occurred.

The Town Council contracts with a private operator to collect and dispose of waste. The operator employs a used compactor truck to collect waste.

In a secluded spot next to the disposal facility, there are about ten discarded car bodies as shown in Photo 3-14. According to a Council officer, the car bodies were there before the landfill site was built. The car bodies were indeed old and rusty.

Photo 3-13 Ba City landfill site

Photo 3-14 Automobile dump site next to the landfill site

3.3 State of Large/Bulky Waste Management

3.3.1 Collection System

Most waste appliances are collected by local authorities.

Western Wrecker buys end-of-life vehicles. Figure 3-2 shows the treatment and disposal process of end-of-life vehicles.

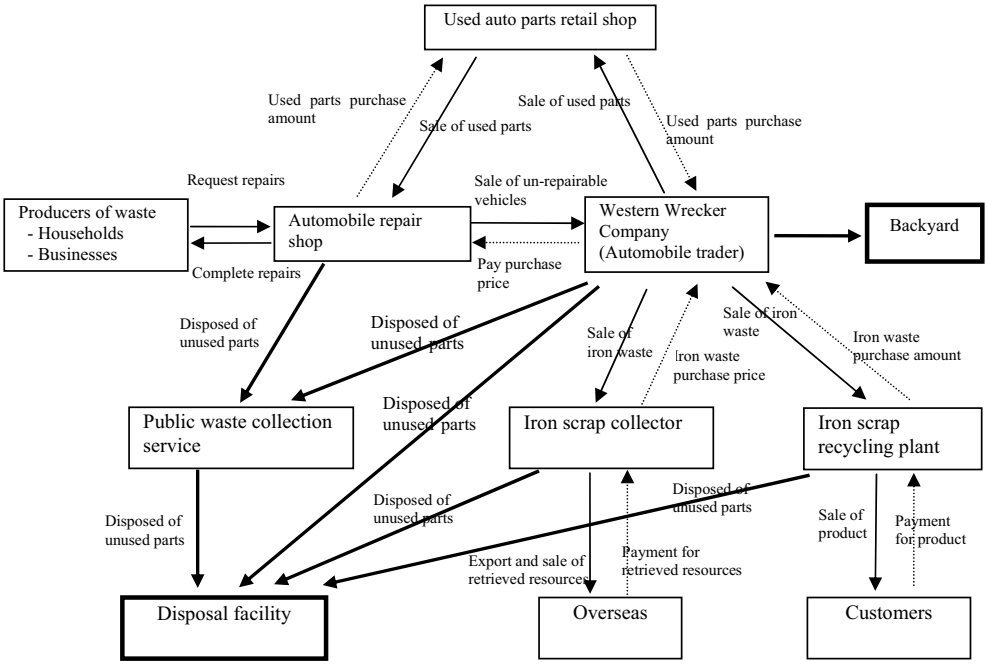


Figure 3-2 Flow of End-of-Life Vehicles

3.3.2 End-of-life Vehicles

a. Number of Vehicles Registered and Number of Vehicles in Use

Once a vehicle is registered, it stays on the record. Vehicles have to be inspected every year to obtain a license for operation. Since the owner of a retired vehicle would have to continue paying the registration fee, he/she must cancel the license immediately. Therefore, all the vehicles operating on the roads carry a license.

Table 3-5 shows the accumulated total of registered vehicles, the number of vehicles with a license, the accumulated total of vehicles with a cancelled license, and the number of newly registered vehicles in Fiji. Since the number of registered vehicles after 1999 cannot be obtained, the number of vehicles with a license after 1999 is calculated using the average annual increase in cancelled registrations between 1989 and 1998. Figure 3-3 shows the secular changes of the increase in the number of vehicles with a license and in the number of newly registered vehicles.

Table 3-5 Changes in the Number of Registered Vehicles and the Number of Vehicles with a License

Year	Accumulated total of registered vehicles	Number of vehicles with a license	Accumulated total of vehicles with cancelled registration	Number of new registrations	Increase in the number of vehicles that cancelled registration
1989	75,340	40,484	34,856	3,932	-
1990	80,139	44,156	35,983	4,799	1,127
1991	83,881	45,654	38,227	3,742	2,244
1992	87,810	46,804	41,006	3,929	2,779
1993	90,126	50,650	39,476	2,316	-1,530
1994	94,136	53,775	40,361	2,316	885
1995	97,202	55,388	41,814	4,010	1,453
1996	100,254	57,206	43,048	3,052	1,234
1997	102,837	58,922	43,915	2,583	867
1998	104,760	54,695	50,065	2,265	6,150
1999	109,276	57,511	51,765	4,516	1,700
2000	112,873	59,408	53,465	3,597	1,700
2001	119,354	64,189	55,165	6,481	1,700
2002	124,602	67,737	56,865	5,248	1,700

Source: Statistic Authority Home Page, LTA database

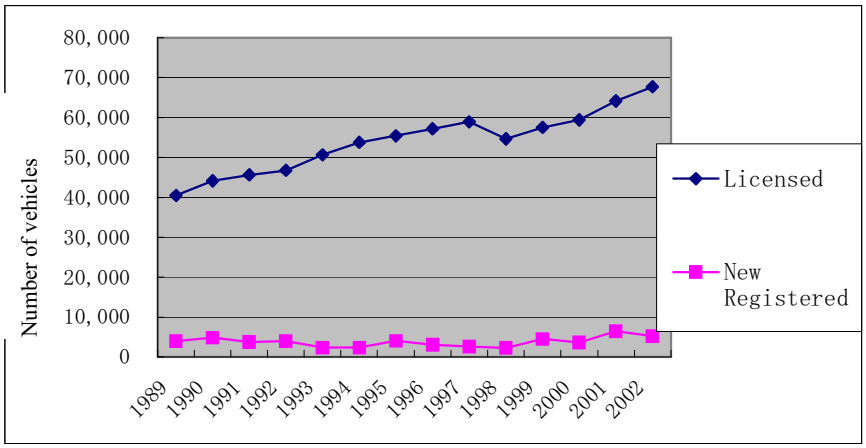


Figure 3-3 Secular Changes of the Increase in the Number of Vehicles with a License and in the Number of Newly Registered Vehicles

Table 3-6 shows the percentage of new and used vehicles in the number of newly registered vehicles. Used vehicles account for 60% and most of them are commercial vehicles such as taxis and trucks.

Figure 3-4 shows the percentages of registered vehicles by type. Passenger vehicles and trucks account for 79% of the total.

These data show that the number of newly registered vehicles have increased drastically in 2001 and 2002, which coincides with residents' impressions of a sudden increase in cars. The increase in the number of vehicles that cancelled registration in Table 3-5 represents the number of vehicles to be discarded, and it is said that some of these vehicles were exported to neighboring countries such as Tonga.

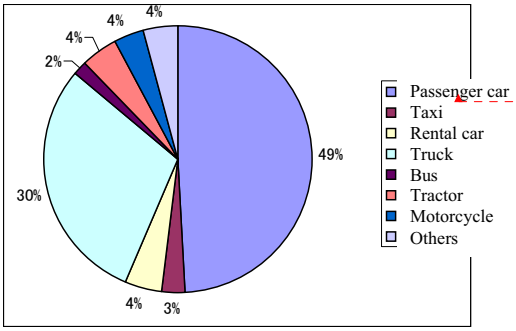
Similar to Japan, Fiji uses cars with right-side steering. Therefore, Japanese cars account for 80–90% of cars in Fiji, overwhelmingly outnumbering the other manufacturers. Used auto parts shops are found in areas with dense population, such as Suva and Lautoka, and many repair shops operate around these areas.

Table 3-6 Percentage of New and Used Vehicles in the Number of Newly Registered Vehicles (2000)

Category		Passenger car	Taxi	Rental car	Truck	Bus	Motor-cycle	Total
New vehicle	No. of units	959	27	1	312	24	37	1,360
	Percentage (%)	41.0	23.3	16.7	46.7	42.9	69.8	42.0
Used vehicle	No. of units	1,381	89	5	356	32	16	1,879
	Percentage (%)	59.0	76.7	83.3	53.3	57.1	30.2	58.0
Total		2,340	116	6	668	56	53	3,239

Source: Load Transport Authority (LTA) database

The number of vehicles currently in use is 67,000. The newly registered vehicles from import is 5,000–6,000 units/year, showing a rapid increase in recent years. The number of discarded vehicles is estimated at a little less than 2,000 units/year now. When the increase in the number of vehicles stops, the number of newly registered vehicles will eventually be equal to the number of discarded vehicles. Thus, the number of discarded vehicles will obviously increase in the future.



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Source: LTA database

Figure 3-4 Registered Vehicles by Type (%)

b. Estimated Number of Discarded Vehicles

Because of the high customs duty and VAT, a ten-year old light van still costs about 600,000 yen, making automobiles a valuable asset for Fijians. Comparing the number of licensed vehicles to the number of newly registered vehicles from 1989 to 2000 in Table 3-5, the years when relatively stable increases in the number of automobiles are seen, the numbers are an average 52,000 units to 3,400 units, respectively. Dividing the former with the latter, the lifespan of a vehicle is 15 years. According to our interviews, it is common to repeatedly repair a 10 year-old used car and stretch its lifespan another 15 years. In reality, however, due to the bad road conditions in Fiji, some vehicles end up having a much shorter life. Given that over 40% of the imported vehicles in Table 3-5 are new cars, the average life of the newly imported vehicles is 15 years.

In 2001 and 2002, the number of newly registered vehicles increased drastically. Although it is difficult to predict the future trend, we estimate the number at which the number of vehicles in Fiji will stabilize in the future based on the following assumptions:

The current number of households in Fiji is 175,000 and about half of them are in local regions. Since there are many low-income Fijian Villages in local regions, we assume the ownership rate of automobiles to be about 10% of the households. There are also low-income squatters and Fijian Villages in the cities. So we estimate the ownership rate of automobiles in the city to be at 80% of the households.

Figure 3-4 shows that taxis and rental cars together account for 7% of the automobiles and 30% of the trucks, with half or one-third of them used for commercial purposes. Taking into consideration cars owned by government offices and businesses, we set the value of non-private

ownership of automobiles at 20%. We calculate the number of vehicles based on the assumptions above.

a/(a+175(1/2x0.1+1/2x0.8))=0.2

[a: number of vehicles not owned by private individuals (number of vehicles in use)]

a=0.2a+(8.8+70)x0.2, 0.8a=15.8, a=19.7

Total number of vehicles in use = 78.8+19.7=98.5 (thousand units) -> 100 (thousand units)

We made a simulation on the premise that the number of vehicles with a license will be about 100,000 units in the future, the average lifespan of automobiles is 15 years, and the number of vehicles will reach saturation in ten years. In the simulation, the numbers of vehicles for disposal are estimated as shown in Figure 3-5 and 3-6. Specifically, the current number of vehicles for disposal is estimated at about 2,000 units, and in the future about 6,000 units a year will be discarded.

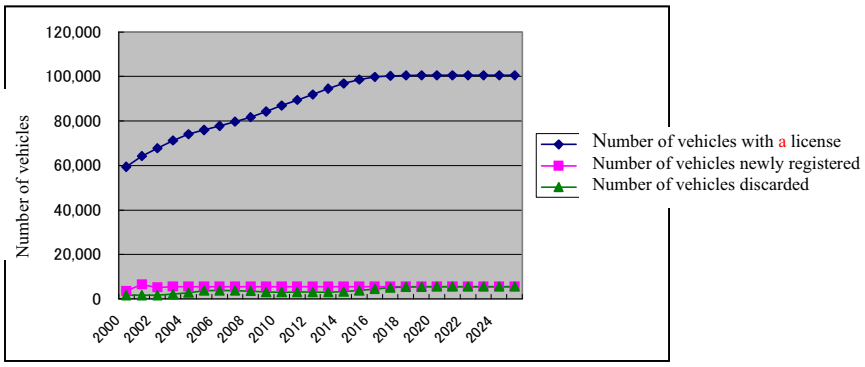

Figure 3-5 Estimated Numbers of Vehicles with a License, Newly Registered, and Discarded

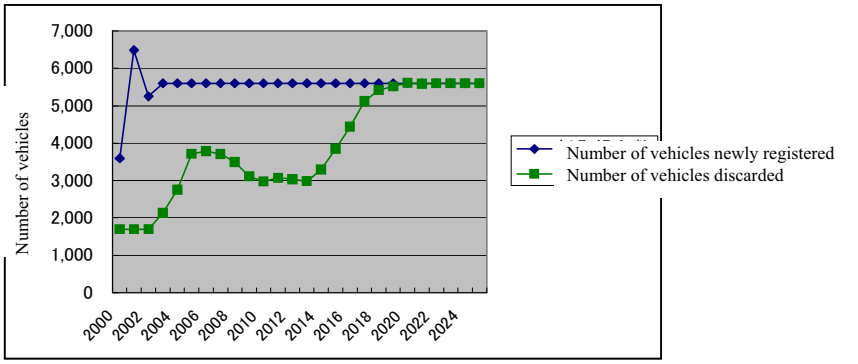

Figure 3-6 Estimated Number of Vehicles Newly Registered and Number of Vehicles Discarded

c. State of Automobile Disposal

According to our interviews and a field survey of 250 km of roads, there was no illegal dumping of end-of-life vehicles on private or public land. Automobile bodies are disposed of (i) in the yards of private homes; (ii) within the site of repair shops or neighboring private land; (iii) within the site of traders of accident-damaged vehicles and abandoned vehicles, and (iv) within landfill sites.

(i) is shown in Photo 3-15, (ii) in Photo 3-16, and (iii) in Photo 3-17. There are very few cases

of (iv) and we have already shown them in the landfill site photo.

Photo 3-15 Vehicle disposed of near a garage

Photo 3-16 Vehicle left next to a repair shop

Photo 3-17 Western Wrecker's car dump site

The vehicles disposed of in Fiji are characterized by the fact that the auto parts have been completely removed from the car bodies, as shown in Photo 3-18. This shows that parts from vehicles with relatively sound auto parts have value in the used auto parts market. On the other hand, car bodies have absolutely no market value in Fiji.

Photo 3-18 Discarded vehicle with all auto parts removed

3.3.3 End-of-Life Large Home Appliances

Since we did not have any data on the ownership rate of large home appliances, we could only draw our estimate from the condition of ownership in households and the numbers of imports and sales. At present, 127,000 households out of a total number of 175,000 households, have electricity service contracts. Assuming 95% of these service contracts are for private households, the percentage of households with electricity supply is as follows:

127,000x0.95/175,000x100=69%

Since we have surveyed data on home appliances that passed through customs and the retail number from 2003 (SWM and Recycling in the Fiji Islands, JICA, 2003), we compared the two in Figure 3-7.

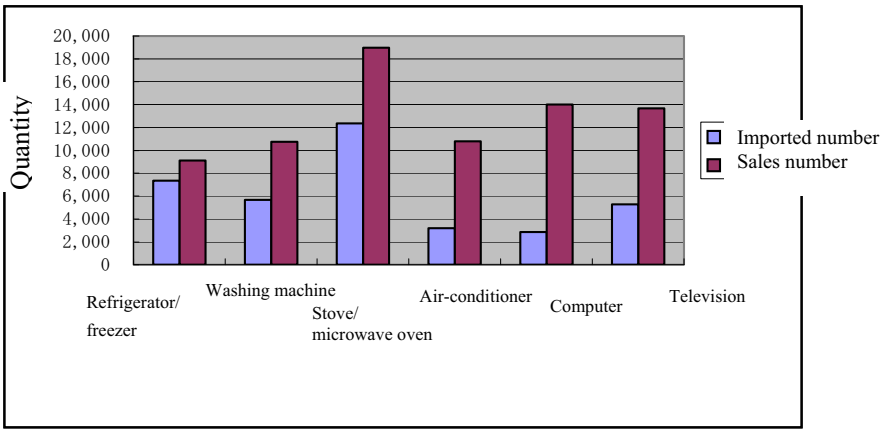

Figure 3-7 Comparison of the Number of Home Appliances Passed through Customs and the Number of Home Appliances Sold

Similar to the Samoa case, the two sets of numbers in Figure 3-7 show a big discrepancy. The customs record is mostly based on declaration, and since there is a strong tendency to underreport the quantity to cheat customs, the customs record is not reliable. For this reason, the sales quantity is closer to the real figure. When the number of home appliances reaches the point of saturation, the number of home appliances in use in Fiji can be calculated by multiplying the number of sales by the lifespan of the product (about ten years, due to the high number of used home appliances imported). When the number in use is increasing, it is necessary to multiply with a smaller number.

Due to the high customs duty, refrigerators, washing machines, stoves, televisions, etc., are valuable assets for families; and therefore, it is hard to imagine that one family will have more than one of these appliances. It is common, however, for offices to have multiple units of air-conditioners and computers, and affluent families, in particular, tend to have multiple units of air-conditioners installed.

The number of home appliances owned is estimated using the number of sales in Table 3-7 as reference and the number of households with electricity service contracts. Table 3-7 also estimates the number of home appliances to be disposed of in 2003, as well as the number of home appliances owned, to be disposed of, and to be sold ten years later in 2013. Since the government has set the increase in utility service contracts at an annual rate of 5.3%, the number of households with electricity supply will reach the current total number of 175,000 households in six years. We can assume, however, that there will still be areas that will end up not getting any electricity, notwithstanding their electricity service contracts, because of inefficient electricity supply. Therefore, we estimated that it will take ten years, instead of six, for the

number of households with electricity supply to reach 175,000. We also assume that any households not included in the number of households with electricity supply、 and any increases in the number of households, are households without electricity supply.

Table 3-7 Estimated Number of Home Appliances in Use and Number of Home Appliances to be Discarded

Condition	Households with electricity supply	Import record	Retail record	Quantity owned	Rate of ownership	Disposal number	Status
Number of households with electricity supply in 2003: 127,000 households	Refrigerator/freezer	7,340	9,110	63,500	50%	3,200	Rapid increase
	Washing machine	5,660	10,750	63,500	50%	3,200	Rapid increase
	Stove/microwave oven	12,340	18,980	76,200	60%	3,810	Rapid increase
	Air-conditioner	3,170	10,795	38,100	30%	1,900	Rapid increase
	Computer	2,850	14,000	31,750	25%	1,600	Rapid increase
	Television	5,280	13,690	101,600	80%	8,100	Gradual increase
	Total	36,640	77,325	374,650		21,810	
Condition	Households with electricity supply		Estimated retail	Quantity owned	Rate of ownership	Disposal number	
Number of households with electricity supply in 2013: 175,000 households	Refrigerator/freezer		12,150	122,500	70%	9,300	
	Washing machine		12,150	122,500	70%	9,300	
	Stove/microwave oven		11,485	122,500	70%	9,900	
	Air-conditioner		6,840	70,000	40%	5,400	
	Computer		3,900	43,750	25%	3,800	
	Television		13,890	140,000	80%	12,000	
	Total		60,415	621,250		49,700	

Table 3-7 assumes the following for each of the home appliances:

- Many families already own televisions, including families in Fijian Villages. Currently, the ownership of television sets has reached saturation, accounting for 80% of all households with electricity service contracts. We determined that as more households receive electricity supply, ownership of televisions would increase in the same proportion.
- We assumed that a few families in the Fijian Villages and among the squatters, and most of the other families have refrigerators and washing machines. We set the ownership rate at 50% of the families with electricity service contracts and at 70% in ten years.
- Due to the high volume of stove and microwave sales today, we set the diffusion rate at slightly higher than refrigerators, at 60%, and assumed that it will reach 70% in the future.
- Air-conditioners are not as popular because of the high electricity cost. On the other hand, offices have many units and affluent families tend to have multiple units, so we set the diffusion rate at 30% at present and at 40% in the future.
- Although many computers are sold today, it is difficult to imagine that many families will own computers. Therefore, the diffusion rate is set at 25% for the present as well as for the future.

As shown in Table 3-7, the number of refrigerators, washing machines, stoves, microwave ovens, air-conditioners, computers, and televisions to be disposed of is expected to double from the current 22,000 units to approximately 50,000 units in ten years.

Disposed home appliances are brought to the landfill site for disposal together with bulky furniture. Since the disposal amount is going to double from the current level and heavy metals are used in electronic parts, it is necessary to draw up some policy measures to tackle contamination of the soil and effluent.

3.4 Conditions Related to Counter Measures

a. Repair Technology

a.1 Repair of Automobiles

Similar to Samoa, JICA has been providing Fiji with assistance in automobile repair technology since long ago. For automobile repairs, it is important to have not only repair technology but also access to auto parts. In this respect, Fiji has a very well established supply system. As shown in photos 3-19 to 3-22, the used auto parts company in Ba City has all Japanese car parts from engines to windowpanes and inventories are classified by car models. A used auto parts shop sends several of its employees to visit junkyards in Japan to retrieve auto parts and ship them in containers to Fiji. According to the company, due to the bad road conditions in Fiji, the auto parts that the company retrieves locally are too old and the quality is not good enough for reuse.

Photo 3-19 Auto parts company Specializing in Japanese cars

Photo 3-20 The auto parts classified for sales

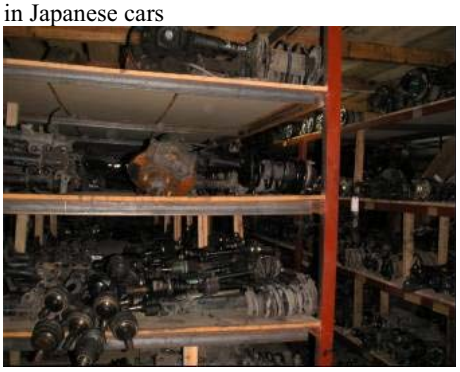

Photo 3-21 The auto parts classified for storage

Photo 3-22 The auto parts classified for sales

However, the fact that all discarded vehicles have their parts removed shows that these parts still have some market value. These used auto parts companies can be seen not only in Suva but also in Lautoka and Ba.

The Japanese cars are imported after they have been used for ten years (the value of a ten-year old car in Japan is close to zero) and they are used in Fiji for another 15 years with repeated repairs. Therefore, in terms of repair technology and the network for procuring auto parts, it is hard to expect any more improvement above the current level.

Since the road conditions are very bad for vehicles, such as buses, which travel extensively on these bad roads, the axles of even a new car may break in three to five years, making repair impossible. So depending on the conditions, some cars have extremely short service life. In this sense, it is necessary to improve the road conditions first.

a.2 Repair of Home Appliances

Due to time constraints, we were unable to conduct any direct survey regarding the repair of home appliances. From what we saw at the disposal facility, however, the discarded ones were all very old appliances. Similar to automobiles, it seems these appliances are repaired repeatedly and are disposed of when they are no longer repairable. Compared to Samoa, Fiji's electricity supply is more stable, and since the humidity is lower, the operating conditions are better.

JICA has also cooperated for a long time in providing technology for repairing home appliances. However, as electronic technology advances in home appliances, many parts are made into black boxes, making the repair of home appliances increasingly difficult.

b. State of Recycling

For small island nations, most of the recycling activities involve only the recovery of raw materials, compressing them, and exporting them. There are very few examples of recycling within the country. However, since Fiji has, to a certain extent, an industrial infrastructure and a market supported by a relatively large population, the recycling of materials is done very actively.

A unique example is a company in Ba City called Nagan Steel Rolling Mill Co., Ltd. It uses an electric furnace to melt iron and bronze from chips of reinforcing bars, steel chips from tooling, cast iron heads from engines, etc. that are produced in Fiji, and uses the materials to make cast iron products and gunmetal molds, selling them in the domestic market. As shown in photos 3-23 to 3-26, the company makes 400 tons of products from iron scrap annually. The cast iron products range from iron covers, grating, iron boxes, joints, roller bearings, etc. Gunmetal is used to make sleeves, roller bearings, etc. and there are also products made by inserting sleeves into a roller bearing with cast iron.

There are various kinds of machinery in the factory. The company is an extremely valuable resource in the south Pacific region because it reuses waste metals from Fiji to make products that meet domestic needs. It is a labor-intensive foundry for small custom-made orders. Such operations are fast disappearing in advanced countries such as Japan. They can, however, be a hopeful industry in Fiji and in other developing countries.

Photo 3-23 Iron scrap as raw material

Photo 3-24 Electric oven (300 kg /cycle)

Photo 3-25 Cast iron grating products

Photo 3-26 Cast-iron manhole

The factory shown in Photo 3-27 is the only cement factory in Fiji. It uses 50,000 tires as fuel annually. In Japan as well, 60% of the old tires there are used as fuel for cement factories. It is an efficient way to recycle used tires.

Photo 3-27 Cement factory in Fiji

Most of the iron scrap is exported to New Zealand, Australia, and Asia. For the recycling of iron scrap, the scrap must be of high density. In this sense, a car body is not suitable. There are four major recycling companies in Fiji.

c. Measures for the Handling of Hazardous Substances Resulting from the Treatment and Disposal of Large/Bulky Waste

Fiji has a relatively high awareness of hazardous waste, partly due to the appeals made by South Pacific University. Actually, Fiji has begun the collection of chlorofluorocarbon, an activity not commonly seen in other countries. With JICA assistance, chlorofluorocarbon recovery equipment was installed in the occupational training school where senior overseas volunteers from Japan are dispatched.

Fiji has also been recycling batteries and waste oil. There is, however, no prospect for the treatment of heavy metals and chlorofluorocarbon contained in home appliances.

3.5 Evaluation

3.5.1 Evaluation of the Overall SWM

Almost no scattered waste is seen in the streets; and consequently, there are no waste-related health or sanitation issues. In particular, the roadside collection is functioning well thanks to the cooperation of residents and the reliable waste collection service. The collection and transportation system is also in good condition.

The problem lies with the final landfill site but completion of the new Naboro landfill site is expected to resolve the squalid condition of the Lami landfill site. The remaining major landfill site that requires urgent improvement is the Lautoka landfill site. There are problems with the collection and disposal of waste in the countryside but they are not serious.

Although the overall cities' waste treatment does not pose serious problems, potential problems exist as the waste issues of the countryside will gradually gain importance. There is also a problem of hazardous waste treatment that has not been addressed much so far. Among the island nations, Fiji is a relatively big island nation and its cities are spread out. Waste management is very difficult because a limited number of officers have to cover a wide area. Therefore, even though the current condition is satisfactory, the situation may deteriorate in the future. There is a strong need for donors to continue providing technological assistance to support preventive and improvement measures.

3.5.2 Evaluation of the Large/Bulky Waste Issues

a. Illegal Dumping

Illegal dumping is a typical social problem related to large/bulky waste. However, throughout our survey period, we have not seen any illegal dumping of discarded automobiles or used home appliances. They were all placed on private land with permission of the landowners, so they do not pose any problem. At present, discarded vehicles are towed away by waste operators for value. In the future, as the number of discarded vehicles increases, residue treatment will become a problem.

b. Environmental Pollution

There is no problem with the scenery, health, or sanitation at present. However, since no measures have been taken to tackle the issue of hazardous substances contained in the discarded vehicles or unwanted home appliances, there is the possibility of soil contamination. When the numbers of discarded vehicles and unwanted home appliances increase substantially, the treatment of large/bulky waste is expected to pose a serious problem. Therefore, even though there is no problem at present, it is recognized that the increase of such waste will surely become a problem in the future, and so there is great need to draw up measures to tackle large/bulky waste in preparation for the future.

c. Priority in Large/Bulky Waste-related Problems

Government officials in Fiji currently do not perceive discarded vehicles and unwanted home appliances as a problem but believe they might become one in the future. In reality, the large/bulky waste issue is hardly serious, despite many vehicles and home appliances being disposed of each year. One of the biggest reasons for this is due to the very active recycling activities of the private sector. Therefore, if these activities are given support, the situation will remain under control. Although the municipal SWM is relatively good, considering that the waste issue will become serious in the cities, priority shall be placed on municipal SWM rather than on large/bulky waste.

Chapter 4 Current State of the Republic of Palau

4.1 Geography and Society

The Republic of Palau (hereinafter referred to as "Palau"), situated in the Pacific Ocean near the Equator at 131 - 135 degrees East longitude, is made up of approximately 340 small islands. The temperature is 25~31 degrees Celsius and the annual rainfall is approximately 3,800 mm. Due to the extremely high average humidity of 80%, there is great need for refrigerators and air-conditioners. The sea breeze is very strong throughout the year, creating a harsh environment for automobiles and home appliances.

Palau has a land area of 489.5m^2. The population is 19,129 (year 2000), with 67% Palau natives, 15% Filipinos, and the remainder being people from many other races. In recent years, people coming to Palau to seek work is on the rise, Filipinos being the most common. Since Palauans can work in the United States with a labor visa, many have immigrated to the United States, including Guam. Eight thousand Palauans are said to be living in the US. For this reason, Palau also has considerable revenue income from overseas remittance.

70% of Palau's population lives on the island of Koror, where the capital is located. The population density of the island is as high as 739 persons/km^2. Another 25% of the population lives on the neighboring big island of Babeldaob, but its population density is very low, at 12 persons/km^2. Therefore, only Koror and a certain developed area in the southern part of Babeldaob have a municipal waste problem.

The per capita GDP is as high as 6,056 USD (2002). The largest industry component of the GDP is public service. The population has an extremely high percentage of public workers. As of 2000, there were 2,415 public workers, accounting for 13% of the population and 26% of the 9,383-person labor force. The trade balance has always been unfavorable because Palau's exports are only at 10~20% of its level of imports. The main reason for this imbalance is the large sum of Compact money that Palau receives from the US government. It greatly distorts Palau's economy because the 14 million USD that Palau receives accounts for as much as 26% of the revenue income in the Palau government's budget. The US government has promised to continue the financial aid until 2009.

Manufacturing accounts for only 0.7%, so that the automobiles and home appliances are of course all imported and there is no industrial infrastructure to recycle their waste.

The average annual wage is 8,520 USD and the average annual income of a public employee is high, at 11,414 USD. The unemployment rate is extremely low at 2.3%. A labor shortage has been going on for some time, which explains the influx of workers from the Philippines and other countries.

Since Palau is not that far away from the Philippines and Taiwan, the price of imported goods in general is low and home appliances are sold at half of the list prices. Due to the labor shortage, however, all service-related costs are high. Therefore, the living expense for a JOCV member is set at a higher level of 475 USD per month.

There is almost no public transportation such as buses and taxis. Families move around in their own vehicles and many families in Koror own 2 to 3 cars. Probably because of the frequent rain, almost no motorcycles can be seen, which is unthinkable for a developing country. Although the sea breeze creates a harsh environment for the vehicles, because vehicles operate at less than 40 km/h on the small island and most of the roads are paved, the operating conditions are favorable.

4.2 State of SWM

4.2.1 Non-technical Systems

a. Self-governing System

It is very important to understand Palau's self-governing system. Since Palau has adopted the American political system, despite the small size of the country, it has 16 states. Each state has its own constitution, congress, and governor. However, even the largest state Koror has only about 13,300 people and the second largest state Airai has about 2,100 people. Other states have less than 1,000 people and the smallest state only 23 people. Consequently, most of the states do not have all the necessary documents, such as laws and regulations, in place. They follow traditional rules, which are not consistent with the laws enacted by the central government. In that sense, the central government can only govern the states indirectly. For a small country, such a political system is extremely inefficient.

b. Organizational Structure for SWM

The central government makes policy decisions and enacts laws for SWM. However, no single government agency is in charge of SWM. It is under the jurisdiction of the Office of the President, Ministry of Resources, Environmental Quality Protection Bureau (EQPB), Office of Environmental Response and Coordination (OERC), as well as the National Environmental Protection Committee. For this reason, the decision-making process is inefficient and time consuming and there is no clear distinction of responsibilities. The government also recognizes these drawbacks and it plans to set up a unit within this year to take charge of waste exclusively.

Each state government is responsible for carrying out its own waste operation. Koror is the only exception because the Public Works Bureau of the Ministry of Resources under the central government is in charge of the operation of Koror's landfill site. In other states, the state government takes care of all waste operations, including landfill sites. Most of the states have their own final disposal sites and the state governments are in charge of the operation.

Koror is the only state that has set up a SWM unit, beginning in 2003 within the Public Works Bureau. The unit, however, has only one staff member. Other states do not have a unit dedicated to SWM. This is understandable considering the extremely low amount of waste (most states collect less than 1 ton/day) in these states.

Regulations relating to waste operations can be found in the document below. The contents are simple but they cover all the necessary issues. They are adequate given the size of the country.

Chapter 2401-31 Solid Waste Management Regulations, May 26, 1996

The Integrated SWM Plan was drawn up in October 1999 as a national plan for waste operations; unfortunately, it has not been approved by the related organizations. EQPB, however, has started implementing, albeit in small scale, the parts of the plan that cover recycling, home compost, waste oil treatment, collective compost, etc., since 2004. No policy regarding discarded vehicles and unwanted home appliances has been implemented yet.

Although the Palauan government intends to ratify the Waigani Convention (the Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region adopted in 16 September 1995), due to delays in domestic procedures, the Convention has not been ratified yet. Therefore, even though EQPB took the lead in collecting and storing several types of hazardous wastes, they could not be accepted by the Australian government and are still stored at Palau.

EQPB formulated the Best Management Practices for Scrap Metal Processing Facilities and imposed a mandatory reporting duty on operators who handle waste oil, discarded batteries, and other hazardous substances. A waste-oil treatment facility has been set up in Dengibu, which also collects and stores discarded batteries. EQPB pays great attention to preventing pollution of

the surrounding water areas and seems to be implementing the necessary measures.

EQPB initiated the 2004 Earth Day on April 22 and collected used batteries as one of the Earth Day programs. People who brought in used batteries were given a T-shirt for exchange. The funds for the T-shirts were all donated by NGOs and donor countries. The used batteries collected were exported to China and Korea.

The Koror state government employs workers to collect residential waste with state-owned equipment, rather than hiring contractors. Business waste is collected by private operators for a fee. The Koror state government started collecting end-of-use vehicles free of charge beginning in January 2004. Upon receiving a request, the government uses UNIC truck-mounted cranes to collect the retired automobile and disposes of it at the M-Dock landfill site. It collected 75 vehicles within the three months after the program's launch.

c. Financial System

None of the states charges any fees for the collection of residential waste. Private operators collecting business waste are also not required to pay any fees for disposal. Therefore, the waste operation does not generate any revenue income; and it is completely paid for with tax money.

The annual operating cost of the M-Dock landfill site in Koror is 150,000 USD. Assuming the waste amount per day is 15 tons and the unit cost for disposal is 27 USD/ton, this is quite expensive considering the fact that almost no environmental measures have been implemented at the landfill site. The high cost is due to the small landfill amount and the use of over-sized equipment. It is to its credit that Koror employs such a huge sum of money to operate the landfill site; however, if these expenses were used more efficiently, the site could be operated in a more eco-friendly way.

d. Capacity to Undertake SWM

At present, the EQPB is the key entity undertaking the nation's SWM. Despite the fact that EQPB is a weak organization, it has a high level of environmental awareness. It is undertaking the collection of waste oil and used batteries, the collection and storage of hazardous wastes, the collection of recyclable waste, etc. Although it should be given credit for its active approach, the lack of progress shows that the organization does not have sufficient implementation capacity.

Mr. Tiger, who is in charge of EQPB, is a highly qualified individual. He not only takes great interest in SWM, he is also very knowledgeable about the subject matter. The organization relies heavily on his ability. Besides him, there are also persons of great understanding in other waste-related organizations. Unfortunately, the layer of people of such caliber is very thin in this small country. Devoting more efforts to strengthening this layer of people will be difficult given that the number of public workers has already reached 26% of the labor force and that highly qualified people tend to move overseas.

The Koror State's SWM unit has also started the collection of discarded vehicles. The section's high level of environmental awareness and positive attitude should be highly commended; however, the squalid situation at the M-Dock landfill site also manifests the unit's limited capacity in implementation.

While it is necessary to strengthen and develop human resources, it is hard to imagine that such measures alone can improve waste operation. It is highly essential, therefore, to establish at the same time a system or an institution that will enable the trained personnel to fully utilize their abilities. The current political and administrative systems pose great challenges.

One of the ways to compensate for the government's lack of administrative ability is to engage the private sector. A country with a population of 20,000 has no SWM consultant. Therefore, direct assistance in implementation, such as the formulation of laws and standards, will be extremely helpful.

4.2.2 Technical System

a. Solid Waste Discharge Amounts

According to the existing data, the discharge rate is 1 kg/person/day in the urban areas of Koror and 0.6 kg/person/day in other parts. The total amount of waste generated is estimated to be 17.9 tons/day and 6,500 tons/year. Large/bulky wastes, such as unwanted home appliances, discarded vehicles, and demolition waste disposed of at the landfill site stand out. If these wastes were included, the wastes brought to the site are estimated to be 1.5 times the earlier figures.

b. 3Rs

Since Palau does not have any factory producing drinks, all cold beverages and beer are sold in disposable containers such as PET bottles or cans. There is no deposit system. A recycling project has been launched but it is a very limited, small-scale operation.

One private company collects non-ferrous scrap such as aluminum cans, aluminum materials, copper, etc., for recycling. After being compressed, the scrap is stored in containers, and over 100 tons are exported annually to the United States because the United States government provides inexpensive sea transportation to Micronesian countries. Employees of the company collect these aluminum cans from collection spots and disposal facilities.

Photo 4-1 The collected aluminum cans

Photo 4-2 Compressed aluminum cans

c. Collection and Transportation

Families and shops use metal barrels as storage containers for waste and place them along the roadside. The waste is then picked up by compactors or trucks.

Photo 4-3 Waste put out by shops and businesses

Photo 4-4 Waste put out by households

Koror collects waste once a week, the governments of two other states also collect waste, but in the rest of the states, waste generators bring their waste to the disposal site themselves. Besides the Kayangel State (population of approx. 140) that uses Koror State's landfill site, all other states have their own disposal facilities.

The Koror State hires its own employees to collect waste directly. It uses five compactor trucks for collection (Photo 4-5). Other states use pickup trucks because of their small population.

Upon request, Koror employs UNIC truck-mounted cranes to collect retired vehicles and transport them to the landfill site. Since the service was started not long ago, only 70 units have been collected. Since there is no collection of waste home appliances, individuals or repair shops have to bring the items that do not fit in the metal barrels directly to the disposal facilities.

Photo 4-5 Compactor truck used by the Koror State

d. Final Disposal

d.1 Koror State's M-Dock Landfill Site

The Koror State's M-Dock landfill site has an area of 15 acres (6 ha). It is close to the city center, within a 1-km distance. It has been used for about fifty years. The landfill area is about 2 ha, where 27,000 m^3 of waste has been disposed of. As shown in Photo 4-6, the original site of a mangrove forest is now a mountain of waste about 5~7 m high, where many discarded vehicles are buried.

Aluminum, which has relatively high value, is mixed in the waste (Photo 4-7). Employees of recycling companies come to collect it. Discarded vehicles are brought in everyday and they are piled up next to the landfill yard as shown in photos 4-8 and 4-9. A large amount of unwanted home appliances and construction waste are also disposed of in the same manner. As shown in Photo 4-10, most of the parts of the discarded vehicles have been removed.

The cover soil is only put on after the landfill has reached a certain level so that trucks can enter and drive on the landfill. A wide area of the waste is still exposed, causing a strong, foul smell and attracting many flies.

The position of the access road to the landfill site is badly designed; it is similar to going from low elevation to high elevation. During rain, the access road becomes a drainage canal, making passage impossible until the road dries up.

Photo 4-6 Koror State's M-Dock landfill site (large/bulky waste can be seen on the left side)

Photo 4-7 Valuable parts among the waste

Photo 4-8 Discarded vehicles

Photo 4-9 Discarded vehicles and unwanted home appliances

Photo 4-10 Discarded vehicle with auto parts removed

d.2 Airai Landfill Site

The landfill site at Airai, which is the second most populated state (population: approximately 2,100), is a reclamation of a valley as shown in Photo 4-11. Since the population is small and the amount of waste is little, the discarded vehicles (Photo 4-12) near the entrance of the site stand out in comparison. The aluminum cans at this landfill site are also recovered for recycling.

Photo 4-11 Airai State landfill site

Photo 4-12 Discarded vehicles

As time has passed, the location of the Airai landfill site has become inappropriate due to the following reasons:

a) The area around the site is turning into a residential area and houses began to be constructed near the landfill site.

b) The building of the former Imperial Japanese Army headquarters stands right next to the Airai landfill site. Part of the building is currently being used as a factory for repairing heavy construction equipment. Since there are still tanks and machine guns of the now-defunct Japanese army near the facility, the area is visited by delegations and tourists.

4.3 State of Large/Bulky Waste Management

4.3.1 Collection System

Koror State collects discarded vehicles free of charge, though no such system exists in other states. Unwanted home appliances are also collected free of charge with garbage.

4.3.2 End-of-life Vehicles

a. Number of Vehicles Registered and Number of Vehicles Imported

Table 4-1 shows the annual number of vehicles registered, imported, and discarded. The annual number of cars discarded is calculated by deducting the figure representing the increase in number of registered vehicles from the number of vehicles imported in each fiscal year.

Table 4-1 Number of Vehicles Registered, Imported, and Discarded

Item	1997	1998	1999	2000	2001	2002	2003
Number registered	8,486	9,736	11,588	10,920	8,904	(8,000)*	7,109
Number imported			1,398	1,014	1,149	1,022	
Number discarded			2,066	3,030	2,053	1,913	

* The 2002 figure is an average of the 2001 and 2003 figures.
Source: Answers from questionnaire

As shown in Table 4-1, the number of vehicles registered in Palau peaked in 1999 and then decreased by about 1,000 units annually in the following years. This was largely due to a change in the automobile tax system in 1999. Despite the decrease, there were still 7,109 vehicles registered in 2003. In 2000, the total population was 19,200, of which about 4,600 were between 0 and 14 years old. The population of those above 16 years of age who were eligible to obtain a driving license was 14,000. In other words, half of the population eligible to drive owns a vehicle. The number of households in Palau is 3,350. This means that each household owns more than two vehicles. This is due to the following reasons: (1) there is almost no public transportation such as buses, (2) while the national income is high (per capita GDP is over 6,000 USD), the customs duty is relatively low, so a ten-year old Japanese car can be purchased at a relatively low price of about 3,000 USD, and (3) since Palau has high temperatures and frequent rain, people are less inclined to walk outdoors.

As shown in Table 4-1, the ownership of automobiles has reached the point of saturation. With the tax increase, the number of registered vehicles tends to decrease year by year, giving rise to a phenomenon in which the number of vehicles to be discarded will surpass the number of vehicles imported.

Among the vehicles imported, 75% are used vehicles (questionnaire data). Our interview results show that many ten-year old Japanese cars are imported. According to our observation, about 70~80% of the cars running in Koror City are Japanese cars. Korean cars account for a relatively high percentage among the new cars. As a rule, Palau uses cars with left-side steering, but since there was a period when the import of cars with a right-side steering was permitted, there still exist many Japanese cars with right-side steering.

b. Estimated Number of Discarded Vehicles

There are many car repair shops in Palau and the cars are properly repaired, but very old cars are few in number. The fact that the number of registered vehicles peaked in 1999 and is now in decline, as shown in Table 4-1, shows that the current number of vehicles is sufficient. Furthermore, in relation to the 7,000 to 8,000 vehicles registered, the number of vehicles imported is over 1,000 units. This shows that the lifespan of a vehicle after being imported is seven to eight years on average. In other words, the number of vehicles registered in Palau has already reached saturation, and the average lifespan after import is less than eight years.

The following is a forecast of the number of vehicles to be discarded in the future based on the assumption that the number of vehicles registered will increase at the same 2.1% rate as the increase in population and that the lifespan of imported vehicles is eight years. The forecast results are shown in figures 4-1 and 4-2.

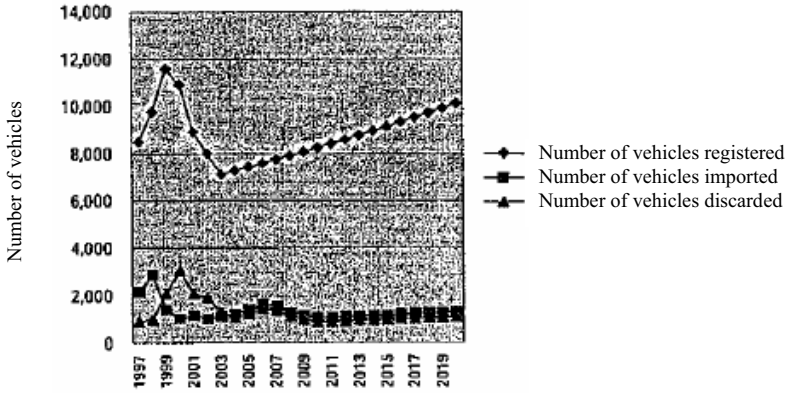

Figure 4-1 Estimated Numbers of Vehicles Registered, Imported, and Discarded

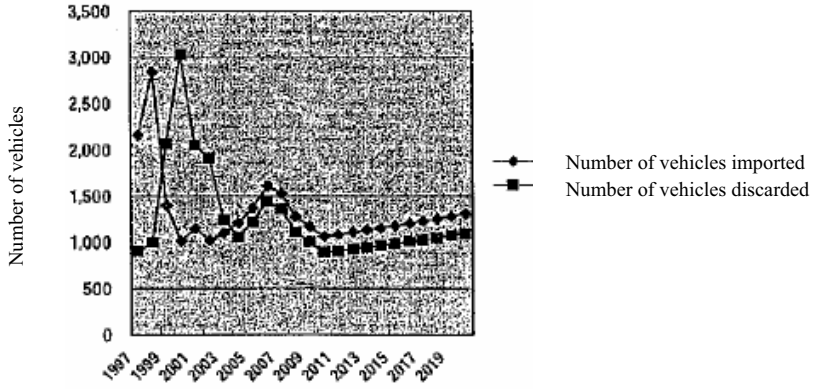

Figure 4-2 Estimated Numbers of Vehicles Imported and Discarded

c. State of Automobile Disposal

Automobiles are mainly disposed of at each state's landfill site. Some are stored in the yard of a private home, or are stored in the parking lot of automobile repair shops waiting to have their auto parts recovered.

The auto parts of many vehicles disposed of at the landfill site have already been removed. Only the car bodies are discarded. The vehicles stored at the repair shops will also have their auto parts recovered and then be discarded at the landfill site. In Koror, the retired vehicles stored in the yard of private homes will be taken to the landfill site upon request. As long as there is enough capacity at the landfill site, these vehicles will not cause any serious problem.

Photo 4-13 Disposed vehicles stored at a repair shop

4.3.3 End-of-Life Large Home Appliances

Table 4-2 is compiled based on answers to our questionnaire. It shows the ownership of home appliances in Palau's households. Since we did not have any data on air-conditioners, we compiled the data based on interviews of residents. Almost 100% of the households in Palau have electricity supply.

Table 4-2 Ownership of Home Appliances

Item	Ownership rate (%)	No. of units
Refrigerator	100	3,350
Television	67	2,245
Washing machine	25	838
Microwave oven	50	1,675
Computer	10	335
Air-conditioner	100*	3,350
Total		11,792

*: Although the ownership rate of air-conditioners is not 100%, considering that there are many government offices and households with multiple units, we use 100% as the ownership rate for air-conditioners.

According to interviews with repair shops, many refrigerators, air-conditioners, and washing machines are used Japanese products. Due to the high humidity in Palau and frequent voltage fluctuation, the average lifespan of these used products is about three years. These data, however, are from products that were brought in for repairs, so it is questionable whether they represent the average or not. Many new home appliances at the appliance stores are from China. They are cheaper than Japanese products and many people prefer to buy new ones. Though most televisions are bought new, they do not last ten years on average, because they lack durability.

We estimated the number of units for disposal in Table 4-3 on the premise that these bulky home appliances have an average lifespan of eight years. We estimated the ownership rate in 2013, ten years from 2003, as shown in Table 4-3. Since the ownership rate in 2003 is still

increasing quite rapidly, we estimated the number of units for disposal as 10% of ownership. In 2013, the disposal rate for washing machines, of which diffusion is expected to continue and increase at a high rate, is set at 10%; the disposal rate for other appliances is assumed to be at 12.5%.

Table 4-3 Estimated Ownership of Home Appliances in the Future and Units for Disposal

Year	2003			2013		
Number of households	3,350			4,124		
Item	Ownership rate (%)	No. of units	Units for disposal*1	Ownership rate (%)	No. of units	Units for disposal*1
Refrigerator	100	3,350	335	100	4,124	515
Television	67	2,245	224	80	3,299	412
Washing machine	25	838	84	50	2,062	206
Microwave oven	50	1,675	168	67	2,763	345
Computer	10	335	34	15	619	77
Air-conditioner	100	3,350	335	110	4,536	567
Total		11,792	1,179		17,403	2,124

*1: Since the ownership rate increased rapidly, the number of units to be disposed was estimated at 10%.
*2: Since the ownership rate of washing machines will see healthy growth, the number of units to be disposed of is set at 10% of the ownership rate and the other appliances are set at 12.5% of the ownership rate.

Home appliances that can fit into the metal barrels have no problem of disposal. Those that do not fit, such as refrigerators and washing machines, have to be brought directly to the landfill site. This, however, seems to cause no problem because of the high ownership rate of automobiles, especially pickup trucks.

4.4 Conditions related to Counter Measures

a. Repair Technology

a.1 Repair of Automobiles

There are 37 automobile repair shops in Palau, and about 150 people work in these repair shops, most of them being guest workers from the Philippines. Although the repair technology is satisfactory, it is difficult to procure auto parts and repair takes a long time. Since it is relatively economical and easy to purchase a vehicle, people opt to purchase another vehicle or have an extra one.

For this reason, there is less incentive to use imported vehicles for a long time, shortening the lifespan of vehicles. On the other hand, auto parts are recovered from the high amount of discarded vehicles and sold together with the imported used auto parts at auto parts stores as shown in photos 4-14 and 4-15. Unfortunately, these auto parts do not have as high a quality as the ones seen in Fiji.

Photo 4-14 A used auto parts store

Photo 4-15 A used auto parts store

Because a used vehicle tends to break down easily, the owner must repair it frequently in order to extend the service life of an imported used car. To enable the owner to repair the vehicle, the auto parts need to be procured easily, the repair time needs to be short, and the repair cost needs to be inexpensive. Otherwise, the broken-down vehicle will be left un-repaired or if the sale price is not too high, the owner may trade it in for a new one. This sums up the situation in Palau.

Given the limitations of a small market and high repair cost, it is unlikely that technical measures will have much effect in lengthening the lifespan of automobiles. Rather, it is necessary to pursue policy measures such as banning the import of used cars.

a.2 Repair of Home Appliances

We do not have any data on shops that repair home appliances. In Palau, the repair shops are divided into two types: the ones that focus on motors and compressors for refrigerators, air-conditioners, and washing machines; and the ones that focus on televisions and acoustic equipment. Photo 4-16 is an example of the former one. This is the same case as in other countries. The broken-down units are kept near the store waiting for the retrieval of parts. Unlike the repairs in Samoa, which include the exchange of refrigerant pipes, people in Palau tend to buy new products if the repair requires a high labor cost. According to our interviews, it is common for customers to repair if the charge is 50 USD, but to purchase a new one if the charge is 100 USD. Such consumer behavior is similar to that of developed countries like Japan.

Therefore, rather than putting emphasis on technology to repair home appliances to extend their lifespan, the recommendation is to work with manufacturers to develop products that will work well in the high temperature and high humidity environment of Palau, regulate the import of old equipment, etc.

Photo 4-16 Repair shop for refrigerators, etc.

b. State of Recycling

There are many recycling activities in Palau despite its small population. In addition to the recycling of aluminum and copper mentioned earlier, the recovered auto parts from discarded automobiles as well as the car bodies, though small in scale, are recycled. Photo 4-17 shows a car body being melted down into small parts to separate useful parts with relatively high iron purity and to disassemble other parts. Photo 4-18 shows the remaining unusable parts, which are of a considerable amount.

Iron scrap is collected from heavy steel waste such as waste steel molds. They are stored for several years until they accumulate enough to fill up a chartered ship to be transported to Malaysia and other countries for export.

Various usable parts from a discarded vehicle are recovered. The car body is melted down to recover iron scrap with high iron purity for export. Because Palau is close to the Asian markets, the transportation cost is low, facilitating export from Palau.

Photo 4-17 Usable parts from disassembled vehicle

Photo 4-18 Unusable parts from disassembled vehicle

There is an example of ships chartered to export iron scrap from Palau to Malaysia and other countries. In 2004, a company in Palau exported 2,000 tons of steel materials and another one exported 1,000 tons of steel materials. These materials had been accumulated over the course of several years. Photo 4-19 shows the iron scrap stored at the above-mentioned company that had exported 2,000 tons.

EQPB is actively appealing to citizens to collect and store batteries and waste oil. In 2003, the batteries that had been gathered for five years were loaded onto a container ship and exported free of charge. EQPB is also reviewing ways to recycle waste oil.

Photo 4-19 Accumulated iron scrap

c. Measures for the Handling of Hazardous Substances Resulting from the Treatment or Disposal of Large/Bulky Waste

EQPB is very concerned about the ocean being polluted by batteries and waste oil from discarded automobiles and ships, and it is collecting and storing these wastes. It collects and exports the batteries for recycling and is working on a system to treat waste oil domestically.

4.5 Evaluation

4.5.1 Evaluation of the Overall SWM

Almost no scattered waste is seen in the streets and consequently, there are no waste-related health or sanitation issues. This shows that the waste collection system is working properly. However, the current collection and storage system of using metal barrels is not efficient. Together with the shortage of labor force, this may pose a problem in the future.

Both the M-Dock and Airai landfill sites have implemented few measures to protect the environment. The negative effect has already been felt and it is necessary to make immediate improvement.

Due to the small size of the country, the amount of waste is also small. Although the waste amount does not pose any serious problem, the difficulty of SWM in this small country is the result of limited human resources and an inefficient political system. The limited human resources will have to take care of all kinds of waste, so it will be impractical to manage solid and liquid waste separately. Substantive assistance from donors in wide areas of SWM is needed.

4.5.2 Evaluation of the Large/Bulky Waste Issues

a. Illegal Dumping

During our field survey, we have not found any illegal dumping of retired automobiles or home appliance waste. They are kept on private land or in the disposal facilities, thus they pose no social problem. This is due to the free-of-charge collection of discarded automobiles and unwanted home appliances, and the active recovery of valuable parts from discarded vehicles and home waste by the private sector.

b. Environmental Pollution

In comparison to the measures undertaken for waste oil and used batteries, measures to tackle other hazardous substances contained in discarded automobiles and waste home appliances are still insufficient. Since almost no measures have been taken to tackle such hazardous substances, there is the possibility of soil contamination.

c. Priority in Large/Bulky Waste-related Problems

The ownership rates of automobile and home appliances, as well as the annual disposal amount, are already high. The families on Koror Island, where the population is concentrated, are running out of space on their small plots of land to store these wastes. To counter this situation, the government has started the collection of retired automobiles free of charge. As a result, the large/bulky waste is using up a huge amount of the landfill site. Undertaking measures to extend the lifespan of the landfill site is as important as conducting activities to reduce municipal waste. Measures to take control of large/bulky waste have a high priority.

Chapter 5 Current State of the Republic of the Marshall Islands

5.1 Geography and Society

The Republic of the Marshall Islands (hereinafter referred to as "Marshall Islands") lies at 5-19 degrees North latitude and 160-175 degrees East longitude, and has a total of 29 atolls and 1,225 islands. Almost all of the national land is at or below 3 meters above sea level, and all the land is narrow atolls created from coral. The climate is tropical with an average daytime temperature of 27 degrees Celsius and an annual rainfall of 3,444 mm. Trade winds come from the northeast throughout the year. In addition, the sea breeze from the ocean presents an extremely harsh environment for automobiles.

The land area is only about 181 km^2, but the nationally held coastal waters area is much larger at 1.82 million km^2. The population is 56,429 (July 2003 estimate, CIA Fact Book); the population density of Majuro is high at 6,314 per km^2 (1999). The ethnic make up is mainly Marshallese, at about 98%. In terms of age composition, about 50% of the population is 18 and under. The average family size is large, at about 7.8 persons per family.

Agricultural products are primarily coconut and breadfruit. All of the cereal grains, such as rice, that make up the staple foods are imported. Major industries are copra and tuna processing. After processing, tuna is transported to American Samoa for canning. In other words, there is neither the market nor the industrial infrastructure for recycling collected materials.

Although the per capita GNP is 1,540 USD statistically, this does not reflect the actual social situation. Consumption clearly is in excess of this figure. The price levels of imported items are about the same or somewhat cheaper than in producing nations such as Japan or the U.S.A. Since very little food or goods are produced locally, products from developed nations must be purchased for daily necessities Therefore, it is almost like living in a developed nation price-wise, and the cost of living is extremely high. Although a JOCV member receives a living allowance of at most 700 USD per month, it is far less than the salary of an equivalent local position. This social situation is very unique.

The major reason for this strained economic society is related to the Compact of Free Association made with the USA and because large sums of compact money are received from the USA each year. The compact was renewed in April 2003 and extended for 20 more years. Currently, the money from the compact accounts for about 60% of the national budget.

The Marshall Islands has extremely high land values and a very strict land system. Traditionally, land on atolls is divided into *wetos,* strips of land that run across an atoll from the lagoon to the ocean. Wetos are further divided into 2 to 5 smaller strips. Land is held communally by family groups called *bwijs* that consist of the following four levels.

Paramount Chiefs	Holder of the absolute rights to the land
Lesser Chiefs	Intermediary between the Paramount Chief and Land Manager
Land Managers	Person in charge of the actual management and development of the land
Land Tenants	Residents

The transfer of land ownership is practically impossible. Even the roads built with grant aid have owners, and the government pays rent. Furthermore, since supermarkets and retail stores built with foreign capital also pay rent, landowners receive quite an income from the land. The land below the high water mark belongs to the government.

Automobiles drive on the right side of roads, and only automobiles with left-hand-side steering are permitted for import. Because there is very little public transportation, such as buses or taxis, the necessity for having a privately owned vehicle for transportation is high. Motorcycles

are rare, and most vehicles are automobiles. The widest span on the islands is about 300 meters, and most places only have a single road. Thus, if public transportation were provided, it would be possible to decrease the need for private cars.

The tax is a 4% VAT, which is the revenue for the local government. Tariffs were reduced about three years ago and are currently as shown below.

Food	5%
Items other than food and automobile	8%
Automobile	- For a new car, 2,500 USD - For used cars, 1,500 USD or 15% of the CIF price, whichever is higher

5.2 State of SWM

5.2.1 Non-technical Systems

a. Self-governing System

The system consists of a central government and local authorities corresponding to cities. There are no states or prefectures.

b. Organizational Structure for SWM

The central government has jurisdiction over policy decisions, legislation, and some implementation duties regarding SWM. Among the related agencies in the central government are the Environmental Policy Coordination Office, the Environmental Protection Agency (RMI-EPA), and the Ministry of Public Works.

The Environmental Policy Coordination Office makes policy decisions and legislation.

In addition to environmental management and provision of environmental education, the Environmental Protection Agency (RMI-EPA) enforces environmental protection measures that are outside the responsibility of local authorities such as oil spills from ships, and implements environmental projects.

The Ministry of Public Works is responsible for the landfill site in Majuro City, and for its development and management.

Each local authority is responsible for SWM and performs the garbage collection and transportation duties.

The government of Marshall Islands has not ratified the Waigani Convention.

c. Financial System

No local authorities levy a collection fee for household waste. Furthermore, they do not levy private companies that collect industrial waste for disposal. Accordingly, there is no revenue from SWM, and it is all paid for by taxes.

d. Capacity to Undertake SWM

There are four ministries and agencies and also each of the local authorities involved in waste administration. For such a small country, there are more organizations involved than for a much larger country. Accordingly, it is unclear where responsibility lies, leading to a weak sense of responsibility in each organization. Both human resources and equipment are limited. These valuable resources are divided among the organizations, leaving each weak. Cooperation and coordination among the organizations is also insufficient. This problem had been pointed out in previous reports as well. The government, recognizing the importance of solving this problem, once transferred the responsibility of landfill management from the Ministry of Public Works to the City of Majuro, but the experiment ended in failure because of the city's inability to meet

the responsibility.

There is no history or results that show residents' cooperation either by providing labor to collect garbage or by paying for collection fees. Residents also have shown no capacity to engage in such cooperation.

Among private companies, there is one construction company that has a virtual monopoly. Currently, this company does not participate in the waste-related business, but it has sufficient capacity to participate and contribute.

Overall, the management capacity of the government is weak.

e. Aid from Other Nations

Because diplomatic relations between Taiwan and the Marshall Islands are quite friendly, and Taipei is a sister city of Majuro City, Taiwan provides the most cooperation in the field of SWM and had provided waste collection equipment in the form of grant aid several years ago. Furthermore, the Taiwanese government recently invited Majuro City officials to observe an incineration plant in Taiwan.

In 1996, the USEPA studied Majuro's SWM situation and proposed a plan that focused on an incineration plant that used waste oil as a subsidiary fuel. It aimed at simultaneously solving the processing of waste oil and treatment of waste. However, this plan has not been implemented.

5.2.2 Technical System

a. Solid Waste Discharge Amount

The amount of garbage landfilled in 2003 in the capital of Majuro, the city with the largest population in the Marshall Islands, was 4,800 tons for the year. The amount collected is estimated at 5,148 tons for the year.[3] Based on the visit of the study group to the landfill site, the capacity of the site is about 36,000 m^3 and was expected to be filled in about five years. Given that the specific gravity of landfilled waste is 0.7 tons/m^3, the amount of garbage landfilled annually is 5,040 tons, showing little difference with the above figure. The population is estimated to be about 24,700 (23,676 x $(1.017)^{2.5}$) representing the median population (year 2001) from 1999 to 2004, the years that landfill was performed. This figure was obtained from a target population of 23,676 from the 1999 census, and assuming that an average population growth over the previous 11 years was at 1.7%. Therefore, using a figure of 5,000 tons/year as the annual amount of solid waste generated, and using a 90% collection rate, the per capita waste amount is 0.61 kg (5,000 x 10^3/(365 x 24,700) x 0.9)/person/day.

b. 3Rs

As shown in Photo 5-1, a small scale pilot program of aluminum can, plastic container, and battery collection was started this year under the leadership of the Environmental Protection Agency. However, while recycling of aluminum cans has started, as described below, the recycling method for plastic containers has not been determined.

As shown in Photo 5-2, a Taiwanese owned company has started recycling aluminum and copper in 2003.

[3] Majuro-Solid Waste Management: Infrastructure Development and Maintenance Plan 2003

Photo 5-1 Collection container for valuables

Photo 5-2 Aluminum and copper collection

c. Collection and Transportation

In Majuro, as shown in Photo 5-3, 50 large public container units (2.4 meters wide x 6 meters long x 1.2–1.5 meters high, capacity of about 19 m^3) and 20 medium containers with a capacity of 12 m^3 are placed at 58 permanent stations. Local residents place their garbage in the containers, and Roll-on/Roll-off vehicles transport these containers to the landfill site. Roll-on/Roll-off has rails and winches, as shown in Photo 5-4, and since a single driver can operate this vehicle, it is a labor-saving system. There are two Roll-on/Roll-off vehicles, and 170 trips are made every month, and collection occurs at least 3 times a month for each of the 58 permanent stations. Furthermore, 10 containers of the same system and one truck are used in Ebeye for the waste collection there. They were all donated by the Taiwanese government in 2000, but corrosion on the containers is starting to be noticed and many holes are found on the bottom of the side panels.

There is quite a bit of scattered garbage. The reason is that the large containers are too large must be placed at a location that exceeds the distance residents are willing to transpire to dispose of their garbage. It implies that the necessity of regular garbage collection is getting high in suburban areas.

Photo 5-3 12 m^3 garbage container

Photo 5-4 Roll-on/roll-off truck

Furthermore, aluminum cans, plastic bottles, and other containers are particularly evident along the shoreline and destroy the beautiful scenery (Photo 5-5).

Photo 5-5 Scattered garbage along the shoreline

d. Final Disposal

The Batkan Landfill Site is located on the ocean side on the way to the airport from downtown. The coastal reclamation site sits along the shoreline at about 50 meters in width and 400 meters in length. Since houses are built along the road, the houses act as a screen hiding the landfill from the road.

The landfill structure is as shown in Figure 5-1. Just before the coral bedrock drops off suddenly into the water, gabions (metal netted baskets filled with coral rocks) are stacked up to form a dyke. The space between the dyke and the land is used as a landfill site. The lower bedrock of the coral is exposed during low tide, but is under more than one meter of water at high tide. The landfill has been approved by the landowners living next to the site (no use fees, but the landowners receive reclaimed land in return). At the end of use, the reclaimed land is to be covered with a layer of coral stone obtained from a lagoon and returned to the landowners. Since the land will be used to build homes, the landfill cannot be much higher than the ground level on the island. Accordingly, the average depth for the landfill is about 1.8 meters. In other words, the landowner has firm plans for use of the reclaimed land. This same landowner is also supervising the work. Since the plan is well followed, there is little chance that waste will accumulate to a height of 10 meters or more, as in the case of the Lami landfill in Fiji.

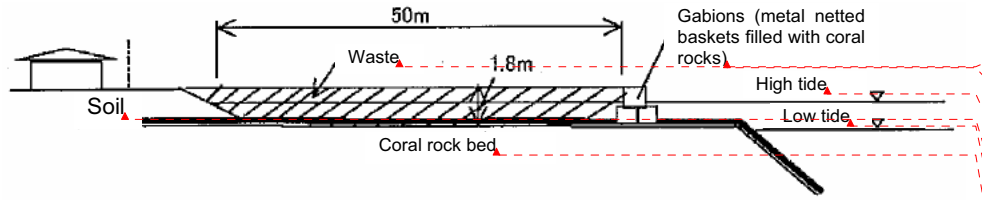

Figure 5-1 Cross-sectional View of Landfill Site

The state of the landfill site is shown in Photo 5-6.

This landfill site is about 50 meters wide, 400 meters long, and filled to a depth of about 1.8 meters. It has a capacity of about 36,000 m^3.

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Photo 5-6 Majuro landfill

As can be seen in the photo, cover soil is not used intermediately, and the specific gravity is taken as 0.7 tons/m^3 because compaction has not progressed much. Furthermore, because the landfill is performed over five years, the annual landfill amount shown above is calculated as follows: 36,000 m^3/5 years x 0.7 tons/m^3 = 5,040 tons/year

Photo 5-7 shows the landfill site and the shoreline partitioned by the dyke of gabions. Since the photo was taken at low tide, the coral bedrock is visible. No water pollution was observed from the shore.

Since the gabions do not impede water flow, ocean water flows into and out of the landfill according to the tides, and washes out pollutants that result from the waste decomposition. Also, since the waste is thinly layered and is composed of comparatively porous material, as shown in the photo, and aerated regularly by the ocean tides, the interior of the garbage maintains an aerobic state and decomposition probably progresses rapidly. In fact, the odor from the landfill was very faint, especially for this type of site.

Photo 5-7 Shore protection of the landfill site

Furthermore, as shown in the physical composition data for the waste in Figure 5-2, one important characteristic is that there are few food scraps, which are a cause of leachate. This also contributes to the fact that the odor is faint and water pollution is not observed. At the actual landfill site, in addition to paper including cardboard, clipped branches, palm leaves, plastic, discarded metal products and aluminum cans were evident.

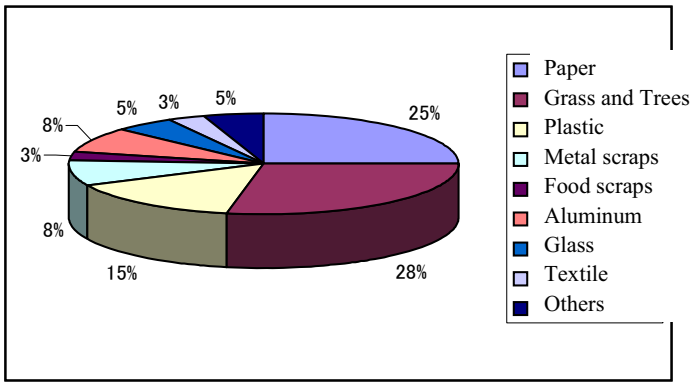


Figure 5-2 Composition of Solid Waste

The two primary problems with the current landfill method are (i) periodic coverings with soil are neglected, and (ii) the structure of the shore protection is weak. The coated steel wire used in the gabions' metal netting has lost its coating in several locations, allowing rust to spread and causing the wire to break. This has led to the problem of the destruction of the shore protection. As shown in Photo 5-8, the wire breaks due to rust, gabions break down, and after the rocks are dispersed, garbage starts protruding in several places.

Photo 5-8 Broken shore protection with broken wires

The view at the current landfill is particularly bad because regular covering with soil is not carried out, but there is little odor, few flies, and almost no water pollution. The fact that there are no complaints from the surrounding residents shows that no severe adverse impact is placed on the environment. The following are presumed to be the cause for this.

- There is little kitchen waste. (Fruits and vegetables are imported and are expensive. Traditional custom does not permit leftovers)
- The landfill structure creates a favorable aerobic environment. (Good supply of oxygen to the landfill garbage through permeable shore protection. Narrow landfill width and shallow landfill depth)
- The amount of collected garbage is small, and there is a small amount of leachate.

To improve the final landfill site, however, the following steps should be taken in stages:

- Periodic coverings (Should be implemented immediately. Coral can also be the covering material)

- Improve leachate treatment by using porous local materials, such as coral, in the dam
- Improve the shore protection by using large rocks on the surface
- Implement measures to prohibit hazardous materials in the landfill
- Control the leaves and pruned waste in the landfill by chipping the materials where they are found and disperse them there
- Compact large pieces of landfill garbage to reduce the amount

The following are considered landfill sites:

- Batkan Landfill Site: A landfill site currently in use; will close after being filled up sometime between June and August 2004.
- Utinban Landfill: A small landfill secured on short notice because the long-term Jenrok Landfill construction did not start. The landowner is a staff member of the Ministry of Public Works. The capacity is about two years worth. JOCV member Shimizu has created plans for this landfill site.
- Jenrok Landfill: A long-term landfill with a capacity that should last for 20 years. The Marshall Islands are showing signs of expectation for Japan to perform the construction.

5.3 State of Large/Bulky Waste Management

5.3.1 Collection System

There is no collection system for discarded vehicles.

Unwanted home appliances that are placed in the large public containers are all collected and disposed of.

5.3.2 End-of-life Vehicles

a. Number of Vehicles Registered

The majority of registered vehicles are used on the Majuro atoll, and less than 5% in Ebeye. Majuro has 45% of the entire population, Ebeye has 23%, and the remaining atoll islands have 32% of the population. The other islands do not have maintained roads, so vehicles are not used much. Ebeye is in the Kwajalein atoll. Its main island is an American military base where no general residents may live. Those who work on the base live in neighboring Ebeye, a narrow island with a high population density.

Table 5-1 shows the secular change in the number of vehicles registered in Majuro since 1986. The five year period from 1991 to 1996 showed a decrease, but the next five years show a drastic increase. Table 5-2 shows that the number of registered vehicles plateaued after 2000.

Table 5-1 Number of Vehicles Registered in Majuro by Year

Year	Number	Annual Increase (%)
1986	932	-
1991	1,488	9.8
1996	1,307	-2.6
2001	2,749	16.0
2002	2,919	6.2

Source: Statistic Year Report in the Republic of the Marshall Islands

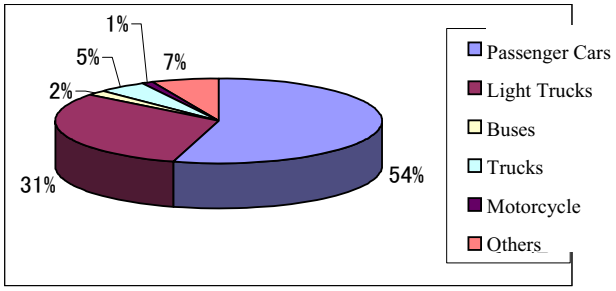
Table 5-2 Number of Vehicles Registered in the Marshall Islands by Year

Year	Number of Units		
	Private Use	Public Use	Total
1999	2,416	168	2,584
2000	2,507	241	2,748
2001	2,899	170	3,069
2002	2,946	155	3,101
2003	2,700	287	2,987

Source: Reply from Environmental Protection Agency to a Questionnaire

The types of registered vehicles in 2002 are shown in Figure 5-3 and Table 5-3: Passenger cars accounted for more than half.

The median annual income for a family on the Marshall Islands is 25,000 USD; and the average is 3,200 USD. Since the average household has 7.8 persons, median annual income and the average annual income per capita are 3,200 USD and 4,100 USD, respectively. Considering that children under 18 years of age account for more than 50% of the population, the income of workers is extremely high. The tariffs for vehicles are not high. They are 1,500 USD for the used cars and 2,500 USD for new ones. The purchase price is 6,000 USD or more for used and 20,000 USD or more for new vehicles. When compared to annual family incomes, the purchase of a vehicle is not that difficult.



Source: Statistic Year Report in the Republic of the Marshall Islands

Figure 5-3 Vehicles on the Marshall Islands by Type

Table 5-3 Types of Vehicles Registered in the Marshall Islands (2002)

Type	Majuro	Ebeye	Total
Passenger Car	1,647	27	1,674
Light Truck	857	95	952
Bus	58	6	64
Truck	138	6	144
Motorcycle	32	3	35
Other	187	18	205
Total	2,919	155	3,074

Source: Statistic Year Report in Republic of the Marshall Islands

b. Estimated Number of Discarded Vehicles

403 vehicles passed through customs in the one-year period beginning in October 2001. Of these, 288 (71.4%) were used vehicles. This is the number of vehicles sold after 2001 and is included in the number of newly registered vehicles.

If the vehicles imported during the above one-year period are assumed to be registered in 2002,

then, from Table 5-4, the number of vehicles discarded in 2002 (vehicles that were previously registered but not registered for this year) is shown in the following table.

Table 5-4 Increase over the Previous Year

Year	Registered Vehicles	Increase (No. of units)
1999	2,584	
2000	2,748	164
2001	3,069	321
2002	3,101	32
2003	2,987	-114

403 – 32 = 371 (Unit: number of vehicles)

Furthermore, since the total number of vehicles was 3,101, then 371/3,101=12.0%, the percent of vehicles discarded. In other words, the lifespan of a vehicle in the Marshall Islands is 1/0.12=8.3 years, as estimated from these figures. Although this seems to be an extremely short life span, it is probably accurate due to the following reasons:

- Many used vehicles are imported
- The islands are narrow and long with an altitude of two meters or less, and in addition to being surrounded by the ocean and subjected to salt breeze, the high temperatures and humidity create a harsh environment for machinery.
- Although there are repair shops, complete repair is difficult because there are no schools to teach repair skills. The influx of foreign technicians is restricted, and parts are difficult to procure because the market is even smaller than Palau.

Furthermore, Table 5-4 shows that there were no major changes in the number of vehicles after 2000, but the number of taxis increased from 298 in 2000 to 444 in 2002. From this, it can be said that no major problems in convenience have occurred, even with the number of vehicles leveling out. Therefore, if the number of vehicles plateaus at 3,000 after 2004 and the average lifespan is eight years, then the numbers of imported vehicles and of discarded vehicles are expected to be as shown in Figure 5-4.

The number of discarded vehicles is expected to stabilize at around 375 units per year.

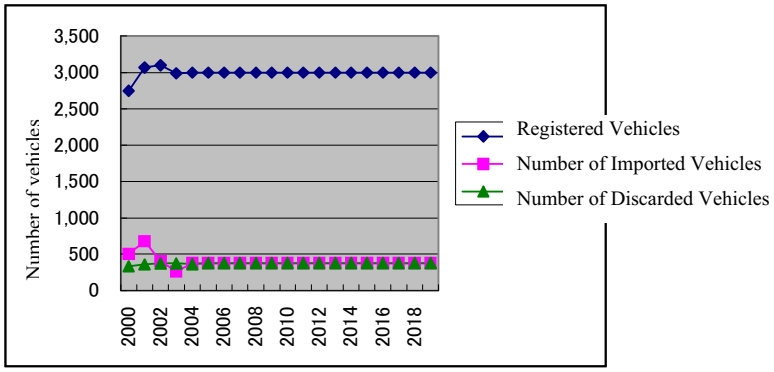


Figure 5-4 Estimates for Number of Registered, Imported, and Discarded Vehicles

c. State of Automobile Disposal

In comparison to the other three nations, discarded vehicles in the Marshall Islands stand out noticeably against the scenery. The most common observed methods for discarding vehicles, also frequently observed in other nations, are (1) to leave them in a private yard (Photo 5-9), (2) to leave them in a repair shop compound so that parts can be removed (Photo 5-10), and, (3)

collecting a large number of vehicles in one location (Photo 5-11) (whether permission from the landowner was given is unknown.) In addition, unique to this area is (4) discarded vehicles in the shoreline landfill (Photo 5-14).

Photo 5-9 Discarded waste left in a yard

Photo 5-10 Discarded vehicle left next to a repair shop

Photo 5-11 Discarded vehicles stacked along the coastline and likely to be landfilled

Photo 5-12 Illegally dumped vehicles left in disarray

Photo 5-13 Discarded vehicles and steel along the coastline, likely to be landfilled

Photo 5-14 Landfill site stretching into the ocean due to discarded vehicles and rubble

Furthermore, although not observed at the time of the inspection, other popular methods include: to bury in a landfill site in which the Ministry of Public Works allows disposal, or to bury in reclaimed land to which private citizens are permitted access.

5.3.3 End-of-Life Large Home Appliances

The 2003 estimated rate of ownership of home appliances in the Marshall Islands is shown in Table 5-5, assuming an annual increase of 5%.

Table 5-5 Ownership of Home Appliances

Item	1999[*1]						2002[*2]	2003 Estimated	
	Urban Areas		Rural Areas		National				
No. of Households	4,238		2,282		6,520		6,820	6,920	
Name	Ownership Rate (%)	No. of Units Owned	Ownership Rate (%)	No. of Units Owned	Ownership Rate (%)	No. of Units Owned	No. of Units Owned	Ownership Rate (%)	No. of Units Owned
Television	40.7	1,725	4.9	112	28.2	1,837		34	2,369
Refrigerator/freezer	42.8	1,814	3.3	75	29.0	1,889		35	2,437
Computer	16.6	704	1.7	39	11.4	742	1,143	17	1,176

Sources: 1. Reply to Questionnaire
2. Source: Statistic Year Report in the Republic of the Marshall Islands

According to the "Household Income & Expenditure Survey in 2002," the number of home appliances in the 355 households that replied to a 2001 household expenditure survey was 52 refrigerators, 104 washing machines and dryers, and 26 air conditioners. In addition, 52 houses reported using oil stoves for cooking, though these are not home appliances. In contrast to other Pacific islands, electric ovens are not used much here.

Based on these survey results, the number of washing machines, microwave ovens, electric ovens, and air conditioners is estimated in the left column of Table 5-6. Although the number of air conditioners purchased is comparatively small, they are used rather widely in homes in the Marshall Islands, so the ownership rate is set to 30% here.

There are very few appliance repair shops in the Marshall Islands. According to interviews, repairs are not popular because the feeling is that there is greater merit in purchasing a new product rather than repairing a damaged one. People tend to think so because repair skills are inadequate, repair costs are high due to high labor costs, and new products are cheap compared to incomes. In addition, there are also climatic problems and voltage fluctuation on the electricity supply. Therefore, the number of discarded units was calculated by assuming that the average life of an appliance was eight years, that 10% are discarded annually considering the sudden increase in recent appliance ownership, and that new ownership will slow down by 2013 and replacements purchased every eight years. Furthermore, an annual increase of ownership of 5% and a household growth rate of 1.7%, the same as the population growth rate, were assumed.

As shown in Table 5-6, it is estimated that the number of home appliances owned will double in the next ten years and that the number of discarded units will increase by 2.4 times.

In addition, large/bulky wastes, such as home appliances, are currently discarded at the landfill sites. The items that can fit in the garbage containers are collected by the local authorities; the larger items that do not fit are transported and discarded directly by the individual.

Table 5-6 Number of Owned and Discarded Units for Six Home Appliances, and Estimated Units to be Owned and Discarded in the Future

Category	2003 Estimated			2013 Estimated		
No. of Households	6,920			8,031		
Name	Ownership Rate (%)	No. of Units Owned	No. of Units Discarded	Ownership Rate (%)	No. of Units Owned	No. of Units Discarded
TV	34	2,353	235	55	4,448	556
Refrigerator/Freezer	35	2,422	242	57	4,579	572
Washing Machine	40	2,768	277	65	5,233	654
Stove/Microwave Ovens	10	692	69	16	1,308	164
Air Conditioner	30	2,076	208	49	3,924	491
Computer	17	1,176	118	28	2,224	278
Total		11,487	1,149		21,715	2,714

5.3.4 Other Large/Bulky Wastes

In addition to heavy construction equipment, marine transport containers and retired sea vessels are also a major problem. As can be seen in Photo 5-15 and Photo 5-16, moored or grounded sea vessels can be seen all over the island and interfere with the scenery. Many retired marine transport containers are also left in the same way and are decaying (Photo 5-17 and Photo 5-18). There is no statistical data for these items, but some measures must be established.

Photo 5-15 Moored disabled sea vessel


Photo 5-16 Grounded, decaying abandoned sea vessels


Photo 5-17 Discarded truck and discarded marine transport container


Photo 5-18 Abandoned, decaying marine transport container

5.4 Conditions Related to Counter Measures

a. Repair Technology

a.1 Repair of Automobiles

There are no schools to teach vehicle repair technology in the Marshall Islands. Therefore, many of the workers at the repair shops are foreigners, and there are only five vehicle repair garages in Majuro, according to the responses to the questionnaire. In addition, the number of vehicles sold is about 400 units annually, small compared to other surveyed nations. Since this number is not expected to increase much because road extensions are short, the market for repairs is also relatively small. In particular, vehicle repair requires not only skills but also the required parts. So, the small overall number of vehicles is inconvenient. In regards to parts, there is the example of a Korean company that provided the same line of vehicles for taxis, and stockpiled parts for that model to deal with any repairs.

On the other hand, some measures to prevent damage from salt is required because this nation is made up of atolls and is always subject to the impact of the sea air because of the narrow, low islands. If no special protection measures are taken, many car bodies start to decompose after about five years. According to the owner of a Japanese auto import shop, use of commercial vehicles is limited to about six years. For this reason, the lower part of the vehicle body is painted in Majuro, and according to a manager of a repair garage, this can extend the lifespan of an automobile to about 10 years.

As seen above, there are some measures taken against salt damage in the Marshall Islands, but the measures are not widespread. And although there are some examples of measures to have parts available, parts are basically hard to get, repair technicians are few and repair skills are lacking.

a.2 Repair of Home Appliances

Because there are no schools in the country to teach repair of home appliances, most technicians are foreigners. In addition, there are no specialized repair shops in Majuro. According to a person who requested repair of an air conditioner, repair skills are poor, and quality repair is impossible. Furthermore, because repair costs are high due to high labor costs and tariffs are relatively low, consumers tend to buy a new replacement when a unit is damaged.

b. State of Recycling

As a part of an educational program, an aluminum can collection effort was subsidized by the administration, but it did not last long. However, because a public company began collecting non-ferrous metal scrap, i.e., aluminum, copper, and bronze, in 2004, it is possible that the collection of these materials will continue and expand.

As seen in other countries, tires are used in place of curb stones as well as in place of low retaining walls by filling them with concrete, as shown in Photo 5-19. These may be used on the lagoon-side of the atoll where the waves are weaker, but the number is quite small.

In addition, vehicles are used as a landfill material, but this is not effective use of the material and should be considered as a final option of disposal.

The concern of this method is damage caused from disposing of the oil and battery from the landfilled vehicle, damage from oil or lead polluted water after removing the roof or partially crushing the vehicle and disposing of it in the landfill, and unexpected accidents such as cave-ins caused by metal corrosion. Although these dangers are recognized, there is no management to prevent them.

Photo 5-19 An example of effective use of tires

c. Measures for the Handling of Hazardous Substances Resulting from the Treatment and Disposal of Large/Bulky Waste

Although concerned parties recognize the danger of pollution caused by batteries or oil in discarded cars, they do not fully recognize the problem of CFC discharge or heavy metals in home appliances. At the end of several trials, there are high expectations for a battery collection program that has finally started. Most of the collected oil appears to be poured into the ground.

5.5 Evaluation

5.5.1 Evaluation of the Overall SWM

The present garbage collection in Majuro relies completely on garbage collection units supplied by Taiwan. In addition, because the container collection system does not require resident cooperation, resident cooperation has not been tested. Efforts for self-sufficiency are rare because of the abundance of the Compact money. As the current equipment ages, the future of SWM is very insecure.

Because the area covered by a container is too large and some of residents can't afford to carry their garbage to the containers over a long distance, there is scattered garbage seen within the garbage collection areas. In addition, the scattering of garbage around suburban areas without garbage collection indicates, at the least, the need for collecting garbage that is hard to dispose of, such as plastics.

Garbage disposal is performed by burying garbage in the beautiful ocean, and destroying the scenery by neglecting to cover the waste, which is a cause for criticism. However, building a retaining wall out of galvanized metal netting as a boundary before the landfill begins operation is a method much improved over an open dump. As a result, the current landfill site has a favorable aerobic environment which has little environmental impact. These positive points must also be fairly evaluated.

The current condition of the urban waste industry can be evaluated to be relatively good at this time. However, the increasing weakness of the collection system and the room for increased improvement in landfills by self-sufficiency efforts of implementing agencies should be given due consideration.

5.5.2 Evaluation of the Large/Bulky Waste Issues

a. Illegal Dumping

There is no illegal dumping of vehicles or home appliances. Illegal dumping is not expected in the future because of the strong traditional land system functioning in a small country. However, disabled sea vessels are a situation that equals illegal dumping and are a major problem.

b. Environmental Pollution

Counter measures for toxic substances in discarded vehicles or home appliances are in place for waste oil and waste batteries, but are insufficient. There are virtually no counter measures for other toxic substances and there is the possibility of causing soil or marine water pollution.

c. Priority in Large/Bulky Waste-related Problems

When compared to urban wastes, the generation of large item waste is small both in amount and importance. Urban waste has a speedy, but inadequate, collection and disposal system, and because it functions, the problem is under control. But because the treatment and disposal system for large/bulky wastes is not completely developed, accumulations will continue to grow and the impact on the environment will worsen. Accordingly, a response to this problem must be developed quickly in order to prevent it from becoming any worse.

If the problem of environmental pollution from toxic substances is ignored, the problem of large/bulky wastes will probably not be a public health problem because the waste is inert and the main problem will be damage to the scenery. Because the value of the scenery differs according to the concerned party, the decisions of the Marshallese people, who are the responsible concerned party, must be respected. Even so, because there is also the belief that the environment is an asset of all humanity, the opinion of a third party must also be respected. Guessing from various data and reports, it seems that the perception of parties involved in international environmental NGOs and donor organizations is that the large item waste problem on the Marshall Islands is "very serious." Influenced by this, domestic criticism has been growing in recent years against marine landfills for large/bulky wastes. Accordingly, the scenery problem has also been gaining a higher priority.

In conclusion, with the largest issues being the special environment of atolls and the prevailing social conditions, the priority of the large/bulky waste problem in the Marshall Islands should be classified among the highest of the Pacific Island Countries.

Chapter 6 Characteristics of the Regions Surveyed for the Large/Bulky Waste Issue

6.1 Waigani Convention[4]

The Waigani Convention is a South Pacific region version of the Basil Convention that controls the transboundary movement and disposal of hazardous wastes. The regions covered by the convention are shown below.

1) American Somoa	13) Niue
2) The Commonwealth of Australia	14) Northern Mariana Islands
3) Cook Islands	15) Republic of Palau
4) Federated States of Micronesia	16) Papua New Guinea
5) Fiji	17) Pitcairn
6) French Polynesia	18) Solomon Islands
7) Guam	19) Tokelau
8) Kiribati	20) Tonga
9) Republic of Marshall Islands	21) Tuvalu
10) Nauru	22) Vanuatu
11) New Caledonia and Dependencies	23) Wallis and Futuna
12) New Zealand	24) Western Samoa

The main points of the convention are as follows:

i. Control of Import/Export of Hazardous and Radioactive Wastes
   - Nations other than Australia and New Zealand are prohibited from importing the above wastes.
   - Australia and New Zealand are prohibited from exporting the above wastes to other member nations.

ii. Cooperation in Information Exchange for Measures to Prohibit the Import and Export of Hazardous and Radioactive Wastes

iii. Prohibition of Dumping Hazardous and Radioactive Wastes into the Ocean

iv. Duties of Each Nation

v. Radioactive Wastes

vi. Items Prohibited Domestically

The Australian government provides a hazardous waste collection service via ship for countries that have ratified the Waigani Convention. The Convention was approved in September 1995, but there are still few ratifying countries.

[4]The formal name is the "Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Waste and to Control the Transboundary Movement of Hazardous Waste within the South Pacific Region."

6.2 Characteristics of Large/Bulky Waste Management in the Countries Surveyed

Table 6-1 shows the current state of and future projection for large/bulky wastes in the countries surveyed.

Table 6-1 Current State and Future Projection of SWM and Large/Bulky Waste Management

Country			Samoa	Fiji	Palau	Marshall Islands
Land Area (km^2)*1			2,935	18,272	460	180
Population (estimated 1000s)			180*2	843*2	20.4*2	54.3*2
Annual Population Increase (%)			0.92*2	2*1	2.1*1	1.7*2
Number of Households (1000 households) *2			23/2001	175/2002	3.35/2000	6.9
Per Capita GDP (USD)			1,020*1	2,110*1	6,056*2	1,540*1
Electric Supply Rate (%) *2			About 100	69	About 100	68.5
Garbage Collection Ratio by Population (%)*2			Over 90	About 50	72	58
Waste Amount of Collected Garbage (kg/person/day) *2			Including industrial waste, 0.71 on Upolu Island (population 125 thousand)	Including industrial waste, 02 - 1.5 in the urban areas	Excluding large/bulky wastes, estimated at 1.0 in urban areas and 0.6 in rural areas	Including industrial waste, 0.61 on Majuro (population 23 thousand)
Vehicles *2	Number registered (1000 units)		11	67	7.2	3.0
	New registrations (1000 unit/year)		1.65	5.2/2002	1.0/2002	4
	New registration for used cars: ratio (%)		80	60	75	71
	Average vehicle life (years)		10	15	8	8
	Estimated number of currently discarded units (units/year)		0.2	2	2	0.37
	Estimated number of discarded units in 10 years (1000 units/year)		2	6	1	0.38
	Current Disposal Method		Leave in yard, leave in repair shop yard	Leave in yard, repair or second hand stores, dispose at disposal site	Leave in yard, dispose and bury at disposal site	Leave in yard or abandoned lot, illegal dumping, use for land reclamation sites, dispose/bury at disposal site
Home Appliances *2	Current Estimated Usage (%) Number of units in {} (1000 units)	TV	65 {15.0}	80{101.6}	67{2.2}	34{2.4}
		Refrigerator/ freezer	55{12.7}	50{63.5}	100{3.4}	35{2.4}
		Washing Machine	40{9.2}	50{63.5}	25{0.8}	30{2.1}
		Microwave/Oven	40{9.2}	60{76.2}	50{1.7}	20{1.4}
		Air Conditioner	10{2.3}	30{38.1}	100{3.4}	30{2.1}
		Computer	10{2.3}	25{31.8}	10{0.3}	17{1.2}
		Total Number (1000 units)	50.6	621.3	11.8	11.5
	Estimated number of currently discarded units (1000 units/year)		2.5	21.8	1.2	0.9
	Estimated number of discarded units in 10 years (units/year)		8.2	49.7	2.1	2.2
	Current Disposal Method		Public Collection/Disposal Site Disposal	Public Collection/Disposal Site Disposal	Dispose at Private Disposal Site	Public Collection/Disposal Site Disposal
Implementation of large/bulky waste recycling			Reusing Vehicle Parts	Reusing vehicle parts, using tires as fuel, battery	Reusing vehicle parts, some body parts, battery	Reusing vehicle parts
Hazardous Waste Measures				CFC Collection (pilot)	Battery/waste oil collection	

*1: Guidelines for Solid Waste Management in Pacific Island Countries (Background Report), JICA
*2: Figures were determined by this survey

6.2.1 Independent State of Samoa

a. Collection Services

Collection services for large/bulky wastes, including home appliances, are provided to citizens free of charge. The collected home appliances are buried in the landfill site. There is no collection system for discarded vehicles.

b. 3Rs

Vehicles and home appliances are repaired well and are used for a sufficiently long period, and this is largely attributable to the cooperation JICA has provided to the technical school for a number of years.

.Private recycling operators remove usable parts and non-ferrous metal parts from discarded home appliances and either reuse them or export them. However, collection and export of iron scrap, which makes up the majority of the composition of large/bulky wastes, are rarely done since financial results end up in the red.

c. Treatment and Disposal

Most discarded vehicles are left on the owner's private property. Sorted collection and treatment of hazardous substances, such as waste oil and batteries, are not performed.

Collection of unwanted home appliances began at the same time as large/bulky waste collection (April 2004). Most of it is transported to a final disposal site where it is dumped; no treatment for hazardous substances is performed at landfills.

d. Number of Discarded Vehicles

Currently, about 11,000 vehicles are registered. Since demand has surpassed supply and the number of vehicles registered has drastically increased, it is estimated that about 200 vehicles are currently discarded every year. It is expected, however, that the number of vehicles registered is expected to double to 20,000 and the number of discarded vehicles to increase tenfold, to 2000 per year.

e. Number of Discarded Home Appliances

The number of discarded home appliances in the six categories (TV, refrigerator/freezer, washing machine, microwave oven/electric oven, computer, and air conditioner) is expected to triple from the current approximate 2,500 a year to about 8,000 per year in about 10 years, and remain level at or near this number after that.

f. State and Evaluation of Large/Bulky Waste Problem

Since the amount of waste generated from discarded home appliances and vehicles is still small, and there is no illegal dumping, the problem has not been actualized. The government currently does not view these wastes as a problem. Rather, its priority is on the establishment of a municipal SWM system.

Since the start of large/bulky waste collection, the amount of home appliances discarded in landfills is rapidly increasing. Since these appliances are large in terms of volume, it is expected that they will pose a great burden on the remaining capacity of the final disposal sites. Furthermore, because the numbers of home appliances and vehicles owned have increased rapidly, the numbers discarded will certainly increase rapidly in the near future, making it a challenge for the government to cope with such a rapid increase. As a result, the importance of advance measures is growing.

6.2.2 Republic of the Fiji Islands

a. Collection Services

The local authorities collect large/bulky waste, such as unwanted home appliances, with general waste free of charge, and the collected home appliances are buried at landfill sites. For discarded vehicles, a substantial collection system exists as private operators buy discarded vehicles according to their quality.

b. 3Rs

Repair technology for vehicles is high due to the contribution of technical schools, and a supply system of used parts is well managed. In addition, because the costs of vehicles, including tariffs and VAT, are high compared to income, the vehicles are well maintained and used for a long period of time.

Useable parts and non-ferrous metal scrap are recovered and either reused or exported. The private sector recycles used vehicle batteries, and tires are used as fuel at the cement factory. In addition, parts with a high bulk specific gravity, such as vehicle engine blocks or doors, are exported as iron scrap. Furthermore, there is a private company that manufactures molded products, such as gratings and manhole covers, by melting iron scrap in an electric furnace. Of the four nations in this survey, Fiji is the only nation that is using recycled materials as a resource to create products. In general, recycling of large/bulky wastes in Fiji is quite active.

Collection and export of iron scrap, which makes up the majority of the composition of large/bulky wastes, rarely occurs since they end up in the red financially.

c. Treatment and Disposal

Most discarded vehicles are left on the owner's property, on the premises of discarded vehicle handlers or on disposal site premises. Sorted collection and treatment of hazardous substances, such as waste oil and batteries, are rarely performed.

d. Number of Discarded Vehicles

The increase in the number of imported vehicles (number of vehicles newly registered) over the last several years has been particularly remarkable. There are 67,000 vehicles currently registered and the number of vehicles discarded has reached about 2,000 per year. In ten years, it is expected that the number of registered vehicles will reach 100,000 and the number of discarded vehicles will reach about 6,000/year.

e. Number of Discarded Home Appliances

The rate of increase for discarded home appliances differs according to the category. Currently, there are about 600,000 units in the six categories that are owned, and about 20,000 units per year are thought to be discarded. The number of discarded units is expected to reach 50,000 per year in the future.

f. State and Evaluation of Large/Bulky Waste Problem

Since there is no illegal dumping and the problem has not been actualized, the government does not recognize this as a problem at present. The current concern of government authorities is to establish a municipal SWM system. The government authorities, however, have recognized that the problem of large/bulky wastes may be a challenge in the future.

Although the problem of inappropriate treatment and disposal has not been actualized, it may become so in the future. Since discarded home appliances are large, the burden they place on the final disposal sites is great.

6.2.3 Republic of Palau

a. Collection Services

Since Koror state, a major local authority, has a high density population and there is no room to leave large/bulky wastes on home properties, the state collects unwanted home appliances and discarded vehicles free of charge.

b. 3Rs

The fact that it is difficult to obtain repair parts despite above average levels of repair skill, incomes are high, and tariffs and VAT are low, have fostered a trend to buy a different vehicle rather than spending the time and money to repair one. For this reason, the lifespan of vehicles is relatively short and is estimated to be about eight years after import.

Recycling is popular due to the nearness of the export destination of collected materials. In addition to the active collection and export of non-ferrous materials such as aluminum and copper, several thousand tons of iron scrap is also exported via chartered ship. In addition, there is active collection of valuable materials, exemplified by the collection of discarded batteries from residents under the initiative of a government organization, and exported via container ship.

c. Treatment and Disposal

A pilot program for collecting waste oil is being carried out and treatment methods for it are being examined. Private companies are permitted to transport large/bulky waste to the disposal sites for free. Although a manual for the appropriate treatment and disposal of iron scrap was created and implementation following the manual was attempted, the actual implementation still remains insufficient.

d. Number of Discarded Vehicles

With each household owning two or more vehicles, the saturation level has probably been reached. During the last several years, about 2000 vehicles per year were discarded; it is estimated that about 1000 per year will discarded in the future.

e. Number of Discarded Home Appliances

There is a large variation in the ownership rate for appliance categories, with refrigerators at 100% and TVs at about 67%. The ownership rate is expected to increase in the future, and with this expectation, the current estimate of 1,200 units discarded per year in the six categories will probably increase to about 2,100 per year.

f. State and Evaluation of Large/Bulky Waste Problem

The government has started a free collection service for discarded vehicles due to the following reasons: although there is no illegal dumping, the ownership rate of vehicles and home appliances is already quite high; the number of units discarded yearly is already high; and there is no space to leave discarded items on private property on the crowded island of Koror. Accordingly, large/bulky waste is already a major cause of declining space in the landfill site. As a measure to lengthen the life of the disposal site, measures for large/bulky wastes have the same importance as activities to reduce municipal waste. The priority for large/bulky waste measures is quite high.

6.2.4 Republic of the Marshall Islands

a. Collection Services

Although unwanted home appliances are collected free of charge along with general waste, there is no collection service for discarded vehicles.

b. 3Rs

Repair of vehicles and home appliances is not active. The reasons for this are high repair costs due to a shortage of skilled labor and high labor costs. With purchase prices being low due to low tariffs, combined with high incomes, the tendency is to buy a new product rather than to repair a damaged one. Furthermore, the expected life of vehicles and home appliances is short due to the impact of climatic factors such as sea air on these products.

As for material recycling, the collection and export of non-ferrous scrap metal, such as aluminum and copper, just started a few months ago. Iron scrap is not collected or exported at all. Of the four targeted nations, the Marshall Islands was the least active in this regard.

c. Treatment and Disposal

Hazardous substances are neither treated nor removed from discarded home appliances and vehicles. They are disposed of in the local authority's coastal landfill sites.

d. Number of Vehicles Discarded

The majority of vehicles are used in Majuro city, and, after 2001, a steady number of 3,000 vehicles has been reached. The import figure is about 400 per year, and the average useable life is estimated at about eight years.

e. Number of Discarded Home Appliances

The electricity supply rate outside Majuro remains low, resulting in a relatively low ownership rate of home appliances. Currently, about 12,000 units in the six categories are owned, and the amount of disposed units is estimated at about 900 units per year. It is expected that this will reach 2,200 units per year in the future.

f. State and Evaluation of Large/Bulky Waste Problem

There is almost no illegal dumping of unwanted home appliances or discarded vehicles, but because the Majuro atoll has a high population density and the atoll islands are small in area, discarded vehicles, discarded heavy machinery, discarded marine transport containers, and abandoned ships are found at many sites along the shoreline. Large/bulky wastes have been used as material for coastal reclamation, but opposition to the use of large/bulky waste for coastal reclamation has grown stronger due to the possibility of collapse in the landfills and the overall rise in environmental consciousness among the residents. Considering the special environment and social conditions of atolls, the priority of the large/bulky waste problem in the Marshall Islands should be classified as being among the highest of the Pacific Island Countries.

6.3 Findings

6.3.1 Types of Large/Bulky Waste Recognized as Requiring Measures

From the survey results obtained in the target nations, it was found that the following categories of waste need to be treated with active measures:

i. Vehicles, ships, marine transport containers, refrigerators, freezers, TVs, washing machines, microwave ovens, electric ovens, personal computers, heavy equipment for construction.

ii. Hazardous substances contained in the above large/bulky wastes (discarded batteries, waste oil, CFCs, heavy metals, etc.)

The above categories resemble the categories that the following EU Directives are targeting: Waste Electric and Electronic Equipment (WEEE) and Restriction of the use of certain Hazardous Substances in electric and electronic equipment (RoHS.) The above categories, however, do not include small items, such as mobile telephones, due to the fact that this survey focuses on volume as the cause of the problem.

6.3.2 Overview of Large/Bulky Waste Treatment

Up until the 1970s, the Pacific Island Countries had little economic trade with foreign nations and were self-sufficient, virtually closed societies. Economic activities were feeble, an almost completely sound material-cycle society was maintained, and almost no garbage was generated. For this reason, many languages in this region do not have a word for "garbage" and use a foreign borrowed word for it.

However, after the 1980s, all of these nations increased the imported amount of daily necessities due to economic development, the spread of electricity, and the globalization of the economy. In addition, the rapid spread of electricity was accompanied by a rapid increase of the import of home appliances, and the development of roads was accompanied with an increase in the number of vehicles. And the fact that many countries simply developed roads without developing public transportation systems, such as public buses, in addition to the fact that vehicles are not used efficiently, spurred an increase in the number of vehicles.

With exports largely stagnating from these island nations, poor in both technology and resources, the import of many goods has increased markedly, and the material flow is biased in favor of imports from advanced industrial nations to the island nations. Because the cost of marine transport is high in the island nations, it is economically difficult to export the resources collected for recycling to industrialized nations. Furthermore, domestic recycling is difficult since there is no technological base for domestic recycling; and even if it existed, there isn't a large enough market for recycled products. Therefore, most of the imported goods are discarded locally after consumption, and the problems of collection and disposal become evident.

All the vehicles and home appliances - the large/bulky wastes targeted in this survey - are imported by the island nations. In particular, many used cars are imported from developed nations. Since most of the lifespan of these cars had been spent in their country of origin, their remaining life to be spent on the island nations is short. The island nations also present a very severe climate for these products, with strong sea winds and high humidity. In particular, since air conditioners are kept on for long hours because of high temperatures all year round, even with good maintenance, their lifespan is generally quite short on these island nations.

Both new and used products are expensive due to the marine transportation costs, tariffs, and VAT. Since employment opportunities are scarce, repair technician is an important profession, and repair of these imported items is actively performed. Since donors support technical schools on these island countries, the level of repair technology is high and the problem is often in the procurement of replacement parts. Therefore, even after an item loses its value as a product, it maintains value for its used parts. It does not fit in the category of garbage that is considered worthless or a minus.

After all the valuable used parts have been removed from the product, the materials that can be retrieved and exported for a profit are actively collected because labor costs in these countries are low. At present, profitable materials that can be collected in most of these countries are non-ferrous metal scrap, such as copper, aluminum, lead, and brass. These are collected very actively. In most regions, iron scrap, except those with high bulk specific gravity, such as engine blocks, is rarely collected because it pays very little to do so.

If domestic recycling were possible, the required transportation costs would become lower and the amount of materials that could be collected would increase, but there are few countries or materials for which domestic recycling systems have been established, with Fiji as an exception. Since Fiji has some of the industrial infrastructure necessary to make recycling a business, and

also a market for recycled products, gratings and manhole covers are manufactured from iron scrap using an electric furnace. It is, however, difficult to spread this kind of undertaking to other island countries.

Because of low disposal costs and weak regulations for the treatment of hazardous substances currently, there is no economic incentive to establish a dismantling business, and most of the wastes are disposed of with little concern for waste reduction or environmental protection. These large/bulky wastes that possibly cause water or soil pollution are inevitably sent to the final disposal site.

The ownership rates of vehicles and home appliances, with the exception of a few countries, are still low but are in the growing stage. The amount of annual disposal is still not large, but will surely grow rapidly in the future. However, the strong traditional self-governing and land system characteristics of the Pacific Island Nations are still functioning today and are working to prevent illegal dumping of large/bulky wastes. Accordingly, the need for the government to collect large/bulky wastes is great, and many countries collect unwanted home appliances free of charge. Palau has even started the collection of discarded vehicles for free. Currently, the numbers are still small and are within the capacity of the government, but when the numbers increase rapidly in the future, it is expected to exceed the capacity of the government to cope with the problem. Even if collection can be managed, it will not be easy to secure new disposal sites to cope with the increase in both large/bulky waste and municipal waste, making the final disposal of large/bulky wastes even more difficult.

In addition to these island nations being under unique social and natural conditions that make them ill-suited for SWM, these countries do not have strong institutional systems to cope with the difficult problems of waste. The traditional self-governing and land systems severely limit the function of the government, and there is also a limit to human resource development due to small populations and, with few employment opportunities, a large outflow of people to developed nations.

6.3.3 Shared Characteristics in the Region

Table 6-2 summarizes the characteristics shared among the Pacific Island Nations, and their impact on the large/bulky waste problem.

Table 6-2 Characteristics Shared in the Pacific Island Nations, and Impact on Large/Bulky Waste

Common Characteristics	Impact on Large/Bulky Waste
(1) Small island nations with a very small population. With the exception of Fiji and the Solomon Islands, the countries have populations of less than 200,000.	・ Both import and export require high transportation costs. ・ Although the total amount of waste is much less than a large country, the types of waste almost equals that of larger countries. ・ The scale and environmental impact of disposal sites are small, but the sites are not managed in an economical manner. ・ Government organizations cannot assign enough personnel. ・ Since both the land area and population are small, systems are easily enforced and supervised. ・ The market for recycled products is small, and it is economically difficult to implement recycling.
(2) Most vehicles, home appliances, parts for repair, and fuel are imported.	・ It is difficult to apply the Extensive Producers Responsibility (EPR) system in which manufacturers are responsible for products up to disposal. ・ Since most products clear customs, measures at customs are easily taken. ・ Since tariffs are imposed, imported products are expensive. ・ Since products are expensive, there is an economic incentive for repairing, reusing, and recycling. Actually, in most island nations, useable items are thoroughly collected and reused.
(3) Industrial infrastructure is fragile or virtually non-existent.	・ There is no industrial infrastructure necessary for recycling. Such infrastructure includes ways to add energy to waste in order to manufacture new products. Domestic recycling is practically impossible, even if materials are collected, and they can only be exported for recycling.
(4) Low labor costs (the exceptions are countries that have Compact	・ The cost of sorting, the most labor intensive part of recycling, can be low.

Common Characteristics	Impact on Large/Bulky Waste
money).	
(5) Little chance for employment.	・ There is sufficient manpower necessary for sorting wastes. ・ Expansion of a sorting industry by promoting recycling will create important employment opportunities.
(6) The export of manpower is intense.	・ The implementation of recycling led by government organizations has a reduced sustainability factor from this aspect. The private sector must be fully utilized.
(7) Strong traditional systems of self-governing and land ownership remain in the social system.	・ There is a large area where the government does not have jurisdiction in effect. ・ Traditional rules take precedence, and legal punishments are emphasized less. ・ These are potential obstacles to securing land for disposal sites.
(8) Severe conditions for home appliances and vehicles ・ Strong ocean winds. In particular, atoll nations have the same conditions as at sea. ・ Air conditioners are used year-around. ・ Frequent power outages and unstable voltage.	・ Cause for increase of waste appliances and discarded vehicles. ・ In countries with low tariffs or high labor costs, it is cheaper to buy a replacement rather than to repair. This reduces thelifespan of products even more. ・ The requirement for tropical climate specifications and rust-resistant specifications is high.
(9) There are private recycling activities for large/bulky wastes.	・ The purchase of materials is required for recycling, and because of the large fluctuation in those prices, a flexible, timely management system is essential. Accordingly, this industry is not suitable for the public sector, and it is desirable for the government to provide support so that private companies can be very active. The groundwork more or less exists in each country. ・ Furthermore, we suggest that private companies have a certain amount of technological know-how, and the necessity for technical support will not be high.
(10) Although non-ferrous metal scrap can be exported for profit, iron scrap export is financially in the red.	・ It is conceivable that there can be an option for domestic processing of iron scrap. ・ The collection and export of non-ferrous metal scrap is being proactively performed by the private sector. ・ Iron scrap is rarely collected or exported. ・ Public assistance is essential for collecting and exporting iron scrap. ・ Since there is a valid reason for domestic iron scrap treatment, it is necessary to establish an appropriate system for treatment.
(11) Private vehicles are necessary because public transportation systems are feeble.	・ If public transportation systems were improved, the number of vehicles that are needed might be reduced.
(12) Free service for collection of waste home appliances is available.	・ There is no reason for illegal dumping of waste appliances. ・ The free collection service may become difficult for the government to implement in the future.
(13) Most waste is discarded in final disposal sites; and there is almost no illegal dumping.	・ There is almost no illegal dumping, and therefore no environmental and social problems.
(14) When disposing of waste home appliances, there is almost no appropriate treatment of hazardous substances.	・ The possibility of soil pollution, water pollution, and adverse impact on workers' health exists.
(15) There are no dismantling experts.	・ A system for disassembling, sorting, treating, and disposing of discarded home appliances or discarded vehicles is not established.

6.4 Characteristics of Large/Bulky Waste Problem in Pacific Islands Nations

a. The large/bulky waste problem is more serious for smaller countries

The island nations of Oceania import most of the materials and products needed for living. Since they are consumed domestically and there is no industrial infrastructure, there is no exporting of new products manufactured by processing or assembly. Accordingly, the flow of materials is overwhelmingly coming from foreign nations. Since there is no waste reduction technology available, the amount imported directly increases the amount of waste to be reclaimed, greatly reducing the remaining capacity of valuable disposal sites.

In island nations with small population density, securing a disposal site is not very difficult and does not pose any serious environmental and social problems, if it is properly constructed and operated. On the other hand, for island nations with a high population density, people recognize that the large/bulky waste problem is already quite serious. There are many countries experiencing an escalation in the problem of final disposal. Such countries statistically have low population density overall, but high population densities are present locally. The reasons for such final disposal problems in these countries are as follows: the physical limitations of a small land area, strong social restrictions on the land use due to strong traditional self-governing systems and land systems that still remain today, the fact that infrastructure is confined to small areas, and the economic difficulty of using disposal sites on other islands due to distance.

In particular, in the countries consisting of multiple atolls, even though there are many of them, the atolls where people can live and have some infrastructure are limited and have very high population densities. In these places, the amount of waste is large for the land area, there is little land available to be used for waste disposal, and there is little soil available to cover the landfill. Since even the highest points of the land are only about 2 meters above sea level, unattractive mountains of piled bulky waste become the highest point on the land and is visible over a large area, significantly impeding the scenery. However, transporting this waste to an uninhabited island is economically not feasible, and it is not a practical procedure for most atoll countries.

Although the large/bulky waste problem has not caused a big illegal dumping problem, or an outbreak of harmful insects or a water pollution problem, the destruction of the scenery has certainly had an adverse impact on the tourism industry. Local residents may become accustomed to scenery that includes mountains of large/bulky waste, but it is a scene that causes foreigners to be surprised and angered at what seems to be an illegal dump site. Furthermore, the destroyed scenery eventually affects even the morale of the local residents, and their consciousness to protect the environment is weakened, littering is fostered, and a weakened patriotic attitude results, that is perhaps an underlying cause of the outflow of people to foreign countries. When considering that water or soil pollution may occur in the future, the bulky waste problem is critical, and urgent measures need to be implemented especially in atoll nations with a small land area, no mountains, and little available soil.

b. Significance of the Problem of Hazardous Substances associated with Large/Bulky Waste

Since bulky wastes are large in volume, the main problem associated with them is that they greatly reduce the remaining landfill capacity when disposed of. There is, however, another significant problem of hazardous substances contained in such wastes.

Primarily, these substances include the oil and batteries from discarded vehicles, CFCs used as a coolant in refrigerators and air conditioners, lead used for soldering electronic components or in cathode-ray tubes, hexavalent chromium used in chrome plating, and halogens used in casing resin for electric wire or in printed circuit boards as a flame retardant. Currently, these are generally disposed of in landfills without any safeguards.

Even though the amount of hazardous substances may not be large and the problem may not

become serious, there has been no investigation into the necessity for policy measures, so a policy of non-response cannot be given. Furthermore, since the total amount of such substances is small and the land area is also small, a simple method such as collection and storage may easily be implemented.

Even if the development of non-toxic products is accelerated, it is expected that the vehicles and home appliances containing hazardous substances currently in use will continue to be discarded for the next 20 years. During this time, some type of measure to address hazardous substances will probably be necessary.

Even if the problem is not evident, these substances can also adversely affect workers' health and cause soil and water pollution. Therefore, consideration for the problem of hazardous substances in large/bulky wastes must be given.

c. Municipal SWM Problem and Large/Bulky Waste Management Problem

Just a few decades ago, the Pacific Island Nations imported very little and generated no garbage, they were self-sufficient Sound Material-Cycle societies. Since civilization has advanced suddenly in these countries and the amount of imports and their consumption has increased rapidly, the amount of waste increased rapidly. This is how the Sound Material-Cycle Society collapsed rapidly in these nations. These changes necessitate SWM, including garbage collection, transportation, and final disposal. This is now in the beginning stages. Even though these nations are trying to implement SWM in earnest, the implementing agencies lack both the knowledge and experience necessary for collection, transportation and final disposal of wastes. While these countries have embarked on capacity building in the area of SWM implementation with the cooperation from SPREP and donors, municipal SWM in the island nations is still fragile and unstable.

Since the populations of most of these countries are very small, at 200,000 or less, and the populations of the urban areas that require serious garbage collection are even smaller, at about 20% to 50% of the population, the amount of garbage that needs to be treated is extremely small. Furthermore, because of the very short history of SWM in these countries, there are virtually no difficult problems usually associated with the SWM, such as labor problems, collusion, or problems in vested interests. Therefore, when compared to the urban waste problems of metropolitan areas in Asia or Africa, the urban waste problems in the island nations of Oceania shall not be so difficult.

On the other hand, large/bulky waste is difficult to collect, removal of hazardous substances is essential, and intermediate processing such as compaction for more efficient disposal is necessary. In other words, large/bulky waste management needs technology as well as expenditures. Additionally, to collect and recycle valuable resources as much as possible, the cooperation of private companies and residents is essential. In terms of waste generation volume, these items are not generated every day, as is municipal waste, but to have appropriate treatment and disposal, the effort and expenses incurred are not small. Furthermore, since the environmental impact risk is extremely high if done inappropriately, recycling efforts must be done in earnest. Therefore, when municipal SWM and large/bulky waste management are compared, the importance of the bulky SWM is higher than for normal countries and municipal SWM takes on roughly the same importance.

d. Necessity of Measures to Diverse Waste

Since the amount of garbage generated on the island nations is small overall, the problems caused by the amount of garbage are few. However, the diversity of the garbage generated is large, and is not all that different from larger countries. The government must cope with the varieties of garbage that require appropriate treatment and disposal. However, with small populations, some countries already have over 10% of their population working as public servants, and further increasing this number is virtually impossible. It is hoped that a large diversity of waste can be properly treated with a small number of personnel.

Chapter 7 Proposals

7.1 Basic Policy Proposal

7.1.1 Basic Principle

The natural environment is an important asset for island nations, but because it is also very fragile, environmental protection is placed at the highest priority.

While there is a problem with disposal of vehicles and home appliances after use, because they contribute to health improvement, human resource development, economic expansion, and promotion of democratization, the limitations on expanding their use should be kept minimal, even for environmental protection purposes.

7.1.2 Objectives

Minimize the environmental impact of large/bulky waste with appropriate treatment and disposal.

7.1.3 Strategy

1) Moderate Consumption Amounts (Import Amounts)

For example, by improving public transportation systems, it becomes possible to both provide convenient transportation and minimize the number of privately owned vehicles. In addition, by restricting the age of used cars that can be imported, the lifespan of a car will increase, resulting in a lesser number of cars to be imported.

2) Maximization of the Amount of Resources Recovered from Waste

Usable parts should be collected and reused as much as possible. The parts that cannot be used should be recycled as raw materials, as much as possible.

3) Prevention of Environmental Pollution by Appropriate Resource Recovery

Workers should be protected from health risks caused by hazardous substances during disassembling and sorting of waste. Also, appropriately treat and dispose of hazardous substances so that environmental pollution occurrences can be prevented.

4) Appropriate Disposal of Items that Cannot be Reused or Recycled

Even when it is technologically possible to recycle and reuse products, appropriately dispose of such items should large sums of subsidies be necessary to make it economically feasible.

7.1.4 Implementation Policy

1) Prudent Selection of Recycling or Domestic Disposal

For material for which collection and recycling cannot be established without subsidies, the decision whether to spend the subsidy for this process or to appropriately dispose of these materials domestically must take several factors into consideration: what amount of aid is needed, how easy it is to secure a disposal site, and the value of the post-closure disposal site. These conditions are different for each country, and they also are related to individual values. Accordingly, the relevant countries must carefully examine each case, and then make a decision of its own.

2) Maximum Use of the Private Sector

In recycling, it is important to sell used parts or discarded materials at a high price. However, because the selling price for discarded material greatly fluctuates and the buyers giving the highest prices are always changing on a global scale, it is imperative to identify

international market changes and to implement expedient, timely decisions in order to have successful management. Government organizations are not particularly good at this type of high risk business that requires flexibility. This must be handled by a private organization.

In addition, because Pacific Island Nations have a severe problem with the outflow of personnel to developed nations, it is difficult, from the sustainability point of view, for the government organizations that are also experiencing severe loss of personnel to train their staff for recycling. It would be ultimately preferable to use the dynamism of the private sector.

3) Creation of Economic Incentives for Recycling through the Introduction of Economic Instruments

The most effective way to promote recycling is to have the private sector actively participate in the recycling business. To promote this participation, the best way would be to use economic instruments, such as deposit systems, subsidies, tax imposition, tax reduction, tax exemption, or fee collection, to make recycling profitable.

4) Use of Labor as a Value Adding Item to Waste Collection

A mechanism to increase the value of raw materials would also be effective to promote recycling. For this reason, it is important to disassemble parts constructed of several different materials and sort by material as much as possible. An important policy is to use local, cheap labor effectively rather than machinery for this process. This would not only promote recycling but also contribute greatly to creating employment opportunities.

7.2 Proposal for an Institutional System Suitable for the Pacific Island Nations

To carry out appropriate sustainable disposal requires securing operational capital. In addition, to increase the material recovered, rather than increasing the supply of resources to be collected by encouraging the sorting of resources, it is more important to increase the demand for resources. For either, institutional measures will be more effective than technology and establishment of the system should be placed at a higher priority.

7.2.1 Policy for Large/Bulky Waste Treatment and Disposal

For materials other than those recycled based on economic principles, there will be additional costs necessary, either to dispose of them domestically or to collect and recycle them. Both cases generate benefits as well; in cases of recycling, profit from the sales of collected material is the benefit, and in cases of disposal, it is derived from the value of the landfill site. Therefore, it is necessary to make a decision from a comprehensive point of view and for the long-term. The answer for each country will differ according to the conditions of the country and will also change with time. Each country should give this careful consideration and then make a decision of its own.

7.2.2 Establishment of Recycle Fund

This fund is established with the purpose of promoting recycling to minimize the final disposal volume of large/bulky waste.

Using the fact that all vehicles and home appliances are imported, collect a recycling fee along with the tariff when these products pass through customs and accumulate the fees collected in the recycle fund. The fund would be used as follows in order to promote the recycling of large/bulky waste.

1) As collection cost for discarded vehicles and home appliances

2) As subsidies or low interest loans to implement recycling of material for which it is

financially difficult to recycle (iron scrap)

Note 1) Since container ships cannot be used for exporting iron scrap in general, it is necessary to use chartered ships. However, several thousand tons of iron scrap is required to charter a ship. In countries with small populations it may take several years to accumulate such amounts of iron scrap. In other words, capital is required over several years to purchase iron scrap, but the selling profit is obtained only once every several years. This requires taking on a very large financial burden. If a low interest loan could be guaranteed by putting up the collected iron scrap as collateral, it would be far easier for businesses to operate.

Note 2) Subsidies are to be used for ship chartering costs.

3) As guidance and training fees for appropriate dismantling and sorting of discarded vehicles and home appliance waste

4) As low interest loans for investment in discarded vehicle and home appliance recycling businesses (equipment and facilities for recycling, equipment and facilities for environmental damage prevention, etc.)

5) As costs for appropriate disposal of recycling residue of discarded vehicles and home appliances

Since the introduction of a Recycle Fund will invite increased financial burden on consumers, some opposition is expected from politicians and citizens. The following must be considered in order to keep the opposition to a minimum and to establish and implement the program smoothly.

i. An effective plan would be to offer services in advance by having seed money invested. The support of donors would be expected.

ii. In the Pacific Island Nations, it is expected that tariffs will be reduced in the near future. Since it is most efficient to collect the recycle fund during customs, the increased burden to consumers can be controlled by introducing the recycle fee at the time tariffs are reduced.

This survey targets large/bulky waste items, and so it is limited to the above mentioned application. but if the scope of the recycle fund were expanded and a recycle tax collected when aluminum can drinks or PET bottle drinks were imported, it would be possible to subsidize the collection and export of aluminum cans and PET bottles as well. In addition, if applied to vehicle oil imports, it would also be possible to pay for the collection of waste oil.

7.2.3 Appropriate Recycling Business Operator Certification System

This system aims at promoting appropriate disassembling and sorting of discarded vehicles and waste home appliance in order to prevent any damage to the health of workers and soil pollution due to hazardous substances contained in these items.

Under a pure economy, private companies would prioritize maximizing profits and would minimize environmental measures that require additional costs. In other words, in a pure economy, maleficent businesses would beat out beneficent businesses, and the beneficent businesses would be eliminated. To prevent this, it becomes necessary to develop a system that would allow beneficent businesses a handicap.

Development of the following system is thought to be appropriate.

i. Guidance and training for appropriate dismantling and sorting operations for recycling businesses

ii. Issuance of Recycling Technician Certificate to those who take the training and pass the test

iii. Issuance of Proper Recycling Business Certificate to the recycling businesses that provide the appropriate equipment and facilities, and technicians who are certified as the

Recycling Technicians.

iv. Public announcement of proper recycling certified businesses

v. Measures to provide tax reduction or subsidies to proper recycling certified businesses

7.2.4 Appropriate Final Disposal for Recycling Residue

This system targets the appropriate final disposal of material difficult to recycle because of technological or economic reasons to prevent its negative impact on the environment.

The organization responsible for SWM would bear the implementation responsibility for the appropriate final disposal of recycling residue. The costs for this would be budgeted from the recycle fund.

7.2.5 The Option of Appropriate Landfill of Large/Bulky Wastes and its Thorough Implementation

A realistic option for situations where large financial subsidies are needed to transport large/bulky waste items long distances for resource collection or recycling is burying the waste in local landfills. For atoll nations in particular, large/bulky waste items are an important landfill material used to expand the small land area. The concerned nations should make decisions after giving careful consideration to this option.

When a nation chooses to bury large/bulky waste items, guidelines should be created and followed to safely bury large/bulky waste in a landfill so that problems can be prevented from occurring when the site is utilized afterwards for different purposes.

7.2.6 Establishment of a Monitoring System

The following should be understood in order to find out the current conditions and to take appropriate measures in a timely manner.

1) Number of imported vehicles and home appliances

   (When vehicles are imported, they are not packed. Therefore, customs has an accurate count of the imported cars. In case of home appliances, however, the number indicated by customs is thought to be a fraction of the actual number imported. When packages pass customs, boxes in which several units are packaged together are not all opened to verify the number of units being imported. Most of the customs data is based on the customs application form, but it is assumed that importing businesses may falsify the numbers to reduce tariff costs.)

2) Export amounts of iron scrap and non-ferrous metal scrap

7.2.7 Development of Public Transportation such as Buses

If public transportation, such as buses or taxis, was developed, it is possible to reduce the number of necessary vehicles and also provide people with a new convenience. Furthermore, this can reduce household expenditures and make people's lives more affluent.

7.2.8 Import Restrictions for Used Products

By banning the import of vehicles older than a certain age or with more than a certain odometer figure, the lifespan of imported cars can be lengthened. This would lead to the reduction of the amount of large/bulky waste. Therefore, it is essential to set conditions for the age and odometer figure of a vehicle to be imported.

As for home appliances, the prohibition of importing used appliances should be given serious consideration because, given the current situation, there would be no social problems caused by such a prohibition and this may contribute to a reduction of home appliance waste.

7.2.9 Loan or Supply of Land to Recycling Business Operators for Storing Collected Resources

Recycling on island nations requires exporting collected materials, and a large piece of land is required to store the collected materials. Loaning land is an effective way to collaborate with recycling businesses.

7.2.10 Promoting Construction of a Recycling Facility Complex

By concentrating the recycling business operators in one location, the recycling process can be made more efficient, environmental protection measures become easier to implement, and monitoring is more easily performed.

7.2.11 Add Recycling Classes to the Repair School Curriculum

Add recycling courses on disassembling, sorting, and safety measures to the curriculum of the repair courses for vehicles or home appliances in technical schools.

(The disassembling industry will be hard to establish due to the small market size. Therefore, it is thought that having the repair industry also perform the disassembling would be a realistic option. Therefore, the know-how for disassembling and sorting should be taught in the repair courses. In addition, a mechanism by which an income can be gained through the disassembling industry must be created.)

7.2.12 Role Sharing

i. Government bears the responsibility of formulating and implementing an appropriate system after taking into account the native circumstances based on the above proposal.

ii. Recycling businesses have an obligation to follow the above system.

iii. Waste generators have an obligation to cooperate in the implementation of this system.

7.2.13 Donor Support

In addition to technical support, the most effective way to give strong support for the island nations of Oceania to implement the proposed system is for donors to provide seed money, with the condition that the system must be developed and implemented.

7.2.14 The Role of SPREP

SPREP will explain the contents of the proposal included in this survey to the island nations of Oceania, provide technical support for each country to prepare for implementation, and mediate so that each country can obtain collaboration from donors.

7.3 Options for a Technical System as a Region

7.3.1 Efforts toward Appropriate Treatment of Large/Bulky Waste

When waste generators freely treat and dispose of large/bulky waste or when private businesses are left to handle large/bulky waste items without any regulations, the method with the least economic burden is chosen without concern for the impact on society or the natural environment. Therefore, the administration that manages waste must decide on fixed rules and methods for discarding, treating, and disposing of waste and call upon waste generators to follow them, as is the case with SWM.

The following are the items that should be considered and observed from the technical aspect:

i. Understand the types and amount of waste being discarded

ii. Of the large/bulky waste items that are discarded, consider how to reduce amounts by lengthening product life and taking the necessary measures

iii. Have enough knowledge about appropriate handling of the parts that can adversely impact industrial health or the surrounding environment through operations, transportation, storage, and treatment/disposal at the disposal site for each type of large/bulky waste.

iv. Formulate a system to be implemented after determining the necessary treatment method based on the above (3) for each type of waste.

v. Formulate a system to be implemented after determining the necessary treatment/disposal method in each jurisdiction for each type of waste

7.3.2 Specific Proposals for the Appropriate Treatment of Large/Bulky Waste

a. Understanding the type and amount of large/bulky waste

To properly treat waste, the type and amount of waste must be understood as accurately as possible. This is critical for large/bulky waste items because of their diversity. As described below, this is due to the fact that many large/bulky waste items use parts with materials that have a negative impact on the environment or that are expendable. How much of these materials are being used differs according to type, manufacturer, and model of each product.

In other words, to perform appropriate treatment and disposal, the type, manufacturer, and model of the large/bulky waste must be identified when received by the treatment plant so that they can be properly treated and disposed of based on the method determined for each type of waste.

b. Measures to lengthen the product life (emission reduction) for those products that will become waste when discarded (reducing waste volume)

The following four methods described can be used to lengthen the product life of vehicles and home appliances.

i. Import new products, as much as possible, suitable for the target nation's climate, geography, and power supply situation. In particular, manufactures should study ways to cope with damage caused by saltwater, humidity, and voltage fluctuation. Some sort of import policy is necessary to lengthen the product life of imports.

ii. Technicians for repairing these products should be cultivated domestically or, if not practical, brought in from foreign countries.

iii. Getting inexpensive parts is critical for repairs. So, it is worth considering a system where countries with similar conditions create a database so that countries can send out items immediately when necessary. In this case, it is clearly advantageous to have fewer models.

iv. Publicize and approach users on how to prolong the life of their products, how to maintain their products, and educate them on preventative measures (coating to protect from salt damage, etc.).

c. For vehicles and home appliances, study treatment methods and materials that may pose a problem

Under the leadership of SPREP, find out the materials used in vehicles and home appliances that are imported and used in the Pacific Region. Among the materials used, extract the ones that may pose a problem and study their appropriate treatment/disposal methods. Table 7-1 outlines the materials that are currently considered as a problem, their danger, and the proper treatment methods.

Table 7-1 Conceivable Dangers and Treatment Methods for Discarded Vehicles and Home Appliances

Category	Material	Danger	Proper Treatment
Discarded Vehicles	Battery	Low pH, high concentration of lead	Filler liquid processing
	Waste lubricant oil	Water pollution	Remove and incinerate
	Refrigerant	Ozone destruction due to CFC	Remove and breakdown the CFCs
Discarded Appliances	Waste lubricant oil	Water pollution	Remove and incinerate
	Refrigerant	Ozone destruction due to CFC	Remove and breakdown the CFCs
	Electric parts	Heavy metals and chemical sealant	Remove and store

As shown in Table 7-1, problems with vehicles are not so complicated, but for home appliances, in addition to CFCs used as refrigerant in cooling equipment, there can be heavy metals, oil, and other dangerous chemicals in various electronic products, such as heavy metals in TV cathode-ray tubes or cadmium in cadmium batteries. For these, after interviewing academic researchers and manufacturers, it is necessary to consider a treatment method such as extraction or removal and storage, as necessary.

d. Formulation of treatment/disposal methods for hazardous substances

For each large/bulky waste item listed by type, manufacturer, and model, write down which hazardous substances shown in (c.) above are present. Then, determine a treatment method appropriate for each substance. Care must be given to removing gasoline, destroying TV cathode-ray tubes (possibility of dispersion of hazardous material including heavy metals), and battery fluid because these are dangerous to humans. Furthermore, because certain equipment will be required, it is necessary to construct factories that treat large/bulky waste with those items of equipment furnished.

Although it is important to actively promote the reuse and recycling indicated in (e.) below, it is also important to neutralize devices that may present problems through pre-treatment at factories that have met fixed qualifications.

e. Formulation of recycle or reuse methods for large/bulky waste items

On island countries, because the population is so small, recycling methods are limited due to the limited domestic market. Therefore, in addition to promoting reuse and recycling within the country, it is desirable also to export materials to foreign countries where a recycling market for those materials exist.

The following are some recycle or reuse methods for vehicles and home appliances.

e.1 Domestic reuse or recycling for vehicles

i. The parts of discarded vehicles were removed and stored for repair of damaged vehicles in all the countries surveyed. This is the ideal reuse situation. To make more effective use of these parts, a data base should be created and information exchanged not only within the country but also with nearby countries.

ii. Fiji has a relatively large population and implements battery recycling and using tires as a fuel source in the country as well as creating various cast metal products with melted iron scrap (including vehicle engines) and gunmetal. It is desirable to expand this process with more efficient collection of resources and cooperation in market expansion.

iii. Since tires are difficult to export, it is desirable to expand applications in countries other than Fiji, where they are used as fuel.

iv. In the Marshall Islands, vehicle bodies are used in landfills. This is for disposal rather than effective use, but if there will be no danger in using the site after it closes, then this is a particularly potent use of tires for atoll countries.

v. Waste lubricant oil is generated continually in large amounts by driving vehicles. Currently it is saturating the ground, but its effective use, such as using as fuel, shall be established.

e.2 Discarded vehicle recycling

i. In addition to the aluminum and copper tubing used in vehicles, the lead used in batteries is also currently mostly recycled. Recycling and effective use of parts must be expanded even more.

ii. Parts with large unit weights, such as the cast iron portion of vehicle engines and doors, are exported from Fiji and Palau by private operators. The part with the lowest value in a vehicle is the body, including seats, but there are examples in Palau of the body being melted and the iron extracted for export. Therefore, most of the iron in a vehicle can be exported as iron scrap by decreasing the amount. It must be systematically done on a larger scale.

iii. Tires are used in Fiji as fuel for the cement factory. Because tires are expendable and waste tires are generated in large amounts and have little value, it is necessary to consider effective uses and disposal methods, such as that used in Fiji.

iv. After a vehicle has been dismantled and the parts that can be exported are removed, there are still a large number of parts made of cushion material, plastic, and thin steel plates that cannot be used and that must ultimately be put into a landfill. Consideration must be given in this case as to whether a simple method can be formulated to reduce plastic with low bulk specific gravity along with the plastic containers that are found in large amounts in municipal waste. For example, it is worth studying the possibility of burning used tires and waste oil as fuel that does not emit soot as a method to thermally denature plastic.

e.3 Used home appliance recycling

i. Although the best way to reuse parts from appliances is to use them for repairs, as is currently done, as parts become more modularized, the product life increases but repairs become more difficult. On the other hand, along with the enforcement of recycle laws in developed nations, these appliances should be manufactured so they are more easily recycled. It is necessary to ascertain this and find a recycle method suitable for the Pacific Island Nations.

ii. Unlike vehicles, home appliances have high value, non-ferrous materials, such as stainless steel, copper, and aluminum that can be used for recycling. Therefore, this is the most likely recycling method. In this case, however, the body portion, which makes up most of the amount, will still remain as waste material that should be buried in a landfill within the country. A reduction in volume is required to extend the life of landfills and for the use of the site after closure.

iii. Appropriate disposal methods must be formulated for items difficult to recycle such as TV cathode-ray tubes that are generated in large amounts and have an interior coat of dangerous heavy metals. This disposal method is an issue to be addressed.

iv. Although using large/bulky waste items in coastal landfills is a pragmatic method for atoll islands, it is necessary to remove materials that may cause future environmental problems and pack waste items without open spaces to prevent ground instability due to iron rusting. However, because there will probably be a certain degree of ground subsidence, the value of the developed landfill site will most likely be low.

f. Final Disposal of Large/Bulky Waste

Waste that cannot be reused cannot be exported under the Basel Convention. Therefore, the parts of vehicles and home appliances that can be recycled need to be recycled as much as possible domestically. Even when these waste items are exported, there will be a large amount of composite materials, such a plastics, cushion materials, iron, and resins, that will remain within the country.

These materials do not contain substances hazardous to the environment (substances listed in (c)), and there is no problem in disposing of them in landfills, so they should be disposed of in landfills.

However, as mentioned above, items that are difficult to compress, such as seat sponges, are a detriment to landfills, so some type of process to reduce volume, such as thermal hardening, is required. This point is also an issue for further consideration.

g. Flow of Measures against Large Waste Items

Figure 7-1 is a summary of (a) -- (f) and shows the flow up to the point when large/bulky waste items are actually treated. The items in Figure 7-1 enclosed in a solid line are technology related actions, and the items enclosed in a dotted line are soft actions.

Large waste treatment primarily requires the formulation of a system on the soft side, and the implementation should be performed according to economic principles (and measure up to economic principles). It is important, however, to implement a mechanism that does not cause major problems for the environment and that solves technical issues.

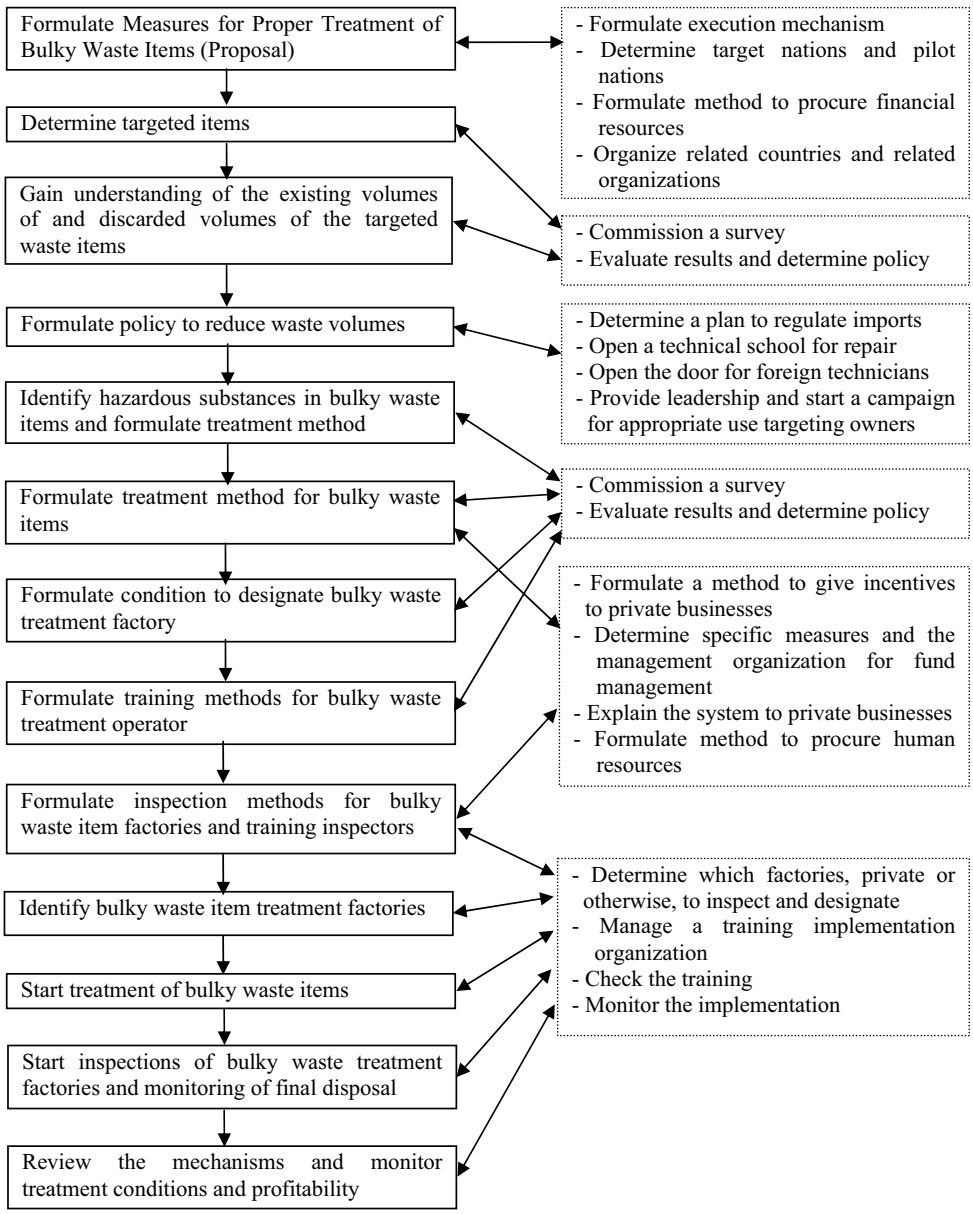


Figure 7-1 An Example of Flow up to the Processing of Large Waste Items

7.3.3 Proposal for Transboundary Management of Large/Bulky Waste Items

This proposal is to transport large/bulky waste items from the island countries to a specific country with a relatively established industrial infrastructure in Oceania and to try to reuse the items there. Here, some consideration is given to the appropriateness of this proposal.

a. Considerations on the side of the country generating waste

Non-ferrous metal parts in the large/bulky waste are collected by most island countries in Oceania by the private sector because of low labor costs, and these parts are exported to countries with reuse factories. Therefore, no measure is required for non-ferrous metal parts.

Because hazardous substances can only be exported to Australia or New Zealand under the Waigani Convention, a transboundary treatment is impossible. Instead, the Australian government provides a collection service for hazardous substances to the countries that signed the Waigani Convention, so proper treatment measures are available. Therefore, if a country signs the Convention, and collection and storage of these materials are taken care of within the country, then those substances would be collected by Australia. Each nation can implement this process independently with some assistance.

Since one major reason why it is not economically feasible to recycle iron scrap is its low bulk specific gravity, it is necessary to increase the bulk specific gravity before loading it onto a ship. In addition, by using a regularly scheduled transport container ship rather than a chartered ship, the collection fees can be recovered in a shorter period of time. A process to decrease the bulk specific gravity is necessary for this reason as well. Two methods available to do this are compacting with machinery and disassembly using an oxygen cutter. The determination of which method is more appropriate requires careful examination, but in a small country where labor costs are low and generated amounts are small, the latter method may be more appropriate, with lower required investment costs and lower operation and maintenance costs.

b. Considerations on the side of the receiving country

To reuse the received materials, technology is required, and for this, a somewhat established industrial infrastructure is required. Specifically, to recycle iron scrap requires electric furnace technology. Because electric furnaces are available as small scale furnaces, this has the characteristic of being appropriate for small volume, large variety production. Production technology is not very easy, but it is already in use in Fiji, and with technical assistance, application in smaller countries such as Samoa should be possible from the technology side. However, considering this as a measure to resolve large/bulky waste issues, larger scale electric furnaces are required to handle a large amount of iron scrap, and sophisticated technology would be needed to operate and maintain such furnaces.

When considering the demand for recycled products, they are primarily cast iron products, such as grating, manhole covers, and fences, but the demand for any of these is not large. Accordingly, even though careful consideration is necessary, it will probably be difficult to establish an industry when considering only the country supplying the materials as the market. It is also necessary to bring exporting to countries outside of Oceania, including developed countries, into view. Since the casting industries, with their severe labor conditions, are in decline in developed countries, it may be possible to create a complementary relationship.

The final problem is that of disposing of the items that cannot be recycled (residue). Final landfill is practical for these, but this may become a major problem for countries where it is difficult to secure landfill sites.

The determination of the validity of this plan requires further consideration, but since there are several difficult elements, such as a requirement for advanced technology, large investment costs, securing a demand, and disposing of residue, this is probably a high risk industry even with sufficient assistance from donors and concerned countries. In particular, the cultivation of

demand requires the active participation of the private sector.

If this is the case, then the more practical method may be to reduce the volume amount of large/bulky waste within the country that generates the waste and then dispose of the waste in landfills. The immediate task is to attempt to intensify practical measures such as volume reduction and proper disposal of large/bulky waste and exporting for recycling. This proposal must be examined with a long term view.

7.4 Outline of Proposed Measures by Country

The following are the examples of translating the measures proposed for the region and applying them to the four countries for which this survey was conducted.

7.4.1 Proposed Measures for Samoa

The following are the basic conditions related to large/bulky waste in Samoa.

i. Problems related to large/bulky waste are not evident except for the abandonment of construction machinery.

ii. There are no local authorities, and the central government is the sole entity in charge of SWM.

iii. There is a private company that collects metal scrap, including iron, and exports it.

iv. Discarded vehicles are still few, and they are stored in various places.

v. The repair level for vehicles and home appliances is high.

vi. Home appliances are collected, and disposal to landfill sites has begun.

vii. The problem of hazardous substances in large/bulky waste has not been recognized.

viii. Since SPREP is stationed here, there are many advantageous points such as information collection for measures and training.

Using the above conditions, Figure 7-2 indicates the proposed measures for Samoa. Although the large/bulky waste problem has yet to surface in Samoa, it is suggested that active efforts to formulate a system should be performed early on before the problem surfaces. The items in Figure 7-2 enclosed in a solid line are methods that Samoa should be involved in proactively, but the basic technology studies and decision-making on regional policies should be carried out by organizations and donors led by SPREP, and Samoa should participate in the process. Samoa does not have any local authorities and the national organization holds all the governmental functions single-handedly, so it is an environment where various measures are easy to implement.

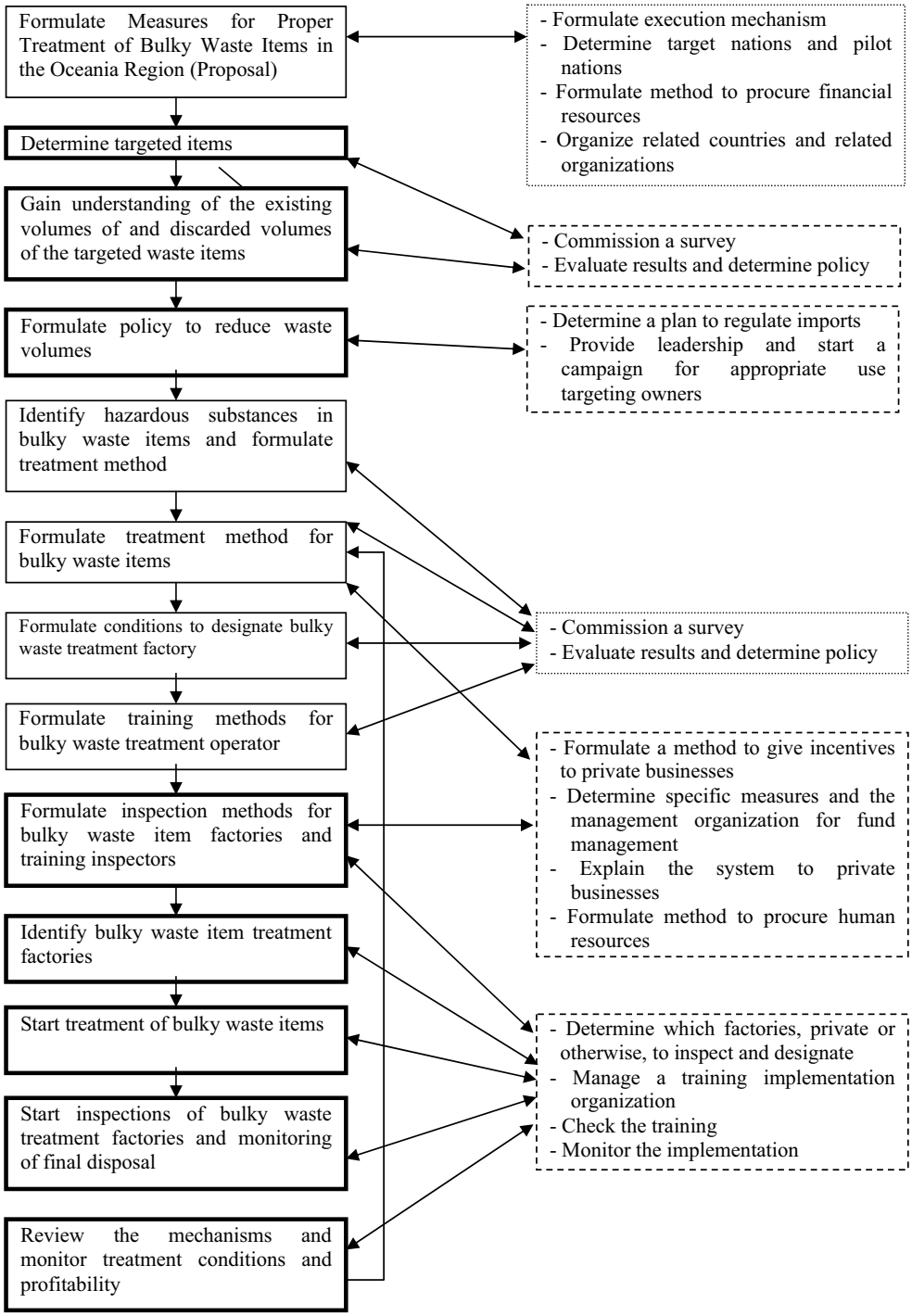


Figure 7-2 Efforts for the Large/Bulky Waste Item Problem in Each Targeted Country

7.4.2 Proposed Measures for Fiji

The following are the basic conditions related to large/bulky waste in Fiji.

i. Problems related to large/bulky waste, such as vehicles, are not evident, even though there are many abandoned vehicles scattered in many places.

ii. The waste administration is under the guidance of the nation and implemented by local authorities.

iii. There are private businesses that export metal scrap, including iron, to foreign countries, but vehicle bodies are not used. There are also businesses that manufacture fused cast products from iron scrap. Tires are used for fuel, and batteries are recycled.

iv. There are already a large number of discarded vehicles, but they are left or stored in open areas.

v. There is a thorough collection of vehicle repair parts, and repair skills are high.

vi. Bulky home appliances are collected and taken to waste disposal sites.

vii. Of the hazardous substances contained in large/bulky waste items, batteries are recycled and CFCs are recovered.

From the above conditions, the proposed measures for Fiji are the same as for Samoa. Since there is a large population, a cultivated domestic recycle industry, and the leadership of experienced academic technicians from the South Pacific University, Fiji should become the leader of activities for the region. In addition, because the number of discarded vehicles and home appliances is already large, it is in a position to implement measures as a pilot nation. Furthermore, the fact that a recycling industry is already growing is an advantage for recycling. The items in Figure 7-2 enclosed with a solid line are the methods that Fiji can also implement proactively.

The local authorities will implement these methods under the leadership of the country. It is important to clarify the role of the government organization in charge.

7.4.3 Proposed Measures for Palau

The following are the basic conditions related to large/bulky waste in Palau.

i. Large/bulky waste items such as vehicles are thrown away at disposal sites, and some of these have noticeable volumes. Furthermore, the number of vehicles owned has probably already reached saturation.

ii. The SWM administration is allocated to states under the guidance of the country. Population outside of Koror state, where the capital is located, is small and there should be few problems.

iii. There are private businesses that export metal scrap, including iron, to foreign countries, and vehicle bodies are disassembled and exported as well. The iron scrap is not exported in containers but in chartered ships.

iv. Vehicle repair skills are high, but vehicle life is short due to high labor costs and the difficulty of procuring parts. Used home appliances are also abundant, with short life spans.

v. The owners of bulky home appliances dispose of them at disposal sites.

vi. Collection of batteries and waste oil occurs under government supervision.

Although Palau is a small country, the numbers of vehicles and home appliances, which are the source of large/bulky waste, have already increased and the problem has already been actualized in the densely populated state of Koror. The early implementation of measures is desirable.

In addition, even with a small population, there are sixteen states and each has a different system. However, for the foreseeable future, only Koror state has the potential to be bothered by the problem of large/bulky waste, so there should actually be no problems even if measures are concentrated on this state.

The flow for the measures is also as shown in Figure 7-2, and Palau should be proactively involved in those items enclosed with a solid line.

7.4.4 Proposed Measures for the Marshall Islands

The following are the basic conditions related to large/bulky waste in the Marshall Islands.

i. Large/bulky waste items, such as vehicles, are abandoned or discarded along the coastline, and many discarded vehicles have been used in land reclamation in the past.

ii. Abandoned or discarded vehicles, construction equipment, containers, and ships are highly visible, and this condition is the most serious amongst the four countries in this survey.

iii. Most of the vehicles are on the Majuro atoll, where the capital is located, and a small number are on Ebeye Island.

iv. The roles of the related organizations to administer SWM are unclear and this presents a problem in implementation.

v. Recycling activities are lethargic, and only a small amount of non-ferrous metals are collected and exported.

vi. The capacity to repair vehicles and home appliances is low because even without a vocational school within the country, inflow of foreign technicians is restricted. Procurement of parts is also a problem.

vii. The lifespan of a vehicle is short due to the severe salt damage that occurs on atoll islands. The product lifespan for electric products is also short because they are inexpensive to replace.

viii. Home appliances are collected and taken to waste disposal sites by local authorities.

ix. Although the danger of batteries and waste oil and the danger of using vehicles in landfills is recognized, no particular measures have been adopted.

The Marshall Islands have special natural and social conditions, and these contribute greatly to the seriousness of the large/bulky waste problem. Accordingly, action must be taken immediately. The major problem in implementing measures is the lack of clear role distribution for waste administration. If this is not improved, it will be difficult to carry out effective measures for the large/bulky waste problem or the municipal SWM problem. Reform of the organizational system is the highest priority issue in this country.

Appendix

1. Attendees

2. Notes on Meetings

3. List of Documents Collected

1. Attendees

(1) Independent State of Samoa

1) JICA Samoa Office JICA
Junji Ishizuka, Resident Representative
Ichiro Mimura, Assistant Resident Representative

2) Pacific Regional Environmental Programme (SPREP)
Dr. Frank K. Griffin, Coordinator – Pollution Prevention
Shiro Amano, Project Officer in Charge of SWM and JICA Expert (Term will end in April)
Takeo Tashiro, Project Officer in Charge of SWM (To be assigned in May)

3) Ministry of Natural Resources & Environment
Ietitaia Setu Taule'alo, CEO
Laavasa Malua, Vice CEO
Paulind Pania, Senior Urban Management Officer
Mikaele Teofilo, Contract officer

4) Ministry of Works, Transport & Infrastructure
Misi Tupuola, Vice CEO, Transport Control Board

5) Ministry for Revenue, Custom Office
Tanuvasa Iosefa Kalolo, Principal Officer
Fuimaono Poufa Te'o, CEO

6) Samoa Polytechnic
Takuya Endo (JOCV senior volunteer)

7) West End Co., Ltd.
Tui Sua, CEO

8) Aleipata Junior High school
Mili Matila, Principal of Alelpata Junior High school

(2) Republic of the Fiji Islands

1) JICA Fiji Office
Hideki Tomobe, Resident Representative
Masayoshi Ono, Project Formulation Adviser

2) Embassy of Japan in The Republic of Fiji Islands
Kenro Iino, Ambassador
Shigeki Takaya, the First Secretary

3) Ministry of Environment
Epeli Nasome, Director Environment
Isoda, Expert in EIA

4) The University of South Pacific
Dr. Kanayathu C. Koshy, Director, Pacific Center for Environment and Sustainable Development Department
Fabrice Mathieux, Environmental Management and Recycling

5) EU Delegation of the European Commission for the Pacific
Horst M. Pilger, Adviser, Infrastructure and Energy
Patricia Ciszewska, Development-Attache

6) SKM (Sinclair Knight Merz (Fiji) Ltd.)
Maleli Naiova

7) FEA (Fiji Electricity Authority)
Babu D. Signh
Eferens Tovak

(3) Republic of Palau

1) Embassy of Japan in Palau
Kiyoshi Suwa, Charge d'Affaires ad interim

2) President's Office
Yukio Tanaka, Economic Adviser to the Office of the President of Palau, JICA expert

3) JICA Palau Office
Kenji Aizono, Project Formulation Advisor

4) Office of Environmental Response and Coordination (OERC)

Joe Aitaro, International Water Program Coodinator

5) Environmental Quality Protection Board
Terangue Tiger Gillham

6) Koror State
John O Ngirakeel Jr., SWM Office

7) Palau Equipment Co., Inc. (PECI)
Sam Masang, President

(4) Republic of the Marshall Islands

1) Embassy of Japan in Palau
Akira Ikeda, Charge d'Affaires ad interim
Takehiro Kurosaki, Researcher/Adviser

2) JOCV Marshall Islands Office
Noriko Ishii, Coordinator
Thomas R. Jack, Assistant Coordinator

3) Ministry of Foreign Affairs
Raynard Gudeon, Acting Secretary

4) Environmental Protection Agency
Ted Tarkwon, Acting General Manager
Roney Arelong, SWM Officer
Koji Fukuda, JOCV member in charge of Environmental Education

5) Ministry of Public Works
Mattian Zackhras, Minister
Wilbur Allen, Assistant Secretary
Ko Shimizu, JOCV member in Charge of Civil Engineering

6) Office of Environmental Planning Policy Coordination
Deborah Baker, Acting Director

7) Majuro Atoll Local Government
Riley Albertter, Mayor

8) Japanese companies in the Marshall Islands
Hideo Kikuchi, Manager, Marshalls-Japan Construction Company

2. Notes on the Meetings (p102 - p105)

	Date	Place	Attendees	Time	Contents
Samoa	4/12 Mon	Faleolo International Airport		1:30	Arrive at Samoa
	4/13 Tue	JICA Samoa Office	Junji Ishizuka, Resident Representative Ichiro Mimura, Assistant Resident Representative	9:00 - 9:40	Explain the contents of the survey and the condition JICA has found
		SPREP	Dr. Frank K. Griffin (Coordinator – Pollution Prevention) Shiro Amano, Project Officer in SWM	10:00 - 11:30	The state of difficult waste treatment in the Pacific. Ask questions based on the Questionnaire
		Ministry of Natural Resource & Environment	Laavasa, Malua (Vice CEO) Mikaele Teofilo (Contract officer) Paulind Pania (Senior Urban Management Officer)	14:00 - 16:00	Interview on the Ministry's measures for solid waste treatment and its policy for large/bulky waste. Ask questions based on the Questionnaire
	4/14 Wed	Ministry of Natural Resource & Environment	Mikaele Teofilo	9:00	Meet and set out together
		Tafaigata Landfill Site	Mikaele Teofilo	9:30 - 10:20	Visit the biogas generating facility, sanitary landfill site, and large/bulky waste disposal site
		West End Co. Ltd.	Tui Sua (CEO) MikaeleTeofilo	10:30 - 11:00	Interview on the waste recycling business and on other businesses dealing with used articles
		Ministry of Works, Transport & Infrastructure	Misi Tupuola (Vice-CEO, Transport Control Board)	11:00 - 11:30	Collect data on the number of registered automobiles for inspection
		Ministry for Revenue (Custom Office)	Tanuvasa losefa Kalolo (Principal Officer), Fuimano Poufa Te'o (CEO)	13:40 - 14:30	Request for preparation of custom clearance data for automobiles and home appliances
		Samoa Polytechnic	Takuya Endo (JOCV senior volunteer)	15:30 - 16:30	Interview on the use of automobiles and the level of repair techniques in Samoa
	4/15 Thu	Ministry of Natural Resource & Environment	Mikaele Teofilo	9:40	Meet and set out together
			Mikaele Teofilo (Attendant)	9:40 - 15:00	Survey two-thirds of the eastern coast of Upolu Island. Interview if there are large/bulky waste problems
		Principal of Alelpata Junior High school	Mis.Mili Matila	11:00 - 11:30	Interview on the use of home appliances and the state of large/bulky waste problem
		Repair shops	Manager	13:30 - 13:40	Interview on the state of used car repair and part suppliers
		Ministry for Revenue (Custom Office)	Revenue Officer	15:10	Receive the custom clearance data for automobiles and home appliances

	4/16 Fri	Ministry of Natural Resource & Environment	Paulind Pania	9:00	Meet and set out together
		Mcdonald' Motor Distribution Co., Ltd	Manager, Paulind, Pania (Attendant)	9:10 - 9:30	Sales of home appliances (mainly refrigerators)
		Home appliances repair shops (2 shops)	Manager, Paulind Pania (Attendant)	10:00 - 10:40	Repair state of home appliances and the volume of discarded appliances
		Bilight Co., Ltd.	Salesclerk, Paulind Pania (Attendant)	10:40 - 11:00	Sales of used home appliances
		Samoa Polytechnic	Trainers (2), Paulind Pania (Attendant)	11:10 - 11:30	Interview on the training of repair technicians and the state of repairing
		Ministry for Revenue (Custom Office)	Revenue Officer	13:00 - 13:10	Interview for the second time on custom clearance data
		JICA Samoa Office	Junji Ishizuka, Resident Representative Ichiro Mimura, Assistant Resident Representative	16:00 - 16:40	Report on the results of survey in Samoa
	4/17 Sat	Faleolo International Airport	Leave for Fiji	3:50	Leave for Fiji
Fiji	4/18 Sun	Nadi International Airport		4:30	Arrive at Fiji
		Hotel at Suva		7:50	Arrive at Suva
	4/19 Mon	JICA Fiji Office	Hideki Tomobe (Resident Representative), Masayoshi Ono (Project Formulation Adviser)	10:30 - 11:30	Explain the purpose of the survey, confirm the meeting arrangements, interview Mr. Sakamoto on the situation of Fiji, and ask about Fiji skill level for automobile repair and the life of automobiles
		Embassy of Japan in the Republic of Fiji Islands	Kenro Iino (Ambassador) Shigeki Takaya (First Secretary)	11:30 - 12:00	Make courtesy call at Japanese Embassy in Fiji and explain the purpose of the survey
		Ministry of Environment	Epeli Nasome (Director Environment), Isoda (Expert - EIA)	14:30 - 15:30	Explain the purpose of the survey, and interview on the state of Fiji's SWM and the general situation concerning large/bulky waste
			Isoda (Expert)	15:30 - 16:30	Interview on further details of the state of SWM and EIA implementation
	4/20 Tue	Pacific Center for Environment and Sustainable development Department, the University of South Pacific	Dr. Kanayathu C.Koshy (Director, Pacific Center for Environment and Sustainable Development Department), Fabrice Mathieux (Environmental Management and Recycling)	9:15 - 9:30	Explain the purpose of the survey, and interview on the management of large/bulky waste and difficult waste in the South Pacific
			Fabrice Mathieux (Environmental Management and Recycling)	9:30 - 11:20	Interview on the contents of the report "Solid Waste Management and Recycling in the Fiji Islands"

		EU Delegation of the European Commission for the Pacific	Horst M. Pilger(Adviser) Patricia Ciszewska (Development-Attache)	14:30 - 15:00	Explain the purpose of the survey, and interview on the EU activities in Fiji, efforts on large/bulky waste treatment, and acceptance of waste at Naboro landfill site
		SKM (Sinclair Knight Merz (Fiji) Ltd.)	Maleli Naiova (Environmental Scientist)	15:00 - 15:50	Explain the purpose of the survey, and interview on the Naboro landfill site construction plan and the state concerning large/bulky waste in Fiji
		Fiji Electric Authority	Babu D. Signh Eferens Tovak	16:00 - 16:30	Explain the purpose of the survey, and interview on power supply status
		JICA Fiji Office	Suzuki (Office staff), Ono (Project Formulation Adviser)	16:45 - 17:00	Confirm the meeting schedule and appointments
	4/21 Wed	Department of Local Government	Mr. Subban ALI (Director of Housing)	9:00 - 9:20	Interview on the background of construction, present condition, and future operation of Naboro landfill site
		Tour to the Naboro landfill site construction site	Constructor's site agent, Mr. ALI	9:50 - 10:40	Visit the construction site of Naboro landfill site
		Lami Landfill Site	ALI	10:50 - 11:10	Visit the Lami landfill site
		The University of South Pacific	---	14:00 - 15:00	Attend Mr. Fabrice Mathieux's seminar on SWM
	4/22 Thu	Ministry of Health	Timothy Young (Senior Environmental Health Officer)	9:00 - 10:15	Explain the purpose of the survey, and interview on the system and organization for waste treatment administration, and relation between local government and the Ministry of Health
		JICA Fiji Office	Mr. Faafetai Sagapolutete (Samoa Puma Chief Urban Management Officer)	11:00 - 11:50	Interview on the study theme at the University of South Pacific, comparison between Samoa and Fiji, and PUMA's SWM activity in Samoa
		Suva City Council	Charter Pal Semesa Dradera	14:00 - 15:30	Interview on the current state and future plan of Suva City's waste collection. Later, move to automobile disposal site.
		Land Transport Authority	Director of Suva Region Office	16:00 - 16:20	Clarify the car registration system, and request for annual data of vehicles inspected
		Daiich Co. Ltd (Used auto part shop)	Manager	16:30 - 16:50	Visit an auto part shop to see the sales condition of parts for Japan-made automobiles, and interview on suppliers of those parts

	4/23 Fri	The WHO Representative in the South Pacific (Suva)	Steven Iddings	8:00 - 8:40	Explain the purpose of the survey, and interview on WHO's activities in Fiji and the South Pacific
		JICA Fiji Office	Tomobe (Resident Representative) Suzuki/ Ono/ Asai (Staff members), Isoda (Expert)	9:00 - 10:15	Report on the results of the survey and discuss the contents
		Nagan Steel Rolling Mill Co. Ltd	CEO	14:30 - 14:50	Interview on iron scrap collection and cast metal. Tour the plant and observe the electric furnace, in particular.
		Ba Town Council-Dump site	Council members	15:10 - 15:40	Visit Ba Town landfill site and see the condition of vehicle disposal
		Lautoka City Landfill Site	Manager of the landfill site	16:30 - 16:50	Visit the Lautoka City landfill site
		Western Wrecker Co., Ltd		17:15 - 17:30	Visit the sales floor of used cars and the disposal site of discarded vehicles
		Nadi International Airport		22:00	Depart from Fiji
Palau	4/24 Sat	Palau International Airport at Koror	Aizono (Project Fermentation Officer), Tanaka (Adviser)	9:00	Arrive at Palau
	4/26 Mon	JICA Palau Office	Aizono (Adviser), Tanaka (Adviser)	9:00 - 10:00	Discuss survey schedule and method. Interview on the Palau situation.
			Aizono (Adviser), Tanaka (Adviser), Joe Ailaro (IWP Coordinator), John 0 Ngirakeel Jr. (Koror State Covant)	10:00 - 11:10	Interview on the state of waste administration, solid waste treatment, large/bulky waste treatment, and the contents of the Questionnaire
		M-Dock Landfill Site of Koror State	Aizono (Adviser), Tanaka (Adviser), Joe Ailaro (Attendant)	13:15 - 13:30	Visit the landfill site and interview on the condition of the landfill.
		GF Car Parts Co., Ltd	Salesclerk, Joe Ailaro (Attendant)	13:30 - 13:40	Visit the store
		Koror iron scraps company	Joe Ailaro (Attendant)	13:40 - 13:50	Visit the company
		Koror auto disassembly company	Joe Ailaro (Attendant)	13:50 - 14:00	Visit the company
		GF Car Parts Co., Ltd	CEO, Joe Ailaro (Attendant)	14:05 - 14:20	Visit the company and interview on vehicle repair and handling of end-of-life vehicles
		Airai State' disposal facility	Joe Ailaro (Attendant)	14:30 - 14:50	Visit the facility
		Koror home appliance (refrigerator) repair shop	Shopkeeper, Joe Ailaro (Attendant)	15:10 - 15:20	Visit the shop and interview on the condition of repair, home appliances brought in, and the method of final disposal

		Koror home appliance (TV) repair shop	Shopkeeper, Joe Ailaro (Attendant)	15:25 - 15:35	Visit the shop and interview on the condition of repair, home appliances brought in, and the method of final disposal
	4/27 Tue	PECICo., Ltd Office	Sum Masang (CEO)	9:00 - 9:40	Visit the company and interview on recycled items, condition, method of collection, and importing countries
		Environmental Quality Protection Board	Terangue Tiger Gillham (Executive Officer)	10:00 - 11:00	Ask additional questions to the Questionnaire, and hear opinions on proposed solutions for large/bulky waste treatment and disposal
		JICA Palau Office		13:30	
		Embassy of Japan		15:00	
	4/28 Wed	Palau Airport in Koror		1:45	Depart from Palau
	4/28 Wed	Majuro Airport		18:45	Arrive at the Marshall Islands
		Marshall Islands Resorts Hotel	Ishii (JOCV member)	19:40 - 20:00	Confirm the schedule and interview on the local condition
			Ikeda (Charge d'Affaires ad interim), Kurosaki (Expert investigator), Ishii (Coordinator)	20:00 - 20:45	Have lecture of Charge d'affaires Ikeda on the Marshall's current situation concerning recent waste-related request
	4/29 Thu	Marshall Islands' EPA Office	Ted Tarkwon (Acting General Manager), Mr. Roney Arelong	10:00 - 10:40	Explain the purpose of the survey, and interview on SWM and large/bulky waste management. Interview on the Questionnaire
		Ministry of Public Works	Ko Shimizu (JOCV member)	13:30 - 14:30	Interview on Public Works' operation and the disposal site being planned, and visit the current disposal site.
		Office of Environmental Policy Coordination	Deborah Barker (Acting Director)	15:00 - 15:30	Explain the purpose of the survey, and interview on the management of solid waste and large/bulky waste, and on the Questionnaire
		Majuro Atoll Local Government/City Hall	Hon. Riley Alberttler (Mayor)	15:45 - 16:05	Explain the purpose of the survey, and interview on large/bulky waste problems and municipal administration
		SEAFOO Cooperation	Joseph Hu (CEO)	16:15 - 16:40	Interview on the state of recycling aluminum, copper, and bronze
		Toyota Repair Shop	CEO	17:00 - 17:15	Interview on the state of vehicle repair
	4/30 Fri	Majuro Trans-reef Road		10:00 - 12:00	Visit the Majuro Trans-reef Road

	5/3 Mon	Pacific International, Inc	Kenneth Kramer (Operation Manager)	10:05 - 10:45	Interview on the construction method of shore protection (landfill) and, landfill method for discarded vehicles. Visit the landfill site.
		Ministry of Foreign Affaires	Raynard Gudeon (Acting Secretary)	11:00 - 11:20	Explain the purpose of the survey, and discuss problems for Marshall's waste administration and large/bulky waste problems
		Revenue of tax	Revenue Officer	11:25 - 11:35	Interview on the number of automobiles cleared customs and tariffs
		Majuro Police Department	Traffic officer	11:40 - 11:55	Interview on the number of newly registered automobiles (No data available)
		JOCV Office	Ko Shimizu (JOCV member in civil engineering)	13:05 - 15:00	Interview Mr. Shimizu on his operation, discuss new disposal site (waste disposal site). JOCV member Tuchii provided information of other country's waste management cases.
			Koji Fukuda (JOVC member in environmental education)	15:00 - 17:00	Interview Mr. Fukuda on his operation. JOCV member Tuchii provided information of other country's waste management cases.
		A restaurant in Majuro	Ikeda (Charge d'Affaires ad interim) and other 4 members	19:00 - 20:45	Report the results of the survey, and discuss the issue of final disposal site for which aid is requested.
	5/4 Thu	Ministry of Public Works	Wilbur Allen (Assistant Secretary)	8:55 - 9:10	Explain the purpose of the survey, and interview on the state of waste disposal, methods of disposing discarded vehicles in landfill, etc.
			Mattian Zackhras (Minister) and other 3 members	9:10 - 9:25	Explain the purpose of the survey. Explain the outline of proposed measures to tackle large/bulky waste
		Japanese construction company in the Marshall Islands	Kikuchi (Manager)	10:00 - 10:30	Interview Mr. Kikuchi, who has lived there for a long time, on the local condition and the state of trade
	5/5 Wed	JOCV Office	Ishii (JOCV member)	15:30 - 16:30	Report the results of the survey of the Marshall Islands
		Majuro Airport		19:50	Depart from Majuro
Samoa	5/6 Thu	Faleolo International Airport in Samoa		1:05	Arrive at Apia
		PUMA	Shida (Senior volunteer in charge of waste)	9:30 - 11:00	Interview on PUMA employees operation and Mr. Shida's activity, exchange opinions on SWM

		Macdonard Construction Inc.	Shida (Attendant)	11:05 - 11:20	Visit the container yard from which iron scraps are shipped
		SPREP	Dr. Frank K. Griffin (Coordinator – Pollution Prevention) Tashiro (Project Officer in SWM)	15:00 - 16:15	Explain the results of large/bulky waste surveys in 4 countries and proposed countermeasures
		JICA Samoa Office		16:30 - 17:40	Explain the results of large/bulky waste surveys and proposed countermeasures. Explain the local condition of waste disposal sites at the Majuro, the Marshall Islands
	5/7 Fri	Samoa International Airport		1:45	Depart from Apia

3. List of Documents Collected

Date		
4/13	SPREP	1.1 : 2003 Annual Report: SPREP 1.2 : Scrap Vehicles, Batteries and Tires: Eco.Health Pacific 1.3 : Scrap Metals in Micronesia : Ro Botler Consulting Metal Legist
4/14	Samoa Ministry of Works, Transport & Infrastructure	2.1 : 2003-2003 Motor Vehicle Statistic Report
4/15	Samoa Ministry for Revenue (Custom Office)	3.1 : Import Record of Motor Vehicles and Home Appliance (2001-2003) /Floppy-Disk
4/19	JICA Fiji	4.1 : Solid Waste Management and Recycling in The Fiji Island : JICA 4.2 : Statistical News : Fiji Islands ANDS Bureau of Statistic
4/19	Fiji Department of Environment	5.1 : Organization Chart and Pamphlet of Department 5.2 : Pamphlet of Ministry of Local Government, Housing & Environment
4/20	Fiji The University of South Pacific	6.1 : Pamphlet of Pacific Center for environment and sustainable Development
4/22	Ministry of Health	7.1 : Shaping Fiji's Healthy Islands : National Environmental Health Action Planning
4/23	WHO Fiji	8.1 : Mission Report of Environment Health Impact for Suva Fiji 8.2 : Health-care Waste management *Kry Element and Technological Option 8.3 : Tonga Commitment to Promote Healthy Lifestyle and Supportive Environment
4/24	JICA Palau	9.1 : Answers to the Questionnaire 9.2 : Solid Waste Management Status Report in Palau 9.3 : General Condition in Palau
4/27	Palau, Environmental Quality Protection Board	10.1 : Best Management practices for Scrap Metal Treatment Facilities 10.2 : Solid Management Regulations
4/28	JOCV Marshall Office	11.1 : Answers to the Questionnaire 11.2 : Strategic Plan 2004-2007 : Republic of Marshall Islands Environment Protection Authority, 11.3 : Majuro-Solid Waste Management : Beca Consultants 11.4 : Outer Islands : Beca Cosntsultants 11.5 : Majuro Atoll Local Council/Local government Ordinance No.1986-16 11.6 : Majuro Atoll Local Government "Survey Plant" for Large Difficult Waste 11.7 : Solid Waste Management in Majuro : Beca Consultant 11.8 : Proposal for Improving Solid waste Reduction and Recycling for Majuro Atoll : Economic Policy, Planning and Statistic Office
4/28	Embassy of Japan - Marshall	12.1 : Documents for the request concerning landfill side
4/29	Economic Policy, Planning and Statistic Office	13.1 : Statistic Year Report in Republic of the Marshall Islands (also in CD)
5/3	JOCV Office	14.1 : MSWM Workshop, Samoa Country Report : Republic of Marshall Islands 14.2 : Samoa Third Country Training "Island States Waste Management" Report: 2004, Fukuda/Shimizu volunteers