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Acronyms and Abbreviations

ACP	African Carribean Pacific
SPREP	South Pacific Regional Environment Programme
EU	European Union
WASTE	Lome IV Pacific Regional Waste Awareness & Education Programme
FSP	Foundation of the Peoples of the South Pacific
TUC	Teinainano Urban Council
BTC	Betio Town Council
MESD	Ministry of Environment and Social Development
EPR	Extended Producer Responsibility
SMEC	Snowy Mountains Engineering Co-orporation
PUB	Public Utilities Board
ADB	Asian Development Bank
TA	Territorial Assistance
TOR	Terms of Reference

Executive Summary

Action Plan

IMPLEMENTATION OF THE PLAN	ACTION			RESPONSIBILITY	TIMEFRAME
	Priority One	**Priority Two**	**Priority Three**		
	• Establish a National Solid Waste Management Committee	• Organise a workshop to discuss the Plan, allocate responsibilities and timeframe		MESD	
WASTE MINIMISATION INITIATIVES					
General	• Establish a transfer site at the landfill for sorting green waste			BTC and TUC	
Paper	• Implement segregation of paper at transfer site • Establish paper bins in offices	• Distribute waste cardboard to community • Distribute to schools, craft centre, hospitals		BTC and TUC	
Glass	• Establish options for glass recycling eg shipping to Australia	• Implement segregation of glass at the transfer site	• Circulate, to be reused by the community	BTC and TUC	
Metals	• Implement segregation of metal at the transfer site • Install a large can crusher • Manufacture more can cages	• Distribute can cages to cover community in S. Tarawa • Investigate feasibility introducing an EPR fee		BTC and TUC	
Biodegradable	• Segregate green waste at landfill transfer site • Increase green waste collection days • Educate households on	• Investigate feasibility for the purchase of a shredder • Involve community in the composting project • MESD,		BTC, TUC, NGO's & MESD	

IMPLEMENTATION OF THE PLAN	ACTION			RESPONSIBILITY	TIMEFRAME
	Priority One	**Priority Two**	**Priority Three**		
	benefits of composting	Councils and NGOs prepare for educational campaign on composting			
Construction & Demolition			• Education about distribution of materials to the community		
Big Wastes (Scrap Metal)	• Follow up on the SMEC proposal				
REFUSE COLLECTION	• Raise or extend trailer sides with mesh wire • Green waste to be collected on two days	• Investigate feasibility of purchasing 2 three tonne trucks with extended sides • Source for donation of 100 litre plastic bins		BTC, TUC and National Solid Waste Management Committee	
DISPOSAL TO THE LANDFILL	• Investigate new landfill sites in S. Tarawa • Erect fence and signs to prevent scavenging • Establish Landfill Management Plan	• Analyse water in Red Beach landfill • Tractors to be fitted with blade/hoe • Mud/ sand from causeway for landfill cover	• Conduct EIA on identified landfill sites • Rehabilitate closed landfills	BTC, TUC , MESD and National Solid Waste Management Committee	
SPECIAL WASTES	• Conduct audit of hazardous substances • Waste oil to be sent Mobil • Recycle batteries • Commission incinerator at the hospital	• Prepare plans for disposal or emergency response		MESD, Ministry of Health	
COMMUNITY INVOLVEMENT	• Increase community awareness • Anti litter campaigns, information booklets	• Identify funds for community competition		MESD, National Solid Waste Management Committee	

IMPLEMENTATION OF THE PLAN	ACTION			RESPONSIBILITY	TIMEFRAME
	Priority One	Priority Two	Priority Three		
	• Assist FSP implement KEEP				
ORGANISATION OF SOLID WASTE MANAGEMENT	• Review new Environmental Legislation • Councils to work with the community	• Identify funds for equipment and manpower • New landfill sites to be endorsed by new National Solid Waste Management Committee • Repeat waste characterisation studies every 2-3 years		MESD, National Solid Waste Management Committee	

Introduction

Sinclair Knight Merz was commissioned by the South Pacific Regional Environment Programme (SPREP) to carry out the Solid Waste Characterisation and Management Plans Project in 8 Pacific Countries in including Fiji, Tonga, Vanuatu, Papua New Guinea, Kiribati, Tuvalu, Solomon Islands and Western Samoa.

This is the final report for Kiribati, based on the findings of the fieldwork carried out by the author in South Tarawa from 1st – 15th September 1999. The aim of the report is to present the results of the waste characterisation work carried out while in Kiribati and to describe the current waste management practices in Kiribati. The report also aims to formulate options and priorities for an integrated solid waste management plan for Kiribati. The terms of reference for this project are given in Appendix A.

This report was financed by the European Communities from a grant of the European Development Fund and is presented by the consultant Sinclair Knight Merz Ltd for consideration of the Kiribati

Government. It does not necessarily reflect either the opinion of the latter or the European Commission.

1.1 Background

The Republic of Kiribati is located 5 degrees N and degrees S and 170 degrees E and 150 degrees W in the central Pacific. Kiribati consists of three island groups, the Gilbert Group, the Phoenix Group and the Line Islands. All of the islands are atolls or low-lying coral islands with the exception of Banaba.

The republic has a land area of approximately 811 km^2 and an ocean area of 3.5 million km^2. It has a total population of approximately 77, 658(Popn Census,1995) with an annual growth of rate of 1.42 % and a population density of 103 persons/km^2.

The island group has alkaline soils with a high water table of shallow depth, which relies on surface water precipitation for replenishment. Groundwater from Funafuti to Bikenibeu is contaminated with high levels of faecal coliforms, and these areas have been closed by the Public Utilities Board (PUB). Water supplies are now sourced from Bonriki and Buota and a new desalination plant that was out of order during this visit.
The subject area of South Tarawa in Kiribati, comprises of a number of small islets joined by causeways with a population of approximately 28 350(Popn Census, 1995). Urban drift (migration of people from outer islands into S. Tarawa)is a major problem with a growth rate of 2.21% per year, resulting in overcrowding and degradation of the physical and biological environment. One of the major environmental issues associated with this type of expanding urban environment is the management of solid waste.

2. An Overview of Existing Solid Waste Management, Practices, Methods & Regulations

2.1 General

According to the Kiribati State of the Environment Report (1994), "Disposal of solid waste is a serious and increasing concern in Kiribati. A change in lifestyle from traditional subsistence to a Western oriented lifestyle, especially on South Tarawa, has dramatically increased the amount of imported goods and the volume of waste material requiring disposal." The Kiribati UNCED Report (1991) points out that solid waste disposal is a major problem. It recognises that solid waste problems can create hazards, provide breeding places for mosquitoes, flies and rats, and restricts land use.

The general situation has deteriorated since the early 1990s because further influx of imported goods and associated packaging, the indiscriminate dumping of junk vehicles, machinery, construction equipment, waste material from households and wastes from economic activities have exacerbated the problem. The problem is further compounded by the shortage of suitable land for siting proper rubbish disposal sites and the proximity of groundwater and marine resources to possible sources of contamination. Furthermore, South Tarawa is undergoing rapid population growth because of high birth rates and immigration

from outer islands. The population is expected to reach about 50,000 by 2010. The high population density of South Tarawa is resulting in overexploitation of resources and more serious pollution, sanitation and public health problems than ever before.

2.2 Current Waste Disposal

At present domestic and other solid wastes are left by the side of the main road. In general the rubbish is not contained in any way, but just left on the ground as a heap. The rubbish stays there for about a week before collected by employees of either the Tarawa Urban Council (TUC) or Betio Town Council (BTC). The rubbish is disposed of at surface dumps by the two councils at six major locations around South Tarawa: McKenzie Point, West Bikenibeu, the Catholic Mission at Teaoraereke, near Bairiki Sewage Outfall, Red Beach, and North-West Betio. Only the dump at the Catholic Mission is contained by a seawall, at the other dumps rubbish gets spread over large areas because there are no barriers to contain the rubbish. Rubbish is also dumped at many uncontrolled locations, usually on the upper beach, or is burned or buried on private land by residents. Medical wastes such as tissues, cultures, stools, dressings, vials, plastics, syringes, needles, other sharps, bags and gloves, is either burned using kerosene in a non-functional incinerator at the Tungaru Hospital or is collected by TUC workers and disposed of in a dump.

2.3 Previous Studies

In 1994, the Government of Kiribati requested assistance from the Asian Development Bank (ADB) to deal with some of the problems mentioned above. As a result, the ADB funded a series of technical assistance projects to obtain an in-depth understanding of the problems faced by Kiribati in areas such as water supply, electricity generation and supply, solid waste management, and water and sanitation issues.

As regards solid waste management issues, the ADB funded technical assistance entitled “Sanitation and Public Health Project” (1996) recommended the implementation of a comprehensive solid waste collection service and construction and efficient operation of four managed landfill sites. The recommendations include the re-equipping of the collection services, rehabilitation of landfill sites and replacement of the hospital incinerator. Furthermore, collected waste is to be managed by a Waste Management Division of the proposed Kiribati Utilities Company Limited (KUC), which is to be formed by privatising the Public Utilities Board (PUB). Solid wastes

are to disposed of at the following landfill sites which would also be upgraded as part of the ADB project:

Table 2.1: Landfill sites recommended by the ADB TA Study

Landfill Sites	Comment
Red Beach at Betio	This is an existing dumpsite and it is proposed to enclose the area by a seawall.
Bairiki	Solid waste is to be placed in pits created in newly accreted land (on the lagoon side of the causeway); sand is to be extracted for other uses.
Nanikai	Same as for Bairiki.
Temaiku reclamation	Waste to be disposed of on swampy land.

The disposal of larger metallic items was not covered by the ADB study as this issue had already been investigated under a European Union funded study (see Section 2.7 for details).

In the light of some of the recommendations made by the consultants preparing the report of the above-mentioned "Sanitation and Public Health Project", the ADB commissioned another TA Study entitled "Environmental Improvement for Sanitation and Public Health Project". This TA was designed to get another group of consultants to identify key environmental issues relating to the project preparation and technical assistance undertaken under the original study and to ensure that environmental considerations were appropriately considered. This second group of consultants concluded that all but two of the recommendations of the first group of consultants would have a positive effect on the environment. The two recommendations that there were concerns about were the upgrading of the Red Beach dump and the setting up of a new dump at the Temaikau swamp.

The ADB has approved funding for a comprehensive Sanitation and Public Health Project for South Tarawa, preliminary work has begun and construction work should begin in 2000.

2.4 Solid Waste Collection

The two councils that are responsible for the collection and disposal of municipal waste on South Tarawa are Betio Town Council(BTC)

at Betio and Teinainano Urban Council (TUC) covering an area from Bairiki to Bonriki.

The two councils currently use tractors and open trailers that have holding capacity of between 3.75m^3 and 4.5m^3. TUC has four tractors and trailers and BTC has two tractors and trailers. During the period of study BTC had one operating tractor and the other under repair whilst for TUC three were hauling refuse and the fourth was in the garage. The rubbish is disposed of at surface dumps by the two councils at six major locations around South Tarawa: TUC uses four of these and BTC uses the other two.

The collection staff usually consists of a driver and two or three loaders or unloaders with a shovel and rake for removal of refuse. Collection is on a weekly basis.

Less than three-quarters of the population is covered by the municipal collection service.

Some households, government houses and private businesses use 44 gallon drums as refuse receptacles. The drums are difficult to handle for the waste collectors and without covers are open to vermin, dogs, flies and mosquitos. Households without rubbish bins pile up their rubbish on the roadside for collection.

In TUC areas, most of the refuse collected is dumped in small landfills that are sited on causeways and often on request on private land that are being reclaimed on either the ocean or lagoon side. Most of these dumpsites are unprotected, are often on fire and refuse is washed on to the lagoon beaches and the sea. At Red Beach dump there is already signs of leachate seeping beneath the dump wall onto the seafront.

2.5 Collection and Disposal Fees

Both Councils have a service charge for waste collection and disposal. Charges in the two Councils are generally similar. The TUC charges Government Ministries $600/year, private businesses $400/year, stores $50/year, and civil servants living in Government quarters $1.85 per fortnight. For BTC, households pay $17 for a local type house, $29 for permanent houses. The total annual income of TUC is about $300,000 per annum of which waste management service fees account for about 25%.

Representatives of both Councils feel that they need more tractors, trailers and staff to do a better job, but they do not have any spare funds to invest in these areas. At present there are insufficient vehicles and inadequate resources to provide a satisfactory service to the public.

Generally the current rate structure is acceptable to the public. However, any changes to the rates would need to be discussed widely with the public, the government and the Council.

2.6 Landfill Issues in Tarawa

Much of the material at all three dumps is of organic origin. Other material present at the dumps is cardboard and paper, plastics, aluminium cans, fabric, tins, engine parts, etc.

Rubbish is in contact with high tidal waters and as a result a significant amount of newly-dumped rubbish is actually being swept away from the dump. It was also noted that a smaller proportion of the rubbish has been transported along the beaches, resulting in these beaches being generally polluted.

The main impacts of these dumps is visual effects, possible health risks associated with toxic materials, glass and other sharp objects, and the breeding of pests such as mosquitoes, flies, rats and cockroaches. There are also impacts associated with possible contamination of freshwater lenses by leachate from the dumps.

No odour could be detected at the dumps, and once again this is attributed to the absence of putrescible organic matter in the waste stream because all waste food and any edible peelings are fed to pigs.

It was also noted that housing was encroaching onto the dumps. The shortage of land and the high population growth rate means that this is unavoidable.

2.7 Recycling and Resource Recovery

The residents of South Tarawa practice reuse and recycling to a limited extent. For example, glass bottles are often reused to store red toddy (*kamwaimwai*) and some plastic items (such as ice cream containers) and aluminium cans are used to store water or other materials or in decorations. Some plant material is composted and used in swamp taro (*bwabwai*) culture and for mulching.

The ADB Study "Institutional Strengthening of the Environment Unit" (1997) estimated that 2.7 million aluminium cans per annum are available for recycling in Kiribati. Of this 2.3 million are beer cans and 0.4 million are soft drink cans. The Study estimated that total costs incurred in shipping compacted cans to Australia, excluding labour costs for collection, is $A475/tonne. The 1997 market price for a metric tonne of aluminium cans was $A1100. Since approximately 58,000 cans make up a metric tonne, there are about 37.2 tonnes of cans available for recycling each year at 80% recovery rate. Therefore, the financial return would be approximately $A24,000 per annum.

There are two private businesses involved in the recycling of aluminium cans and other non-ferrous metals in South Tarawa. They both offer $A0.20/kg to the can depositors. Although recycling is not their core business, both companies seem to be doing reasonably well in this area and are able to capture a small but significant proportion of the cans available for recycling. Copper radiators are also recycled and are collected for 40c/kg.

In 1994 the Ministry of Finance & Economic Planning in Kiribati commissioned the Snowy Mountains Engineering Corporation Limited (SMEC) of Australia to undertake a feasibility study for the South Tarawa Environmental Recycling Project. This national project was funded by the European Union with the Ministry of Environment being the Executing Agency. The main objective of the Project was to collect, process and recycle the large number of abandoned vehicles and machinery that were present in South Tarawa in order to improve the natural and social environment of the island. To satisfy the TORs of the consultancy, the consultants undertook the following activities:

- liaised with relevant Government authorities in Kiribati;
- established the type and quantity of abandoned vehicles and other machinery on South Tarawa that required processing;
- prepared documentation outlining design, technical specifications and supply of required equipment for tender that

was suitable for collecting, cutting, shredding and compacting the waste material;

- visited recycling companies in Australia to determine the best available market for receipt of South Tarawa scrap metal;
- determined costs of ordering, supply, package and delivery of equipment to South Tarawa via available shipping services;
- recommended the technical assistance and training necessary for the establishment and operation of the project.

The consultants found that there was about 1,500 tonnes of scrap metal in South Tarawa that could be recycled in Australia or New Zealand, located at the Public Works. Department yard at Betio, Bairiki, Betio shipyard, wharf access at Betio, Takoronga Point, Nanikai Causeway, Temaiku foreshore, and also in private yards. Some recycling companies in Australia and New Zealand were also willing to supervise the entire recycling operation and take responsibility for the shipment and re-sale of the scrap metal. It was estimated that under this mode of operation, the entire clean up could be completed within six months. The consultants estimated that the Project would need to buy a hydraulic excavator (reconditioned) and a material densifier which would cost about $A585,000. The consultants also determined that the least cost option to deliver scrap metal to Sims Metal in Melbourne from Tarawa would be $A80/tonne for containerised scrap and $A90/tonne for bolster and break bulk scrap. The price offered by Sim Metal for scrap metal delivered to Melbourne on a FIS basis is summarised in Table 2.2.

Table 2.2: 1994 prices for scrap metal delivered to Melbourne

Scrap Metal	Price ($A/tonne)
Non-Ferrous Metals	
Car batteries	150
Copper radiators	1200
Brass	1560
Copper	2350
Aluminium	1000
Ferrous Metals	
Vehicle bodies	70
Heavy machinery	85
Small steel sections	110

Source: South Tarawa Environmental Recycling Project, SMEC, 1995

The SMEC consultants recommended that a scrap metal merchant be appointed, following a competitive tender process, to dispose of

the scrap metal. This company would recover the loading, shipping and inward port costs from the re-sale of both ferrous and non-ferrous metals. The SMEC consultants estimated that the above-mentioned EU Project would need to spend an additional $A 8,000 for the tender process and $A15,000 for a technician to visit the site and provide installation supervision, commissioning, operator and mechanical training for the major item of machinery.
This project has been revived and is once again being considered for approval by the European Union.

It was noticed that a large number of junk vehicles have already been deposited on the eastern end of the Dai Nippon Causeway.

2.8 Education and Awareness

FSP Kiribati is coordinating a wide range of activities to improve the environmental management capabilities of the people of South Tarawa. Most of the activities are undertaken under the Kiribati Environment Education Programme (KEEP). These activities focus on raising knowledge and awareness in the community of environmental problems currently threatening South Tarawa as well as environmental solutions that can be implemented at the community level. The project is funded by AusAID, British DFID, NZODA and SPREP. FSP Kiribati is liaising closely with the Environment Unit and other partners such as the municipal councils in coordinating and implementing the programme.

There is also another initiative called the “Kiribati National Waste Management and Prevention Consultation” being coordinated by the Environment Unit. The planning stage is already underway. At this early stage, it is envisaged that the aims and objectives of such an initiative would be:

- providing a high level forum for discussing the priorities of a waste prevention, minimisation, reuse and recycling strategy and to formulating an Action Plan, with feedback and reporting procedures;
- strengthening the capabilities of participants in identifying and redressing their purchasing behaviour, and avoiding the importation of high waste or dangerous products;
- assisting participants to update knowledge of waste prevention, minimisation, reuse and recycling activities.

Possible topics could include the following:
- Payment for disposal of rubbish - consider ways in which importers and large scale users of non-biodegradable wastes pay

at least some of the costs of collection and safe disposal of the waste material;
- Packaging - focus on low waste, non-disposable, recyclable packaging.
- Reduction and Reuse before Recycling - due to limitations of Recycling on small islands;
- Discussion on Recycling Licence for current recycling agents to protect them and encourage best practices;
- Best value acquisition/purchasing - combining environmental costs and economic costs and selecting those goods and services which support a better quality of life. By adding in costs of disposal, pollution and public health, a more realistic product price can be obtained.

Possible participants:
- Members of the Kiribati Chamber of Commerce;
- Private enterprises with major focus on importers, warehouses, etc.
- Ministers/MPs;
- Senior Managers from relevant Ministries (Commerce, Environment, etc.);
- Recycling company managers;
- Municipal Council Managers.

FSP Kiribati also has excellent resources for conducting training in participatory techniques of project formulation, implementation, monitoring and evaluation.

2.9 Existing Data on Solid Waste Generation in Tarawa

According to the ADB Study entitled "Sanitation and Public Health Project" (1996), approximately 6,500 tonnes of solid waste is produced in South Tarawa each year. Another ADB Study, "Institutional Strengthening of the Environment Unit" estimates that 80% is generated by the domestic sector, 11% by Government agencies, and 9% by the commercial sector.

A number of domestic waste composition surveys have been undertaken in South Tarawa since 1994. The results of these surveys are summarised in Table 2.3.

Table 2.3: Summary of domestic waste composition surveys

Material	Wt % Total		
	Gangaiya (1994)	ADB Study "Environmental Improvement for Sanitation and Public Health", (1996)	ADB Study, "Institutional Strengthening of the Environment Unit" (1997)
Food wastes	5		1
Organics (green and yard wastes)	75	62	75
Plastics	2	12	5
Wood			<1
Paper	2	14	5
Textile/Rubber	<1	3	<1
Glass/ceramics	3		3
Metals (including aluminium)	7	7	10
Miscellaneous	6	2	
TOTAL	100	100	100

Notes:

1. Gangaiya (1994) and ADB Institutional Strengthening of the Environment Unit (1997) are based on household surveys.
2. ADB Environmental Improvement for Sanitation and Public Health Project (1996) is based on waste survey at Red Beach Dump.
3. Between 1994 & 1996/7, the general trends indicate increased use of plastics, paper and metal (cans). This may reflect a change in consumption patterns.

The results of Table 2.3 indicate the value of waste characterisation surveys undertaken on a regular basis, say every three years. However since all three surveys have used a slightly different methodology, care has to be undertaken in comparing the trends. It is important to emphasise that whatever methodology is chosen for waste classification, any future analyses of the same waste stream needs to be carried out with the same methodology so that the results are comparable over time.

2.10 Other Wastes

Waste oil is generated from the power station, repair shops and bowsers and there is generally a lack of appropriate waste oil collection systems.

Mobil Oil and KOIL (Kiribati Oil Limited) collect their waste oil and ship it to Fiji for recycling.

The island is also littered with scrap metals such as derelict vehicles, mechanical equipment and World War II relics. This waste is a hazard, occupies valuable space, and should be dealt with in an appropriate manner.

At present there is no system to deal with used batteries properly. In 1999, Kiribati is expected to import more than 1 million small batteries (projected from figures in Customs, Republic of Kiribati, 1999).In addition there are millions of batteries that have already been spent and discarded all over the country.

Batteries make up 0.8 % of the household waste and were also noted in significant quantities around the landfill. According to the locals, this problem is more prominent in the outer islands where there is no electric power.

The Battery Education Programme, funded by the European Union in the early 1990s was successful to some extent. More recently I-Matang volunteers have organised school children and villages to get involved in battery collection with monetary reward (1 cent/appliance battery). However, these stockpiled batteries are non-rechargeable and disposal has now become a problem. Disposal to a lined landfill would be suitable.

At present medical wastes, sharps and syringes are put in small containers or boxes with dressings, clothes etc. to be burnt on site or buried in the hospital grounds or on other islands. This practice is unacceptable and all medical waste should be incinerated.

2.11 Legislation and Regulations

The Local Government Act 1984 empowers Local Council to make provision for sanitary services dealing with rubbish and the prohibition of acts detrimental to the sanitary condition of the area.

The Ministry of Health is supposed to advise Local Councils on the location of rubbish dumps, particularly in relation to distances from dwellings and the threat of pollution to groundwater. This advice process is not working properly. For example most of the rubbish dumps are sited adjacent to the sea, with resulting pollution of the marine environment.

At present in Kiribati rubbish dumping takes place on any private property as long as the land owner has agreed to this. However, under the Foreshore and Land Reclamation Ordinance, the ownership of the foreshore and the seabed is vested in the Government. The laws define the foreshore as the area alternatively covered and uncovered by the sea at high and low tide.

Under the Public Health Regulations:

- it is an offence to deposit a receptacle at any public place or allow receptacles to remain upon any premises;
- all premises and land must be kept clean;
- rubbish must be burnt if possible, and if not, put in bins ready for daily collection.

The Public Highways Protection Act 1989 prohibits the depositing of litter or rubbish on the public highway. A conviction could lead to a fine of $200 and three months imprisonment.

The Betio Town Council (Public Health) By-laws 1975 prohibits the littering of villages and public places and the sea. The owner or occupier of land can be ordered to remove unsanitary refuse.

The ADB assisted the Environment Unit in drafting its Environment Protection and Conservation Act in 1996. Part IV of the proposed Act deals with waste management and pollution issues. The draft legislation is still being considered by the Attorney General's Office. The new Environmental Bill is very general and does not concentrate on any specific aspects of waste management.

A number of other pieces of legislation and regulations have provisions which apply to waste management, such as the Harbours Act(Chapter 40), Kiribati Ports Authority Act(1990), Merchant Shipping Act and Merchant Shipping Order (1975). Some of these Acts are outdated, contradictory and are not enforced. The fragmented and out dated nature of solid waste management legislation creates co-ordination and administration problems. This is further compounded by the lack of expertise and resources to enforce any existing laws.

In Kiribati there is a need for the formulation of specific waste management policies that would give clear direction and focus to waste management issues.

2.12 Capacity Building

2.12.1 Personnel

During this study it was observed that human resources and expertise in waste management was lacking in key areas such as the Health Department and the Town Councils.

Within the Environment Unit, there are two Waste Management staff plus others that have responsibility in related areas. One of the waste management staff is funded through SPREP for one year. The number of staff and training in waste management within the Environment Unit needs to be increased if waste management plans are to be implemented in the future.

2.12.2 Institution

From discussions with the BTC's Treasurer and TUC's Town Clerk, it was obvious that the councils survive on a very small budget. Waste management has a low priority within the organisations causing mismanagement of existing resources and a lack of formal planning or short term improvements. Consequently there is a delay in maintenance of vehicles, inadequate equipment and un-trained staff with minimal education in waste management.

Despite these shortcomings the Councils believe that given the required technical and financial resources they can improve solid waste management in Kiribati.

3. Audit and Characterisation of the Solid Waste Stream

3.1 Introduction

In Kiribati one of the factors that contributes to the poor management of solid waste is the lack of consistent data on the composition and quantity of solid waste being produced. The data will be necessary for the design of a new landfill site for the South Tarawa area and for the setting of targets for waste reduction, reuse, recycling and will allow the measurement of success of any waste minimisation initiatives.

3.2 Methodology

3.2.1 Bag and Bin Collection

3.2.1.1 Preparation

The household survey was carried within the Teinainano Urban Council Municipality in West Bikenibeu, South Tarawa for 8 consecutive days.

1. For the waste characterisation at source, nineteen households were selected at West Bikenibeu on South Tarawa with assistance from the Foundation of the Peoples of the South Pacific (FSP), in an area they currently are working in.

2. The houses were selected according to the following socio economic groups; low, middle and high income households. A number of small businesses were included into the high income group sample.

3. Each house was assigned a number and given eight garbage bags, one for each day. The purpose of the survey was explained during the distribution of the garbage bags, and the number of persons in each household recorded.

4. The waste generated in the selected households/businesses was collected every day at a fixed time for 8 consecutive days to allow variation in waste generation over the week.

Note:

The first day's samples were excluded from the analyses as they may have contained waste from previous days.

3.2.1.2 Sorting Procedure

The following procedure was followed:

1. Weigh all 19 garbage bags and record against allocated number.

2. Select randomly 10 bags from the total but with equal representation of the different income earning groups. Open all the 10 randomly selected bags and empty their contents into a bucket. Weigh each households waste in the bucket.

3. The bucket will be emptied and its content spread over a plastic sheet or tarpaulin (7m x 4m). Repeat the process until all the bags for each sample area are emptied and count the number of bucketful loads, which is to be recorded for the volume determination.

4. Separate the waste into the 9 different components and weigh each constituent on a scale and record on data sheet.

5. Dump all the waste properly and clean the equipment used. Repeat 1-4 every day the refuse is collected for the duration of the study.

3.2.1.3 Analysis and Reporting

The main points in analysis are;

- the statistical unit is the household, not the bag
- detailed analysis and reporting is by weight
- total volumes of waste should also be determined to give general indications of landfill space requirement keeping in mind that volume is greatly affected by the compaction of the refuse.

The mean % composition for a waste type is determined from the total weight of the constituent divided by the total weight of refuse sampled. This is not the same as the average of the compositions of the individual samples.

Data from the number of households sampled is extrapolated up to provide an estimate of refuse generation for the full number of houses in the collection area. For potentially hazardous substances it is appropriate to only list the substances found.

The analysis will identify the following data:

1. Mean Bulk Density of waste
2. Mean Daily Generation of waste(domestic/small business)
3. Percentage(by weight)of waste streams

3.2.2 Classification at the Landfill

This survey was carried at the Betio Town Council landfill at Red Beach in South Tarawa on two consecutive days.

1. Divert all vehicles carrying household wastes arriving at the landfill for two consecutive days away from the normal dumping area and unload.

2. Do not cover this heap of refuse with sand.

3. At the end of the second day mix this heap of refuse into one pile using a shovel.

4. Push out a typical pile of approximately two trailer loads.

5. Fill the bucket with the sample pile of the two days refuse. Record the number of bucketful loads. Record the volume of the bucket and trailer.

6. Sort the refuse into the nine different waste streams on the plastic sheet.

7. Weigh each pile of sorted component and record the weight.

8. At the end of sorting and recording push the pile back into the normal dumping area

3.3 Results

3.3.1 Waste Characterisation of Bag and Bin Collection

Table 3.1 below shows the weight of waste in kilograms collected from each of the selected houses each day. The column showing "family size" is the number of people living in each house.

Table 3.1: Data sheet for daily domestic generation rate

House No	Family Size	Day 1 Kg	Day 2 kg	Day 3 kg	Day 4 kg	Day 5 kg	Day 6 kg	Day 7 kg	TOTAL kg
1	12	4	1.9	3.3	1.5	5.0	5.0	1.9	22.6
2	5	6	5.2	3.2	1.5	1.0	2.4	1.6	20.9
3	10	0.7	3.0	1.5	1.5	1.2	1.4	1.5	8.1
4	7	1.2	2.8	0.6	1.7	2.0	1.6	2.0	11.9
5	8	4.5	1.0	1.0	3.7	-	1.4	8.9	20.5
6	12	5.9	1.6	1.4	1.1	13.8	8.5	1.9	34.2
7	6	1.2	2.1	1.6	2.6	1.8	1.6	-	10.9
8	9	1.4	2.4	2.0	-	8.4	3.6	2.5	20.3
9	9	1.9	2.4	2.4	2.6	3.0	0.5	1.6	14.4
10	6	5.5	2.4	5.3	3.5	1.5	1.5	5.9	25.6
11	9	2.5	5.0	1.6	0.6	3.6	4.8	1.6	19.7
12	18	1.8	4.6	1.5	2.9	1.6	2.2	1.0	15.6
13	6	2.4	2.4	1.0	1.3	1.4	0.9	1.8	11.2
14	6	2.3	1.5	3.0	3.0	2.0	2.8	2.9	17.5
15	7	5.0	5.3	2.4	3.4	14.5	2.5	3.4	36.5
16	7	3.2	9.9	3.0	1.9	1.4	2.1	1.5	23.0
17	2	1.6	2.0	0.9	1.0	-	1.2	1.0	7.7
18	9	0.6	1.6	2.5	0.5	0.5	0.5	0.3	6.5
19	2	7.3	-	0.8	1.5	7.4	-	-	17.0
TOTAL	150 (A)								344.1 (B)

Table 3.2 below shows the records of the total volume of waste from the 10 randomly selected houses in the bag and bin collection. The total volume can be used to calculate the average density of the waste.

Table 3.2: Data sheet for recording the volume of waste from the 10 randomly selected houses

Day	1	2	3	4	5	6	7	Total
Total No. of bucketful loads	17.0	18.5	13.0	11.0	17.0	13.0	7.0	96.5
Volume of bucket (litres)	12	12	12	12	12	12	12	
Total	204	222	156	132	204	156	84	1158

Volume (litres)

Table 3.3 below shows the weight of waste recorded for each of the 10 randomly selected houses on each day

Table 3.3: Data Sheet for recording the weight of waste from the 10 randomly selected houses

Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7	
Hse No	Wt kg	Hse No	Wt kg	Hse No	Wt kg	Hse No	Wt kg	Hse No	Wt kg	Hse No	Wt kg	Hse No	Wt kg
1	4	1	1.9	1	3.3	1	1.5	1	5.0	1	0.5	12	1.0
2	6	2	5.2	2	3.2	2	1.5	2	1.0	13	0.9	13	1.8
3	0.7	3	3.0	3	1.5	3	1.5	3	1.2	14	2.8	14	2.9
4	1.2	4	2.8	4	0.6	4	1.7	4	2.0	16	2.1	1	1.9
9	1.9	9	2.4	9	2.4	5	3.7	16	1.4	3	1.4	3	1.5
10	5.5	10	2.4	10	5.3	6	1.1	10	1.5	2	2.4	4	2.0
11	2.5	11	5.0	11	1.6	7	2.6	12	1.6	5	1.4	2	1.6
12	1.8	12	4.6	12	1.5	9	2.6	13	1.4	10	1.5	11	1.6
13	2.4	13	2.4	13	1.0	12	2.9	7	1.8	18	0.5	18	0.3
14	2.3	14	1.5	14	2.5	18	0.5	9	3.0	9	0.5	9	1.6
Total	28.3		31.2		22.9		19.6		19.9		14		16.2

Table 3.4: Data sheet to determine weight of the various components

Primary waste category	Day 1 Kg	Day 2 kg	Day 3 kg	Day 4 kg	Day 5 kg	Day 6 kg	Day 7 kg	Total Weight	Wt %
Paper	2.2	1.9	0.9	0.9	1.9	2.4	1.6	11.8	7.0
Plastics	1.08	4.0	1.3	0.3	2.8	1.5	1.0	11.98	7.2
Glass	1.0	8.1	3.8	-	7.3	2.6	-	22.8	13.6
Metals	1.3	5.0	1.3	1.3	5.1	1.4	0.4	15.8	9.4
Bio-degradable	10.4	13.6	14.1	13.9	12.7	11.9	9.4	86.0	51.3
Textiles	-	1.2	1.3	1.7	0.3	0.5	-	5.0	3.0
Hazardou	-	0.3	0.7			0.4		1.4	0.8

s									
Constructi on and	-	-	-	-	-	-	-	-	-
Demolitio n	6.0	2.4	1.7			1.3	1.5	12.9	7.7
Other									
Total	22.0	36.5	25.1	18.1	30.1	22.0	13.9	167. 7	100

3.3.2 Summary of Results for Bag and Bin Collection Analysis

1. Mean Bulk Density of Waste = 130 kg/cubic metre

2. Mean daily generation (domestic/business) = 0.33 kg/person/day

   = 2.55 kg/household/day

3. Percentage of waste streams:

Table 3.5: Waste Classification of Bag and Bin Survey: Results

Primary Waste Classification	Secondary Waste Classification	Average Percentage (wt%)
Paper	Cardboard boxes and other – magazines, newspaper, office, tetrapak, packaging and Sanitary	7.0
Plastic	Polyethylene terephthalate (PET) and Rigid High Density Polyethylene (HDPE) and Flexible HDPE and other plastics	7.2
Glass	All glass	13.6
Metals	Aluminium cans And other metals	9.4
Biodegradable	All organic	51.3
Textiles	All textiles including clothing, carpets and curtains	3.0
Potentially Hazardous	All	0.8
Construction and Demolition	All	7.7
Other	Including rubber and other	0

Total	100%

3.3.3 Waste Characterisation at the Landfill

Table 3.6 below gives the results of the waste sorting and classification carried out at the Red Beach Landfill on 8-9th September 1999. The sorting and classification was carried out by the consultants and assistants from Betio Town Council. The waste had been collected in the Council vehicles over 7-9th September (Monday, Tuesday and half day Wednesday) and was collected from Betio households, businesses, commercial properties and government properties. The total number of loads was 20, with the volume of the trailer at 3.74 m^3. Therefore the total volume of waste collected was approximately 74.8m^3 and the sample size for sorting and weighing was 2 loads or approximately 7.5m^3.

Table 3.6: Waste Classification at Landfill: Results

Primary Waste Classification	Secondary Waste Classification	Weight of Waste Recorded (kg)	Average Percentage (wt%)
Paper	Cardboard boxes	50.7	53.6
	Other – magazines, newspaper, office, tetrapak, packaging	0.9	0.95
	Sanitary	1.8	1.9
Subtotal		53.4	56.45
Plastic	Polyethylene terephthalate (PET)	1.0	1.06
	Rigid High Density Polyethylene (HDPE)	5.0	5.29
	Flexible HDPE other plastics	0.9	0.95
Subtotal		6.9	7.3
Glass	All glass	2.9	3.07
Metals	Aluminium cans and other metals	10.5	11.1
Biodegradable	Kitchen waste Garden Waste	18.9	19.98
	Soil	2.0	2.11
Subtotal		20.9	22.09

Textiles	All textiles including clothing, carpets and curtains	0	0
Potentially Hazardous	All	0	0
Construction and Demolition	All	0	0
Other	Including rubber and other	0	0
Total		94.6	100%

3.3.4 Analysis of Waste Characterisation Results

It is assumed that the result of the household survey at West Bikenibeu represents waste generation patterns for South Tarawa.

1.	Average No. of People in a Household	= 7.8
2.	Total population of South Tarawa	= 28,350 (1995)
3.	Total no of households	= 3,634
4.	Bulk Density of Waste	= 130kg/ m^3
5.	Waste Generated from households	= 2.55 kg/household/day (0.33kg/person/day)
6.	Therefore in 1 year	= 120 kg/person/year
7.	For South Tarawa in 1 year	= 3,410 tonnes/year = 26,267 m^3/year
8.	If the refuse were compacted to half its volume	= 13,134 m^3/year
9.	Surface Area needed for a 1 metre high landfill	= 13,134 m^2 / 1000m^2
10.	Surface Area of landfill	= 0.0131 km^2

4. Evaluation of Waste Management Systems and Markets for Recyclable Materials

This section of the report reviews existing integrated waste management programmes and resource recovery systems and evaluates them for their applicability to conditions in Kiribati. Access to markets for recyclables is assessed and the cost of utilising these markets is discussed.

The feasibility of establishing recycling markets within the country is examined with respect to scrap metals, glass, paper, plastics and compost.

Factors to be considered in strategic waste management planning is summarised in Table 4.1, taken from the World Health Organisation Publication titled "Healthy Cities – Healthy Islands". This table is prepared to help decision-makers at national and local government level make strategic decisions for the improvement of their solid waste management services. The table shows issues that should be considered when prioritising waste management strategy actions.

Table 4.1 Strategic Issues for Solid Waste Management in Tarawa

Requiring Special Attention	Special Characteristic of Solid Waste Management	Strategic Measures to Improve Solid Waste Management
Small country size	Excessive amounts of packaging - recycling is difficult due to lack of economies of scale and remoteness from recycling market	Firm commitment of the relevant Authorities for better solid waste management - credibility of waste management authorities is vital
Economy of country – small economy – dependence on foreign aid	Difficulty in equipment maintenance - problems getting spare parts - lack of skilled mechanics	Strategic planning - waste management planning is essential to achieve cost-effective use of limited resources
Improvement of environmental health - through better solid waste management	Difficulty in site acquisition for landfill - lack of land - land ownership issues	Waste minimisation first - source reduction is the most important rule for solid waste management in the future
Protection of fragile environment - groundwater - coral and mangrove ecosystems are	Insufficient or not duly trained human resources for waste management	Improvement of collection service and cost saving - collection is the most expensive process in solid waste management;

resource base for fisheries and tourism		improvement and cost savings can generate financial resources for sanitary landfilling
Promotion of tourism - clean town and beaches will attract more tourists	Lack of cleanliness awareness among the public - urban dwellers not familiar with disciplines of urban living such as refraining from littering	Use of saved cost for final disposal improvement - careful siting and management are key to successful landfill

It is recommended that the people involved in solid waste management in the government, the Betio Town Council and the Tarawa Urban Council use the World Health Organisation document "Healthy Cities – Healthy Islands" as a reference for strategic planning of waste management in Betio. This document contains specific recommendations and criteria for the collection service, vehicles, waste receptacles, composting, recycling, transfer stations, management of contractors, landfill site selection, controlled landfill requirements, operation of landfill, as well as management and organisation of solid waste.

4.1 Evaluation of Waste Management Programmes

4.1.1 Waste Reduction

Waste reduction activities are important to halt or slow down the increasing rate of waste generation per capita. Waste reduction has several aspects, all of which should be addressed. These include toxicity reduction and volume reduction as well as encouraging products that can be recycled more easily. There are many successful cases of reduction of wastes by individuals, commercial enterprises and agencies using their purchasing power, as well as government and industries.

In Pacific Islands countries, almost all goods are imported to sustain people's daily needs. This generates an excessive amount of packaging waste which, because of the limited market, has very little possibility of recycling except for aluminium cans and beverage bottles. Waste minimisation measures such as recycling of package waste practicable in other parts of the world are not easily applicable in Pacific Island countries.

Waste reduction is therefore one of the most critical elements of a solid waste management strategy for Honiara and is a practical option for a Pacific Island country. There **must** be a major focus on waste reduction in Tarawa in the future.

Recommendations

1. Prepare an action plan identifying how to reduce the amount of waste produced in Tarawa, including education, media campaigns, legislation, home composting.
2. Set targets for waste reduction for various waste streams and monitor them at regular intervals.

4.1.2 Collection and Transfer of Wastes

The waste collection system in Tarawa is generally unsuccessful in terms of providing for the efficient, effective and economic removal of waste from source to point of disposal. This is the case in many of the Pacific Islands. The domestic collection system has not been privatised in Tarawa - the benefits of privatisation have not been achieved.

The collection system is an integral part of the waste management strategy for Tarawa and in order to improve the current collection system and overcome the inefficiencies the following factors must be considered in a detailed analysis of how to improve the current situation:

1. Distance to disposal site
2. Suitability of individual household collection or communal bins
3. Size and type of waste receptacles
4. Conditions of roads and proximity to residences
5. Transfer station requirement
6. Size and type of collection vehicles
7. Frequency of service
8. Willingness to pay
9. Methods of charging and collection
10. Privatised operation or local government operation
11. Separation of policy setting, implementation and operations for collection and disposal of waste.

Recommendations

1. It is recommended that a complete review of the collection system arrangements in Tarawa is carried out and the following issues are considered:

- Possibility of privatising the collection system
- Identify a funding source and plan for the next 5 years
- Plan for maintenance and operations of collection vehicles
- Clarify the definition of services to be provided
- Clarify responsibilities and key performance issues
- Ensure the contractors/waste workers are competent and trained
- Effective monitoring and control – implementation and enforcement of services to be provided
- Foreign aid and privatisation – public sector assets donated by foreign aid may be leased by contractors

4.1.3 Legislation/Regulation

One mechanism for waste reduction is to examine the imports to a country and identify which materials will lead to significant quantities of wastes. Action by the Government to reduce the imports that create wastes, through legislation or tariffs could be part of the waste management strategy. This type of intervention may not be appropriate due to the following reasons:

1. Reluctance to interfere with consumer choice
2. Contravention of World Trade Organisation agreements
3. Restricted sources of imported goods.

In Kiribati the use of legislation or tariffs to influence the purchasing and distribution policies for imported goods is a waste management option that should be considered in detail.

Government can also have influence on the success of waste minimisation schemes through tax structures. The exemption of taxes for the export of recyclable materials from Kiribati or other tax incentives should be considered as part of the waste management strategy.

There is no environmental legislation in Kiribati that covers waste management. An important part of the waste management strategy will be the implementation of specific legislation as well as improving the enforcement of the Litter Bylaw and Public Health Act. Factors that need to be considered to achieve this are:

1. Which authority will have responsibility for implementing waste management legislation
2. Multisectoral nature of waste management legislation
3. Number of officers for enforcement of Litter Bylaw
4. Training for enforcement
5. Level of fines
6. Regular review and updating of legislation
7. Financial resources for enforcement of legislation

Recommendations

1. Set up a working group to specifically examine, recommend and implement waste management legislation.

4.1.4 Recycling

There are two basic approaches to recycling. The first involves separating recyclable materials at source (by the waste generator) and separately collecting and transporting these materials to recycling markets. The second involves collecting mixed wastes and separating these at a central processing facility. The key factors in the success of pre-separation efforts are the cooperation and willingness of the waste generator to participate in the programme over the long term, and the additional collection and transport costs that may be required. The success of centralised recycling plants depends on the processing costs and the quality of the recyclable material produced.

The highest recycling rates reported in15 countries in 1990, were in the range of 10-18%. There are many good examples of successful recycling programmes throughout the world.

A major recycling impediment is the question of continued viability and availability of secondary materials market. The key points are:

- Recycling only occurs when the separated material is incorporated into a product that can be sold.
- Separation of materials does not constitute recycling – markets must be found first.
- Recycled products must be of a quality and price that compete in the marketplace.
- The difference in cost of disposal and recycling must be examined – ie. the price received for the recycled material, the waste collection and disposal costs avoided, the cost of separation, the costs of collection and processing the separated materials.

“The remoteness, relatively small size of the country and high degree of dispersion pose severe difficulty in transportation and market fragmentation. As a result, procurement of solid waste management tools, equipment, machinery, spare parts and even fuel is not only expensive but in many cases, very difficult to obtain. Very often the procurement encounters excessive delay. This situation also creates many constraints in waste recycling and often renders many alternatives not feasible.” (Ref: World Health Organisation Document Series, No 6. “Healthy Cities – Healthy Islands”).

The transportation of recyclable goods is one of the highest costs and can be higher than the return on the commodity carried. The opportunity to backload recyclable goods should be investigated in

detail. The significant imbalance of imports to exports in Kiribati means that there are significant opportunities to utilise empty ships leaving Tarawa. Negotiation of appropriate shipping rates will also be critical to the viability of recycling in Tarawa. It is recommended that a working group is formed to examine the feasibility of shipping recyclable materials to Australia, New Zealand and Asia, including importers, shipping companies, container leasing companies, government and local government representatives.

Recycling has considerable to be potential, but is likely to be marginally viable in economical terms and may need to be subsidised by the community, government or another body wishing to dramatically reduce the amounts of material entering the landfill. Recycling of some materials might be feasible in Tarawa or within the Pacific Region. Government, community and business support will be critical to the success of recycling.

Recommendations

1. Form a working group on feasibility of shipping recyclable materials from Tarawa to overseas destinations.
2. Gain government and business support for implementing recycling in Tarawa.
3. Negotiate a deal for the recycling of materials that have been identified as feasible. Consider using the existing metal recyclers, an overseas recycling company or a new business to implement the project.

4.1.5 Incineration

Incineration/combustion processes use the controlled combustion of solid waste for the purposes of reducing its volume. The advantages are destruction of hazardous waste, reduction of volume by up to 90%, and the possibility of energy recovery. In Denmark, Switzerland and Luxembourg over 75% of the municipal waste stream is treated by combustion with energy recovery. In Sweden it is over 60%, in France 43% and in USA 17%. Japan uses waste combustion to treat over 75% of the waste remaining after recycling.

The disadvantages of incineration are high capital expense, complex technology, complex operations, air emissions and management of ash residues. Incineration in Tarawa has not been very successful to date as the Hospital incinerator is currently not in use due to poorly designed/selected equipment that is difficult to use.

It is likely that incineration will be viable on a small scale for the disposal of hazardous wastes, if appropriate management systems are put in place. Detailed planning is needed prior to selecting a system, with investigations into waste composition, potential users, funding and operations and maintenance.

Recommendations

1. Conduct a feasibility study on the existing or a new incinerator for hospital waste and quarantine waste.
2. Identify funding for a recommission of existing incinerator or a new incinerator and training for the operation of it.

4.1.6 Sanitary Landfills

The disposal of waste to landfills continues to be the predominant method used worldwide. The 1990 International Solid Waste Association report indicated that the percentage of waste disposed of by landfills ranged from 20% to over 90% for 15 countries that were examined (Ref. Skinner, J.H. 1998. International Progress in Solid Waste Management in "Solid Waste in the Pacific". Proceedings 6th Annual Conference, Christchurch 1994).

Open dumping of waste on land without adequate controls as occurs in Tarawa can result in serious public health and safety problems and severe adverse environmental impacts. Modern sanitary landfills are equipped with leachate collection systems, liner systems, systems for control of landfill gas, groundwater monitoring, closure and post-closure care plans. The objective is to ensure that the landfilling activities are performed in a manner that greatly reduces the chance of release of contaminants to the environment and that any release is quickly detected and corrected.

The issues that need to be considered in improved landfill management for Tarawa are:

- Sources of funding and financial constraints
- Short term and long term planning
- Access to suitable land
- Lack of technical training
- Inappropriate selection of equipment

The provision of sanitary landfill services is a critical component of the integrated waste management strategy for Tarawa.

Recommendations

1. Conduct a full review of the existing waste disposal sites and evaluate each site against set criteria to identify the future of each site and the type of rehabilitation required for sites that should be closed.
2. Develop a programme and timeframe for the implementation of a new landfill and closure and rehabilitation of the existing sites identified in the review.

3. A landfill management plan for the existing landfills that are in use should be prepared and implemented.
4. Identify funding for new landfill.

4.1.7 Composting

Due to the quantity of biodegradable waste being produced in Tarawa it is recommended that composting be implemented as a major part of the waste management strategy. Composting produces a valuable product that can minimise the need to import expensive fertilisers. Composting is a well known technique and there are numerous proven operations around the world.

The issues that need to be carefully considered before implementing a composting scheme in Tarawa are:

- Composting at community level or household level?
- Initial funding
- What is the economic value of the product - can it be sold?
- Private scheme or government operated scheme?

Assuming a community or municipal scheme, there is at least 1, 750 tonnes per annum of organic matter available in Tarawa based on the current waste generation figures. Assuming an 80% capture rate for this material and an average compression ration of 20 to 1 from loose green matter to finished product then there is approximately 540 cubic metres per annum of compost as product available. (This figure is conservative). Assuming compost could sell at Aus$20/cubic metre, there is a potential return of Aus$10,800 per annum. Note: the value of the compost product in Tarawa will have to be determined.

Home composting could be successful in Kiribati and beneficial to both waste management schemes and the community. Three key factors in the support of home composting are:

- Improvement in nutritional balance
- Waste reduction at source
- Reduction in importation of food items

Keys to successful home composting are – organise community group; use grass-root communications; and make the operation simple with use of local resources.

Recommendations

1. Implement community scheme to encourage and train people in home composting. Use an existing community group to implement this initiative and provide incentives for involvement in the scheme such as free composting bins or reduced rates.
2. Implement a municipal demonstration composting scheme. Use market waste initially.

4.2 Opportunities and Obstacles

A summary of specific opportunities and obstacles to the successful implementation of waste minimisation initiatives in Tarawa is highlighted in Table 4.2.

Table 4.2. Opportunities and Obstacles for Waste Minimisation in Tarawa

Opportunities	Obstacles
FSP Kiribati is in a good position to implement community schemes eg. home composting	Lack of funds for waste management initiatives
Kiribati has been recognised by several aid agencies as needing assistance with solid waste management	Lack of public awareness on waste management issues
Considerable studies have already been carried out on the feasibility of scrap metal recycling	Poor management of existing waste collection scheme
Likely to be a market for compost due to geology of island environment	Lack of expertise in waste management
	Lack of public ability to pay
	Lack of public "perception of waste"
	No financial incentive to segregate waste at source
	Small volume of recyclable material available
	Cost of shipping material to Australia or Asia for recycling

Further key opportunities that must be considered in justifying strategies and expenditure on solid waste management are related to the following significant environmental health impacts:

- **Fisheries** is an important economic resource which can easily be affected by improper solid waste management
- Protection of the "enchanting environment" as a valuable resource for the **development of tourism** is an important objective in the development of solid waste management. Tourism development has become an important economic strategy for the Kiribati. Tidy towns, clean beaches and healthy people will definitely attract more tourists.
- **Health impacts** from contamination of the groundwater lens can be significant – protection of this vital resource is a priority in solid waste management
- Preventative measures to control the outbreak of infectious diseases through the improvement of solid waste management will improve the **cost-effectiveness of health care**.

4.3 Existing Markets

The only recycling that is being carried out at present in Tarawa is recycling of aluminium cans by two private businesses. They both pay Aus$0.35/kg to the can collectors.

4.4 Potential Markets

Table 4.3 gives a rough indication of the prices at present in New Zealand and Australia paid for recyclable materials, the estimate of amounts available in Tarawa.

Table 4.3 Potential Markets for Recyclable Materials

Material	Type	NZ$/tonne (bailed and shipped to NZ	Aus$/tonne (bailed & sorted to Asia)	Amount available in Tarawa (tonnes/year)
Glass	Colour sorted	80 - 85		238
Paper	Cardboard Newspaper Mixed	100 - 140 100 40	160 112	640
Plastic	PET HDPE LDPE	Low density = 50 – 100 High density = 350 – 440		245
Metal	Al cans Steel cans	1,500 25		320

Note:
Low density = loose to less than 500 kg/m^3
High density = 500 kg/m^3

4.4.1 Glass Recycling

There is the potential for glass recycling to be implemented by shipping of crushed glass to Australia, New Zealand or Asia for recycling. If there was an 80% capture of waste glass there could be up to 10 containers of glass per annum.

4.4.2 Paper Recycling

Paper recycling is available in New Zealand, Australia and Asia. The waste paper is sorted and bailed in NZ and shipped to Indonesia, Malaysia and Australia for processing. It is recommended that only two grades of paper be used for recycling in the Islands – mixed grade and cardboard grade. The key aspects to making a paper recycling operation successful are:

- big equipment to bail a large volume of material,
- sufficient capital behind the operation to invest in equipment,
- the ability to withstand the fluctuations in the market price,
- the ability to put a large weight of material in a container to economise on shipping costs,

- the negotiation of cheap shipping costs,
- the volume, form and quality of the material.

A small paper bailer would cost approximately Aus$8,000 – 11,000 and could process about 5-6 tonnes paper per eight hour day. The operational costs and shipping costs must be kept to a minimum in order for paper recycling to be feasible. Assuming that 50% of the waste paper Tarawa is recyclable and there is an 80% capture there could be up to 13 containers of paper sent from Kiribati for recycling.

4.4.3 Plastic Recycling

Plastics including PET, HDPE and LDPE are sent to Indonesia, Philippines, Thailand and Australia for recycling. New Zealand can recycle HDPE. The process generally involves collection, sorting, grinding and packing before shipping to Australia or Asia for re-processing.

The sorting of plastics is more critical to the successful recycling of plastics. LDPE can only be processed if well sorted, HDPE is better if it is uncontaminated with other materials eg. Milk bottles are good, household chemical bottles require separation of parts. Clean plastic bags can be recycled also. Assuming that 80% of the plastic wastes are recyclable and there is an 80% capture rate then there could be up to 8 containers of plastic for recycling from Kiribati.

4.4.4 Metal Recycling

At present only aluminium can recycling is being carried out in Tarawa. There is the potential to significantly increase the volume of metal being recycled. It is recommended that a small working group is set up, including a representative from the existing aluminium can recyclers, to identify what actions are needed and what support from government is needed to increase and diversify the amount of metal recycled.

4.4.5 Composting

Composting is identified as a highly favourable option as the process can be carried out locally thereby removing the requirement for transportation of goods. The process makes a valuable product that is useful in Tarawa. Composting will need to be carried out on a small scale initially to ascertain the best operating parameters. A

demonstration composting project using market waste run by the Councils would be an ideal way to start composting in Tarawa.

4.4.6 Prices for Recyclables

Table 4.3 gives prices for recyclable materials in 1992 in New Zealand as a rough indication of the value of various materials:

Table 4.3 1992 Prices for Recyclable Materials

Material	1992 Price (NZ$/tonne)
Glass (broken and sorted by colour)	58
Glass bottles for reuse	3-30 cents
Window glass	45-75
Cardboard	80-100
Newspaper	10-40
Mixed waste paper	35-40
Computer paper	100-120
Cardboard (kraft)	60-80
Plastics	50-350
Plastic film	10-350
Textiles (clean cotton)	300
Textiles (clean woollen)	100
Non- ferrous metals	180-3000
Scrap iron and steel	30-150
Car bodies	$15 per car stripped
Household batteries	No market
Compost	$5-7 per 40 litre bag
Compost (bulk)	$50 per cubic metre

4.4.7 Issues for Recycling from Pacific Islands to Overseas Destinations

1. Government needs to look at shipping costs
2. Container Leasing Companies need to be part of the negotiations – Is there a build up of containers in Tarawa that need to be transported back to another centre?
3. Shipping to a hub will be required eg. New Zealand, Australia or Asia
4. The frequency of shipping is a key factor
5. Mixed containers can be utilised eg. half plastic, half paper
6. 44 gallon drums can be used for compression of recycled materials such as paper, metal, cans, and crushed glass.

5. Alternative Integrated Solid Waste Management Activities

5.1 Introduction

Alternative integrated solid waste management systems have been developed emphasizing source segregation, collection, composting, reuse, recycling and resource recovery as well as collection, transfer and disposal to landfill. The alternative systems have been evaluated and ranked for feasibility and compatibility with the needs of the Kiribati. Ranking characteristics include:

- Capital costs
- Technical requirements
- Administrative requirements
- Operational requirements
- Ease of implementation
- Operation and maintenance costs
- By-products
- Political acceptability
- Social acceptability
- Environmental impacts

5.2 Implementation

The strength of an integrated waste management system lies in its working towards sustainability using an integrated approach and emphasizing prevention rather than cure. The waste management hierarchy is an important tool for prioritising actions. The definitions of levels of the hierarchy are given below:

- Prevention: covers methods whereby wastes or emissions are prevented from being generated at their source.
- Reduction covers methods whereby the quantity or hazardous nature of wastes and emissions are reduced at source.
- Re-use covers methods whereby waste and emissions are re-introduced to the same production process or re-used for the same purpose. These wastes do not require processing prior to re-use.
- Recycling covers methods whereby wastes and emissions are re-introduced to the same process or made available for use in another process. Recycling can occur on-site or off-site and the

wastes and emissions usually require some form of processing prior to re-use.

- Treatment covers methods whereby wastes and emissions are altered in some way to reduce their quantity, concentration or hazardous properties.
- Disposal covers methods whereby wastes and emissions are eventually returned to the earth or the atmosphere.

Good waste management also depends on a partnership between all levels of government and the community. The success of recycling collection schemes can be highly variable. Often the collection and sorting of recyclables has been emphasized rather than the development of recycling schemes which produce marketable products. The future of recycling schemes is dependent on establishing viable markets for targeted materials.

Options for implementation of these integrated waste management strategies include the following:

- Through national environmental or waste management legislation
- Through health legislation
- Through local legislation and regulations
- Research, education and promotion of environmentally sound waste management practices
- Technical and general advice to authorities, operators and industry
- Voluntary measures such as codes of practice
- Economic instruments
- Bans of particular materials or products
- Systems for recovery

The options can be implemented at all levels of the community including the following groups:

- Central Government
- Local Government
- Waste collection and disposal operators
- Commercial waste producers
- Manufacturers
- Importers
- Domestic waste generators
- Special interest groups
- The public

5.3 Ranking of Alternatives

Table 5.1 gives a ranking from 1 to 3 for various waste management options against criteria including cost, social, environmental and technical criteria. A ranking of 1 is generally indicates a more preferable options where 3 indicates a less preferable option. The cost criteria are added to give a costs total and cost ranking and then all criteria are added to give a total and overall ranking.

Table 5.1 Ranking of Waste Management Options against Criteria

	Costs				Effectiveness				
Criteria	**Capital Costs**	**O&M costs**	**Cost Total**	**Cost Ranking**	**Technical Requirements**	**Operational Requirements**	**Ease of Implement-ation**	**By-products**	**Political Social acceptabi**
Waste Management Option									
Disposal to landfill	2	1	3	**2**	2	2	1	3	1
Incineration	3	3	6	**5**	3	3	3	3	3
Municipal Composting	2	2	4	**3**	2	2	2	1	1
Home Composting	1	1	2	**1**	1	1	3	1	2
Recycling within country	3	2	5	**4**	3	2	2	1	1
Recycling overseas	1	2	3	**2**	1	2	2	2	1
Reuse	1	1	2	**1**	1	1	2	1	3
Legislation to ban products	1	1	2	**1**	1	2	3	1	3
Legislation to tax packaging	1	1	2	**1**	1	2	3	1	3
Segregation at landfill	2	2	4	**3**	2	1	1	1	1
Segregation at source	1	2	3	**2**	1	2	2	1	2
Education programme	2	1	3	**2**	1	1	1	1	1
Media Campaign	2	1	3	**2**	2	1	1	1	1
Glass recycling to supplier	1	2	3	**2**	2	1	2	1	1
PET recycling by Cococola	1	2	3	**2**	3	1	2	1	1
Paper recycling	1	2	3	**2**	2	2	2	1	1
Metal recycling	1	2	3	**2**	2	2	1	1	1

Note:
1. Cost total is equal to the sum of rankings for capital costs and O&M costs.
2. The effectiveness total is equal to the sum of rankings for technical and operational requirements, ease of implementation, by-products, political and social impact and environmental impact.
3. Overall total is equal to the sum of ranking for all criteria.

Based on the criteria described under effectiveness the prioritised options would be as follows:

Effectiveness Priorities

1 Education Programme
2 Media campaign
3 Segregation at landfill / Metal recycling/ Glass recycling to supplier
4 Home composting / Segregation at source/ Reuse / Municipal composting
5 PET recycling by Cococola Amatil / Paper recycling / Segregation at Landfill / Recycling both within Tarawa and overseas
6 Legislation to ban or tax products
7 Disposal to landfill
8 Incineration

This ranking process gives the following overall priorities for waste management options in Kiribati:

Overall Priority

1 Education programme
2 Media campaign
3 Metal recycling / Home composting / Reuse / Glass recycling to supplier
4 Segregation at source
5 Paper recycling / Legislation to tax or ban products / Segregation of wastes at landfill / Municipal Composting / Recycling overseas PET recycling by Cococola Amatil
6 Disposal to landfill / Recycling within Tarawa
7 Incineration

6. Rate Structure for Finance Waste Management Activities

This section of the report assesses the capital and operational costs of the waste management programmes and the benefits of income generating waste minimisation activities. Recommendations are made on fee collection systems/disposal costs.

6.1 Cost Priorities for Waste Management Options

Based on the ranking procedure carried out in Table 5.1 above based on cost criteria only the following priorities were determined for Tarawa:

Cost Priority

1 Legislation to tax or ban products/ Reuse / Home composting
2 Education programme / Media campaign / Segregation at source / Recycling overseas / Paper recycling / Metal recycling / Disposal to landfill / Glass recycling to supplier / PET recycling by Cococola Amatil
3 Segregation at landfill / Municipal composting
4 Recycling within country
5 Incineration

6.2 Recommendations on Fee Collections

The current rate structures for waste collection and disposal are given in Table 6.1 below for the eight countries in the Pacific that have been studied are part of the SPREP Waste Characterisation and Management Plans Study.

Table 6.1 Comparative Costs of Waste Collection and Disposal

Country	Collection per week	Domestic Waste	Commercial Waste	Industrial	Tip Fees	Skip/Bin (per load)
Kiribati (Aus$)	1	(Aus$17 – 29)	(Aus$50 – 600)	-	Free	-
Solomon Islands - SBD	1 - 2	Free	2.50/ collection (Aus$0.79)	5.00/ collection (Aus$1.59)	Free	
Fiji - FJ$	2 - 3	Free	Free	-	3.30 ($2.5) – household 5.50 ($4.30)– trade/ comer. 16.50 ($12.85)- condemned 22.00 ($17)- hazardous	30 (Aus$23)
Vanuatu - Vatu	3	6,000 (Aus$72)	9,000 (Aus$108)	60,000 – 360,000 (restaurants – hotels) (Aus$722-4,337)	100 – car ($1.2) 200 – Hilux ($2.4) 300 –Lorry ($3.6) 1,500 – Disclutcher ($18)	2,500 – 3,500 (Aus$30 – 42)
Tonga - Panga	1 - 2	6 (Aus$5.77)	12 – 18 (Aus$11-17)	24 (Aus$23)	Free	-
Tuvalu (Aus$)		(Aus$30 10/load green waste)	(Aus$100 – 400)	-	Free	15
W. Samoa	2 - 7	Free	Free	Free	Free	-
Papua New Guinea (Aus$)	1-7	120 – 420 (Aus$60 – 208) (small) 395 – 1380 Aus4$196 – 685) (240l)	240 – 1380 (Aus$119 – 685)		2(2.5) - car/utility 7(3.5) -1.5Tonne 10(5) -K600 Truck 8(4) -industrial bin	
New Zealand (Aus$)	1	185 (Aus$145) 6.5(Aus$ 5.10) – recyclables			50 (Aus$39)	

Note:
Figures given in brackets are in Australian Dollars.
All other figures are in the local currency.

The table above shows that the charges for waste collection and disposal in Tarawa are low compared with other Pacific Island countries. In Western societies the rate structure for waste management is moving towards full cost recovery. Full cost recovery for waste collection and disposal in Tarawa is the ultimate aim. However the public "ability to pay" is a significant factor to be considered in Tarawa. It is recommended that the costs of waste collection and disposal are accounted for on an annual basis and that charges are set for the public based on a survey of "ability to pay", with increases towards full cost recovery over the long term. Also, improvements in efficiencies and cost savings in the collection service and landfill operation will generate financial resources for improved sanitary landfilling

It is also recommended that a gate fee for using the landfill be implemented as this is an area where there is not enough revenue to maintain the facilities adequately. Records of vehicles entering the landfill and the amount collected should be kept as part of the daily operations.

7. Integrated Solid Waste Management Plan

7.1 Introduction

The Integrated Solid Waste Management Plan will address the different phases or aspects of solid waste management i.e. waste generation, collection, waste minimisation and disposal.

7.2 Objectives of the Plan

The objectives for the Integrated Solid Waste Management Plan for South Tarawa are:

1. To create a framework for solid waste management in South Tarawa that integrates all levels of solid waste management including legislation, government involvement, municipal council management, waste management operations, businesses, community bodies and the public.

2. To ensure that solid waste is managed in the most appropriate manner for South Tarawa and the people that live there, both economically and environmentally.

3. To incorporate sustainable environmental management principles and waste minimisation initiatives into the plan so as to minimise the environmental effects of solid waste management.

The Plan will provide a basis for prioritising actions required by waste managers in South Tarawa in the short to medium term.

The Plan will be based on the information as presented in this report as well as economic factors, regional waste management activities and international best practice in solid waste management. The Plan will take into account the current situation for solid waste management in South Tarawa, the current waste generation rates and waste classification data. It will also look at factors such as future solid waste generation, population changes, wealth, social change, education, markets for recyclable materials and regional influences.

This draft report only discusses some of the priorities and options that have been identified during the fieldwork in Kiribati, that may be incorporated into the final solid waste management plan. Other

issues such as institutional strengthening will need to be addressed for the implementation of the Plan.

Consultation with members of the public, civil servants and the business community was carried out. The following objectives were agreed on;
1. Improved Land Management.

A good solid waste management plan will maximise the use of the land which is critical on an atoll where land is scarce. Proper disposal areas and removal of scrap metal around the island will reduce land wastage.

2. Reduction of waste through the use of the waste management hierarchy: avoidance, reduction, re-use, recycling and disposal.

Goals for prevention, recycling, reduction, and reuse need to be set in order to reduce the amount of waste that needs to be disposed of. There is significant scope for this to happen in Kiribati.

3. Encourage Community Involvement

Community involvement is essential for successful changes to current waste management practices in the Pacific Islands where a communal society exists. Education, awareness and community involvement will be given a high priority in the management plan.

4. Improved Environmental and Health Conditions

An important objective of the Solid Waste Management Plan for South Tarawa will be the reduction in the adverse effects on the groundwater lens as well as the marine and terrestrial flora and fauna, and public health risks.

5. Revival of the Tourist Industry

The current waste management problems in Kiribati create a negative impact on the tourist industry. This situation can be improved through better solid waste management.

7.3 Waste Minimisation

7.3.1 Paper

From the waste characterisation conducted in South Tarawa, 7 % of the waste stream comprised of paper with the majority being cardboard or packaging. All of this waste stream could be recycled or reused if there was an appropriate outlet.

- Waste paper could be distributed to the locals on South Tarawa and the outer islands to be used as floor covering, walls, and mats and as mulch for the gardens.

- Other forms of paper could be sent to primary, secondary schools, rehabilitation centres and hospitals to be used for drawing and writing.

- In government departments and business houses, a dedicated paper bin could be placed in the offices as a paper receptacle for reuse or recycling purposes.

7.3.2 Glass

According to the survey, approximately 14% of waste glass recorded has been reused a number of times.

- Glass jars and bottles are valuable storage containers for people living on the outer islands eg. used to store water, toddy, cooking oil, body ointment, graveyard boundaries, home garden boundaries etc.

- Glass has sand properties and could be crushed and mixed with cement in its powder form.

7.3.3 Metals

Tins and aluminium cans accounted for 9.4% of the waste stream. There are currently two recycling initiatives on South Tarawa. The presence of numerous cans around the island and the landfills indicates that the current collection method being used is not very effective. Recycling bins for cans provided by the recyclers are concentrated on bars, nightclubs and motels.

- Tin could be crushed and buried into the soil to elevate nutrients such as iron.

- A bigger aluminium can crusher to replace the current one in use, maybe for use by both recycling companies. The existing

crusher is small and cannot cope when a lot of cans are delivered.

- Manufacture new cages or bins for holding empty aluminium cans.

- Recycling company to work closely with the Ministry of Environment, Councils and NGO's so that new cages or bins are distributed around the country to the various community organisations. The community should manage the bins with proceeds from the cans being used for community projects.

- The government should introduce Extended Producer Responsibility(EPR). This is the introduction of a fee on purchase of a can of beer or soft drink. Refund of the empty will be made at number of collection points or shops e.g 4c/can. The government should help subsidise this venture in the initial stages until it becomes self-supporting.

7.3.4 Biodegradable

More than 51% of the domestic waste stream on Kiribati is green waste and includes garden waste, tree-lopping, branches, leave litter etc. The majority of the kitchen waste (food waste) is fed to pigs. One of the main issues for the Betio Town Council and Teinainano Urban Council is the diversion of biodegradable waste from the landfill.

- Green waste could be composted, mixed with bio-solids or utilised as a soil conditioner or manure to increase agricultural productivity on the atoll.

- Educating people in segregating at source for home composting (this is currently taking place on a small scale) or the separation at the landfill is a key issue. Educating households to segregate green waste and place separately from other waste on collection days.

- Improve collection of green waste on designated days by the BTC and TUC – management plans for the collection systems.

- A sorting site could be set aside at the landfill or another designated sites for sorting of organics and other waste.

- Feasibility study for the purchase of a shredder and associated equipment and spare parts. Equipment to be leased as a community composting facility with assistance from the Councils and the Ministry of Environment.

- The Ministry of Environment, Councils and NGOs' to be part of the education campaign to villages, settlements, schools, etc. on the benefits of diverting biodegradable waste away from the landfill.

7.3.5 Construction & Demolition

Currently there is very little construction and demolition waste reaching the landfills. Any building material such as timber should be collected and distributed for utilisation as fuel or for repairing houses in villages or outer island communities.

7.4 Refuse Collection

Currently the refuse collection on South Tarawa by BTC and TUC is inefficient. The turnaround time for the collection vehicles is too long. Also the majority of the population do not possess rubbish bins. The 44 gallon drums that are being used are too heavy for Council workers to lift into the trucks.

Waste collection vehicles are constantly breaking down. During the study, one tractor from each of the Councils was under repair. Also the carrying capacity of the trailers is too small.

- Raise sides of trailers with extending wire mesh to increase carrying capacity

- Designate at least two days per week for green waste collection

- Purchase one three tonne vehicle with extended sides made of wire meshing and parts for each council.

- Government to look for funding for or donation of 100 litre plastic wheelie bins with lids for distribution within collection area.

7.5 Disposal of Refuse to the Landfill

Both Councils dump their refuse along the coasts or causeway or an area that is to be reclaimed. No management of the sites is observed apart from occasional burying of wastes.

- Prepare additional landfill sites. The Environment Unit will identify potential sites, conduct full environmental impact investigations and select appropriate sites.

- Fences to be erected with signs, especially on causeways to prevent scavengers from burning the rubbish

- Water at the BTC Red Beach dump to be analysed.

- Council tractors to be fitted with a blade, bucket or backhoe for landfill operations.

- Dredged mud or sand to be sourced from the main Betio causeway and used as cover material at the landfill.

- Prepare a National Landfill Management Plan for the operation of the landfill sites. The plan should include health and safety issues, segregation of recyclable, re-useable items, compaction, landfill cover, leachate control, wall lining, site rehabilitation, pesticide control etc.

- Conduct an Environmental Impact Assessment (EIA) for the siting of the proposed landfills on the identified foreshores and causeways.

The EIA should address issues such as:

- Feasibility of constructing engineered landfills on identified sites with minimal impact to the environment
- Area of land available and the amount required (sourced from results of waste characterisation)
- Rehabilitation of the landfill sites at the end of its life.
- Rehabilitate current and old landfills to minimise on-going adverse environmental effects.

7.6 Special Wastes

Hazardous or special wastes on Kiribati include medical wastes, waste oil, paint solvents, batteries etc.

It is recommended that the following measures be taken:

- Conduct a quantitative audit of producers or consumers of hazardous and special waste substances. Identify and list storage, transportation and disposal methods for the different items.

- Prepare a National Hazardous Waste Management Plan to minimise adverse effects of hazardous wastes in handling and disposal.

- Industries and companies dealing with oil to construct bunds around oil storage facilities. All waste oil to be collected and sent to Mobil Oil depot at Betio for transportation to Fiji for recycling. Approach oil companies for support and funds for education and collection systems.

- Car batteries to be collected and sent to Fiji for recycling. Small appliance batteries could be sent to Australia for safe disposal.

- Purchase and commission a new hospital incinerator. Training to be undertaken for medical staff in waste segregation and disposal methods.

7.7 Community Involvement

It is also important that community participation and consultation is encouraged so that the people feel a sense of ownership of the development of the waste management plan.

To effectively promote better waste management in the Kiribati community, the following recommendations need to be implemented:

- Increase awareness to the community for the need to better manage solid waste on the island. In conjunction with the Ministry of Environment, Councils and NGOs', develop public information and education programmes which focus on specific waste management and waste minimisation issues.

- Promote anti-litter campaigns in rural and urban areas

- Community education on waste management initiatives through regular column in the local newspaper

- Prepare information booklets on waste management for different NGO's, community groups, Councils etc.

- Assist FSP in implementing the Kiribati Environmental Education Program(KEEP)

- Find sponsors for annual "keep the village clean contests", school & business competitions, etc. through the Ministry of Environment

7.8 Organisation of Solid Waste Management

In order for solid waste management to work effectively the following institutional changes should be considered:

- Review the new Environmental Legislation and the adequacy of the sections on solid waste management. Review the responsibilities of the Ministry of Environment and the Councils for solid waste management and the setting of standards, appropriate legislation and enforcement of littering and illegal dumping

- Councils to instigate the projects for the segregation of waste streams for recycling, reuse composting etc. ensuring involvement of community and businesses.

- Appoint a Solid Waste Management Officer to organise solid waste management and waste minimisation in South Tarawa and to liase between the Government Departments, waste management contractors, local business and the public as well as international organisations that can assist in solid waste management in Kiribati.

- Collection, transport and disposal of municipal waste by the Councils to be improved through;

  1. Investigating the possibility of funding from the EU or other aid agencies for vehicles, spare parts, and in terms of community education, awareness and implementation the management plan.

2. Obtaining funding for a Waste Specialist to train local counterparts and assist with the initial implementation of the solid waste management plan.
3. Siting of landfill sites should be reviewed by Solid Waste Management Officer, Councils and Department of Environment.

- The Councils, the Ministry of Environment and the Health Department need to repeat waste characterisation surveys every 2-3 years to allow the monitoring of any changes or trends in waste management.

7.9 Implementing the Plan

The following actions are recommended:

- A National Solid Waste Management Committee is established (similar to the one in Fiji) including the following: Mineral Resources Department, Lands & Survey Department, TUC, BTC, Ministry of Health, Planning Division, NGO's, business and community representatives etc. The committee could be chaired by the Ministry of Environment. Its functions should include:

  1. Facilitate waste reduction and minimisation initiatives
  2. Research and co-ordinate EIA and feasibility studies for new landfill sites and the rehabilitation of old sites
  3. Coordinate any further solid waste management studies that are carried out in Kiribati
  4. Source funds for solid waste management initiatives from relevant funding agencies
  5. Lobby for reviews on legislation and regulations on waste management

- The above committee to organise a national workshop on Kiribati's environment management plan including solid waste management with the aim of prioritising actions, confirming responsibilities and timeframes for implementation.

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Appendix A - Terms of Reference

Appendix B - Study Methodology

Appendix C - Curriculum Vitae

Appendix D - List of Contacts

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