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Acronyms and Abbreviations

SPREP	South Pacific Regional Environment Programme
WHO	World Health Organisation
MoH	Ministry of Health
DoH	Department of Health
PET	Polyethylene teraphthalate
HDPE	High density polyethylene

Executive Summary

Action Plan

Waste Management Sector	Action			Responsibility	Timeframe
	Priority 1	Priority 2	Priority 3		
Implementing the Plan	<ul style="list-style-type: none"> Workshop with government ministers, NGOs, business and community leaders, DoH and Dept. of Environment. Prioritisation of actions and responsibilities 	<ul style="list-style-type: none"> Form a Solid Waste Committee Appoint and train a Solid Waste Officer Set targets for waste reduction 	<ul style="list-style-type: none"> Obtain funding for demonstration recycling schemes Review funding of waste management Report on future effects of tourism on waste management 		
Waste Minimisation Initiatives		<ul style="list-style-type: none"> Negotiate cheap shipping of waste materials for recycling 	<ul style="list-style-type: none"> Investigate possibility of national waste management fund 		
Metal wastes	<ul style="list-style-type: none"> Increase quantity of metals recycled through increased publicity for existing scheme 	<ul style="list-style-type: none"> Government to support of project to crush large waste steel items 			
Biodegradable Waste	<ul style="list-style-type: none"> Designate area at landfill for green waste and organic waste Implement shredding and composting of green and organic waste 				
Plastic waste	<ul style="list-style-type: none"> Separate Pet and HDPE collection 	<ul style="list-style-type: none"> Implementation of packaging legislation 			
Paper waste	<ul style="list-style-type: none"> Separate paper collection 				
Refuse Collection System	<ul style="list-style-type: none"> Implement segregated municipal waste collection of all recyclables 				
Landfill	<ul style="list-style-type: none"> Select new landfill site 	<ul style="list-style-type: none"> Management plan for Lautoka Landfill 	<ul style="list-style-type: none"> Management plan for Nadi Landfill and phase out of hard wastes 		
Special Wastes	<ul style="list-style-type: none"> Publicise waste oil collection facilities 	<ul style="list-style-type: none"> Implement waste pesticide container collection 	<ul style="list-style-type: none"> Publicise waste batteries collection Strengthen hospital waste segregation and disposal 		

Community Involvement	<ul style="list-style-type: none"> • Education programme for schools, businesses, community groups • Education programme for tourism and hotels on waste minimisation 	<ul style="list-style-type: none"> • School collection schemes for recyclables • Publicity campaign on new recycling schemes and segregated waste collection 	<ul style="list-style-type: none"> • Investigate curriculum changes 		
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1. Introduction

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

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 including Fiji, Tonga, Vanuatu, Papua New Guinea, Kiribati, Tuvalu, Solomon Islands and Western Samoa.

This is the final report for Lautoka and Nadi, based on the findings of the fieldwork carried out by the author in Lautoka from 8th September – 21st September 1999. The aim of the report is to present the results of the waste characterisation work carried out while in Fiji and to describe the current waste management practices in Lautoka and Nadi. The report also aims to formulate options and priorities for an integrated solid waste management plan for Lautoka/Nadi. The terms of reference for this project are given in Appendix A.

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

2.1 Introduction

Lautoka is Fiji's second largest municipal centre and has a population of about 46,000 or 10,000 households. The annual income of Lautoka City Council is about \$2,000,000 per annum and approximately 20% of this is spent on waste management. \$100,000 per year is paid to a private contractor for rubbish collection services, \$80-90,000 per year on street cleaning and sweeping, \$200,000 per year on cleaning drains and other public amenities such as parks and \$40,000 per year is spent on cleaning the market.

Nadi has a population of approximately 13,000, and the waste collection and disposal is managed by the Nadi Town Council.

2.2 Lautoka Landfill and Collection System

The landfill in Lautoka is used by Lautoka City and Nadi Town for domestic, commercial and industrial wastes as well as waste contractors and the general public. The landfill in Lautoka is located on flat reclaimed land, about 10 hectares in size, adjacent to mangrove swamps and sugarcane farms, on the east side of town. About 1 hectare of the landfill is in use and the remainder is covered in grass and shrubs. The landfill is relatively well organised with section of the landfill used at different times and a separate area for burning of waste and burial of dead animals. There is no segregation of waste at the landfill and all types of waste are accepted.

There is a bulldozer in operation about half of the time, and newly dumped waste is shifted, compacted and is covered daily with topsoil. The landfill is sprayed for flies, but at the time of the field work the spray machine was out of order. However the flies and the smell did not appear to be a significant problem.

The landfill is divided by man-made channels for sea water to prevent spread of fire (previously caused by arson), and to provide water for fire fighting. Some waste was on fire at the time of the fieldwork but this was separated from the rest of the waste and moved towards the mangrove swamps.

The landfill is fenced and there is a gatehouse with a lockable gate. House of operation are 7am – 5pm Monday – Saturday. The gatehouse is manned and a record of all vehicles is kept. Fees are

collected and recorded. The income from gate fees is approximately \$40,000 per annum. The fees as of 6/8/98 are as follows:

Table 2.1 Garbage Dumping Fees

Type of Garbage	City Boundary - Per Load	Outside City Boundary - Per Load
Household	\$3.30	\$5.50
Trade/Commercial Waste	\$5.50	\$7.70
Condemned Food	\$16.50	\$22.00
Offensive/Hazardous Waste	\$22.00	\$27.50
Motor Vehicle (Shell)	\$5.00 per piece	\$7.70 per piece
Williams and Gosling		\$14.50

There are scavengers working at the landfill, collecting scrap metal, textiles and other goods.

Household rubbish is collected twice per week in Lautoka and three times per week in Nadi in compactor trucks or covered trucks. Commercial and industrial waste is collected daily except Sundays. Green waste is discouraged and will generally not be collected. Nadi Town Council operate a garden waste collection every two months and take the waste to a small dumpsite in Nadi. The green waste collection with also pick up hard waste, and inspection of the “garden waste dump site” in Nadi there was all types of waste including domestic waste evident.

Lautoka City Council will be initiating green waste shredding and composting at the botanical gardens as a public demonstration scheme and to use the product on the gardens. The Council is also encouraging backyard composting as part of the management of biodegradable wastes.

2.3 Private Waste Contractors

Williams and Gosling offers a waste collection service in Lautoka, Nadi, Denerau, Vuda and Ba using two sizes of skips (3.7m³ and 1.5m³). They charge \$30/skip and are used extensively throughout the region. They are used by hotels, offices, island resort, sports clubs, and villages outside the city or town boundaries that do not have municipal collection, the airport, and industries such as a soap factory and Post and Telecommunications.

2.4 Education

Environmental education is stated to be a major component of the present school curriculum, however the effectiveness of the programme has not been evaluated in depth. It was suggested that rather than looking at the contents of the curriculum it would be important to look at the teaching methods in schools, especially at primary level. The Council has a schools programme whereby staff

of the Health Division visit schools within the city boundaries and make presentations on aspects of environmental health including the concepts of waste minimisation such as reduction, recycling and recycling of solid wastes.

There is a moderate level of awareness in the general public of waste management issues, but littering and illegal dumping of waste is still a huge problem. It was suggested that the immediate solution would be more effective implementation of the Litter Act and not public education because people are fully aware of what they should and should not do with regards to littering.

2.5 Littering and Illegal Dumping of Wastes

Littering and illegal dumping of wastes is a significant problem in Lautoka and Nadi indicating a lack of awareness of waste management practices. Littering along all major highways occurs, and illegal dumping by island resorts, supermarkets, other industries and rural households is common. The Councils are under-resourced to carry out sufficient enforcement of the Litter Decree 1991. This Act covers litter prevention, offences and procedures for prosecuting alleged offenders, and enables public authorities to appoint litter prevention officers. The lack of manpower is not the only issue, and improvements must be made in training of staff in implementation, implementation of the Act with existing resources, and better efficiencies in the area of enforcement.

Cleanups of the highways and beaches are often carried out by businesses or community groups such as William and Gosling, Punjas and Sons and Sheraton Denerau, as well as the Councils.

2.6 Legislation

As well as the Litter Decree described above, the Draft Sustainable Development Bill has a comprehensive section on waste management. This Bill should be approved by Cabinet in the very near future.

The municipal authorities have by-laws dealing with waste management issues such as the Lautoka (Garbage Disposal) By-laws 1944, stipulating that every owner or occupier of a house, resident or shop is required to provide proper garbage pans with lids for storage of rubbish at roadsides to be collected. The by-laws also prohibit the indiscriminate dumping of waste within the city boundaries.

The Public Health Act has several sections relevant to solid waste including issues such as “garbage pans and accumulations”, inspections to be carried out by health inspectors, duties of sanitary inspectors etc. The Public Health Act is the main legislation for waste management in Fiji. In rural areas it is administered by Rural Local Authorities, although for designated Fijian Village areas there are Village Health By laws as well which are not particularly effective.

The Rivers and Streams Act also has aspects relating of pollution.

2.7 Recycling Initiatives

Coca-Cola is involved in PET bottle collection and recycling (to Australia) in Lautoka and Nadi, although the success of this scheme could be improved. Lautoka City Council has been trying to get Coca-Cola to involve schools in the collection of PET bottles by offering a 1-2 cent refund per bottle.

There is beer bottle recycling at the Carlton Brewery which operates successfully, probably because they pay a refund for each bottle returned.

There is scrap metal recycling for most metals, including copper, aluminium, brass, zinc, lead, stainless steel, also batteries (part of the battery), air conditioners and radiators. There are three scrap metal businesses operating in Lautoka: Scrap Metal (Fiji) Ltd, Waste Recyclers Ltd and IA Traders. Ferrous metals are collected but are stored at present as the market price of steel is too low to make export to for recycling viable.

There is paper and cardboard recycling carried out – collection by Waste Recyclers Ltd, transport to Suva for baling and shipping to Australia.

Waste oil recycling is available, although not widely utilised at present.

3. Audit and Characterisation of the Solid Waste Stream

3.1 Introduction

In Fiji 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 Lautoka/Nadi area, in the event that this proceeds. It is also necessary for the setting of targets for waste reduction, reuse, recycling and will allow the measurement of success of any waste minimisation initiatives.

An initiation meeting was held at the Lautoka City Council on 23rd August 1999 to discuss the objectives of the project and the activities to be carried out during the fieldwork. The attendees were as follows:

1. Juliet Woodward Sinclair Knight Merz
2. Andrew Reeve Sinclair Knight Merz
3. Sefania Nawadra Sinclair Knight Merz
4. Dr Suresh Raj SPREP
5. Premila Kumar Department of Environment
6. Vandana Naidu Department of Environment
7. Phylis Jaureguy Votua Village Cooperative Project
8. Ravendra PrakashNadi Town Council
9. Prem Sundar Lautoka City Council
10. Gyneshwar Rao Lautoka City Council
11. Pisep Raj Lautoka City Council
12. Jope N Sadranu Divisional Health Inspector Western
13. Isoa Nasendra District Officer

The minutes of the meeting are given in Appendix F.

3.2 Methodology

The following activities were programmed during the 2 weeks of fieldwork in Fiji:

- Survey of all vehicles using the Lautoka Landfill over a 7 day period to determine vehicle numbers, waste types and quantities
- Waste classification at the Lautoka Landfill
- Waste vehicles to weighbridge
- Waste Audits on selected businesses
- Interviews with people involved in waste management

The fieldwork was followed up with a workshop for stakeholders, to present the results of the investigations and to determine options and priorities for a solid waste management plant for Lautoka and Nadi.

The methodology for the first three activities is given in Section 3.2 below and the results are given in Section 3.3.

3.3 Vehicle Survey

In order to calculate total volumes and types of refuse reaching the landfill, a record of all types of vehicles and their volume and type of refuse was recorded over a one week period. The survey of vehicles entering the Lautoka Landfill was carried out each day (except Sunday) over a 6-day period from the 13th September – 18th September. The hours covered were 7am – 5pm (Note: these are the hours the landfill is open). The survey recorded the following data:

1. Time of arrival
2. Vehicle type based on the categories – waste compactor truck, from Lautoka or Nadi, Williams and Gosling skips, large truck, medium truck, small truck, van/station wagon or car.
3. Waste type – domestic, industrial or commercial
4. How full was the vehicle – 25%, 50%, 75% or 100%
5. Visual analysis of waste based on volumes of the following categories – paper, plastic, glass, metal, organic, textile, hazardous, construction and other.

3.4 Classification at the Landfill

Waste analysis was carried out on a mixed sample of waste from the waste compactor truck on four consecutive days. A sample size of approximately 1-2 m³ was unloaded from the compactor truck at a clear area for sorting, and the remaining waste was dumped into the landfill area. Sorting into the 9 primary categories, and some selected secondary categories of waste was carried out on a large plastic sheet and each category was weight using a mechanical hanging weigh scale. The scales read up to 100 kg in 0.5kg intervals. Weighing was carried out using a 60 litre plastic rubbish bin and the scales were zeroed for the weight of the empty bin. Once weighed, the waste was returned to the main landfill area.

The density of the mixed waste was also checked by weighing the full 60 litre bin 7 times and averaging the results. It must be noted that this waste had already been compacted by the collection truck, so the density is likely to be higher than uncompacted waste.

3.5 Vehicles to Weighbridge

The weighbridge at the Punjas Combined Manufacturing site was identified as suitable for weighing selected vehicles in and out of the Lautoka Landfill. The Lautoka compactor truck and the Nadi waste truck were weighed three times when full and the Lautoka green waste truck and the Williams & Gosling truck were weighed twice when full. The vehicles were also weighed when empty and the total weight of waste carried in each load was calculated. A count of the number of residential and commercial properties collected from by the Council trucks for each of the loads that was weighed. This allowed an average weight factor for the vehicles weighed to be calculated and an average weight of waste generated per household and per person to be calculated.

Typical waste factors for smaller vehicles have been taken from work previously carried out by Egis Consulting (Australia).

The total weight of waste going to the landfill was calculated using the vehicle numbers and types and multiplying by the weight factors for each vehicle type.

3.6 Results

3.6.1 Vehicle Survey

There are three sections (a, b, c) of information that have been drawn from the information recorded during the 7 days of vehicle survey at the landfill. The results of the Vehicle Survey are given in Appendix H.

(a) A summary of the results on vehicle types is given below in Table 3.1.

Table 3.1: Number, and Type of Vehicles

	Total Number in Week	Percentage %
General Waste Type		
Domestic	83	28
Industrial	74	25
Commercial	139	47
Total	296	100
How Full is Vehicle		
25%	33	11
50%	24	8
75%	33	11
100%	206	70

(b) Total Quantity of Waste Delivered to Landfill

The total quantity of waste delivered to the landfill during the week of the survey can be estimated using the total number and type of vehicles and the waste factors obtained from the weighbridge results and from the Egis Consulting data.

The waste factor for the compactor was checked using the data gathered at the weighbridge and an average waste factor of 4.61 tonnes for the Lautoka truck, 3.76 tonnes for the Nadi truck and 1.19 tonnes for the Williams & Gosling truck was obtained. A factor for the average percentage fullness of the vehicle has been used and this was calculated using a weighted average based on the records taken during the vehicle survey (80% full). The Council trucks and Williams & Gosling trucks were assumed to be 100% full.

Table 3.2 Total Waste Quantities (Domestic and Commercial) Per Week

Type of Vehicle	Total Number in Week	Waste factor - domestic (tonnes)	Average % full	Total weight of waste (tonnes/week)	Wt %
Lautoka Compactor	35	4.61	-	161	42
Nadi Compactor	10	3.76	-	38	10
Williams & Gosling	78	1.19	-	92	24
Large Truck	56	1.16	80	52	14
Medium Truck	42	0.62	80	21	5
Small Truck	41	0.30	80	10	2.9
Van/Station wagon	29	0.30	80	7	2
Car	5	0.06	80	0.3	0.1
Total Weight/week (tonnes)				381	100

If the total population using the landfill for waste disposal is Lautoka = 46,000, plus Nadi = 13,000, then the average waste generation rate per capita is:

Total waste per week (tonnes/week) ÷ 7 (days) ÷ 59,000 (persons)
= 0.92 kg/person/day

However Nadi also carries out a “green waste collection” which includes green and hard wastes, every 2 months and on average they collect 450m³ (or approximately 76 tonnes) and dispose of this to the Nadi dump. This would increase the **average waste generation rate per capita** to:

$$= 0.94 \text{ kg/person/day}$$

$$= 343 \text{ kg/person/year}$$

Any waste that is disposed of through illegal dumping, or through burning in back yards or at industrial properties is not accounted for in the figure above.

c) Visual Analysis During Vehicle Survey

Each vehicle that entered the landfill during the vehicle survey was observed while unloading and an assessment of the proportion (by volume) of each of the major waste streams was carried out. The data was then entered into a spreadsheet and the average composition of all waste, domestic waste only and commercial and industrial waste was calculated. The results are given in Table 3.2 below. The results of waste classification (Table 3.3 below) from the sorting and weighing carried out at the landfill (described in Section 3.4 above) are more accurate and the visual analysis results below should be used as a comparison only.

Table 3.3 Visual Analysis of Waste Classification

Waste Type	All Waste - Domestic Commercial & Industrial (Average %v/v)	Domestic Only (Average %v/v)	Commercial/Industrial Only (Average %v/v)
Paper	23.6	15.5	27.0
SPlastics	15.3	18.8	13.8
Glass	3.6	4.5	3.2
Metals	5.3	4.8	5.5
Organics	41.1	50.4	37.3
Textiles	8.0	2.8	10.2
Hazardous	0.4	0.3	0.4
Construction	1.7	2.4	1.3
Other	1.1	0.5	1.3
Total	100	100	100

The notable points from the data above are:

- Combined waste is high in paper and organics
- Commercial waste is over one quarter paper
- Domestic waste is over half organics
- There are still low levels of metals reaching the landfill
- Domestic waste is high in plastics
- There is a significant amount of textiles going to the landfill

3.6.2 Results of Waste Classification at Landfill

Table 3.4 gives the typical average composition of the waste collected in the government collection system based on the waste classification carried out at the landfill on 13th – 16th September 1999. The results of the weighing and sorting on each day were entered into a spreadsheet and the average results were calculated. The spreadsheet with complete data is given in Appendix G. A total of 1,057kg of waste was sorted and weighed over the four days.

This data provides an indication of the waste composition but is based on a short period of time (4 days only) so will not allow for weekly or seasonal variations. The analysis should be repeated in the future at regular intervals to give more accuracy to the data and to allow trends to be identified.

Table 3.4 Waste Classification Results

Primary Waste Classification	Secondary Waste Classification	Average Percentage (wt%)
Paper	Cardboard boxes	3.5
	Other – magazines, newspaper, office, tetrapak, packaging	10.1
	Sanitary	1.1
Plastic	Polyethylene terephthalate (PET)	1.1
	Rigid High Density Polyethylene (HDPE)	0.4
	Flexible HDPE and other plastics	6.6
Glass	All glass	2.7
Metals	Aluminium cans	0.3
	Other metals	2.9
Biodegradable	All organic	67.8
Textiles	All textiles including clothing, carpets and curtains	3.0
Potentially Hazardous	All	0.2
Construction and Demolition	All	0.0
Other	Including rubber and other	0.2
Total		100%

Summary Points

- Paper wastes very high at 14.7%
- Plastics high at over 8%
- Very few returnable bottles reaching landfill – this recycling scheme is working

-
- Aluminium cans are only 0.3% - a high proportion of these are being collected before reaching the landfill
 - There is still 2.9% other metals reaching the landfill
 - Biodegradable material is very high at 67%.
 - There is very little construction waste reaching the landfill as it is used by villagers for village purposes

3.6.3 Results of Vehicles at Weighbridge

The Lautoka compactor truck was weighed with a full load of domestic waste 3 times in total, the Nadi waste truck was weighed 3 times with mixed waste and the Williams and Gosling skips were weighed 3 times with full loads. The number of households or commercial premises collected in each truckload is recorded and a generation rate per person is calculated. The results are given in Table 3.5 below:

Table 3.5 Results of Vehicle Weights

From	Number of houses collected	Average number people/house	Total number people	Number Commercial properties collected	Weight of vehicle before unloading	Weight of vehicle after unloading	Weight of Waste	Generation Rate
					kg	kg	kg	kg/person/
Lautoka	890	4.6	4094		11440	5460	5980	0.42
Lautoka	551	4.6	2535		9590	5460	4130	0.47
Lautoka	1315	4.6	6049		9170	5460	3710	0.18
Nadi	277	4.6	1274	158+18	10360	5950	4410	1.50
Nadi	387	4.6	1780	248+16	10080	5950	4130	1.01
Nadi	147	4.6	676	197+17	8680	5950	2730	1.76
							Average	0.89
W&G					5820	4840	980	
W&G					6210	4810	1400	
Green Waste					6490	4440	2050	

Assumptions: There are 2 collections in Lautoka per week and 3 collections per week in Nadi.
Average number of persons per household is assumed to be 4.6 in Lautoka and Nadi, as given by the Department of Health
Commercial properties are counted as equal to one household.

The generation rate of 0.89 kg/person/day calculated from the results of the vehicle weights and the household count, is slightly lower than the figure calculated using the total weight of waste to landfill and the total population using the landfill in Section 3.3.1 above of 0.94 kg/person/day. It represents a margin of uncertainty of approximately 5% which is acceptable. The weighbridge results are based only on 6 vehicle loads over 3 days where as the figure of 0.94 kg/person/day is based on a full weeks record of waste quantities. Therefore for the purposes of this report we will use the generation rate of 0.94 kg/person/day.

3.6.4 Consultation

3.6.4.1 People Consulted

Interviews were conducted with a range of industries and commercial operations in Lautoka and Nadi as well as all of the businesses involved in waste management and recycling. The purpose of the interviews was to identify what types of waste are produced and what the current waste management practices are in industries, businesses and the Councils, and to gauge the levels of awareness of waste minimisation concepts. The following organisations were interviewed:

1. Lautoka City Council
2. Nadi Town Council
3. Punja and Sons Ltd
4. Williams and Gosling Ltd
5. Lees Industries Ltd
6. Scrap Metals Fiji Ltd
7. Carlton Brewery Ltd
8. South Pacific Distillery
9. Department of Education
10. Fiji Sugar Corporation
11. Waste Recyclers Ltd
12. Department of Health
13. Hanif Industries
14. Lautoka Hospital
15. Fiji Hotels Association
16. Sheraton Denerau Resorts

All of the interviews are written up and given in Appendix I. A summary of the important points is given below:

- Punja and Sons shreds and recycles plastic waste
- They also send cardboard waste from their carton factory to Australia for recycling – get about \$70/tonne.

-
- Shredded paper goes to the boiler.
 - No PET recycling in Lautoka.
 - Many businesses are involved in community clean ups eg Williams and Goslings, Sheraton Denerau, Punjas, Mocambo Hotel.
 - A waste transfer station at Nadi has been proposed by Williams and Gosling
 - 40% of Williams and Gosling waste is from the Sheraton Denerau Resort area
 - Many resort islands are not dealing with waste properly – illegal dumping is a huge problem
 - Western area of Fiji is every important for an expanding tourism industry.
 - Beer bottles are reused 6-10 times.
 - Brewery has negotiated with Australia to take broken coloured glass for recycling, using Waste Recyclers Fiji Ltd. This will be cost neutral for them.
 - Industries practices very little segregation of waste at present

3.6.4.2 Workshop Issues and Concerns

The workshop to present the findings of the fieldwork was held at the Lautoka City Council on 20/9/99. All of the waste management stakeholders were invited and all industries and businesses that had been interviewed. The discussion is summarised below:

1. A query was made as to why the distillery bottles are not reused – apparently there is a risk of health problems and the cost is prohibitive.
2. It was stated that the education programme should be built into the school curriculum.
3. A suggestion was made for PET bottle collections to be made in schools and a deposit system to be implemented eg. The American Samoa packaging legislation
4. Recycling needs to be costs neutral in order for it to be feasible for businesses. Success may be based on the pooling of wastes eg. coloured glass from all of Lautoka, not just the brewery.
5. There could be the provision for taxation in the environmental legislation for containers manufactured in Fiji.
6. Pet recycling is a big concern to manufacturers.
7. Coco-cola in Suva are looking at a return scheme.
8. Someone suggested the use of gaming machines for aluminium cans – as a way of collecting them for recycling.
9. All aluminium cans could have a refundable deposit to provide initiative for recycling.
10. Industries are required to do a Safety and Environmental Analysis for new process developments.

-
11. Education and awareness is a big issue eg education of the staff at the hospital about waste management procedures.
 12. Is the hospital incinerator acceptable for medical waste disposal? – would need to be reviewed, but is likely to be OK.
 13. The collection service is intended to cover only household waste. Garden/green waste should be collected separately for a fee (\$8.75 per load 5m³).
 14. The collection in Ba only amounts to 1 bin per collection every 2 weeks
 15. The Lautoka City Council is intending to obtain a shredder and implement a shredding and composting scheme in the Botanical Gardens.
 16. Jope Sadranu would like to see the formation of a Solid Waste Management Committee including MoH, Environment Department, Agriculture Department, local government, hotels, Peter Drysdale, plus others
 17. He would also like to look at a user pays system for waste management, and taxation of incoming cans, plastic, bottles and bags, and education programme on separation of wastes using pamphlets in 3 languages, and to strengthen and monitor the management of hospital wastes.
 18. The hospital incinerator may need to be improved and a modern one installed to control hazardous fumes causing air pollution and odour.
 19. The formation of a Solid Waste Management Committee is already in the Draft Sustainable Development Act.

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 Fiji. 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 Lautoka

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 markets	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 Lautoka City Council and the Nadi Town Council use the World Health Organisation document “Healthy Cities – Healthy Islands” as a reference for strategic planning of waste management in Lautoka and Nadi. 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 governments 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 Lautoka and Nadi and is a practical option for a Pacific Island country. There **must** be a major focus on waste reduction in Lautoka and Nadi in the future.

Recommendations

-
1. Prepare an action plan identifying how to reduce the amount of waste produced in Lautoka and Nadi, 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 Lautoka and Nadi is generally successful in terms of providing for the efficient removal of waste from source to point of disposal. However the arrangements at present may not be the most effective and economic. While the collections are carried out by the Councils and by private firms, the benefits of privatisation have not been fully achieved.

The collection system is an integral part of the waste management strategy for Lautoka and Nadi 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 Lautoka and Nadi is carried out and the following issues are considered:
 - What is best option for Nadi waste due to distance from current landfill
 - Feasibility study for new landfill
 - Complete privatisation of the waste collection service
 - Privatisation of the landfill operations
 - Foreign aid and privatisation – public sector assets donated by foreign aid may be leased by contractors
 - Options for providing a segregated waste collection service

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 Lautoka and Nadi 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 Fiji or other tax incentives should be considered as part of the waste management strategy.

An important part of the waste management strategy will be the implementation of this legislation as well as improving the enforcement of the Litter Decree. Factors that need to be considered to achieve this are:

1. Multisectoral nature of waste management legislation
2. Number of officers for enforcement of Litter Decree
3. Training for enforcement
4. Level of fines
5. Regular review and updating of legislation
6. Financial resources for enforcement of legislation

Recommendations

- 1 Set up a working group to specifically examine and recommend options for the implementation of the waste management sections of the Draft Sustainable Development Bill. Also look at how enforcement of the Litter Decree can be improved.

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 in 15 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 Publication titled “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 Fiji means that there are significant opportunities to utilise empty ships leaving Lautoka. Negotiation of appropriate shipping rates will also be critical to the viability of recycling in Lautoka and Nadi. 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 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. 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 Lautoka and Nadi to overseas destinations.
2. Gain government and business support for implementing recycling in Lautoka and Nadi.
3. Work with existing recycling companies to implement the recycling of materials that have been identified as feasible. Form a plan to assist existing recyclers to increase the quantity of materials recycled.

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 is carried out at the Hospital for hospital waste and at the wharves for quarantine waste. The most appropriate place for use of incineration are in Lautoka and Nadi.

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 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 Lautoka are:

- Sources of funding and financial constraints
- Short term and long term planning
- Access to suitable land for new landfill
- 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 Lautoka and Nadi.

Recommendations

1. A full review of landfill management in Lautoka and Nadi should be conducted by a working group and a programme and timeframe developed for the implementation of a new landfill and closure of the existing sites in Lautoka and Nadi.
2. Preparation of a daily landfill management plan for Lautoka.
3. A landfill management plan for the existing landfill in Lautoka and Nadi 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 Lautoka and Nadi 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 Lautoka or Nadi 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 13,500 tonnes per annum of organic matter available in Lautoka and Nadi 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 2,200 cubic metres per annum of compost as product available. (This figure is conservative). Assuming compost could sell at FJD\$55/cubic metre (NZD60/cubic metre), there is a potential return of FJD\$120,000 per annum (NZD\$130,000 per annum). Note: The value of the compost product in Fiji will have to be determined.

Home composting has already proven to be successful other Pacific Island countries. 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. Prepare plan to implement a home composting scheme.
2. Implement a demonstration composting scheme at the Botanical Gardens or at the landfill. Use market waste initially.
3. Increase public awareness on segregated green waste collection and use this waste for the demonstration composting scheme.

4.2 Opportunities and Obstacles

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

Table 4.2. Opportunities and Obstacles for Waste Minimisation in Lautoka and Nadi

Opportunities	Obstacles
Council is keen to set up composting scheme at Botanical Gardens	Lack of funds for waste management initiatives
If new landfill is designed a recycling centre could be incorporated	Lack of public awareness on waste management issues
Metal recycling is viable and successful – can be expanded	Lack of public ability to pay
SIDT is in a good position to educate community and promote community schemes	Lack of public “perception of waste”
Likely to be a market for compost	No financial incentive to segregate waste at source
Plastic manufacturer interested in using biodegradable plastics or recycling plastics	Small volume of recyclable material available
Private waste contractors (Williams and Gosling) are	Cost of shipping material to Australia, New Zealand or Asia for recycling
Industries such as Punjas are interested in waste minimisation	Many resort islands are not dealing with waste properly – there are not adequate systems in place
Brewery is intending to recycle broken glass	

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 “enchanted 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 Fiji. 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

There are several recycling businesses in Lautoka at present including Scrap Metals Fiji Ltd, IA traders and Waste Recyclers Ltd. The results of discussions with the existing recycling businesses are given in Appendix I. The following materials are being recycled successfully (generally to overseas markets):

- All non ferrous metals – typically 8.5 tonnes copper, 2.4 tonnes brass, 0.5 tonnes radiators, 9 tonnes aluminium, 2.2 tonnes aluminium cans per month from one recycler, about 10 tonnes per month from another, and a third recycler with a similar amount. Prices paid are in the order of \$1.3/kg copper, \$0.4/kg aluminium, \$0.2/kg stainless steel, \$0.6/kg brass, \$0.5/kg aluminium cans.
- Mixed paper
- Cardboard
- Beer and soft drink bottles
- Broken coloured glass
- Waste oil
- PET bottles
- Batteries

Much of the recycling is centred around a “hub” in Suva, with collection of materials in other centres such as Lautoka and transportation to Suva for grinding, compaction, bailing & shipping to Australia or other process centre.

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 Lautoka and Nadi and the current estimate of shipping costs.

Table 4.3 Potential Markets for Recyclable Materials

Material	Type	NZ\$/tonne (bailed and shipped to NZ)	Aus\$/tonne (bailed & sorted to Asia)	Est. Amount available in Lautoka (tonnes/year)	Shipping cost FJD per tonne
Glass	Colour sorted	80 - 85		535	115 - 150
Paper	Cardboard Newspaper Mixed	100 - 140 100 40	160 112	690 700 700	115 - 150
Plastic	PET HDPE LDPE	Low density = 50 - 100 High density = 350 - 440		220 80 600	115 - 150
Metal	Al cans Steel cans	1,500 25		630	115 - 150

Note:
Low density = loose to less than 500 kg/m³
High density = 500 kg/m³
Shipping cost to Australia

4.4.1 Glass Recycling

There is the potential for further glass recycling to be implemented at two levels - increase the volume of recycled bottles returned to the Brewery, and shipping of crushed glass to Australia, New Zealand or Asia for recycling. Carlton Brewery has indicated that they will implement a project to collect broken glass and transport it to Australia for recycling. They indicated that this would be a cost neutral exercise for them, and that it would be expensive to keep a container on site until it was full. It is recommended that the Council works with the Brewery to implement segregated glass collections for the public and this glass is combined with any glass waste that the Brewery generates, in order to maximise volume of glass recycled and minimise the container leasing costs.

4.4.2 Paper Recycling

Paper recycling is available in New Zealand, Australia and Asia. The waste paper is sorted and bailed in NZ or Australia and shipped to Indonesia, Malaysia and Australia for processing. At present paper is collected by one recycler and is shredded, transported to Suva, bailed and sent to Australia. 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 NZ\$10,000 - 15,000 and could process about 5-6 tonnes paper per eight hour day. These costs and shipping costs must be kept to a minimum in order for paper recycling to be feasible. A larger more sophisticated bailer should be considered for Lautoka and Nadi due to volumes available if a segregated paper collection system can be implemented successfully.

Initially it may be appropriate to use the existing paper recycling centre in Suva, and segregate and collect paper in Lautoka and Nadi for transportation to Suva for high density bailing and shipping to Australia or New Zealand.

4.4.3 Plastic Recycling

Plastics including PET, HDPE and LDPE are sent to Indonesia, Phillipines, Thailand, New Zealand and Australia for recycling. The process generally involves collection, sorting, grinding and packing before shipping and then 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.

Hanif Industries in Lautoka have been considering getting machines to recycle used HDPE and LDPE in polyethylene pipe. They have estimated that it would cost in the order of FJD\$500,000 to set up the recycling machines from Auckland. They have also been in contact with recyclers in New Zealand who have offered to take used plastic for reprocessing, but the shipping costs make it not economically viable. It is recommended that a working group including representatives from the plastics industries, Cococola Amatil, Councils, Government and overseas plastics recyclers be formed to identify the best option for plastic recycling in Lautoka and Nadi. This may either be recycling within Fiji, or shipping to an overseas recycler.

4.4.4 Metal Recycling

At present metal recycling is being carried out successfully by three different recycling businesses. There is the potential to increase the volume of metal being recycled. It is recommended that a small working group is set up, including a representative from each of the metal recycling businesses to identify what actions are needed and what support from government is needed to increase the amount of metal recycled. One recommendation from the recyclers is that the segregation of metal wastes at source would dramatically increase the amount that could be recycled. Large scrap steel items are not being recycled at present because there is no suitable machine for cutting and crushing whitewear, roofing iron and car bodies. Also the low market price of ferrous metal has meant that any ferrous metal collected is being stockpiled at present. Recyclers have asked for assistance in the transportation costs for getting the processing machinery to Lautoka and assistance with obtaining a site for the operations.

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 would be useful in Lautoka and Nadi. Composting will need to be carried out on a small scale initially to ascertain the best operating parameters for a municipal system. A demonstration composting project using market waste and any collected green waste either at the Botanical Gardens or at the landfill would be an ideal way to start municipal composting in Lautoka.

The Council currently encourages backyard composting and this needs to be expanded through education, media campaigns, community workers, and even subsidies for a particular composting unit. The use of an economic incentive to encourage backyard composting is recommended, such as a rebate in rates if green/biodegradable wastes are composted at home.

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/transportation costs
2. Container Leasing Companies need to be part of the negotiations
 - Is there a build up of containers in Lautoka/Nadi/Suva 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

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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 Lautoka and Nadi. 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

Criteria	Costs					Effectiveness							Overall	
	Capital Costs	O&M costs	Cost Total	Cost Ranking	Technical Requirements	Operational Requirements	Ease of Implementation	By-products	Political & Social acceptability	Environmental Impact	Effectiveness Total	Effectiveness Ranking	Grand Total	Overall Ranking
Waste Management Option														
Disposal to landfill	1	1	2	1	2	2	1	3	1	2	11	6	13	5
Incineration	3	3	6	5	3	3	3	3	3	3	18	7	24	8
Municipal Composting	2	1	3	3	3	2	2	1	1	1	10	5	13	5
Home Composting	1	1	2	1	1	1	3	1	2	1	9	4	11	3
Recycling within country	3	2	5	4	3	3	2	1	1	1	11	6	16	7
Recycling overseas	1	2	3	2	1	2	2	2	1	2	10	5	13	5
Reuse	1	1	2	1	1	2	2	1	3	1	10	5	12	4
Legislation to ban products	1	2	3	2	1	2	3	1	3	1	11	6	14	6
Legislation to tax packaging	1	2	3	2	1	2	3	1	3	1	11	6	14	6
Segregation at landfill	2	2	4	3	2	1	1	1	1	2	8	3	4	5
Segregation at source	1	1	2	1	1	1	3	1	2	1	9	4	11	3
Education programme	2	2	4	3	1	1	1	1	1	1	6	1	10	2
Media Campaign	2	3	5	4	2	1	1	1	1	1	7	2	12	4
Glass recycling to supplier	1	1	2	1	1	1	2	1	1	1	7	2	9	1
PET recycling by Cococola	1	1	2	1	2	1	2	1	1	2	9	4	11	3
Paper recycling	1	2	3	2	2	2	2	1	1	2	10	5	13	5
Metal recycling	1	2	3	2	2	2	1	1	1	1	8	3	11	3

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 / Glass recycling to supplier
- 3 Segregation at landfill / Metal recycling
- 4 Home composting / Segregation at source / PET recycling by Cococola Amatil
- 5 Municipal composting / Paper recycling / Recycling overseas / Reuse
- 6 Recycling within Fiji / Disposal to Landfill / Legislation to ban or tax products
- 7 Incineration

This ranking process gives the following overall priorities for waste management options in Lautoka and Nadi:

Overall Priority

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

Cost Priority

- 1 Disposal to landfill / Home composting / Segregation at source / Reuse Glass recycling to supplier / PET recycling by Coca Cola Amatil
- 2 Paper recycling / Metal recycling / Legislation to tax or ban products/ Recycling overseas
- 3 Municipal composting / Segregation at landfill / Education programme
- 4 Recycling within country / Media campaign
- 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)
Fiji - FJS	2 - 3	Free	Free	-	3.30 (\$2.5) - household 5.50 (\$4.30)- trade/ commer. 16.50 (\$12.85)- condemned 22.00 (\$17)- hazardous	30 (A\$23)
Solomon Islands - SBD	1 - 2	Free	2.50/ collection (A\$0.79)	5.00/ collection (A\$1.59)	Free	
Vanuatu - Vatu	3	6,000 (Aus\$72)	9,000 (Aus\$108)	60,000 - 360,000 (restaurants - hotels) (A\$722-4,337)	100 - car (\$1.2) 200 - Hilux (\$2.4) 300 -Lorry (\$3.6) 1,500 -Disclutcher (\$18)	2,500 - 3,500 (A\$30 - 42)
Tonga - Panga	1 - 2	6 (A\$5.77)	12 - 18 (Aus\$11-17)	24 (A\$23)	Free	-
Kiribati (AS)	1	(A\$17 - 29)	(Aus\$50 - 600)	-	Free	-
Tuvalu (AS)		(Aus\$30 10/load green waste)	(Aus\$100 - 400)	-	Free	15
W. Samoa	2 - 7	Free	Free	Free	Free	-
Papua New Guinea (AS)	1-7	120 - 420 (A\$60 - 208) (small) 395 - 1380 A4\$196 - 685) (240l)	240 - 1380 (A\$119 - 685)		2(2.5) -car/utility 7(3.5) -1.5Tonne 10(5) -K600 Truck 8(4) -industrial bin	
New Zealand (AS)	1	185 (A\$145) 6.5(A\$ 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 Lautoka and Nadi are average 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 Lautoka and Nadi is the ultimate aim. However the public "ability to pay" is a significant factor to be considered in Lautoka and Nadi. 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 medium term. Charges may remain as part of the general rates for each property. Full economic transparency for waste

collection and disposal is required before efficient and effective services can be provided.

It is also recommended that the garbage dumping fees for using the landfill be reviewed regularly so that prices can be increased over time towards a full cost recovery basis.

7. Integrated Solid Waste Management Plan

7.1 Objectives of the Plan

The objectives for the Integrated Solid Waste Management Plan for Lautoka and Nadi are:

1. To create a framework for solid waste management in Lautoka and Nadi that integrates all levels of solid waste management from 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 Lautoka and Nadi 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 Lautoka and Nadi 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 Lautoka and Nadi, 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 Fiji, 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.

7.2 Waste Minimisation

- Implement segregated municipal waste collection for all recyclables

-
- Increase the quantity of aluminium and other non-ferrous metals recycled through existing scheme by increased publicity and education.
 - Designate an area for green waste dumping at the current landfill. Notify the public of the change to segregated collection and dumping of green waste. Arrange for separate municipal collection of green waste. Obtain a shredder and mulch or compost any green waste or organic waste at the landfill or at demonstration scheme at the Botanical Gardens
 - Negotiate a subsidised or cheap option for shipping of waste materials to Australia, New Zealand etc. Consider using legislation or regulation to achieve this.
 - Implement a packaging legislation to create an incentive for return of packaging for recycling eg American Samoa has recently implemented legislation.
 - Implement a separate paper collection and buy a shredder and baler to ship waste overseas for recycling.
 - Government to investigate the possibility of setting up a waste management fund for the support of waste minimisation and recycling schemes in Fiji.
 - Local government /Government to review the implementation and support of a business to crush large thin gauge steel waste items such as car bodies and whiteware, for recycling.
 - Demonstration scheme for composting at the Botanical Gardens
 - Create a model of waste management at the Sheraton Denarau Resort - to be used for education and example to all other hotels and resorts.
 - Implement the requirement for “hotel waste management plans” to be submitted annually at the time of hotel license renewal.

7.3 Refuse Collection

- Implement a segregated municipal waste collection service in Lautoka and Nadi – for green waste, glass, metals, PET and paper.

7.4 Disposal of Refuse to the Landfill

- The site for a new landfill should be selected as soon as possible and a programme put in place for the development of the new site and the closure of the existing landfill site. It is recognised that this will be difficult due to the availability of a suitable site within the vicinity of the city.
- A management plan for the operation of the current landfill site should be prepared to ensure that the dump is operated in a safe manner that minimises adverse effects on the public and the environment. The plan will cover aspects such as monitoring of vehicles, monitoring of waste on a regular basis, plan for areas for filling, monitoring of lagoon water quality, methods for daily cover of waste, pesticide control and segregated dumping for green wastes and organic wastes.
- Nadi to implement a management plan for the Nadi Green Waste landfill and to phase out the dumping of domestic waste and hard waste at this site.

7.5 Special Wastes

- Publicise and implement waste oil collection system for burning in a suitable industrial boiler or for pick up by Fletchers. Implement an oil collection depot at the landfill or at one of the oil company premises.
- Publicise and implement waste pesticide container collection. Investigate options for disposal.
- Investigate the availability and suitability of collection of waste batteries for proper disposal.
- Strengthen and monitor the segregation and disposal of Hospital wastes with the aim of having a written waste management system for the hospital and all staff trained in the requirements of the system.

7.6 Community Involvement

- Education programme to raise public awareness of solid waste management principles and waste minimisation concepts. Concentrate on primary and secondary schools, businesses, church groups and women's groups in the community.

-
- Investigate curriculum changes to incorporate waste minimisation education into schools.
 - Publicity on new recycling schemes and segregated collection systems eg. Posters, pamphlets, radio interviews, television
 - School collection scheme for recyclables
 - Implement an education programme for tourism and hotel/resort operators in waste management and minimisation, through the Hotels Association and the Tourism Association.

7.7 Organisation of Solid Waste Management

- Appoint a Solid Waste Management Officer or identify one of the existing Environmental Health Officers to organise solid waste management and waste minimisation in Lautoka and Nadi and to liaise between the Department of Health, Department of Environment, waste management contractors, local business and the public as well as international organisations that can assist in solid waste management in Fiji.
- Review the management of waste in the rural areas and the interaction of rural areas with urban areas in waste management and disposal. Act on recommendations of review with the aim of improving waste management in rural areas.
- Identify responsibilities, funding and staff for the improved enforcement of littering and illegal dumping of wastes and general implementation of the Litter Act

7.8 Implementing the Plan

- Hold a workshop with government ministers, NGOs, business and community leaders, DoH and, Department of Environment, waste management contractors & community leaders. Discuss, revise and agree on the components of the Plan. Prioritise actions, responsibilities & timeframe for the Plan. Set measurable targets for waste minimisation.
- Form a Solid Waste Committee with representation of all waste managers, government and community, to set and monitor on-going waste minimisation objectives.
- Obtain Government or overseas agency funding to implement a demonstration scheme for PET recycling and paper recycling (recycling to Australia). Monitor the costs and success of the

project for future privatisation of the schemes. Obtained business and community support and involvement eg. school collections of PET bottles with Coca-Cola providing refunds, or prizes for best collections.

- Review local, national and international funding of on-going waste management and waste minimisation projects (both in urban and rural areas), to identify new and increased levels of funding.
- Report on the effects on waste management of the future tourism developments in the Western region of Fiji. Examine the options for future waste management.
- Government to consider funding for composting programmes in rural areas.

Appendix A - Terms of Reference

Appendix B - Study Methodology

Appendix C - Curricula Vitae

Appendix D - List of Contacts

Fiji : List of Contacts

Name	Organisation/Company	Position	Phone/Fax
Prem Sundar	Lautoka City Council	Senior Health Inspector	660 433 663 288
Phylis Joureguy and Melike Tupou	Votua Village Co-Op Project (near Korolevu)		530 037
Premila Kumar	Dept of Environment, c/- Ministry of Local Govt Housing & Environment, Suva		
Vandana Naidu	Dept of Environment	Waste Management Officer and Pollution Control	
Ravendra Prakash	Nadi Town Council	Health Inspector	700 133 -18 (ph) 701 202 (fax)
Gyneshwar Rao	Lautoka City Council		660 433
Joep N Sadranu	Health Office, Box 45, Lautoka Old Hospital	Divisional Health Inspector (Western)	663 770, 661 143, 660 441 663 399
Pusp Raj	Lautoka City Council	Town Clerk	660 433
Isoa Nasedra	Lautoka City Council	District Officer	660 158
Peter Drysdale	Williams & Gosling Ltd	Director Western Division	660 644 (ph) 664 355 (direct) 665 844 (fax)
Davendra Nath		Health Inspector, Nadi Rural	
Rajendra Pratap	Lautoka City Council	Director of Health	
Remesio Rogovalali		Divisional Education Officer (Western)	664 033 (ph)
Kevin B Mutton	Sheraton Denarau Resort	Director of Human Resources	758 777 (ph) 750 246 (fax)
Steve Fowler	The Fiji Sugar Corporation Ltd	Chief Engineer, Lautoka Mill	660 800 ext 226 664 778 (fax)
Raymond E Wade	The Fiji Sugar Corporation Ltd	Assistant to General Manager, Lautoka Mill	660 800 (ph) 664 747 (fax)
Abele Daurewa	The Fiji Sugar Corporation Ltd	General Manager, Lautoka Mill	660 800 (ph) 664 747 (fax)

Name	Organisation/Company	Position	Phone/Fax
Henry Seeto	Lees Industries Ltd	Technical Manager	660 000 (ph) 660 906 (fax)
Tai Natawake	Scrap Metals Ltd, Lautoka	Managing Director	668 622 (P/Fax)
Stephen Exinger	Carlton Brewery (Fiji) Ltd Sth Pacific Distilleries Ltd	Production Manager	661 122 (ph) 663 780 (fax) 662 088 (ph) 664 361 (fax)
Vasu D Maharaj	Lautoka Education Office	Senior Education Officer Secondary Western	668 254 (ph) 664 033 (ph) 663 847 (fax)
M. Rafique	M Hanif Industries Ltd	Director	662 562 / 663 755 (ph) 661 858 (fax)
Rakesh K Sharma	Punja & Sons Ltd	Group Manufacturing Manager	661 633 (ph) 663 039 (fax)
Rishi Kant	Punja & Sons Ltd	Health & Safety Manager	661 633 (ph) 663 039 (fax)

Appendix E - References

References

1. Ministry of Foreign Affairs and Trade, NZ. Trade and Economic Prospects in the Pacific Islands. 1997.
2. SPREP, UNEP. Guidelines for Municipal Solid Waste Management Planning in Small Island Developing States in the Pacific Region. June 1999. ISBN 982-04-0200-X.
3. Suresh, Raj. Suva, Lautoka, Labasa Duty Travel Report – Lome IV Pacific Regional Waste Awareness and Education Programme. Project No 7 ACP RPR 584 (Reg/7714/000). October 1998
4. Government of Fiji, Public Health Act.
5. Sinclair Knight Merz. Naboro Landfill EIS and Engineering Studies, Ministry of Local Government, Housing and Environment. September 1997.

Appendix F - Notes of Initial Project Meeting and Final Workshop

Solid Waste Characterisation Study and Management Plan for Pacific ACP States

Project under the Seventh European Development Fund (Lome IV)

Contracting Authority: Forum Secretariat (RAO)

Executing Agency: SPREP

Consultant: Sinclair Knight Merz

Meeting Notes 23 August 1999 at Lautoka City Council Office

Present:

Suresh Raj	SPREP
Premila Kumar	Department of Environment
Vandana Naidu	Department of Environment
Ravendra Prakash	Nadi Town Council
Prem Sundar	Lautoka City Council
Gyneshwar Rao	Lautoka City Council
Jope N. Sadranu	Div. Health Inspector
Pisep Raj	Lautoka City Council
Isoa Nasedra	Lautoka City Council
Phylis Jaureguy	Votua Village Cooperative Project
Sefanaia Nawandra	Sinclair Knight Merz
Juliet Woodward	Sinclair Knight Merz
Andrew Reeve	Sinclair Knight Merz

1. Sefanaia Nawadra welcomed the attendees to the meeting and thanked the town Clerk for making the office available. He then outlined the objectives of the project, study methods and support that is requested from the Councils. Copies of the overheads outlining the project are available. Whilst the study has a broad scope, emphasis will be placed on waste characterisation. Cooperation from the Councils was requested, so that meaningful results can be obtained and the opportunity taken to train staff for future audits.
2. Juliet Woodward outlined the methods that will be used for the waste audits. Surveys will be undertaken at the landfill, audits of industry types and interviews with key personnel. It is

important to test the waste protocols and adapt to suit each area.

3. The study will analyse existing waste collection and disposal practices, legislation and minimisation measures. It was advised that the scope of this project covered urban areas only. However a meeting with the rural authority will be undertaken.
4. Part of the study is addressing education and community awareness programs. However with a limited time for the study it was agreed that an outline only will be provided. More value will be gained from data collection and finding out what recycling initiatives are possible.
5. The Department of Environment requested that the study team meet with private recyclers to find out their needs and what government could do to help support and expand the business.
6. The Department of Environment would like to see the following included in the waste audits if possible:
 - Hospital Fiji Sugar Lautoka Mill
 - Food Industry
 - Punjas oil and soap
 - Plastics Manufacturing
7. The arrangements needed to carry out the study were discussed. Juliet Woodward will return on 8 September and complete the work on 20 September. Juliet will issue a draft programme for the work, the input needed from the Council and a letter for industry introducing the study and a list of questions.
8. Jope Sadranu would like, if possible, to provide an assistant during the study.
9. Arrangements were made to visit Nadi Town Council and interview Ravendra Prakash at 09.00 24 August.

Appendix G - Excel Spreadsheet of Waste Classification Data

Appendix H - Excel Spreadsheet of Vehicle Survey Data

Appendix I - Notes of Meeting with Industry

Nadi Town Council

9.00 am, 24 August 1999

Present: Ravendra Prakash - Health Inspector
Andrew Reeve
Juliet Woodward

Action

- 1 Lautoka City Council dump used.
- 2 Small - green waste disposal - 3 acres, leased outside town boundary (\$200-300/yr).
 - Tree trimming / grass
 - Low lying, supposed to be recreation area
 - Previously a Council dump (trenching burying) 20 years ago
- 3 Wailoloa Dump: Free collection of green waste every two months. Cost to Council ~ \$5,000 every two months.
- 4 Large whiteware/tyres sometimes included and they are buried. Metals collected, buried.
- 5 100 x 7T truck loads / two months (4.5 m³) (hired).
 - Not compressed
 - 2,400 households plus 100 industrial and 250 commercial (~13,000 people).
- 6 Council waste - 2 7T (9 m³) / week.
- 7 Owned trucks for regular collection 1 x 7 ton, 1 x 2 tonne trucks.
- 8 Cartons from commercial
- 9 Regular residential collection (Adams Transport → LCC Dump).
- 10 Rates - no separate waste rates.
 - Used to be: \$18 resident/bin/year, plus %28 commercial/bin/year.
- 11 Bins
 - Metal bins/tight fitting lid, not exceeding 3 m³ capacity
 - Garbage bags not allowed legally (but still used).
- 12 Litter Prevention Officers - 3 plus 1 full-time.

13 \$40 fine for littering. Litter reminder notice used.

14 Provision in Litter Decree requires warnings to be given.

15 Collection Procedure

- Residential – 3 days / week → LCC Dump
- 2 Wards main town – M/W/F
- 1 other Ward [Namaka] – Tu/Th/Sat
- Commercial/Hotels (all) – 6 days/week, Monday to Saturday to LCC
- Hospital – 6 days/week
- Market – 6 days/week – 2 x day to Lautoka CC
- Industrial – 3 days/week – combined with residential.

16 Compactor truck or covered truck used.

17 Green collection – Council asks for separation at collection but this does not happen.

18 Rates based on capital value of land.

19 There could be scope for charging for waste.

20 Bottles/Brewery Coca Cola → returned to service station 20 c / bottle

21 Beer bottle dealers – licensed dealers – approx. 3 in Nadi.

22 Household collection:

- 60 c / dozen bottles – in cardboard boxes
- 60 c / 24 stubbies – in cardboard boxes.

23 PET bottles collection points – 1 at bus station – Coca Cola empty it everyday.

24 Illegal dumping is a problem – from rural areas because they do not have a collection system.

25 Competition – ‘Tidy Towns’ competed against Laubasa/Ba/Sigatoka. Organised by Keep Fiji Beautiful Association – based in Suva; also Department of Environment.

26 Main Street project / Market project / Roundabout project – community based using school children.

- Coke are sponsors – children to collect PET bottles → sports equipment / coke for prizes
- Bins in schools – VERY SUCCESSFUL for coke bottles.

27Yogesh Ratilal contact for @ Coca Cola @ Suva.

28No A1 can collection in Nadi.

29Hospital waste – clinical waste to incinerator in Lautoka Hospital

30Contractor tenders every three years – includes collection/cartage/disposal

31[Confidential - \$333,000/3 years - \$110,000 / year]

32(\$16.50) per load to dump paid by Contractor (special rate)

33Diwali Festival Collection (special) – cultural timing, believe in special cleanup.

34Biggest problem is litter and outside rubbish coming to town

- Would like a dump here
- No suitable site available
- \$70,000 put aside annually to buy land (10 acres = \$70,000)
- Rural Local Authority should do collection.

35Education:

- Circulars – Nadi Town Council
- Floats / Advertising – Nadi Town Council
- Megaphone.

36Environment Week: (National by Department of Environment)

- Lectures and poster competition
- Oratories to school children and public.

37Village Headman/Chief – gives message to village people. Council have meetings with Chiefs.

38Village was dumping by river but it is now cleaned up after Chief intervened.

39Fiji Hotel Association – eg. Sheraton cleans up town 1/year, litter collection, Council provides trucks and dumping at Green Dump, eg Mocambo Hotel also (airport → Natalai).

40Rotary/Jaycees/Apex/Lions: sometimes do beach clean ups.

41Demolition waste – used by locals.

42\$39 / easy bin pick up 1 m³ / 2 m³ (Williams and Gosling).

43Peter Drysdale: Keep Fiji Beautiful Association does street cleanups.

44Dye from Garment Manufacturers – sludge to dump.

45Fiji Bandag do retreads of tyres

462 Car wreckers in Nadi

47Dumping of Island Hotel waste at Wailoaloa Dump.

48McDonald's do clean ups – 1 / week.

492 staff – street sweeping by Nadi District Council.

50Some villages hired an easy-bin for waste

- 6 Supermarkets in Nadi – 1 with own collection and dumping

5125 Hotels in Nadi

52100 food outlets in Nadi.

Meeting at: Punja and Sons Ltd
Lautoka, Fiji
Date: 9/9/99
Attending: Juliet Woodward
Rakesh Sharma - Group Manufacturing Manager
Rishi Kant - Health and Safety and Quality

Assurance

- 1 There are 11 factories and a warehouse in total, production mainly for the Fiji market although some export to other islands.
- 2 The company uses Williams and Goslings easy bins and has their own truck to take waste to the dump. About 19 truck loads per week.
 - Polybags + Ocean Soaps 4 trucks/week
 - Universal Printing + Spice + Warehouse + Rice Factory 7 trucks/week
 - Punjas Supermarket + Tea Factory 3 trucks/week
 - Edible Oil + Ghee Centre 3 trucks/week
 - Company residence 1 truck/week
 - Ganga Ltd (sweets) 1 truck/week
- 3 Ocean Soaps produces soaps, detergents, coconut oil, bleach, air deodorisers, window cleaner, candles. The liquid effluent is discharged to the sea. The majority of waste cartons are burnt in the boiler. Floor sweepings (about 15%), damaged packaging, paper, plastic, paper from the stickers (about 85%) go to the easy bin to the dump.
- 4 Polybags Factory produces plastic bags. Plastic waste is shredded and reused. The raw HDPE and LDPE is delivered in bags, some of which area wasted but not many. Don't use cartons any more.
- 5 The Rice Mill carries out rice processing, polishing, washing, packing of rice. The rice mill has small amounts of paper bags and plastic bags that are torn wasted (to dump).
- 6 The Spice Factory makes spices and lentil flour through raw material processing and packaging. Wrappers, floor sweepings, sticker papers are dumped. Sacks are reused.
- 7 The Universal Printing Press prints commercial labels, boxes, magazines etc. There is waste paper, trimmings, side cuttings and damaged goods to dump.
- 8 The Tea Factory carries out blending and packing of Ceylon tea. Floor sweepings, cartons and boxes are dumped. Wooden crates are reused.
- 9 The Edible Oil Refinery makes cooking oil through bleaching, deodorising, neutralising and packaging. The spent clay is taken to the dump, also some wrappers, plastic, paper waste.

-
- 10 Combined Manufacturing makes cartons. The trimmings are automatically shredded, pressed baled and shipped to Australia for recycling. They get about \$70 per tonne for carton waste.
 - 11 The Plastics Factory makes PET, STP, PVC and HDPE bottles, jars and caps. Plastic is reprocessed, shredded paper goes to the boiler. Small amounts of general waste to dump.
 - 12 The Liquor Department carries out blending and bottling of liquors, using glass bottles and cartons. There are minimal broken bottles. Bottles are from Australia. The spirits bottles are not allowed to be reused. The wine bottles are reused
 - 13 The Ghee Centre carries out repackaging of ghee and oil making. Reuse 44 gallon drums. Burn wooden crates in boiler.
 - 14 There is also a warehouse used for storage of goods. Floor sweepings to dump. Minimal damaged product.
 - 15 There are 4 boilers – 2 wood and 2 diesel oil fired. The wood boilers also burn paper and cardboard waste.
 - 16 They use Scrap Metals Ltd for waste metal, batteries etc. They store old equipment in the yard for resale.
 - 17 There is trimmings, grass leaves from the gardens – to dump.
 - 18 They are very concerned about plastic wastes in the City.
 - 19 They collected waste of the surrounding roads every week and also clean the Saweni Beach once per month, do the main road to Sigatoka once per month.
 - 20 There is no PET recycling in Lautoka at present.
 - 21 They supply drums for Council collections around town. There is a Punja's Park kept clean.
 - 22 One staff member was sent on a paper-making course in Suva run by the UNDP – they will consider following up on this expertise. Could possibly recycle waste paper.

Meeting at: Williams and Gosling Ltd
Lautoka, Fiji
Date: 9/9/99, 3 pm
Attending: Juliet Woodward
Peter Drysdale – Director Western Division

- 1 Have 190 mini skips on hire for waste collection.
- 2 Have 4 x 3-5 tonne miniskip trucks. Each bin is 3.7m³ (average load 2.6 m³).
- 3 Peter has done a feasibility report 9 months ago for the installation of a transfer station at Nadi using a 60 m³ container. Has not got approval yet. He feels he is not able to progress private sector waste management as he is not able to get a decision on his transfer station.
- 4 Denerau Resort is the biggest producer of waste for Williams and Gosling. The generally haul 30% from Nadi and villages, 30% from Lautoka and villages and 40% from Denarau.
- 5 Peter believes the old Navukai Tip is still being used illegally. This puts his business at an unfair disadvantage when companies are dumping for free.
- 6 Peter is very disillusioned with the waste management scene and is reviewing whether to still be involved. HE has had long term difficulties with the central, local and rural governments.
- 7 W&G charge approximately \$30/skip – this includes delivery and pick up of the skip and tipping fees.
- 8 The clients cover rural villages, restaurants, commercial properties, industries, cruise boats, events, and festivals.
- 9 Many of the resort islands are not dealing with their waste properly. Island waste is a major problem. Mana Island has asked for a proposal to remove and dispose of their waste. W&G proposed a horizontal bag compactor on the island, delivery to a skip on the wharf and disposal to the dump.
- 10 Thinks that the biggest problems are the landfill and illegal dumping. Believes that enforcement is crucial.
- 11 Spoke of illegal dumping by industries of oil down drains.
- 12 The western area of Fiji is very important for tourism.
- 13 Believes that a new landfill site should be identified and developed with appropriate technology. Thinks that the structure of waste management in the country should be looked at.
- 14 Peter is the President of the Keep Fiji Beautiful Association. They organise a clean up of the highway from Cost-U-Less Junction to Sabeto, costs about \$200 a time, and is done every two weeks, but they need to find someone to pay for this. Have just secured the Society of Fiji Travel Agents to pay for one year. Every time they pick up 200 x 35 gallon bags.

Meeting at: Carlton Brewery (Fiji) Ltd and South Pacific
Distilleries Lautoka, Fiji
Date: 13/9/99
Attending: Juliet Woodward
Stephen Exinger Production Manager

- 1 The brewery brews beer, for the Fijian market – about 5.5 million litres per year.
- 2 They have 35 full time staff and 15 additional when bottling.
- 3 The raw materials are malt from Australia, local sugar, yeast from Australia, liquid hops.
- 4 Packaging is: bottles from ACI NZ (reused 6-10 times), cartons from Golds Manufacturing in Suva, Crown Seals from Australia and labels from Quality Prints in Suva.
- 5 Wastes:
 - Spent grain, 712 t/year -Pig food (\$10,000/year)
 - Cartons (20 per week) -Landfill
 - Damaged pallets - Reused, or firewood
 - Plastic crates -Reused, when damaged to landfill, will be sent to Aus for recycling
 - Old equipment -Stored
 - Broken bottles -Landfill
 - Clothing -Used for rags
 - Label pulp -Landfill
 - Office waste -Landfill
 - Workshop waste -Landfill
 - Green waste -burnt
 - Canteen waste -Landfill
- 6 Have negotiated with Australia to take broken coloured glass to Waste Recyclers Fiji Ltd in Suva for recycling in Australia. Contacts are: Sunil Singh in Lami Ph 36055, Peter Bray in Australia. This will cost the company to have the container sitting here waiting to be filled.
- 7 Have to Fosters Health, Safety and Environment Policy in place.
- 8 Use 2x Williams and gosling bins for mixed waste. Pay about \$80,000 per year. About 5 bins per week. Waste is collected in 44 gallon drums around factory.
- 9 Old/damaged seals go to landfill (mild steel)
- 10 Plastic crates are collected and taken once per year to landfill
- 11 Malt bags and sugar bags (50kg) are reused by staff
- 12 All raw material containers are reused.
- 13 Paper diatomaceous earth bags go to landfill
- 14 Every week they carry out a loss evaluation, of breakages and wastages. Graphs are given every week to each department. There is a bonus scheme for workers, one of the KPIs is on wastage.
- 15 Purchasing is through the Suva branch

16 No silo for bulk storage of malt (this would save on packaging) because capital cost too much.

17 No segregation of waste at present although are keen.

1 Distillery makes molasses based spirits - 1.7 million litres/year. 66 staff.

2 Molasses is a FSC sugar byproduct

3 Make about 5.8m³ waste/month to landfill using Williams and Gosling, Cost \$1700/year. Major components are: Bottles, plastic wrapping for pallets, cartons, caps, general rubbish.

4 Some Glass bottles are reused in the market. Otherwise to landfill

5 Distillery bottles are clear, are not reused. There is no collection of these bottles

6 Distillery has a wood fired boiler - will change to oil soon

7 The bottling line is not automated - hand filling, hand labelling and hand packing

8 The wrapping for bottles is cartons, shrink wrap and fibreboard dividers. Carton and fibreboard go to boiler.

9 Not a lot of solid waste is generated. Liquid waste to municipal STP

10 Meths is sold in 20 and 25 litre metal drums which go to landfill

11 About 917570 bottles were used to 98/99 year (1125ml - 150 ml). 7865 PET bottles produced for Air Pacific.

Meeting at: Lees Trading Co
Lautoka, Fiji
Date: 10/9/99
Attending: Juliet Woodward
Henry Seeto – Technical Manager

- 1 They have an Icecream Plant, a Plastic Film Plant, and a Plastic Pipes Plant.
- 2 There is a total staff of 70. The plant has been in operation for 17 years.
- 3 Most is for local markets, a small percentage of pipes and icecream is exported to other Pacific Islands.
- 4 The plastic pipes plant has 1 W&G easy bin for waste – 6-7 pickups per month.
- 5 95% of reject pipes is recycled by grinding and reprocessing. Pipes are made of PVC and polyethylene.
- 6 5% of what is dumped is burnt pipe.
- 7 The raw resin comes in 25kg bags – about 50% are reused and 50% are dumped.
- 8 Office paper waste is shredded and dumped.
- 9 Off-cuts of mild steel from the workshop are dumped.
- 10 Wood waste is sold as firewood.
- 11 The head office is in Suva and they have a biscuit factory, 20litre drums factory and a bakery.
- 12 The Plastic Film factory uses cellulose, LDPE, HDPE and polyethylene. They do customised printed for in house use and external sales.
- 13 Wastes are : reject film that is printed is dumped, pallets are sold, general waste.
- 14 Approximately 5 bins per month are used.
- 15 The Icecream Factory : cartons that are damaged are dumped, also old plastic bags, office waste, raw material containers and pallets are sold for reuse, 3 x half size easy bins are used per month.
- 16 The Bakery produces bread, cakes and buns. There is very little packaging waste, egg shells are dumped, damaged cartons are dumped, waste bread is made into breadcrumbs, pig and chicken farmers buy the waste product. 3 large bins are used per month (shared with the Aluminium factory).
- 17 Old/used pipe could not be recycled – too labour intensive and would require cleaning. Off cuts are recycled and this still makes a little money. About 10% of total production is rejected, and recycled.
- 18 The factory is about 2400m² in size.
- 19 Waste oil is recycled – in 4 drum batches (about 4 drums per 6 months). It is picked up for free, any type of oil is recycled.
- 20 Tyres are retreaded once then sold
- 21 Old batteries go to Scap Metals for 50 cents per battery

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- 22 Resin is imported from Japan, SE Asia, USA and Europe – all is packaged as they do not have a silo for bulk storage.
 - 23 Waste flour from the Bakery goes to pig food
 - 24 Plastic film with damaged edges is dumped.
 - 25 Plastic shavings are dumped because the regrinding machines cannot process them, about 25 x 9kg bags per day.

Meeting at: Scrap Metals Fiji Ltd
Lautoka, Fiji
Date: 10/9/99
Attending: Juliet Woodward
Tai Natawake – Managing Director

- 1 Business is to purchase scrap non-ferrous and ferrous metals, and to process for export to Australia, NZ, Jakarta, Singapore or elsewhere. Process is collection, separation, compaction, melting, bagging and export in containers.
- 2 The business turns over about \$550,000 per year.
- 3 They landfill small amounts of waste cardboard, plastic and paper.
- 4 The price of steel is too low at the moment (since Sept 98) and it cannot be exported viably. They were previously doing 2 x 20T container of steel per month, now it is stockpiling. At the moment they are only paying \$50/T but need about \$120/T to make it viable.
- 5 The shipping rate is approximately \$1776/container to Australia + \$200 for Documentation and local transport + \$300 for local transport in Australia.
- 6 Typical figures in a good month:
 - 8.5 T copper
 - 2.4T brass
 - 0.5T radiators
 - 9T aluminium
 - T aluminium cans
- 7 They go out with a scale and pay cash by the kilo of metal – to people at the dump, to industries and to households
- 8 Metals retrievable from the landfill are about \$300/week in Lautoka and \$100/week in Suva
- 9 There are branches in Suva, Labassa, Lautoka, Ba and Sigatoka.
- 10 Other traders are: IA Traders and Waste Recyclers.
- 11 Would like to bring in a machine to cut up and compress car bodies, roofing iron and whitewear and light gauge steel which would allow export if the material. There are no machines in Fiji at present. Need help/subsidies with the land for an operation, also transportation costs of the machinery, from Councils or Government. Have identified a suitable site near to the wharf for proposed operations. Maybe a sustainable management fund could be set up.
- 12 Believes that separation of the waste at the household is the key.
- 13 Will get records of quantities of metals recovered from the dump.
- 14 A lot of resorts are not cooperative for separation of waste materials, burying of waste is still happening.
- 15 Only 3 resorts are directly selling Al cans – Tokoriki, Matamanoa and Beachcomber.

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- 16Near Wailolo there must be illegal dumping because there are cans recovered from this area.
- 17Believes that education and awareness are very important, there must also be enforcement and penalties for dumping.
- 18Often there is supermarket waste dumped by the road.
- 19Need more expertise and funding in the Councils
- 20There is PET recycling in NZ but they only pay \$100 – 200/tonne which is not viable. Would have to send it to Japan. Waste Recyclers are doing PET for Coca cola.
- 21Could do the waste from Kiribati, Tonga and Western Samoa if they could get it to Lautoka cheaply. Often sailors on the ships from Kiribati bring copper and brass to Fiji privately.

Meeting at: Education Department
Lautoka, Fiji
Date: 14/9/99
Attending: Juliet Woodward
Vasu Maharaj – Senior Acting Officer Secondary
Western

1. Could ask schools to observe a Waste Management Day – programme activities, involve community, poster competition, exhibition.
2. At present have an Environment Celebration. Also looking at continuous education, posters, keep schools clean, assemblies
3. Community workshops could be held by the Health Department – could use Education Officers for help.
4. Could have a primary school essay competition or oratory competition with prizes from industry. Could be administered through Education Department
5. For changes in curriculum need to use the Curriculum Development Board in Suva, and the Education Forum looks at grass roots recommendations
6. Need to approach the Department Secretary of Education : Mrs Emi Rambukawaqa, Marela House, Suva, ph 314477.
7. There is currently a cleanliness programme in schools.
8. The Social Science or the Health Science programme could incorporate waste management topics. Should be included as a unit in social sciences and a core subject in secondary school
9. USP does environmental science – could use them to propagate ideas.
10. Fiji Day is a new celebration – could incorporate waste management in here.
11. Ask District Commissioner for help – Mr Shiri Chand – this is an important link to parliament.

Meeting at: Fiji Sugar Corporation
Lautoka, Fiji
Date: 15/9/99
Attending: Juliet Woodward
Abele Daurewa – General Manager Lautoka
Raymond Wade – Assistant to General Manager
Steve Fowler – Chief Engineer
Human Resources Manager

1. There are mills at Lautoka, Labasa, Ba, Rakiraki (Penang Mill). Bulk production of raw sugar, exported to UK, USA, Korea, Japan, Canada and Malaysia. Process 1.5 million tonnes cane/year (max), average of 1.3 million t/year
2. 1,300 employees in lautoka
3. Bagasse is the main waste and this is used as fuel in the boilers – 2 dual fired wood boilers.
4. Process is crushing, extraction, bagasse to silo, sugar to ship. Excess bagasse is stored at back of property, but for last 2 years have not had any excess. Also use bark for a supplementary fuel
5. Ashes from boiler to dump – 200 tonnes/week.
6. Old equipment is stored in yard.
7. Wastes are taken to dump by lorry - 6 lorry loads per week, about 7 tonnes or 25-30m³. Comprises of rags, scrap steel, paper, wire rope, cane, electrode tips
8. Waste oil is burnt in boilers
9. 100 homes – domestic waste – LCC collection 2 times per week
10. Mill mud (residue from clarification – bagasse fines, insoluble from sugar juice, polyelectrolyte) is used by farmers for manure/fertilisers or goes to dump – 200 tonnes/week. Farmers pay cartage only.
11. Reject sugar is reprocessed
12. Make molasses – sold overseas or to distillery
13. Polybags are used at other mills for local supply.
14. FSC believes environmental responsibility is taken seriously, are being guided by corporate Occupational H&S & Env Mgr. Will be looking at requirements of Env Sustainability Legislation. Working towards compliance.
15. Salt water used in condensers – 2,500 litres/sec.
16. Worried about proliferation of plastic bags. PET bottles also a problem
17. Waste oil from ships is taken and burnt in boiler
18. Believes education is important to stopping littering and illegal dumping.

Meeting at: Waste Recyclers Ltd
Lautoka, Fiji
Date: 15/9/99
Attending: Juliet Woodward
Raj

- 1 Offices in Lautoka and Lami
- 2 Recycling of non-ferrous metals and paper and batteries – sent to Sims Metals in Australia
- 3 Pay people at dump to collect:

Copper	\$1.3/kg
Aluminium	\$0.4/kg
Stainless steel	\$0.2/kg
Brass	\$0.6/kg
A/Cs	\$0.5/kg
- 4 Also collect from garages, homes and factories.
- 5 Cans are compressed at Suva
- 6 Main office is at Suva – Sunil Singh ph 361055
- 7 Batteries are sent to Suva, 2-3 tonnes/month
- 8 Takes 2 months to fill a container (about 20 tonnes)
- 9 Shredded paper is bagged and sent to Suva, pressed, baled and sent to Australia
- 10 There are about 3 scrap metallers in Lautoka (including IA Traders).

Meeting at: Department of Health
Lautoka, Fiji
Date: 16/9/99
Attending: Juliet Woodward
Jope Sawadrano – Divisional Health Inspector
Rural(Western)
Peceli Vosanibola – Health Officer

- 1 In 1980s they had a collection in the rural areas but they have changed city boundaries so it is a city council collection. Now they only are responsible for enforcement of littering and illegal dumping.
- 2 The Litter Decree allows a spot fine of \$400 up to \$2000 if taken to court. The Public Health act covers things like disease vectors. A loop hole in the Litter Decree has been amended so that they could not prosecute.
- 3 There is a lot of illegal dumping due to no enforcement and negligence. There is no dump area for rural and there is a reluctance to pay for dump.
- 4 Department of Health advise the villages how to dispose of waste properly – using a campaign, press and house to house inspections and advice, + NGOs
- 5 The collection charge is \$24/year in rural areas
- 6 Education is most important – at present this is incorporated into the daily house to house inspections. Could have a course in Environment and Waste Management in High School; primary school is important too.
- 7 At present enforcement is a long process as it is difficult to prove in court; but people are scared of the law.
- 8 Need more funds and more staff – about 5 more.
- 9 At present government gives \$300 – 500 per year in total!!!! This is all the funds they have for waste management!!!!
- 10 The responsibilities of the health inspectorate are:
 - Building development
 - Environmental Protection – including solid waste
 - Safety Food Control
 - Quarantine
 - Vector Control
 - Water Supply
 - Health Promotion/Education
- 11 Rakiraki, Suva and Navua carry out garbage collection
- 12 Will need a new dump in the near future. This will be the responsibility of the Town and Country Planning, Department of Environment, Native Land Trust Board, Government Lands Department, Ministry of Health and Local Governments. – Combined responsibility to identify new landfill site. Have tried

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- in Nadi and 13 sites have been found but there have been objections from committee members about all sites.
- 13Thinks that it is government responsibility to pay for a new landfill site
 - 14At present are doing a “Healthy Island” concept – primary healthcare activities are combined
 - 15The health ministry has identified that the Health Inspectorate should be empowered/reinforced/strengthened, because they are the policing arm of the Government/Ministry of Health as far as waste management is concerned.
 - 16They are responsible for all of the island resorts
 - 17They educate/advise and do license renewal (in Oct/Nov) annually.
 - 18Thinks that the idea of a waste management plan to be submitted by all resorts at time of license renewal is a good idea – would like help with developing a form they could fill in.
 - 19Could be useful to contact the Assistant Minister for Health – Dr Gounder.

Meeting at: Hanif Industries Ltd
Lautoka, Fiji
Date: 16/9/99
Attending: Juliet Woodward
Mr Rafique - Director

- 1 Makes plastic bags and a small amount of assembly of office furniture. It is a medium sized business, based only in Lautoka with 12 staff.
- 2 The process is blow moulding, extrusion, blowing films. The resin is from Korea, Thailand or USA and comes in bags. Use LDPE and HDPE.
- 3 In the morning at start up there is waste from the machines. There are 7 machines, only running 5 at present.
- 4 Small bags use 300 – 500 kg/resin/day
- 5 There is 8-10 kg resin waste/week. This goes out with all other waste (office) for collection 2 times per week. It cannot be reprocessed because they do not have a machine to cut up the large lumps of waste plastic into small sizes for reprocessing.
- 6 Pay Lautoka City Council \$263/year
- 7 They regrind coloured LDPE and HDPE into a confetti mix and sell for \$2 per 0.5kg bag.
- 8 Waste LDPE bags are reprocessed and added at up to 3-8% into the new resin (only in thick gauge products) – all waste LDPE is reprocessed.
- 9 HDPE cannot be reprocessed.
- 10 HDPE bags are sold for \$3.5-4/kg – sell to supermarkets and shops in Lautoka, Nadi, Ba, Rakiraki and Sigatoka
- 11 To send one container to NZ cost about \$2500-3000. NZ offered to take old plastic for reprocessing, but cannot afford to ship it.
- 12 The machinery is 3-5 year old from Taiwan, India, China.
- 13 Shopping bags sell for \$18/1000 bags
- 14 Bags cannot be recycled if oily or dirty.
- 15 Are considering getting a machine to recycle both used HDPE and LDPE, to make into polyethylene pipe. Might have to buy waste plastic from other factories.
- 16 Would cost about \$500,000 to set up the recycling machines from Auckland.

Meeting at: Lautoka Hospital
Lautoka, Fiji
Date: 16/9/99
Attending: Juliet Woodward
Hospital Secretary, Nurses, Housekeepers

- 1 340 beds – all types of wards.
- 2 Sharps bucket, one in each ward. Emptied once per week to incinerator, or when full.
- 3 Other rubbish bin for other medical waste – to incinerator; and another bin for food waste and non medical waste – to landfill
- 4 Packaging goes to incinerator
- 5 Old equipment is stored for parts
- 6 Kitchens produced 7 bins x 60 litres per day – to the rubbish room for collection. Rations store dispose of tins etc – to collection. Reuse any large plastic containers
- 7 Incinerator is diesel fired. It runs every morning from 8.30am – 2pm. Burns 20 – 40 x 60 litres drums of waste. Produces 6-7 x 100 litres per week of ashes – to landfill
- 8 Garden waste is burnt in garden.
- 9 Aluminium cans are recycled???
- 10 Pharmacy waste is incinerated, plastic bottles go to the landfill.

Meeting at: Fiji Hotels Association / Sheraton Denerau Resort
Nadi, Fiji
Date: 17/9/99
Attending: Juliet Woodward
Ravendra Prakash – Nadi Town Council
Kevin Mutton – Human Resources Manager
Jai Ram – Chief Steward

- 1 Guests – 2000/day. Staff – 992. Sheraton Fiji Resort – 300 rooms; Sheraton Denerau Villas – 167 rooms; Sheraton Royal – 280 rooms; Denerau Golf and Racket Club – 10 tennis courts, 18 hole golf. Starwood Hotels Corporation is listed on NY Stock Exchange.
- 2 Future developments – Trend West Timeshare – 200 units (under construction for Jan 2000); planned Villas part 2 – 164 rooms (2001); Air Pacific hotel site for development (300 rooms) ; 25 shops; 19 food and beverage outlets; Fairway Palm Housing Development (Tabua Investments, Mgr Dir : Martin Davensa).
- 3 Sheraton took a stand against the ad hoc use of the old Navakai Dump and have been using Williams and Gosling since 1989.
- 4 Garden waste is mulched and composted
- 5 Heavy garden waste is put in a dump on the island
- 6 The Hotel Association has 72 members, they pay \$28/room /year fee. The association has an income of \$160,000/year. The association is a powerful lobby group. The aim is to protect members interests – lobbying government, promoting standards, developing educational levels. It has 3 salaried staff – doing research, conducting competitions for staff, admin, information, monthly board meetings, regional monthly meetings (Nadi, Mamanuca, Coral Coast and Suva).
- 7 The CEO is Olivia Pareti Ph 302 980 Fax 300331
- 8 There is a general awareness that disposal systems are needed. Used to dump at sea, now bring to shore. Greenpeace campaign 2 years ago about the degradation of the reefs was successful.
- 9 Resorts that are not members could be bad.
- 10 The distance from the dump can be a problem
- 11 Could use Sheraton-Denerau as a model for waste management in Hotels in Fiji.
- 12 Have an Environmental Policy (see attached)
- 13 There is no segregation of metal wastes/cans – all goes to landfill. Perception that it is too far to Lautoka for recycling.
- 14 All paper/glass/batteries/plastic/food waste to landfill
- 15 2 x 3.75m³ W&G bins per day.
- 16 Priorities are: Properly managed ecological disposal system for existing and future needs of tourism development between now and 2050. Increased volumes of people and the importance of tourism to this area.

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- 17 The Fiji Government Planners have projected figures – tourism is favourable and will be the short to medium term saviour of the country.
 - 18 Lack of infrastructure and access to things in the islands is a problem
 - 19 Doesn't think that "ecotourism" will be a successful marketing line.
 - 20 Useful contacts would be Randike Qeratabua – Mgr Dir of Fijian Hotel ph 520 115 and President of Association Robert Wade (Hideaway Resort).
 - 21 Once per year Sheraton cleans up Nadi Town
 - 22 Standards for joining the Association are hotel license, liquor license and compliance with law.
 - 23 Nadi is expanding very quickly

Meeting with Jai Ram

- 1 Wet waste and dry waste is collected (food waste, paper and plastic) by contractor every day.
- 2 Empty juice container, beer bottles, wine bottles collected and recycled
- 3 Vegetable fats are collected in a 200 litre drum, for soaps manufacturer – about 200l every 2 weeks
- 4 Al cans are collected by contractor; PET bottles collected for recycling; Glass bottles returned to Coca-Cola. There are only these bins at the racket club not at the rest of the resort.
- 5 1 bin of food waste is cleared 3 times per day; 1 in engineering workshop every 2-3 days (leaves, workshop waste); 2 bins at Sheraton Royal – 1 for food 2 times per day, 1 for everything else every day.
- 6 In total - 5/day = 15m³/day
- 7 Cartons – have a compactor which is not too effective.
- 8 Looking at a new compactor for all hotel waste – hotel may invest.
- 9 Pay \$30/bin = \$55,000 per year
- 10 Training of staff includes environmental and waste management
- 11 Have 10 vehicles – old batteries are collected for recycling
- 12 Engine oil is collected for recycling (taken by Carpenters Industrial – now Fletchers)
- 13 Pesticide containers are sent back to supplier
- 14 Cleaning chemical containers are sent back to supplier.
- 15 Broken crockery goes to landfill – can it be recycled?
- 16 Buy some thing in bulk but single serve items are purchased also. Mini jam jars are collected for recycling
- 17 Wine bottles are not recycled – local agents cannot afford to do it.
- 18 There is an animal feed plant at Vuda – could it take food waste?
- 19 Egg trays are recycled.