



# Draft National Solid Waste Management Strategy

## The Vision:

**“A clean and healthy Kiribati where the negative impacts of waste materials are minimized and the economic opportunities are maximized”**

Nei Akoako



Ngkoa, Ngkai ao n Taaainako

**Prepared by:**  
**Environment and Conservation Division (ECD)**  
**Ministry of Environment, Lands and Agriculture Development (MELAD)**  
**October 2007**

## Table of Contents

1	Introduction.....	3
2	Aim .....	3
3	Format .....	3
4	Scope.....	3
5	Principles.....	3
6	Timeframe.....	4
7	Responsibilities .....	4
7.1	Establishment of National Waste Management Committee .....	4
8	Consultation .....	5
9	Waste generation.....	5
9.1	Imports .....	5
10	Priority Issues.....	6
10.1	Plastic Bag .....	6
10.2	Disposal Nappies .....	6
10.3	Expired Vehicles:.....	7
10.4	Disposable Nappies Action Plan.....	7
11	Household waste .....	8
11.1	Organics .....	8
12	Priorities Issues .....	8
12.1	Household composting.....	8
12.2	Discouraging disposal.....	8
12.3	Institutional Composting.....	9
12.4	Household Composting Action Plan.....	9
13	Collection.....	10
14	Green Bag System.....	10
15	Priority Issues.....	10
15.1	Time and Motion Study .....	10
15.2	Expand and maintain the Green bag system.....	10
15.3	“User Pays” garden waste collection system.....	11
15.4	Sustaining the Green Bag System and expanding the use of biodegradable packaging .....	11
16	Recycling .....	11
16.1	Economic .....	11
16.2	Social.....	11
16.3	Environmental.....	12
16.4	Use of Economic Instruments (eg. Waste Material Recovery Act 2004) to include other waste items.....	12
17	Priority Issues.....	12
17.1	Car bodies .....	12
17.2	Tyres .....	12
17.3	White Goods and Large Appliances .....	13
17.4	Electronic waste .....	13
17.5	Recycling of Electronic/Electrical Wastes (e-wastes) .....	13
18	Disposal.....	13
19	Priority Issues.....	14
19.1	Landfills .....	14
19.2	Incineration .....	14
19.3	Management of Landfills .....	14

20	Medical Wastes .....	15
21	Priority Issues.....	15
21.1	Training.....	15
21.2	Health Care Waste Management .....	15
22	Disaster Waste .....	16
23	Priority Issues.....	16
23.1	Dumping sites .....	16
23.2	Management of disaster wastes .....	16
24	Raising Public Awareness in conservation and protection of the environment .....	16
24.1	Incorporation of formal environmental education program into national school education curriculum .....	17
25	Monitoring .....	17
26	Conclusion .....	17
27	Annexes.....	19
27.1	Annex A: Terms of Reference of National Waste Management Committee .	20
27.2	Annex B: Members of the National Waste Management Committee. ....	21
27.3	Annex C: Solid Waste Management in Kiribati .....	22

## 1 Introduction

Waste management is both a threat and an opportunity. Poor waste management can degrade our environment and erode our economy. Just as importantly, it can reduce the communities' desire to be involved in creating a better Kiribati for our next generation. As we have seen from our recycling program, good waste management can also generate employment and economic activity while cleaning up the islands. Waste is truly a sustainable development issue involving environment, economy and social issues.

While Kiribati has made enormous gains in solid waste management over the last decade, it has become necessary to communicate our strategic direction more precisely to aid in departmental planning, budgeting, donor liaison and private sector investment. By detailing our planned activities, all parties will have a far better knowledge of where Kiribati is heading and how best to assist in getting us there.

## 2 Aim

- To help ensure a safe and healthy living environment for all people of Kiribati
- To assign tasks for this work to specific institutions and to provide those institutions with the necessary administrative support.
- To plan for future solid waste management activities in a manner that raises public awareness of the issues and allows for public input into the process

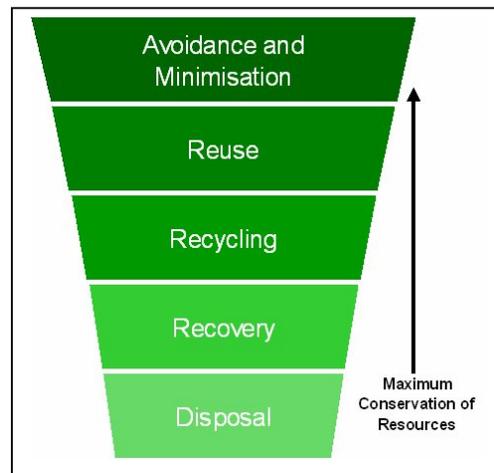
## 3 Format

The issues of Solid Waste can be divided in many ways to make them more manageable. This strategy follows through from generation or import, consumption, collection and disposal. Many issues impact on a number of different levels as do the solutions and management options.

## 4 Scope

This strategy will cover all solid waste issues including medical wastes, industrial wastes, electronic wastes, and disaster residues as well as domestic wastes.

Because of the increasing urbanization of Tarawa, much of the waste problems will be felt more there but solutions must also reduce the issues for the outer islands, Line and Phoenix Islands. The Strategy will not only lay out the general direction but also contain specific actions to advance the situation over the next 4 years. These will be reviewed on a "rolling" basis to ensure they stay current and relevant.



## 5 Principles

Kiribati has used the globally accepted *Waste Hierarchy* as its starting point and also its guiding philosophy of importance. As we know, avoidance and minimization is the most cost-effective place to attack waste, particularly on fragile atolls and islands like ours with no really safe disposal options as yet.

As well, Kiribati will use the widely accepted principle of the *Polluter Pays* – that those who create the problems should be the ones who contribute to its solution.

The Strategy is timely to put into action the recent Environment Act 1999 (amended in 2007) in terms of implementation. Specifically, the Act has now provisions on pollution minimization and prevention, amongst others, the need to control littering, dumping and a duty to clean-up any discharge of waste or other substances, as practiced under the “Polluter Pay Principle”.

Finally, Kiribati recognises the value of *sustainable development* and the need to involve all sectors of government, non-governmental organizations and society in the solutions to issues like waste. By choosing economically efficient, environmentally clean and socially acceptable solutions, Kiribati can continue to improve on its excellent progress in solid waste management.

## 6 Timeframe

The Strategy covers the period from 2008 until 2011 with biennial reviews to ensure all emerging issues are included and addressed.

## 7 Responsibilities

Currently, the lead agency for waste in Kiribati is MELAD but other agencies such as the Ministry of Health & Medical Services, Ministry of Finance and Economic Development and both BTC and TUC Councils will need to be involved in solving the problems that waste creates. Also, there is a strong role for the private sector, non-governmental organizations and the general community in participating in all aspects of this strategy.

It is therefore important that a national waste management committee need to be established immediately with MELAD as a leading agency. A term of reference (TOR) for the Committee is attached as Attachment A. Members to this committee should be selected from relevant key stakeholders as proposed in Annex B.

### 7.1 Establishment of National Waste Management Committee

Actions	By Whom?	By When ?	How Much?
1 Establishment of National Waste Management Committee (NWMC)	ECD	Jan 2008	\$5K/yr
2 Development of TOR and Structure	ECD & NWMC	Jan-Feb 2008	\$0
3 Recognition and approval of NWMC by Cabinet	ECD/ MELAD	Mar 2008	\$0
4 Implementation of National Solid Waste Management Strategy	NWMC	April 2008 onwards	Refer to action plans provided below
5 Monitoring and performance evaluation	ECD	May 2008 onwards	\$40K

## **8 Consultation**

Modern waste management requires the active co-operation of citizens, local government, other departments, private sectors, non-governmental organizations and businesses of Kiribati. The public can reduce the environmental impacts by their voluntary efforts in a way that regulation can never deliver. The private sector needs to know what waste issues it must address or opportunities it can grasp to grow employment and development. Other Departments need information to ensure that their efforts do not cut across the waste management imperatives. For that reason, open and on-going public consultation is an integral part of this Strategy. This will ensure that the waste system is cheaper and more cost-effective.

This draft has benefited from consultation including a JICA-funded SPREP facilitated workshop for many stakeholders. The workshop identified a number of environment issues of general concern. The highest priorities identified were;

1. increasing recycling;
2. public awareness and school education campaigns.

Also of major importance are;

3. the waste collection system
4. legislation and enforcement
5. organic waste and composting
6. electronic waste
7. hospital waste
8. waste oil
9. litter
10. landfill
11. bulky wastes

Many of these issues overlap and will be incorporated into the strategy.

The issues relating to the pollution and health impacts of human and pig wastes were of significant concern to participants but beyond the scope of this strategy. The reasons being of its cultural related nature and its sensitiveness to the public. This may take some time that well beyond the timeframe of this strategy.

The draft strategy was also discussed by a number of private sector organizations, NGO's and Government Departments for comments and suggestions.

## **9 Waste generation**

Most of Kiribati waste problem arrives from overseas as packaging for essential items. The materials produced here are largely biodegradable and can be managed at the household level with little effort and consequence. The major biodegradable wastes are food scraps and garden waste and these will be covered later.

### **9.1 Imports**

Almost all imports have a layer of packaging or the items themselves have end of life issues such as appliances, cars, and plastics. Only some of these are recyclable. The recyclable items can be recovered in South Tarawa through the successful deposit /

refund scheme that are driving the collection and export of car batteries, plastic bottles and aluminum cans. Kiribati intends to maintain this system, and gradually widen its scope to include other imports as the opportunities or problems arise. The obvious next phase might include cars, trucks, electronic waste and glass bottles.

This deposit / refund mechanism has less relevance outside of Tarawa and other actions may be necessary to improve the situation elsewhere. For example, disposable nappies or diapers save a lot of water but can spread disease and cause pollution if they are not collected and disposed of well. It may be necessary to levy an import tax on such items to fund government for the extra costs of collection and disposal.

Also, some new packaging is causing problems in Kiribati. Composite plastic and aluminium juice cans are not recyclable and only add to collection and disposal costs. Kiribati will consider banning such products outright or taxing them highly as they can easily be imported in more suitable and sustainable packaging.

Similarly, the impacts from plastic shopping bags can be significantly reduced by either banning them unless they are bio-degradable like the green bags (as Samoa has done) or taxing them to reduce the numbers as Ireland and others have done.

Some imports are necessary but highly damaging to our natural environment and to the health of the public if disposed of improperly. Materials such as pharmaceuticals (drugs), pesticides, anti-fouling paints and industrial materials all require very expensive disposal. In all cases, the best remedy is to ensure that only the required amount is imported so there are no residuals remaining for disposal. At the least, such materials should be a notifiable import so the government can keep track of the quantities coming into the country and identify the importer if problems arise and disposal needs to be funded.

## **10 Priority Issues**

The most important issue is disposable nappies and car bodies. Both need an integrated plan of action with significant consultation as they both impact on large numbers of the community and private sector.

### **10.1 Plastic Bag**

The Government needs to decide whether to ban non-biodegradable plastic shopping bags or to tax them to reduce their use. To make that decision, a Briefing Paper on the pluses and minuses of the two options will be required.

The other major plastic issue is the discarded packaging from children's frozen iceblocks. This is a litter issue and best addressed through a school-based education campaign or an introduction of a biodegradable iceblock and plastic bags.

### **10.2 Disposal Nappies**

For the diapers, issues such as collection services from squatter settlements and appropriate disposal both in South Tarawa and other islands, will need some definition and then the costs calculated. A public education campaign on the impacts of safe disposal and alternatives to reduce usage to essential will be very useful in reducing the overall costs of the project.

### 10.3 Expired Vehicles:

The Japanese International Co-operation Agency has indicated that they will assist with setting up a pilot project to be used as a good practice example for the rest of the Pacific. This system is only appropriate for South Tarawa but that constitutes the majority of the problem. Expired vehicles in other islands are best disposed in the deep sea (after draining all oils and removing batteries etc) or used for sea walls. Caution should be exercised as some evidence is linking rusting vehicles with ciguatera fish poisoning.

The preliminary data required is the number of vehicles being imported each year and expected life span of those vehicles.

Recycling the car bodies involves getting the cars back to a central yard before they can no longer be driven or towed as the costs of collection will increase significantly if the vehicles lose their mobility and need to be gathered by crane and flat bed truck. The very effective deposit/ refund scheme will be used to encourage end of use vehicles to be returned and also to fund any subsidy the system requires to remain commercially viable. Like the Kaoki Mange system, it is sensible for Government to keep close control to assess costs and potential profits before tendering the entire system out to the private sector. MELAD will determine how much deposit is required to encourage residents to return the expired vehicles to a de-construction yard where they can be cut down or crushed for cheaper shipping overseas.

The yard can store usable parts off the vehicles for re-use and sale to residents. The most viable method of consolidation (gas cutting or crushing) will be determined by the number of vehicles available each year. A training course will need to be held to skill operators in distinguishing between types of metals to maximize recycling value.

### 10.4 Disposable Nappies Action Plan

Actions	By Whom?	By When ?	How Much?
1. Determine how best to manage disposable nappies – brief Minister	MELAD/NWMC	November 2007	\$0
2. Determine costs and liaise with Minister whether tax is required to fund management – (impose higher tax on non-biodegradable nappies while less on biodegradable nappies – 70-100%), or totally ban nonbiodegradable nappies	MELAD/NWMC/ MCIC/NEPO/Chamber of Commerce/Women organizations (eg.AMAK etc)	Dec–June 2007	\$0
3. (a) Hold public education program to	MELAD/NWMC/Women Organisation/private	June 2008 onwards	\$6K (one off)

inform residents about impacts of disposable nappies and alternatives (degradable nappies)	<b>sector</b>		
(b) Consult with suppliers and retailers about options for tax if necessary or total ban of non-biodegradable nappies	<b>MELAD/NWMC/private sector/MFED-Tax</b>	<b>June 2008 onwards</b>	<b>\$2K (one off)</b>
4. Implementation and monitoring of either options mentioned in 3	<b>MELAD/NWMC</b>	<b>November 2008 onwards</b>	<b>\$5K/yr</b>

## 11 Household waste

### 11.1 Organics

The major waste stream that households generate and can manage themselves is organics (leaves, food, paper, cardboard). This represents over half the material going to landfill but its impact is more than consuming this valuable asset. Collection costs are the major component of any waste system so any reduction in householder waste saves significant money. Also, organics in the landfill are the major source of climate-changing methane gas and leachate, a high nitrogen and carbon solution that can contaminate the groundwater and lagoon with excessive biochemical oxygen demand or causing excessive algal growth from the nutrients. Just as importantly, those organics should be seen as a valuable resource that can increase the fertility of Kiribati's coral sands.

Thus, if we can reduce the organics leaving the house, we can reduce collection costs, prolong the life of the landfill and reduce the environmental impacts of disposal. By retaining the organics for composting and increasing vegetable and fruit yields, Kiribati will need less food imports, have healthier diets and require less fertilizer. This must be one of Kiribati's highest priorities for cost-effective waste management.

## 12 Priorities Issues

### 12.1 Household composting

The banana circles and garden compost programs can make a significant improvement to every life on Kiribati. Co-operation with the Health Department and the Taiwanese garden project can provide the synergy needed to convince residents to retain their organics.

### 12.2 Discouraging disposal

The "user pays" system of the bio-degradable Green Bags has the potential to save hundreds of thousands of dollars each year through reduced collection costs and landfill consumption. Just as importantly, it encourages householders to keep their organics at home to use as a resource. The risk is that they will burn them mixed with plastics and other wastes which can be offensive and unhealthy in a crowded

environment like Tarawa. A strong public education campaign is necessary to convince people of the high value of compost in growing food and to reduce any burning.

### 12.3 Institutional Composting

Some householders do not have the time or space or desire to compost their organics. Also, there is organic material generated by businesses and government that will need to be shredded and composted. A “user pays” system with a different coloured biodegradable bag could be used to fund the collection of this material. Even better would be a self-delivered system where clean organics are accepted for shredding cheaper than the price charged for disposal. This saves money on running a collection system and provides an incentive for those delivering waste to the landfill to separate their organics from the materials that need disposal. The same system can be used for recyclables as well.

Shredding and windrow composting is a relatively high operating cost process so some sort of on-going funding will be necessary, even if the capital equipment is provided by donors. Also, a site with secure storage for the shredder and end loader is necessary. It needs to be remembered that every regular turning to aerate the piles is necessary or else you create the same anaerobic conditions and leachate and gas impacts that you are trying to avoid in the landfill.

### 12.4 Household Composting Action Plan

Actions		By Whom?	By When ?	How Much?
1	National consultation with local farmers on South Tarawa	<b>Councils (BTC and TUC) &amp; MELAD, Taiwanese Organic Project, NWMC</b>	<b>April 2008</b>	<b>\$2K</b>
2	Development of a number of Pilot Project Proposals on organic compost - collection and sorting	<b>NWMC, BTC/TUC and Local Farmers</b>	<b>May 2008</b>	<b>\$5K</b>
3	Brief Minister on development of various pilot project on organics	<b>MELAD and NWMC</b>	<b>May 2008</b>	<b>\$0</b>
4	Public education and environment awareness program on making compost and making home gardens	<b>MELAD</b>	<b>June 2008 – Dec 2011</b>	<b>\$4K</b>
5	Implementation of Pilot Project activities	<b>Councils &amp; MELAD &amp; local farmers</b>	<b>July 2008 – Dec 2011</b>	<b>\$80K</b>
6	Monitoring and performance evaluation	<b>Councils &amp; MELAD &amp; local farmers</b>	<b>July 2008 onwards</b>	<b>\$10K</b>

### **13 Collection**

Waste collection is expensive but necessary. The “rule of thumb” is that collection is around 75% (3/4) of the total waste costs but the costs are carried by Local Governments. It is important that the costs are kept as low as possible as waste collection is a major drain on the economic resources of the country. That said, a regular and predictable system is essential to ensure the public and commerce are fully supportive of the waste system. This will, in turn, guarantee political support for waste management in general.

A good service once a week is better for residents and cheaper than a poor one twice a week. The traffic issues on South Tarawa add to the costs of the collection service and so Local Governments need to ensure that the service is as efficient as possible. Local businesses will usually pay for specific services and this should be part of the pricing structure.

### **14 Green Bag System**

The Green Bag programme has been a major innovation in reducing the costs of collection and is now seen as Pacific’s “best practice”. Waste is quick to pick up and volumes are greatly reduced which minimizes the time spent in going to the landfills. Given that the Green bags save government so much money, there is a strong argument for subsidizing the costs of the bags so that the disincentive for garden waste is maintained but there is minimal incentive to illegal dumping. Also, a program like the Green bags needs to be maintained to keep it functioning smoothly. Given its success, it should not be forgotten in the rush to take on other issues.

Collection of garden waste should be considered carefully. It is a high cost service and, while a useful way to provide material for composting, will also reduce the funds for other issues of high priority such as hazardous waste management or waste management on the outer islands.

### **15 Priority Issues**

#### **15.1 Time and Motion Study**

All the waste collection practices should be examined to ensure that the frequency, routes, work practices and equipment are the most cost-effective and appropriate for the customers. Because collection is such a high proportion of the overall waste costs, any efficiency can deliver significant savings.

#### **15.2 Expand and maintain the Green bag system**

A study is now needed to see if the price of green bags is set at the correct level. The study should review

- Illegally dumped rubbish to see if the cost of Green bags is encouraging illegal dumping.
- The savings to collection costs through efficiencies.
- The types of waste material being placed in the bags to make sure they are still discouraging garden waste disposal.

Once these results are found, Government can decide whether the costs of the bags should be subsidized or not.

### 15.3 “User Pays” garden waste collection system

A survey of customers could be used to determine how much they would pay, how often they would want a service and how much material they would put out. This will allow for a design and costing of the service to see if it’s viable through “user pays”. At the same time, people could be asked about the amount they would pay for compost to see if there is a market for the material. It should be remembered that mulching and composting costs around \$20 per tonne as well as the collection.

### 15.4 Sustaining the Green Bag System and expanding the use of biodegradable packaging

<b>Actions</b>	<b>By Whom?</b>	<b>By When ?</b>	<b>How Much?</b>
1 Brief MELAD Minister on details of green bag landing cost, purpose of use and other benefits – on subsidy if possible	<b>MELAD/PPU</b>	<b>August 2008</b>	<b>\$0</b>
2 Seek if government subsidy could be granted on current price	<b>MELAD/PPU</b>	<b>Aug-Sept 2008</b>	<b>\$0</b>
3 Public awareness education program on green bag use and other biodegradable plastic bags (iceblock bags, bread bags, shopping bags – all plastics) – these have alternatives (biodegradable)	<b>MELAD</b>	<b>Oct 2008</b>	<b>\$5K/yr</b>
4 Importation of Green bags from supplier and other biodegradable plastic bags	<b>MELAD/ private sector</b>	<b>Nov 2008 onwards</b>	<b>\$50K/yr</b>
5 Identification and arrangement of outlet shops for green bags to be sold from	<b>MELAD</b>	<b>Dec 2008</b>	<b>\$0</b>

## 16 Recycling

Kiribati has led the Pacific with its approach to recycling. The deposit refund scheme has delivered significant benefits at a minimal cost to the Government. The system has a true sustainable outcome in that its outcomes fall into social, environmental and economic benefits.

### 16.1 Economic

- Minimized collection costs for recyclables;
- Viable recycling business employing over 10 people
- Tourism attractiveness enhanced

### 16.2 Social

- Provided an income source for un-waged people

- Involves public in waste management and minimization issues directly

### 16.3 Environmental

- Less impacts from targeted materials (car batteries, plastic bottles and cans)
- Less truck exhaust as recyclables are self-delivered.

The Kiribati system can be used simply to include other materials that the Government decides to collect for recycling. For example, the export of car bodies currently is not viable from the returns alone. Vehicles could be included in the system to encourage end of life vehicles to be returned for a refund to avoid the high costs of recovering immobile vehicles. Those vehicles could then foster a spare parts business as well as facilitating consolidation for export. The difference between the deposit and refund can fund the costs of administration and the necessary subsidy as has occurred with the other materials.

Other materials that could be considered for inclusion, could be tyres, white goods and household appliances and electronic wastes.

### 16.4 Use of Economic Instruments (eg. Waste Material Recovery Act 2004) to

Actions	By Whom?	By When ?	How Much?
Seek Cabinet endorsement for inclusion of the following waste items under the Waste Material Recovery Act 2004	<b>National Waste Management Committee/MELAD/AGs Office, MFEP/MCIC/BTC &amp; TUC Councils/MISA</b>	<b>March 2007</b>	<b>\$0</b>
Glass bottles	<b>Kaoki Maange</b>	<b>Nov 2007</b>	<b>\$0</b>
Steel cans	<b>Kaoki Maange</b>	<b>Jan 2008</b>	<b>\$0</b>
Car bodies	<b>Lagoon Motors</b>	<b>July 2008</b>	<b>\$0</b>

## 17 Priority Issues

### 17.1 Car bodies

See “Imports” section.

### 17.2 Tyres

The low mileage needed in Kiribati reduces the volumes of vehicle tyres needing disposal compared to the number of vehicles. Used tyres are largely inert and so could be used for land reclamation if shredded enough to not contain significant air pockets. They have also been used as artificial reefs overseas though the securing the tyres over a long period has proved difficult. There is a disposal option in the Fiji cement kiln as a fuel if that plant has the capacity and inclination to accept more tyres for fuel. Including them on the deposit refund scheme could fund these options but a preliminary survey is necessary to establish how many spent tyres are generated to see whether the problem is sufficient to warrant a focused response.

### 17.3 White Goods and Large Appliances

These items take up a disproportionate amount of landfill space and would complement the car body recycling. However, a preliminary survey of volumes needs to be carried out to establish how significant an opportunity and problem this is. Once those volumes have been established, the viability of including them in deposit refund arrangements will be clearer.

### 17.4 Electronic waste

E-waste as it is known is an emerging problem in the developed world. The presence of small amounts of toxic components can make these items dangerous if the volumes get to be significant. Fortunately, it is unlikely that Kiribati has reached this level of disposal as yet. The recycling of these goods remains problematic with either high costs or very poor workplace conditions for the recyclers. In the absence of a safe recycling system, Kiribati will have to be sure that recycling is a sensible option to spend money on.

Fortunately, the Basel Secretariat has funded a scoping exercise to establish how significant the issue is in the Pacific and the results of that survey will inform a decision about whether e-waste needs to be included in the deposit refund scheme.

### 17.5 Recycling of Electronic/Electrical Wastes (e-wastes)

<b>Actions</b>	<b>By Whom?</b>	<b>By When ?</b>	<b>How Much?</b>
1 National stocktaking and assessment of electronic wastes	NWMC/ MELAD	Feb-Mar 2008	\$1.5K
2 Brief Minister of danger posed by electronic wastes poor disposal	MELAD	May 2008	\$0
3 Consultation with Kaoki Maange and local computer dealers to identify computer parts that could be recycled and sent offshore through Kaoki Maange	MELAD	June 2008	\$1K
4 Public education and awareness programs	MELAD	May 2008	\$2K
5 Identification of temporary storage site for electronic wastes	MELAD/ NWMC	May 2008	\$3K

## 18 Disposal

The current landfills are an expensive luxury for an atoll nation. Kiribati just cannot afford to dedicate more land and money to such sites. Just as importantly, there is not yet any environmentally acceptable way to landfill on an atoll. The possibilities of storm surges washing the wastes into the lagoons and the absence of any soil to cover the wastes mean that all efforts must go to minimization of landfill consumption. Previous sections have discussed ways to reduce the quantities going to landfill but consideration needs to be given to minimizing the space consumed to ensure the landfill lasts as long as possible.

The regular compaction of the sites with a large bulldozer is the most practical way to reduce the space the waste is using. A landfill compacter would do a far superior job but they are extremely expensive to purchase and operate and have no other uses to amortise the costs on.

Recent developments in low temperature gasification may hold some hope for the medium future and the recent installation of a system in the Republic of the Marshall Islands will give some indication of the appropriateness of this technology to a semi-marine environment with little technical support. If suitable, there is the possibility of recovering the energy from unrecyclable discarded plastics and other combustibles and possibly generating power from it as well as reducing volumes significantly. While not an immediate solution, a “watching brief “will be held on this first installation over the next few years.

## 19 Priority Issues

### 19.1 Landfills

The airspace (remaining capacity) of the landfills needs to be monitored to ensure that this asset is efficiently utilised and that sufficient time is allowed for closure and location of a new site or technology. Any materials that are consuming inordinate amounts of the landfill also need to be flagged with policy makers to ensure a quick response to the threat. Regular compaction with a bulldozer must also be budgeted for and scheduled to prolong the lives of these precious assets.

### 19.2 Incineration

SPREP should be asked to monitor emerging gasification technologies and report back to Kiribati of any relevant developments to ensure that policy makers are aware of all alternatives to landfill. The possibility of power generation also makes this technology particularly appealing for Kiribati.

SPREP should also be asked to assist with establishing the possibility and costs of sending used tyres to Fiji for use as fuel in their cement kiln.

### 19.3 Management of Landfills

<b>Actions</b>	<b>By Whom?</b>	<b>By When ?</b>	<b>How Much?</b>
1 Development of Landfill Management Plan in accordance with conditions prescribed in the Environment License	<b>Councils and MELAD</b>	<b>Jan 2008</b>	<b>\$0</b>
2 Procurement and maintenance of bulldozer to compact waste in landfill to prolong landfill lifetime	<b>MELAD and Councils</b>	<b>June 2008</b>	<b>\$200K</b>
3 Public education and awareness programs	<b>MELAD</b>	<b>Feb 2008</b>	<b>\$2K</b>
4 Monitoring and evaluation of landfill operations	<b>MELAD/ Councils</b>	<b>Jan 2008 onwards</b>	<b>\$5K</b>

## 20 Medical Wastes

Medical wastes are the primary responsibility of the health care institutions. They are responsible for minimizing the volumes needing disposal through judicious purchasing and also strict segregation of infectious and non-infectious material. The use of on-site incineration remains the most appropriate technology for infectious wastes and the growing threat of HIV/AIDS should ensure that this aspect of disease prevention has high priority from health care staff. There are a number of very cheap and simple incinerators fuelled by wood wastes such as coconut husks that are now available. JICA has a simple stainless steel model and the De Montford designs have wide application to developing countries as they can be constructed and maintained from local materials. While they may be only single chamber, sensible operation to avoid the smoke plume impacting on residents will minimize any possible health impacts.

Appropriate training in the use of these incinerators is the most important aspect of safe handling and the recent un-necessary stockpiling of out-dated pharmaceutical supplies an illustration of the need for a better understanding within the medical professionals of the options available.

## 21 Priority Issues

### 21.1 Training

WHO and SPREP should be approached to assist with training of medical staff in both waste minimization and incinerator operation and management. This needs to be an on-going program at least every five years.

### 21.2 Health Care Waste Management

Actions	By Whom?	By When ?	How Much?
1 Establishment of Health Care Waste Management Committee (could be a subcommittee under NWMC)	MHMS/ MELAD/ WHO		\$0
2 Development of health care waste management plan for Kiribati	MHMS/ MELAD/ WHO	Dec-Jan 2008	\$1K
3 Submission of health care waste management plan to Cabinet for approval	MHMS/ WHO	Feb 2008	\$0
4 Identification and installation of the most appropriate incinerator	MHMS & Donors - WHO	Mar-June 2008	\$500K
5 Public education and awareness programs	MHMS /MELAD/ WHO	Jan 2008 onwards	\$4K
6 Staff trainings in health care waste management and incinerator operations	MELAD/ MHMS/ WHO	Mar 2008 onwards	\$20K

## 22 Disaster Waste

Disaster waste needs to be considered BEFORE any events impact on Kiribati. The lesson learnt from the Sumatran tsunami was that authorities, in the absence of pre-designated dumping grounds, used mangroves and foreshores as a repository. This reduced the buffering provided by those natural areas as well as reducing the fish breeding areas. Also, once dumped in that environment, it becomes very difficult to salvage any materials to assist re-construction.

## 23 Priority Issues

### 23.1 Dumping sites

Each island needs to have a pre-agreed dumping site for temporary storage of dumping waste to allow for salvage and sorting and a final depository for disposal. These need to be agreed to and included in any Disaster Management Plans as Disaster Managers will not necessarily access the Waste Strategy in time for appropriate decisions.

### 23.2 Management of disaster wastes

<b>Actions</b>	<b>By Whom?</b>	<b>By When ?</b>	<b>How Much?</b>
1 Identification of temporary site for waste storage – not at environmentally sensitive areas	<b>Disaster Management Unit/Councils/MELAD/NWMC</b>	<b>Jan 2008</b>	<b>\$1,000</b>
2 Transportation of waste and mobilization of cleaning machineries	<b>MPWU/Councils</b>	<b>Immediately after disaster occurs</b>	<b>\$100,000</b>
3 Public education and awareness program	<b>Disaster Management Unit/NWMC/MELAD</b>	<b>Jan 2008 (occasional)</b>	<b>\$1,000</b>
4 Reuse waste materials as much as possible	<b>Disaster Management Unit/NWMC/MELAD</b>	<b>Immediately after major disaster events</b>	<b>\$0</b>

## 24 Raising Public Awareness in conservation and protection of the environment

One of the Environment and Conservation Division's (ECD) main roles is to raise public awareness for the conservation and protection of the environment throughout Kiribati particularly on South Tarawa and Betio given their populated context. ECD since its inception has been undertaking various public awareness programmes through community workshops, radio programs and newspapers on proper solid waste disposal practices with potential human health implications associated with poor solid waste management.

Having a formal national environment education syllabus established and incorporated into the national school curriculum for primary schools in particular

would complement previous and on going public environment awareness programmes undertaken by ECD.

#### **24.1 Incorporation of formal environmental education program into national school education curriculum**

<b>Actions</b>	<b>By Whom?</b>	<b>By When ?</b>	<b>How Much?</b>
1. Conduct 3 days workshop to review of existing school curriculum on environmental education programmes	<b>National Waste Management Committee/ECD-MELAD/MEYS</b>	<b>August 2008</b>	<b>\$5K</b>
2. Develop appropriate national environmental educations programs and materials for use at schools	<b>National Waste Management Committee/ECD-MELAD/MEYS</b>	<b>July 2008</b>	<b>\$1.5K</b>
3. Seek cabinets approvals for incorporating environmental education programme into national school syllabus	<b>National Waste Management Committee/ECD-MELAD/MEYS</b>	<b>September 2008</b>	<b>\$0</b>
4. Monitoring of national environmental education syllabus	<b>MELAD/MEYS</b>	<b>April 2009</b>	<b>\$1K</b>

## **25 Monitoring**

It is necessary to monitor the progress especially on action plans prioritised and shown in tables in the present waste management strategy. The proposed national waste management committee will play a key role in monitoring progress on the action plans through regular meetings and progressive reports produced by ECD based on the action plans as mentioned earlier. Site visits and community surveys are also considered as monitoring tools that would identify gaps and areas that need improvements.

## **26 Conclusion**

As a small atoll island, Kiribati is facing waste management problems due to its limited resources, shortage of land and an increase in urbanisation. The 2005 Census estimated that more than 43% of the total populations of 92, 428 resided on South Tarawa and Betio only. Indeed, this has encumbered the efforts and determination made by the Environment and Conservation Division and other key bodies to alleviate particularly the perennially problem of litter. Both Councils who are responsible for garbage collection are still struggling to maintain an efficient collection system due to frequent machinery failures and the influx of people from rural areas which have exacerbated littering and the rate of waste items generated annually. Our landfills are

small in size and would be full in 3-5 years time should current trends in waste generation rates have not been tweaked.

The present National Waste Management Strategy is formulated with its primary objective to protect and safeguard our fragile environment and conserve its resources from adverse impacts of improper waste disposal. Hence, Government's financial support and commitment are of utmost importance and required in achieving the objective of this strategy. Community participation and the general public are also considered vital and contributed largely to the effective implementation of the strategy.

The strategy itself will be a living national document that may be amended from time to time and should incorporate waste management issues that need urgent attention.

## 27 Annexes

## **27.1 Annex A: Terms of Reference of National Waste Management Committee**

The National Waste Management Committee (NWMC) will be formalized under the Environment Act to provide oversight on the implementation of the Strategy and other emerging waste related issues with the main goal of improving the aesthetic outlook, preventing and reducing pollution of Kiribati, in particular South Tarawa.

The Committee will be allocated a small budget and depending on the circumstances either a small sitting fee or refreshments for committee meetings could be provided. Membership of the committee should be stakeholders who have knowledge or acknowledgement of waste problems and consideration be given to individuals who voluntary contribution of keen and interested individuals to address the issue and. The committee needs to be established and driven by a person with the appropriate level of authority and the respect of their peers.

Responsibilities of the Committee will not be limited to the following:

1. Raise awareness of the Strategy through their various Ministries, organizations, businesses and with civil society in general;
2. Be resourceful in providing social advice, technological and financial means to advance the implementation of the Strategy;
3. Facilitate and promote implementation of the Strategy within Ministry and organizations which they represent;
4. Meet regularly to review progress of the strategy and identify gaps for improvements;
5. Propose to the Minister aspects of a clean-up policy so that South Tarawa will improve its aesthetic view;
6. Identification of individuals who are both stakeholders and keen to address the issue;
7. Establish appropriate sub-committees as working taskforces to assist in the development of a sustainable waste management system and to ensure that all committees work together and share all relevant information;
8. Prepare the terms of reference for those committees created in 7. above;
9. Assess the work undertaken by the committees and any working groups and to decide on the future direction of the work undertaken;
10. Consider any relevant further legislation or amendments to Acts, Regulations or bye-laws are required and advise appropriate authority;
11. To work closely with aid organisations over the tenure of the taskforce to assess if any further aid is required;
12. Assist the Secretariat to monitor and evaluate the progress of implementation, if an independent evaluator is not possible;
13. Undertake any tasks related to waste management, as delegated by the Minister of Environment.

## **27.2 Annex B: Members of the National Waste Management Committee.**

It is proposed that key members to the committee should represent the following Ministries and organizations;

1. OB
2. MELAD
3. MISA
4. MPWU
5. MHMS
6. MTTCD
7. MCIC
8. LMD
9. ALD
10. BTC Council
11. TUC Council
12. Chamber of Commerce
13. KANGO

## **27.3 Annex C: Solid Waste Management in Kiribati**

### **Introduction.**

Where there are too many people there too, waste is too much. Where there are few people there too, hope is too little. There are too many people on South Tarawa and too much wastes as expected, but what of hope? Hope needs to be maintained in the muddle of wastes and baffling over limited options to deal with wastes.

The waste problem as the SOER2000-2002 notes has an increased alarming rate in Kiribati. This is clearly acute in South Tarawa. Increased urbanization and growing population have accelerated problems associated with the collection and disposal of both solid and liquid wastes. Facilities for waste transportation are also deficient; there are no suitably designed trucks to use for collecting and disposing waste. The land area of South Tarawa is insufficient to allow adequate space and suitable sites for waste dumps and landfills. A possible solution is suggested in the SOER2000-2002 - land reclamation offshore.

In the meantime, responsibility for managing waste collection has been for a long time with the local government councils within their respective areas of authority. Te Inainano Urban Council (TUC) is responsible for part of South Tarawa from Tanaea to Bairiki; and Betio Town Council (BTC) is responsible for waste collection on Betio islet. The two Councils are expected to remove all heaps of rubbish from all different establishments such as households, institutions, industrial and commercial premises. For this service, the councils levy service charges on those establishments, at a specific amount for each type of establishment. BTC charge from 2007 is \$650 per business establishment, an increase \$50 over the rates in 2006

Tractors and trailers are used by the Councils for collecting and transporting wastes to landfills or open dumps. BTC tractors make twice or more collection runs along all designated routes on Betio, and TUC tractors make similar runs but covering Bairiki, Nanikaai, and Bikenibeu. Still, much of the wastes are uncollected, scattered or heaped where not one person may be held responsible for removing them.

Settlements areas and other premises such as shops along the rest of TUC area manage their own wastes. They dispose them at sea and the beach, make compost of them for gardening, bury them or burn them.

### **Present State**

#### **Waste Generation**

The SOER2000-2002 notes the volumes and types of wastes generated by various establishments in South Tarawa, during the years 1994, 1996, 1997, and 2000. On these basis, estimated quantity of domestic waste is 3,500 tons per annum, with a rate of 0.33 kg/capita/day. The quantity and the rate are lower than estimation in 1997 which were 5500 tons per annum, and 0.55 kg/p/day in 1994 by Gangaya.

The most recent study on wastes was in 2004 by Roniti Teiwaki & Associates as part of the Kiribati International Waters Project activities in promoting the use of greenbags. The study came up with an estimated quantity of 2,300 tons per annum for the TUC area only, and a rate of 0.2kg/p/day.

Two alternative explanations of the discrepancy are possible. First, there has been improvement in the control of waste generation, or there has been no proper

management of the wastes. In the latter case regular monitoring of wastes collection and disposal will be required. However, the former is most likely to be the situation.

The types of wastes and their percentage composition in the bulk of all wastes during the different years are shown in a reproduced but extended table below from the SOER2000-2002. From Table 1 below, each of the waste characteristics survey undertaken found organic materials (mostly leaves) as the major component of the waste stream. This was evident at the landfill in Betio, Anderson Landfill and all waste dumpsites along the main road. Not only that but its weight percentage was also declining in each of the waste survey conducted providing three possible assumptions: the use of organic materials as compost in home gardening over the past 10 years had increased and secondly trees had been cut down due to increased urbanization on South Tarawa and Betio. One could argue the validity of these assumptions however the combination of both is much preferred.

**Table 1. Wastes composition over the years**

<b>Types of wastes</b>	<b>1994</b>	<b>1996</b>	<b>1997</b>	<b>2000</b>	<b>2004</b>
All organics	80	62	76	51.3	48
Papers	2	14	5	7	
Plastics	2	12	5	7.2	8
Glass/Ceramics	3	-	3	13.6	15
All metals	7	7	10	9.4	19
Textile/Rubber	Less than 1	3	Less than 1	3	
Miscellaneous	6	2	-	8.5	10
Total (wt %)	100	100	100	100	100

Readers are cautioned that the data in the table are from several reports and there is no assurance of consistency of the methodologies that were used in all the reports to come up with their data.

### **Solid Waste**

The SOER2000-2002 rates a concern about solid waste disposal as serious and increasingly so, particularly on South Tarawa. However, according to a survey (A-N-D Consultants, 2000) only 11% of interviewed members of the communities characterized waste disposal problem as serious, while 57% rated it as a “slight problem”. Here is a challenge for the ECD to make the communities recognize the real extent of the problem.

Disposal of wastes is most likely to continue a serious problem. The TUC and BTC have limited and inadequate resources to deal with the amounts of wastes generated on South Tarawa. Members of communities have no alternatives to how they should regard wastes and their disposals, so the attitudes remain as were from the start when the serious nature of the problem was first advocated. They continue to clean their own residential compounds, but regard as not of their concern wastes scattered or spread along public roads or other places. On the other hand, imported goods with biodegradable or non biodegradable packaging for food or non food contents are increasing and so too with consumption by members of the communities. The urban

population is increasing and the urban area is overcrowded, and all in all littering is well encouraged.

As however noted in the SOER2000-2002, littering is illegal by virtue of the Environment Act 1999 and regulations. Enforcement is difficult. Enforcement will amount to prosecuting 26500 legally responsible individuals living on South Tarawa, every now and then for littering. People will not cooperate with enforcement measures. Most people do not like legal enforcement, and in the same study noted above, only 8.3% of respondents to the questionnaires identified legal enforcement as a way to tackle the waste problem. The most recommended way is improved services, and awareness raising is the second most preferred.

The SOER2000-2002 identified reasons why unmanaged wastes are undesirable. They are: the capital of Kiribati is filled with litter; the environment is dominated with litter; aesthetic tourism value of South Tarawa is greatly devalued by litter; biodiversity and ecosystems are burdened with litter; the environment is odorous from litter; mosquitoes breed best among litters; and, above all the health of the people is harmed by all that.

### **Hazardous Materials**

The SOER2000-2002 defines hazardous materials as substances that can cause adverse impacts on the environment and human health. They can be in the form of a gas, solid, liquid, sludge, or organism. As for their categorization, it is according to their major properties of biological relevance; radiation; explosive relevance; toxicity; chemical relevance; and corrosiveness.

The presence and extent of hazardous materials is being exposed in an in-country survey of persistent organic pollutants carried out by a specialist from SPREP (Burns et al.2000).



**Fig..1 Bitumen near Bonriki airport (photo from SOER 200-2002)**



**Fig. 2 Bitumen near Bonriki airport ( PCU Photo, 23/11/07)**

Using the NZ Rapid Hazard Assessment Scheme, risk ratings of the presence and the site of hazardous materials are determined on the following considerations:

- extent of contamination;
- toxicity and mobility of contaminants;
- contamination potential (food/water); and
- ease of public access.

Each site of the hazardous materials is given a rating between 0 and 100 on each of the above factors, and then the scores are added. The sum is taken as a value of “hazardousness” of the site.

The SOER2000-2002 furthermore presented a table, reproduced below, to show the results of the survey.

**Table 2. Risk ranking of Hazardous Wastes**

<b>Location</b>	<b>Site Activity</b>	<b>Risk Rating</b>	<b>Priority</b>	<b>Treatment Option</b>
<b><i>Pesticide Contaminated Sites</i></b>				
Canton Is	Quarantine former store	30	18	Collect spillage and decontaminate, then off-island disposal.
<b><i>Hydrocarbon Contaminated Sites</i></b>				
Bonriki airport	Asphalt dump	100	1	Local use or solidify and bury.
Bonriki airport	Asphalt dump on beach	100	1	Local use or solidify and bury
Betio	Power station	64	5	Land farming and oil management

				programme.
Betio PVU	Vehicles workshop	58	11	Landfarming and oil management programme.
Bikenibeu	Power station	51	16	Landfarming and oil management.
Kiritimati	Bulk fuel depot	50	20	Landfarming and oil management.
Kiritimati	Linnix (Banana PWD) asphalt.	30	37	Local use or solidify and bury.
<b><i>Miscellaneous Contaminated Sites</i></b>				
Bikenibeu	Landfill	30	22	No remediation but need to upgrade site management.
Betio	Landfill	30	23	No remediation but need to upgrade site management.
Kiritimati	General waste disposal	30	24	No remediation but need to upgrade site management.

Treatment options identified in the table above are not necessarily the best. For example, option of burying asphalt will contaminate limited groundwater lens or the sea. It is more preferable if asphalt could be scooped out, put into containers and disposed offshore or sent to a country that has a better technological option to get rid of it.

Very limited infrastructure and human resources exist for the control and management of hazardous chemicals. For some of the sites, responsibility ought to rest with the few concerned governments including Kiribati government, and other concerned parties. However, the responsibility is burdensome that these wastes are left unattended.

Hazardous materials and chemical wastes from industries are minimal since there are no big industries in Kiribati. However, such materials and wastes are being emitted from power plants, automobile workshops, school laboratories, printing shops, and photographic and electronic dealers.

Electronic products such as computers, monitors and audio-video players become wastes when they are no longer functional. Such wastes become hazardous when improperly disposed.

#### **Management of Special Waste**

The SOER2000-2002 identifies 4 special wastes: medical/clinical waste; sludge/septage; waste oil; and quarantine waste.

Medical and clinical wastes, as observed from Tungaru Central Hospital, Betio District Hospital, and Health Centers and Clinics in South Tarawa, includes various hazardous materials such as sharps, syringes, saline bottles; and, other infectious or non infectious wastes.

Waste collection practice indicates that covered collection is not practiced. Wastes are collected by orderlies and cleaners and are put inside either a rubbish bin or plastic bags. The wastes are delivered to the incineration site depending on the availability of transport. There is no fixed schedule time for burning and no special truck for this purpose.

The current incinerator (200HOS) is however operated everyday due to the high demand of waste disposal. When burning the incinerator does give lots of black smoke, emitting a number of toxic air pollutants including hydrochloric acid, dioxin, furan, lead, cadmium, and mercury. These pollutants pose a major health hazard to the people who are most likely to be exposed to them, and contaminate the environment.

Wastes that do not get to the incinerator are disposed at dumpsites. In dumping or burning hospital wastes, workers need protection, and the public need assurance that they are unlikely to be exposed to any risks from the processes.

The exact amount of hospital waste generated in the country is difficult to know. There is no record keeping system for the waste generated from hospital and clinics activity. Most of health care wastes from health centers and clinics are mixed with the municipal solid waste because of the lack of proper disposal facility specific for medical and clinic wastes.

Health Care Institutions are meant to ensure community and public health. But, with the increasing load of biomedical waste along with increasing hospital beds occupancy rates, especially for the former owing to the increased use of disposable dressing materials, lack of onsite separation practices, lack of proper treatment of these wastes, these Institutions need to address the waste problems they are generating with equal diligence as they show when attending to the patients. To address these current issues, a committee on Health Care Waste Management comprised of key staff from both ECD and MHMS was established in 1996 with an aim to formulate a national health care waste management plan. This plan is still underdevelopment.

Sludge and other matters from all toilets connected to South Tarawa Sewerage System are dumped at outfalls beyond the edge of the reef at some depth below the sea surface. Tungaru Central Hospital has a separate system. Sludge is treated before pumped through a main pipe embedded in the reef flat with an end outfall beyond the reef edge and at some depth below the sea surface.

The SOER2000-2002 notes that waste oil generated from the powerhouse, garages and bowsers was not properly collected and stored. Oil spills into the surrounding soil are noticeable at these locations. More recently PUB powerhouse and KOIL fuel farm are taking measures to store waste oil in empty drums. KOIL accepts used oil from other fuel retail outlets and arrange shipment in drums to TransPacific Industries Group Limited in Australia. Insufficient empty drums and the costs of handling and shipping used-oil-filled drums are major hurdles to this arrangement.

Quarantine wastes are agricultural products that are brought to Kiribati by ships or aeroplanes without having obtained prior clearance from relevant authorities in a country of origin and Kiribati Agricultural Division. Until recently, such wastes were simply burned with kerosene at a prepared ground hole within the Agricultural headquarters, at Tanaea. Recently 3 incinerators are provided by the SPC, one is installed at the Airport Agricultural Station and is used for the purpose; another one is

used at Kiritimati, and the third is used at Fanning. There is a fourth incinerator at Betio Agricultural Station.

Other special wastes are scrap metals from derelict motor vehicles and vessels, mechanical equipment and World War II relics. Derelict motor vessels that were used for inter island shipping are abandoned offshore or at the seaward edges of the lagoon flats. These abandoned vessels together with some relics of WWII make much of Betio shore unsightly, unclean, and rather foreboding.

## **Waste Disposal**

### **General**

The SOER2000-2002 identifies 4 components of waste disposal system in South Tarawa. They are: locations, number and situation of waste dumps; access roads and their conditions; amenities for management of wastes at the dump sites; and characteristics of wastes disposed at the dumps.

About 10 wastes dump sites are located along the shoreline of South Tarawa, mostly on the lagoon side. Some of the sites are considered as filled up and are no longer used. They are open dumps, with no containment, nor compaction. During extra high spring tides, some of the rubbish at most of the dumps are washed away, drifting along the shore as flotsam and become constituents of some other parts of the beach. Winds disburse as well the rubbish, and so too the dogs. More inappropriately children on occasions see the waste dumps as adventuring places for unexpected amusing findings. Some parts of the peripheral areas to the dump sites can be well hidden by the heaps of rubbish from seeing by many people, so others go there to relieve themselves by defecating there.

Dumpsites were regarded as obnoxious sites. Close to them, pig pens were constructed by the BTC which before 1979 all pigs were kept there by different owners on payments to the BTC of monthly fees. The site was at seaward exposed area of what is now known as "Te Oo ni Beki". After several decades the rubbish turns into organic soil and increase the size of Betio. This is worth to note because none of the studies that were carried out to determine the changes in the land area of Betio acknowledge this known fact. Another dumpsite is at Naanikaai, near the BPA Mast where it was more purposefully designed for land reclamation.

Overfilled dumpsites have led to the construction of landfills. One site is at Betio for wastes on Betio, another site is at the built up land along Anderson Causeway for TUC wastes, and one site behind AMAK at Bikenibeu, all were constructed in mid 2000s.



**Fig 3. Landfill at Betio before SAPHE Project (no proper containment (SOER 2000-2002)**



**Fig 4. Landfill at Betio after SAPHE Project ( PCU Photo, 23/11/07)**

The dumpsites are accessible by garbage tractors and trailers operated by the BTC and TUC, through feeder roads which are unsealed that detour from the main and only tarsealed road on South Tarawa. In overcrowded areas, residential houses and other buildings are usually aligned on either sides of the track. The tracks are very dusty in dry weather, and swampy and muddy during rainy weather.

It could not have been conceived in the 1960s and 1970s that it would be useful to station some personnel about the dumpsites as caretaker and recorder of streams of wastes that were disposed at the dumpsites. At each of the landfills, one at Betio and another one along Anderson Causeway, a shelter for a watchman is provided.

The landfills will remain useable for some years. It is therefore informative for monitoring purposes to record observations by the ECD.

### **Betio Landfill**

The landfill constructed at the same site of the waste dump is seawall structure and wire fencing to contain wastes; it was completed in 1998 and has been managed by BTC. It has improved the sight of the original waste dump.



(a)

(b)

**Fig. 5. Southward view from main gate at Betio Landfill (a) and (b) view towards Copra Mill at Betio. (PCU Photo, 08/02/06)**

Waste items dumped at the landfill is mixed with no restrictions whatsoever for anyone to dispose of any waste material. The environmental survey conducted under SAPHE at the area surrounding the landfill confirmed that the shore bottom (adjacent to the landfill) was heavily polluted. As part of the rehabilitation works, a perimeter fence and access gates were constructed to contain the rubbish being dumped in the landfill. Three leachate pump stations were installed in the landfill to drain out the existing accumulated pond water. Screening units need to be installed at all the pumps station inlets to prevent foreign objects clogging the pump station openings.

### **Anderson Landfill**

Anderson landfill was handed over to TUC on June 2004. Prior to the handover of the landfill to the TUC a four-day landfill operation training and demonstration workshop was conducted to TUC and Betio Town Council by a landfill specialist from Japan under the SAPHE project. The workshop involved discussion and demonstrations on the techniques related to rubbish sorting, collecting, transporting, dumping compacting and soil covering of solid waste.



(a)

(b)

**Fig 6. Anderson Causeway Landfill (a) and (b) leachate pump installed at landfill. (PCU Photo, 21/09/07)**

Currently there are numerous seeps of leachate from the landfill cell to the lagoon. While these seeps are all low in volume it can be expected that the volume of discharge will increase with aging of the sea wall, (as more weak points develop) and that the strength of the leachate will increase with greater volumes of rubbish being deposited. It appears that the leachate within the landfill was at least 0.5m deep but could increase during raining season.

At this time it can be expected that the leachate will have the following characteristics:

- Have relatively low pH (perhaps in the range of 4.5 to 6);
- Be high in ammoniacal-nitrogen;
- Be high in BOD and COD; and
- Have a range of other contaminants dependent on the types of waste deposited.

There has been no measurements taken of these contaminant indicators, and the ECD intends to arrange for this to be done.

It is possible that over the long term such discharge from the landfill could increase the likelihood of an algal bloom within the lagoon.

It is desirable that there should be minimal volume of leachate. It is not possible now to drain out the water/leachate and this will be an ongoing problem that require response and may well add a significant cost burden to the landfill operation. As has already been experienced leachate pumps are notorious for breaking down and the more continuously they need to be run the more likely they are to break down.

### **Bikenibeu Landfill**

There is a considerable volume of water in the landfill and more water could be seen entering it through the seawall. There are milkfish within the landfill enclosure and that there is a large pipe through the seawall at the leachate pump site. This pipe may also let water flow across to the landfill.



(a)

(b)

**Fig 7. Bikenibeu Landfill – view toward N.Tarawa (a) and (b) Seawall with fencing at Bikenibeu Landfill**

From discussions between the Project Manager of the PMO and the ADB it was agreed that dumping within the Bikenibeu Landfill would commence after the complete filling of the Nanikaai landfill site. It is estimated that the Nanikaai Landfill site may take approximately three to four years to reach full capacity.

#### **Types of waste disposed of at the landfills**

There is no consistent method used in waste streams surveys conducted as shown in Fig 5 and 6. However, there are plastics, metals, glasses, liquid absorbent materials, and empty cans. All types of wastes collected from residential, institutions and commercial entities are dumped together. Heavy metals and trunks of trees are not generally dumped at the landfills, but derelict electronic and office equipment had been.

Dumpsites are unpleasant to the sense of sight and smell. They are possible human health risks associated with toxic materials, glass, sharp objects, and breeding disease vector insects. Occasionally a portion of the waste heap is burned to lessen odour and provide more dumping area but this creates air pollution including from burning plastics.

It is desirable that there is recording and monitoring of waste streams disposed at the dumpsite and landfills on regular basis so that information can be available for strategic planning to address the increased alarming rate of the waste problem. Regular health inspection of the sites and wastes will also contribute to useful information.



**Figure 8. All kinds of waste dumped (ECD, 2000a)**

### **Pressures on the Environment**

The SOER2000-2001 categorizes pressures under three subheadings: waste storage; waste collection; and resources at the national level to undertake the tasks.

Without proper waste storage at the sources, regular collection from the storage and disposal of wastes at dumpsites or landfills, wastes will disperse around in many places for which they are not intended. They become typical features of the places in South Tarawa.

#### **Waste Storage**

Wastes from various sources are normally heaped at the sides of the road and tracks where BTC or TUC garbage tractors and trailers will collect and dispose them at appropriate dumpsites or landfills. But there are also parts of the road and tracks where the garbage tractors and trailers do not go, yet wastes may still be deposited in those parts. Even along the road and tracks that the tractors normally go through, heaped wastes can remain and in some cases redistributed and dispersed.

In the past, containers were provided along the road and tracks to serve the households. The containers were too good and were removed and used as water containers by unknown persons. Replacement containers of the same type were provided again, but with holes so they would not be removed and used for water containers. They were removed, nevertheless.

These perhaps demonstrate the long established attitude towards wastes outside ones household premises.

More recently leaking empty 44 gallon drums were used as waste containers. They were placed at public open spaces and some along the road and tracks at densely populated areas. There were not enough of these, and some were so filled up that BTC or TUC employees manning the tractors and trailers could not lift them and empty their contents into the trailers. Half drums were then used as well. Some still remain and always filled with garden wastes and other wastes.

Uncontained heaps of waste along the road and tracks appear to be a preferred storage system. It proved convenient for council employees on the tractors and trailers to scoop up the wastes onto the trailers using shovels. But this is unsightly and hazardous.

It is hazardous because some scrap metals of lead, mercury, copper, and zinc are also among heaps. In some cases these are simply dumped on the beach. Bulky scrap metals mainly of derelict vehicles are stored at PVU compounds; some are deposited at Nanikaai dumpsite, others at Lagoon Motors Yard, and others at Betio Kaoki Mange Yard. But still large bulks are scattered around South Tarawa.

The presence of metal scraps in increasingly large quantities expose the groundwater, marine animals and plants to contamination, and people to ill health. A project is underway to remove scrap metals from South Tarawa, and incentives are being offered to get people support the collection of scrap metals for shipment to dealers overseas.

### **Waste Collection**

From the above sections it is evident that the current system of waste management is inadequate. Once or twice a week collection of wastes from heaps or from drum containers along the road and tracks by BTC and TUC using tractors and trailers is inadequate. The attitude of people towards wastes outside their own household premises as not of their concern does not help.

A separate collection system exists for Tungaru Central Hospital wastes. Wastes from patients and their individual relation caretakers are put in drums that are provided. A truck comes every day to empty the content of the drums. This work is contracted to a church-based group. The truck content is emptied at the dumpsite at Temaiku, one among the 10 dump sites on South Tarawa.

Medical and clinic wastes are incinerated at the hospital compound as already noted above.

### **Lack of Adequate Resources at National level**

This is a need capacity self assessment exercise. The SOER2000-2002 identifies needs for national capacity to enable Kiribati to deal more efficiently and effectively with the increased alarming rate of wastes and implications for health and sustainable development. The needs are focused on the capacity to deal with hazardous waste materials; they equally apply to all other wastes:

- Understanding of effects of (hazardous) waste materials;
- Effective legislation to control importation of toxic materials;
- Trained personnel in (Hazardous) Waste Management;
- Protective/safety equipment;
- Appropriate technical expertise;
- National capacity and infrastructure; and
- Specific legislation on chemical management and occupational and health safety.

### **Responses to Pressure**

The SOER2000-2002 identifies these responses: awareness raising programmes; waste minimization activities; legal mandate to control pollution; SAPHE project; and, Betio landfill.

### **Awareness Raising Programmes**

One of the aims of awareness raising programmes is to involve a wide section of the population in cleaning up public places on South Tarawa. This will also change the common attitude about wastes outside one's own household premises.

Workshops for communities' representatives, and weekly radio programmes were undertaken with the aim to make them and the public at large more informed about the hazardous nature of unmanaged wastes and of different waste streams, their harmful effects on human health and the environment.

Through these, it is expected that the communities will feel as rightly so that they own the environment and might readily assume responsibility for keeping it clean and healthy, though it is the part of the environment that lies outside their individual's household premises.

### **Waste Minimization Activities**

The SOER2000-2002 notes that local people have already find ways, much beyond the expectation of waste management authorities, of reusing plastic bags, bottles, containers and other items. Such ways contribute to the minimization of wastes, and they include:

- i. battery chemicals used as soil fertilizers, dyes for mat weaving leaves, and kids' toys;
- ii. car tyres are used as coastal protection walls, washing and bathing tubs, hammocks, roof weights against strong winds, children's toys, and domestic animal's feeding troughs;
- iii. bottles are used for liquid (traditional juice, body oil, and kerosene) storage containers, dug-in decorations on ground around compound and graves;
- iv. plastic bags are washed and reused as shopping bags and rubbish bags; and
- v. aluminium roof sheets are used as garden walls, pig pens, roofing extension to traditional cooking huts which is separate from the main living house.

A larger scale with commercial incentives is minimization of wastes through a recycling of aluminium cans. Two private enterprises have set up operations for collecting and paying for empty cans, which they process for shipment in containers to overseas dealers. Kaoki Maange project initiated by the IWPK and FSP provided initial inputs to the start of the one of recycling operation which was later handed over to one of the two private enterprises. Plastic bottles are also accepted by one of the two enterprises as recyclable items, and consideration is being considered for recycling paper and cardboards but these have many local uses such as firewood, ceilings for sheds, temporary clogs for leaking thatched roofs, etc.

Opportunities and obstacles for waste minimization are identified in the SOER2000-2002 based on a study by Sinclair Consultants (2000). They are indicated in a reproduced table below.

**Table 3. Opportunities and Obstacles in Waste Minimization**

<b>Opportunities</b>	<b>Obstacles</b>
Home composting (ideal for geology and island environment) has already been done and will continue as community schemes.	Lack of funds for waste management initiatives (eg procurement of appropriate machineries such as bailer and shredder, start up cost of any recycling scheme).
Kiribati has been recognized, by several aid agencies, as in need of waste management assistance.	Require constant public awareness on waste minimization and management issues.
Considerable studies had been undertaken on feasibility of scrap metal recycling.	Current waste collection scheme is poorly managed.
	Lack of expertise in waste management.
	Public unable to pay for services.
	Lack of public “perception of waste”.
	No financial incentive to sort waste at source and dumpsite.
	Cost of shipping material to external recycling facilities.
	Small volume of recyclable material volume.

In section 14.2.1 we note that over 50% of wastes is organic and therefore biodegradable. Home gardening and the Banana Circle system which are promoted have minimized organic wastes.

Wastes at public places are occasionally cleaned up by community groups and government employees. Women and youth groups, religious groups, and councils are organized for cleaning up South Tarawa during weekends in a lead up to World Clean-up Days and the national Environment Week.

### **Legal Mandate to Control Pollution**

The Minister responsible for environment has responsibility for the administration and implementation of the Environment Act 1999 (amended in 2007), and as noted in the SOER2000-2002 this responsibility is in practice carried out through the ECD.

One of the objectives of the Act is “to prevent, control and monitor pollution”. The sources of pollution are wastes in their various streams with different degrees of harmfulness. Six streams of wastes are described in regulations under the Act: household domestic waste; building and demolition waste; hazardous waste; clinical waste; quarantine waste; ballast water; and waste oil. Threshold levels and standards of pollution are also set out in the regulations.

Implementation and enforcement of the Act and Regulations are faced with hurdles. These hurdles arise from typical situation of least developed nations: lack of financial, technological and personnel resources. Polluters willingness to cooperate is also lacking, particularly shops and mechanical businesses. They refuse to remove their unwanted waste from current sites which affect aesthetic view because of costs they have to incur. Such irresponsible behaviors of some businesses make implementation and enforcement of the Act and Regulations more difficult.

### SAPHE Project

The SOER2000-2002 notes that government borrowed a sum of money from ADB for the purpose of undertaking a project concept known as SAPHE. The loan was for US\$10.2m and it was approved towards the end of 1998. As further noted in the SOER2000-2002 the aims of SAPHE were, inter alia, to improve and promote efficient soil waste management and hence promote better hygiene and sanitary circumstances for the people of South Tarawa. Activities include composting, household sorting of rubbish, collection of non-organic waste, recycling, identifying landfills and associated regulations, policies and programmes. Physical improvements in waste collection and disposal, and institutional strengthening associated with waste management are expected indicators of outputs from the project.

The project was started in 2000, and it was still in progress at the time the SOER2000-2002 was prepared, which notes for the progress on assessing suitable sites of landfills that implementation was still uncertain. By 2007 the SAPHE had already been completed, and two new landfills were constructed, and one at Betio at the site of what used to be an open dump. As already noted above, one new landfill is along the Anderson Causeway, and the second but remains unused in 2007 is behind the AMAK Offices at Bikenibeu.

Sites for the landfills were carefully selected, and for record which can be useful for any later purpose, the table below reproduced from the SOER2000-2002 describes the considerations given in the selection of sites.

**Table 4. Evaluation in the selection of landfill sites**

Name of landfill	Location	Assess from View of	
		Physical perspective	Environmental perspective
Betio Red Beach	-Northwest of Betio Town, close to the Shipyard -Facing Red Beach	<b>Acceptable:</b> -Convenient Access to site -Capacity 5-7 more yrs	<b>Acceptable:</b> -Some improvement required to prevent leachate
Bairiki Landfills	-Lagoon side of Nippon Causeway -Included in the National Park -Close to private households	<b>Acceptable, however:</b> -Access to site is inconvenient -Require large & extensive restructure works to	<b>Unlikely to Acceptable:</b> -Large restructure work will demolish landscape -Seawall may cause new and accretion -Site included in National Park.

		accept waste sanitary -Dumping period limited to 2-5 years.	
Naanikaai Landfills	-Lagoon side of Anderson Causeway. -Site of sand mining; -Earmarked for National Park.	<b>Acceptable:</b> -Convenient Access from collection sites. - Adequate capacity for 15 yrs dumping with sanitary -Require improvement for sanitary dumpsite	<b>Acceptable:</b> -Require rehabilitation to set up sanitary landfills.
Taborio Landfills	-Lagoon side of Stewart Causeway -Old sand mining area -Earmarked for National Park.	Not acceptable: -Too narrow to make up sanitary landfills & limited capacity to store waste -Poor access from eastern Districts -Ready back filled by sand and created as a Park/Green Belt.	Unlikely to be acceptable: -Spoil scenic spot - Seawall may induce coastal erosion.

### Current status of Betio Landfill

The SOER2000-2002 describes that more efficient coordination of activities relating to, and monitoring of the disposing of wastes at the landfill is required. It was evident that wastes were piling up at areas within the landfill that are closest to access tracks and close as well to the main road. This accumulation merely increased in height, blocking accessibility for dumping at the inner areas of the landfill. Evidence of overflow of the accumulation is noticeable as volumes of wastes pushes the wire fence towards the tracks and the main road running along the Red Beach. In some other locations of the accumulated wastes, the overflow wastes get into the surrounding areas and the sea. The SOER2000-2002 suggests further that it is quite possible that facing the difficulty to get to the inner area of the landfill, waste dumpers may start disposing their load offshore outside the landfill.

Improvement has been achieved. Accumulation of waste has leveled off, and there is no overflowing into the road or tracks. It is however possible that overflow of wastes into the surrounding sea still occurs.



**Fig 14.7 Wastes overflow toward the road. outside landfill.**



**Fig. 14.8 Wastes dumped offshore**