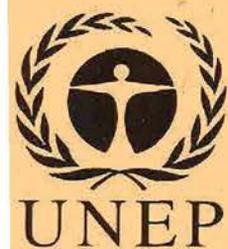


**WASTE MANAGEMENT
IN SMALL ISLAND
DEVELOPING STATES
IN THE SOUTH PACIFIC**

***REPORT OF A
REGIONAL WORKSHOP***

organised by

***UNEP and SPREP
in collaboration with
ENVIRONMENT AUSTRALIA***

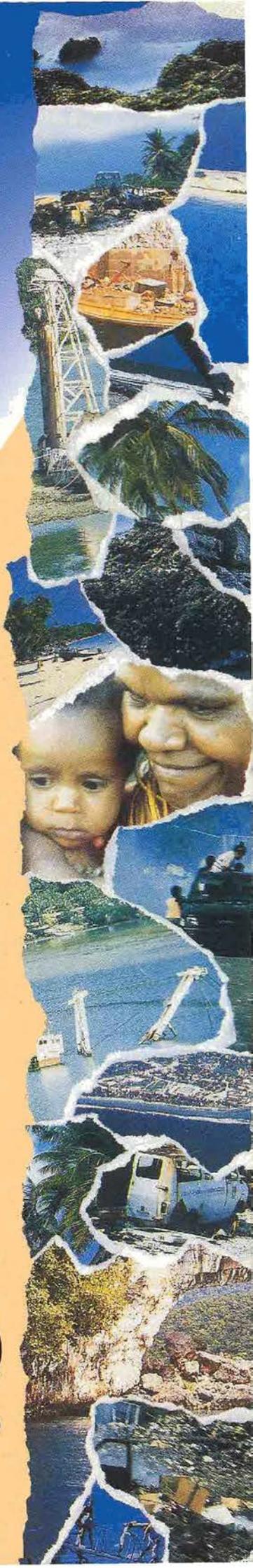


***Canberra, ACT, AUSTRALIA
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SPREP

VOLUME 1 : PROCEEDINGS OF THE WORKSHOP



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VOLUME 1. PROCEEDINGS OF THE WORKSHOP

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REPORT OF THE WORKSHOP

Opening Ceremony, Presentations and Lectures

Opening Ceremony

Dr. Suvit Yodmani, Regional Director, United Nations Environment Programme Regional Office for Asia and the Pacific (UNEP/ROAP), welcomed the participants on behalf of the Executive Director of UNEP, Ms. Elizabeth Dowdeswell, who had visited the region in 1996 to look at how UNEP could best assist small island developing countries in the Pacific. His full speech is given in Appendix 3.

He reported that a 1997 Global Environment Outlook Report by UNEP has indicated that the world environment has deteriorated since the 1992 Rio Earth Summit. The GEO-1 Report has concluded that one third of the world's coastal regions are at risk due to human activities and this is particularly important as 60% of the world's populations live in these areas. As virtually all Pacific Small Island Developing States (SIDS) are effectively coastal areas, this presents a unique set of problems and vulnerability. This was highlighted by the Barbados Programme of Action for SIDS. UNEP has responded by developing an urgent action plan on sustainable development for SIDS, and in 1996 established a SIDS Task Force.

Dr. Yodmani stated that UNEP, SPREP and Environment Australia had already collaborated on a number of projects relating to environmental management for Pacific SIDS, and expressed his wish for continuing cooperation to assist South Pacific SIDS with environmental management and sustainable development issues. He also thanked ANUTECH for the assistance provided with the local arrangements for the workshop.

Mr. Mark Hyman of Environment Australia spoke of the importance of wastes as an environmental problem, and the necessity of changing our focus from wastes as a problem to wastes as a resource. The full speech is given in Appendix 4.

The generation of waste is a symbol of the unsustainable processes occurring in the world today - we need to change our thinking and processes. This is an acute and urgent problem for Pacific SIDS, and solutions are needed, e.g., reduction at source, more sustainable production/consumption systems. The challenge is to change long-term behaviour but also to deal with short-term critical problems. He was pleased to see an emphasis in the workshop programme on practical issues, e.g., industry becoming more efficient, people looking for new recycling and re-use opportunities.

Australia has a different set of problems, with a large land area, and a large range of issues to deal with. Where appropriate, however, Pacific countries can draw on Australian experience, and Environment Australia

will continue to play a role in trying to assist SIDS in dealing with environmental problems.

Ms. Neva Wendt welcomed participants on behalf of the new Director of SPREP, Mr. Tamarii Tutangata. Her full speech is given in Appendix 5. Since its establishment, SPREP has attempted to respond to the needs of regional governments and peoples in dealing with environmental issues. Waste management has always been an issue of concern, but in the most recent review of SPREP priorities, 'waste management, pollution prevention and emergencies' has been included as one of the five key priority areas for action in the period 1997-2000.

A comparison of country concerns in 1981 and 1991 showed that there was an increasing emphasis on problems associated with population and urbanisation. A range of waste management issues was specifically identified as of wide concern in the region and in 1996 a list of 'hot' issues was identified by SPREP member countries and urban waste management was identified as one of nine such issues.

SPREP has developed a new Action Plan statement on waste management, and a range of activities are following on from that. These cover a wide range from training, information gathering, planning and policy development, public awareness, coordinating marine pollution emergency response, implementing Waigani Convention principles, and minimising sea-based pollution. This workshop presents an opportunity to significantly contribute to a number of these activities.

Purpose and Structure of the Workshop

Dr. John Morrison outlined the purpose and structure of the workshop. The purpose is:

- To strengthen the capabilities of the participants in decision-making regarding waste management issues in their countries;
- To provide a forum to discuss common needs and priorities in the region and
 - o develop project concepts
 - o develop recommendations for future activities;
- To assist participants to update knowledge on waste management practices so that they can
 - o impart relevant knowledge and skills in waste management to others upon returning home, and
 - o improve waste management practices in their home countries.

The workshop would consist of a combination of activities including:

- Presentations from resource personnel;
- Presentations of case studies from participants;
- Working groups which will
 - o discuss key points raised in the workshop
 - o develop recommendations for future action
 - o develop project concepts/proposals;

- Field trip to see innovative waste management activities;
- A round up session to review workshop reports, confirm recommendations and adopt the report of the workshop.

Regional Overview of Environmental Management in the South Pacific

Mr. Andrew Munro introduced his presentation by stating that while waste management now represents 20% of SPREP's mandate, there is at present only one officer to carry out activities. This is hoped to rise to three or four within two years. Environmental management and sustainable development go hand in hand. He quoted the definition of Mr. Ieremia Tabai, former President of Kiribati who defined sustainability as 'being able to survive on atolls forever', with the emphasis being on *forever*.

There is a need for national and regional capacity building to produce the information needed for decision making. SPREP has a specific focus on this, and helping countries solve their own environmental problems. Environmental protection is a key component of the development process, and appropriate application of the precautionary principle is needed in the Pacific. Following on from the adoption of Agenda 21 at the Rio Summit in 1992, the specific problems of SIDS were considered at the Barbados Conference in 1994. This developed a Programme of Action needed to deal with the specific issues of SIDS, e.g., scarce land, limited freshwater, education needs, health, coastal pollution and limited natural resources. The transfer of appropriate environmental technologies and the introduction of fair, equitable, non-discriminatory trading policies are also needed.

SPREP is mandated to assist SIDS with environmental management. The work is developed through an Action Plan and priorities developed by participating governments. Mr. Munro outlined the activities within each Action Plan Programme. He considered that a useful activity of this workshop would be to consider whether the Waste Management, Pollution Prevention and Emergencies Action Programme does address the current priorities, and if not, what changes/additions are needed.

He then outlined the current waste programs coordinated by SPREP following from the approval of a work program by an intergovernmental meeting in Tonga in 1994. These included protection of the marine environment, information dissemination, waste education, development of chemicals profiles, and a series of demonstration projects. Mr. Munro stressed the need for continuing and expanded efforts on improving environmental management in the South Pacific. A great deal needs to be done, but there is optimism that improvement will occur and be effective. There is a continuing need for assessing the effectiveness of programmes.

Overview of Waste Management in SIDS of the South Pacific

Dr. John Morrison presented this overview, in which he stressed that many countries in the South Pacific face critical problems with regard to

waste management. A range of common problems has been identified, including: insufficient government priority and political support for action; lack of finance; no long-term planning or business planning; poor landfill siting, design, planning and management; lack of skilled personnel; lack of awareness of the problems caused by poor waste management; poor handling of medical waste; insufficient recycling and reuse, including limited reuse of organic wastes, septic sludge, sewage sludge and effluent. Failure to adequately address these problems will lead to escalating environmental and health problems for Pacific Islanders, in addition to serious consequences for economic development based on tourism, export agriculture and small 'clean' industries.

Dr. Morrison stated that waste management must be given a higher priority in government planning in the Region, so that sustainable funding can be provided for these activities. Governments also need to develop integrated waste management policies, strategies and plans, and provide support through appropriate legislative and institutional frameworks. Waste management revenue raising is an issue that needs serious consideration by regional governments in developing their waste management strategies. There is also an urgent need for improved data on sources, pathways and impacts of wastes in the Region.

Technical issues requiring attention include: improved landfill management, including business plans, 'start to finish' planning, encompassing water management, provision of cover material, closure of the site and final use of the site; up-to-date analysis of recycling and incinerator operations; the provision of suitable long-term storage of hazardous materials while disposal mechanisms are being determined; a distinct deficiency in skilled personnel to work in the waste management industry in the Region - an examination of the training needs for comprehensive waste management is required; and, it is important to carefully consider social and cultural issues in all waste management activities in the Pacific, if progress is to be made.

The Waigani Convention

Dr. David Mowbray presented a historical overview of the development of the Convention. He reported on the approaches made to PNG on the disposal of waste originating in the USA, and the fact that the Basel Convention was not sufficient for Pacific countries to deal with these issues. As a result, the PNG Government led the activities leading to the development of the Waigani Convention which was finalised in 1995. The Convention requires 10 ratifications to come into force, but to date only 3 ratifications have taken place. Dr. Mowbray recommended that countries must both ratify the Waigani Convention and develop or amend appropriate environmental legislation. These could be important steps in improving chemicals management in the South Pacific.

Mr. Ian Fry introduced the Greenpeace 'Guide to the Waigani Convention'. He described the purpose of the Convention which basically

is the prohibition of the import of hazardous and radioactive wastes into the region. The definitions of hazardous and radioactive wastes were discussed as were the general obligations placed on countries by the Convention. These included the development of laws and regulations, banning the export of hazardous wastes between Forum countries, providing waste information to the Convention Secretariat.

The status of Parties and Non-Parties was considered, and the financial implications were described. These include personnel required to inspect movement of wastes, administrative assistance in reporting waste movements, a legal officer from time to time, and development of waste minimisation strategies.

Mr. Andrew Munro briefly presented information on the role of SPREP as the Secretariat to the Waigani Convention. This primarily related to Article 14 of the Convention - Administration. He outlined coordination with the Basel Convention, including an MOU between SPREP and the Secretariat to the Basel Convention (SBC). As the Waigani Convention Secretariat, SPREP will develop a database of regional hazardous waste disposal facilities, information clearing house and consultants database, identify illegal traffic, coordinate emergency responses, and carry out regional record keeping. Collaboration with the SBC will provide additional assistance to Pacific countries including model legislation, training, technical guidelines, notification and movement documents.

Financing and Economic Issues Relating to Waste Management

Dr. Meg Keen started her presentation by stating that economic issues are not clearly addressed at all when considering waste management. Perhaps this is because economics had let environmental planners down in the past. A key problem is that waste generators are not suffering from the impact of the wastes and are not paying for the clean up of them. The environment does not get well looked after if market forces only operate - intervention is necessary for environmental protection.

The role of economics is: to make polluters pay; to provide revenue for waste management; reinforce other policy tools; provide a personal incentive to minimise waste; and to make waste a valuable resource. Options available include: small regional resource recovery estates; performance bonds and environmental insurance; product taxes/subsidy removals; uniform charges; market creation. Information needs for proper economic analysis of waste management options are people's responses to pollution charges, full cost and benefit analysis of an economic technique, likely waste volume over time, and likely markets and their stability.

Recommendations put forward include: the critical need for policy integration; start small, get it working and then look to expand; use economic instruments to encourage waste minimisation and raise revenue for waste management.

Promotion of Public Awareness and Education on Waste Management

Mr. Bill Grant outlined the basic principles of education as applied to the environment. He discussed the question of what determines behaviour, and how people respond to new messages. He emphasised that it is vital to build the community education/response component of a waste management system in from the very beginning. It is most likely to succeed if it is simple, easy, and readily testable. Knowing the audience is also important, and consideration must be given to the most appropriate ways to get the message over (literacy and language skills, use of symbols, etc.).

An assessment of where people get information is important as is assessment of the performance of a programme. Strategies for improving community awareness include: the use of community networks/train the trainers; community/workplace targets; awards, posters, radio, 'Clean Up days', sponsorship. Education of journalists can be very beneficial. Mr. Grant also provided advice on best utilisation of limited financial resources - it is often best to work intensively early in the program, with use of the remaining funds for periodic reminders.

He concluded by confirming the need to identify the target groups and their information sources, keep the message simple and consistent, trial messages and materials before general release, and it is essential to involve and consult groups one is working with.

Introduction to Integrated Waste Management

Dr. John Morrison introduced this topic by stating that waste management in the Pacific Islands is currently inefficient. As a result many waste related problems are occurring, and they are expected to grow, creating unhealthy and environmentally dangerous situations. One of the main reasons for the ineffective and inefficient management of waste is the lack of integration of the various components. This results, at least in part, from the sectoral arrangements operating in most aspects of regional government operations. These lead to a fragmented approach to any issues that are multisectoral in nature, as is the case with most environmental problems.

Major improvements in waste management in the Pacific Islands will only occur if a more integrated approach is adopted in dealing with the situation. Dr. Morrison reviewed the current situation in the region and explained the basic principles of integrated waste management. He also provided some suggestions on ways in which governments and communities can move to a more integrated and effective system of waste management.

There are no easy solutions, and the strategies adopted must have full community acceptance to have any hope of success. The resolution of the situation may occur at the national level, but the benefits will have great impact internationally. The session finished with a round table discussion

on integrated activities in regional countries and the constraints to further integration.

Waste Reduction, Reuse and Recycling

Mr. Doug Holmes opened his presentation by stressing the importance of the fourth 'R' - rethinking. This should include looking at new technologies and recent innovations in waste management. Countries and other agencies must develop a strategic vision. The change from 'end of pipe' controls to 'toxic use reduction' must be continued to 'systematic redesign'. Mr. Holmes described the difference between post-consumer wastes (packaging, etc.) and life-cycle wastes (manufactured goods).

Appropriate small scale reuse operations e.g., oil/fat -> soap should be developed, and the full cycling (and 'cradle to grave' approach) must be introduced. Mr Holmes described industrial clusters, groups of industries that have strong potential interactions, and the Kalundberg (Denmark) industrial ecosystem. A range of policy initiatives and action strategies to encourage the system to change must be developed.

Mr. Holmes concluded by asking participants to consider 2 questions - the possibilities for facilitating innovative exchange of waste, and the measures needed to facilitate such activities. The discussion indicated that new initiatives were occurring, e.g., the production of a fertiliser using waste oil and phosphate rock, the use of waste oil in cement kilns, and the conversion of grease trap waste into a fertiliser material.

Collection and Transfer Practices for Solid Wastes

Mr. Norman Thom introduced this subject by stating that when developing, or evaluating, a system for the collection and transport of solid waste, consideration should be given to the composition and quantities of the wastes involved, where these originate and the location of disposal facilities. From these the frequency of collection, the number and types of vehicles required and the most efficient collection routes can be assessed. The service must be convenient, accessible, regular and reliable. Provision must be made for wastes arising from domestic, commercial and industrial activities and some guidance may be required on the size and types of waste containers that can be serviced, where these should be located and how they should be covered and maintained.

A major factor will be the composition and quantities of solid waste produced and this can be determined by waste classification studies. Mr. Thom indicated that to date, very few of these surveys have been carried out in South Pacific Island countries. Protocols are now available to illustrate the methods for conducting these surveys so as to obtain reliable and repeatable data. In its simple form the survey would involve collection of random samples of solid waste as produced, separating these into common components such as organics, paper, plastics, glass, metals, hazardous and other materials. Each component class is weighed and the totals recorded.

Information so obtained is essential for determining waste management priorities such as the reduction in waste for collection that might be achieved by composting at the domestic or village level, or the quantity of recyclable material which could be extracted from the waste stream.

Data presented by Mr. Thom indicated that the cost of collection contributes significantly to the total cost of a solid waste management program and as it becomes more and more difficult to find acceptable sites for disposal facilities such as landfills, distances involved in collection routes, and hence additional cost, can increase greatly. A point may be reached where it is more cost effective to install stations near the collection area which allow solid waste from a large number of smaller collection vehicles to be transferred to a larger vehicle which needs to make less trips to the disposal site.

Composting and Vermicomposting of Municipal Solid Waste

Mr. Norman Thom presented data which showed that solid waste with a high organic content, particularly those of vegetable origin, arising from domestic, commercial and some industrial sources, as can be expected in most South Pacific Island countries, can be readily decomposed to a soil like humus material by processes such as composting and vermicomposting. This material can be used to replace soils which are continually being lost from many areas. Both are relatively simple processes which can be carried out at household, village or community levels, or in large centralised facilities. He indicated that at least one international tourist hotel chain promotes the use of composting for waste minimisation as part of its corporate environmental policy.

Mr. Thom then described the vermicomposting process which involves the use of particular worm species to break down the organic wastes and while this, like composting, must be carried out aerobically, that is in the presence of air, the processes involved differ significantly.

The composting and vermicomposting processes were described in some detail. Composting involves the separation of organics from the waste stream, shredding this material and placing it into containers, heaps or windrows in a way that ensures ready contact with air. Various organisms act to break down the waste and the increasing metabolic activity of these causes temperatures to rise as high as 70°C. The composting material must be kept moist and be regularly turned to ensure contact with air. When decomposition is complete temperatures return to normal but the compost may require to go through a maturation stage before it can be used. Compost has considerable value as a soil improver and contains higher concentrations of beneficial plant nutrients than present in the waste before processing.

Vermicomposting is carried out in layered beds in which shredded organic wastes are regularly placed in thin layers above the bed in which the

worms are active. Microorganisms act to break down the waste and the worms digest both the breakdown products and the waste resulting in castings which are rich in available plant nutrients. This process requires specific worm species which may not exist in all regional countries. They cannot tolerate temperatures above 35°C, high concentrations of ammonia or salts, or even trace amounts of many pesticides. Vermicomposting therefore requires greater control of waste composition, temperature and moisture content than does composting.

The Incineration of Solid Wastes

Norman Thom introduced this topic by defining incineration as the combustion of solid waste under controlled conditions in an appliance specifically designed for the purpose. In the process the volume of the waste is reduced by about 90% and its weight by 75 to 80%. It does not include open burning which should not be encouraged because of the potential for environmental effects.

The energy available from solid waste, while significantly less than that in similar quantities of common fuels such as oil or coal, can be sufficient to use as a fuel for thermal generation of electricity. Combustible components in solid waste are mainly paper, plastics and other organics. The moisture content can be a limitation particularly if it is above 50% by weight. As the amount of volatile combustibles tends to be high this must be recognised in the design of the incinerator. The chemical content of the wastes will influence the contaminants that will be released into the environment. Incinerators should be designed and operated so that adequate temperatures are reached and these maintained for sufficient time to achieve complete combustion. Sufficient air is also required to be mixed with the combustibles in specific locations in the incinerator to match the two stages over which combustion occurs. In small incinerators this is achieved by the use of multichamber incinerators.

Waste to energy incinerators may be based on mass burn furnaces or fluidised bed combustors. Alternatively, the combustible components of solid waste can be processed into waste derived fuels which can then be used either directly, or mixed with other fuels, in conventional furnaces of thermal power stations. Mr Thom stated that incineration of solid waste, even when waste to energy processes are involved, is not acceptable in all communities. Concerns are raised regarding the potential for adverse environmental effects to arise from gaseous emissions and from the disposal of residual ash. These concerns may not necessarily be alleviated by the incorporation of the most efficient control measures.

The Management of Hazardous Chemical Wastes arising in the South Pacific Island Countries

Mr. Norman Thom described hazardous wastes as wastes from hospitals and clinics, discarded pesticides, used car batteries, waste

lubricating oils, and discarded electrical equipment containing fluids contaminated with polychlorinated biphenyls (PCBs). Special consideration must be given to these so that adverse effects on public health and safety, and the environment generally can be minimised.

An effective system for the management of hazardous waste relies on having a scheme in place for their identification and classification. A common impediment is that the actual identity of the waste concerned is unknown. Assistance in the development of an appropriate scheme can be obtained from the annexes to the Waigani Convention 1995, which in turn are based on those in the Basel Convention 1989. Standard tests are not necessarily available to either identify or quantify such hazards so reliance must be placed on the identification of local products likely to give rise to hazardous wastes and the local availability of hazard information such as in product Material Safety Data Sheets. Mr. Thom recommended a proactive approach to establishing the identity and local quantities of potentially hazardous substances. This could be done by local surveys conducted to produce a national inventory of chemicals. Once identified resulting hazardous wastes must be segregated and consideration given to appropriate disposal options. In some cases there may be opportunities for reuse or recycling of components. Others may be able to be locally disposed in landfills after simple pretreatment.

Mr Thom stated that local disposal of many types of hazardous waste will not be appropriate. These must be separated after identification and then placed in suitable containers. Each container must be clearly labelled with the UN chemical numbers and hazard classes, and other details consistent with the guidance given in the Waigani Convention. These containers must then be adequately stored awaiting the availability of treatment facilities appropriate for the waste involved.

Wastewater Management in the South Pacific: Operations, Options and Opportunities

Dr. John Morrison considered that wastewater represents a very valuable resource for Pacific Islanders that is extremely poorly utilised. A range of reasons for this include: a lack of appreciation of the value of water; lack of long-term planning of water resource management; low cost of freshwater supplies, especially to industry; potential cost of reuse facilities and infrastructure; social and cultural issues with regard to reusing water; health concerns with regard to some possible uses; inadequate treatment facilities; a lack of appreciation of the environmental consequences of poor wastewater management.

The treatment of wastewater varies enormously from very sophisticated centralised systems to effectively no treatment. This poor management of wastewater has profound effects on the Pacific Island environment with contamination of surface, ground and coastal waters being prevalent. Improved management of wastewater will lead to a reduction of freshwater requirements, improved resource use, and a

dramatic reduction in the environmental problems caused by poor wastewater management.

Dr. Morrison reviewed the wastewater situation in the Pacific Islands including the characteristics and properties of wastewaters, sources and effects of contaminants, actual and alternative treatment processes, and outlined a range of reuse options. He also discussed the handling of sludges as these also represent a valuable resource which is under-utilised in this region.

Pollutant Release and Transfer Registers

This topic was introduced by Dr. David Mowbray, who explained what PRTRs meant and why they were potentially important for Pacific Island countries. Mr. Gareth Rees then discussed the Australian experience with PRTRs, including the reasons why Australia was looking at them. He outlined the steps adopted in Australia, including the establishment of goals, the development of an implementation programme, design of a reporting list, the collection and potential dissemination mechanisms for data. Mr. Rees described a trial carried out in 4 centres in Australia, and highlighted how these experiences might be useful to Pacific Island countries thinking of developing PRTRs.

Dr. David Mowbray then discussed some recent PNG experiences with PRTRs. Some 60 organisations were approached to assist with the project. Less than 50% responded, and many of the responses were of little value. The reasons for the poor response were a combination of legal, technical and administrative factors both within government and industry, plus a lack of adequate commitment to product stewardship by industry. Dr. Mowbray outlined the potential role of PRTRs in environmental management in PNG and discussed how this might also be of use in other Pacific Island countries.

Mr. Andrew Munro presented further details on a current SPREP project which is assisting eight South Pacific countries to develop chemicals profiles/inventories using a pro-forma developed by UNITAR. This will provide a useful starting point for these countries in the improvement of the management of chemicals.

Public Health and Environmental Aspects of Municipal Solid Waste Management in Developing Countries with Special Focus on Small Island Developing States

Mr. Jitae Kim introduced this topic by stating that waste is unavoidable in any society but now we produce more and worse waste than ever before. The lack of sound waste management certainly poses potential environmental and health risks. In many cities of developing countries, large amounts of generated waste is not collected. The rest is burnt or dumped in unregulated landfills. The specific socio-economic and environmental conditions of Small Island Developing States (SIDS) such as,

fragile ecosystems, limited natural resources, population growth, excessive urbanization in small areas, make it difficult to develop sustainable waste management.

The combined effects of uncollected wastes, poor handling and inadequate disposal safeguards for municipal solid waste (MSW) have serious implications for human health, such as, direct transmission of diseases and the spread of epidemics, loss of healthy amenable urban environment, and most importantly, the social reinforcement of poor hygiene habits and practices. Mr. Kim indicated that the inclusion of hazardous waste and excreta in MSW stream, moreover, complicates practical responses to the problem. Improper waste management can also lead to serious environmental damage caused by pollution of air, soil, water and the marine environment. Particularly, the transfer of pollution to water resources and coastal areas is very detrimental to the fragile ecosystems of SIDS and public health.

Mr. Kim said that it is therefore obvious that waste management in an environmentally sound manner is an important part of environmental hygiene and needs to be integrated into environment planning for the improvement of human health. Considering the unique situation of SIDS, a comprehensive and multi-disciplinary approach is necessary for the development and implementation of effective strategies of waste management. Environmental and public health impact assessments should be carried out at an early stage and incorporated in waste management planning. Based on the assessment and identification of existing problems of waste management, reduction of waste generation, increased utilization of waste, the proper application of Environmentally Sound Technologies (ESTs), effective legislation and disposal of waste are the main keys to promote sustainable waste management and thus protect human health and natural resources.

SUMMARIES OF SELECTED CASE STUDIES PRESENTED BY PARTICIPANTS

Cook Islands

Mr. Tui Short presented information on the geography and economic development priorities for the Cook Islands. He indicated that the main waste management issue today is on the solid waste stream, particularly the need for a new landfill for the main island of Rarotonga. He reviewed the development of solid waste management in Rarotonga in terms of 3 phases.

In the first phase (1987-1994) there were 5 uncontrolled dumps on Rarotonga, with no proper management or records. In phase 2 (1995-8) there is the Nikao dump, which has a much better level of management, private collection service, and during this period there have been extensive public awareness developments and significant community involvement (e.g, TTT 'my rubbish, your rubbish' programme). In phase 3, post 1998, there will be a need for a new landfill site with associated recycling, an appropriate management.

Mr. Short also explained the impact of the 1995 Rarotonga Environment Act, the development of integrated waste management, and he emphasised the need for inter-relationships between the players in waste management. Political action is also needed for improvements to occur, and there must be sufficient time allowed for planning to be completed properly. Mr. Short concluded by stating that a key question is - what can we afford?

Fiji

Mr. Nacanieli Bulivou described the geography of the Fiji group and then outlined the new 'Healthy Islands' project currently being developed in Fiji. In this project villagers determine their own priorities and health officers provide advice and assistance with project coordination. Mr. Bulivou concentrated on the capital, Suva, which has been experiencing serious urban drift and the associated social and environmental problems.

Garbage collection and disposal are managed by local government, with the solid waste going to the Lami dump. Financial aspects of the system were reviewed, showing an increase in quantities and revenues during the 1990s. Waste composition data over the period 1992-6 shows a marked increase in the proportion of plastic bags.

National government has taken over responsibility for sewerage, and a recent initiative has been the requirement for restaurants to install grease traps. The 1991/1996 Litter Bill is now being actively implemented, and a Sustainable Bill has been drafted and is under review.

Kiribati

Mr. Taulehia Pulefou outlined the geographical situation in Kiribati, including the physical background and the problems of urbanisation. Waste management is a serious problem in South Tarawa where a large proportion of the population live. The poor management of waste has been a major contributor to pollution of Tarawa Lagoon. Municipal waste is collected by local government, with fees being levied. The system is not particularly efficient.

Hazardous wastes are not covered by the local government collection service, and this situation is not helped by the present inadequate waste legislation. There is a lack of skilled personnel to deal with hazardous materials. An Environment Bill has now been drafted and is under review.

Incineration is an option for some aspects of waste management in Kiribati, including quarantine, medical ship and aviation wastes, but new incinerators are required with adequate trained staff, funding and maintenance programs.

Kosrae, Federated States of Micronesia

Mr. Norlin Livaie described the main geographic features of Kosrae, and then reviewed current waste disposal problems in the state. There is no collection system, littering is a problem, and many wastes are disposed of by burning and burying, over which there is very little control. This contributes to both human and environmental health problems.

There is no adequate disposal system for waste oils, leading to serious contamination of soils, streams, and coastal waters. Contamination of land and water is gaining recognition as a problem as this contamination has led to a decrease in land values. The development of a comprehensive solid waste management strategy is essential if Kosrae is to avoid the sorts of problems that have occurred in other Pacific Island countries and even in other states of FSM.

Nauru

Mr. David Scott presented some geographic, geological and mining history information on Nauru. He stated that about 100 tonnes per day of dust are released into the atmosphere from phosphate rock drying processes. There is a recognised problem with cadmium in the Nauru phosphate which now restricts the uses of the fertilisers produced. A draft waste management legislation document is under consideration at present.

Most recycling in Nauru is via the ocean, with all sewage discharged untreated. There is concern about this as some faecal coliforms may enter the water desalination plant. The estimated cost of a treatment plant is \$2

million, but Mr Scott felt there is a critical need for a package designed for the Pacific by a non-profit organisation as all the current offers are from corporations looking for a profit from establishing such plants.

Niue

Mr. Holo Tafea described the geography of Niue, and then discussed the solid waste situation with reference to the location of dump sites and their proximity to water boreholes. Most waste disposal sites are located near the coast. There is a proposal to reduce the number of dump sites to two, but there is no control of what enters the domestic waste stream.

There is no sewage treatment plant and the use of septic systems is increasing. There is limited control of septic system construction, and the sludges are poorly handled. Waste oil often ends up in the dumps, and there is no system in place to deal with batteries. Medical waste is burned in the Health compound as it is not permitted to burn it at the dump site. A Pesticide Committee was established in 1992, but there are still stocks of old pesticides needing disposal. Can recycling to New Zealand is continuing.

Papua New Guinea

Mr. Leo Mandeakali described PNG as a resource rich, rapidly developing country with many problems including waste management. He described the six types of waste management practices currently in use (dumping on land, dumping in water, ploughing into the soil, feeding to animals, recovery and recycling, and incineration. He described some specific aspects of the Port Moresby solid waste management system.

Mr. Mandeakali then outlined what he saw as the ten major management constraints with regard to wastes - no controls at source, rapid development of urban centres, funding limitations, impacts of technology, land tenure, energy limitations, lack of long-term plans for waste sites, lack of data on operations and labour constraints. He discussed the impacts of each constraint and how they might be addressed.

Solomon Islands

Mr. Robinson Fugui presented some geographic data on the Solomon Islands, and then discussed the problems of solid waste management. In Honiara (45,000 people), there is a need for greater control of solid waste management. Constraints include a strong political commitment and the associated legislative support for proposed activities.

Mr. Fugui then outlined some of the activities of the Health and Environment Division. He discussed the problems at the Renadi dump sites and the impact of illegal dumping in Burns Creek. As there are houses and an industrial area nearby, this represents both a human health and environmental problem. He outlined the problems encountered in

locating a new dump site for Honiara, as several sites have been rejected on geological, hydrological, distance or political grounds.

Other issues discussed include the management of sewage and the impact of sewage discharges on coastal areas around Honiara, and the situation with unused pesticides which has been addressed with assistance from SPREP and WHO.

Vanuatu

Mr. Tonny Ata presented some basic geographic data on Vanuatu and then discussed improved solid waste management around Port Vila. This resulted from a World Bank low-cost housing project, and resulted in the establishment of the new Bouffa landfill.

Solid waste management had also been assisted greatly by the recent arrival of some new vehicles donated by Japan, which meant that 5 vehicles were now available for collection, including a new vehicle specifically for green waste. A back hoe loader was also received which would assist with operations at the Bouffa landfill site.

Western Samoa

Ms. Fetoloai Yandall-Alama outlined some geographic features of Western Samoa, including the land ownership system. She then described aspects of the problems of solid waste management, particularly relating to the Tafaigata dump site. There is no public sewage system in Apia, and this situation may change in the near future. The Apia hospital sewage treatment plant is in need of improved maintenance. Hazardous wastes are poorly managed.

The municipal solid waste collection system is free to urban householders, but can often be irregular and inefficient. Waste separation is starting in villages and schools. There has been some progress with the development of legislation, e.g., a national waste management policy. The major constraints to major improvements in waste management are government budgeting limitations and insufficient human resources in the Department of Lands Surveys and Environment.

Other Case Study

Ms. Carole Douglas presented a 'story' report of a case study carried out in Wewak, PNG, which examined the poor management of a dump site and the related environmental and health impacts. Wewak is a rapidly expanding urban community in a low lying area which is experiencing significant economic development, but has major problems including malaria and pollution.

Waste management in the area is poor with a major waste dump located in an area close to a lagoon, several settlements and a 600 people

school. There is a collection service, scavenging at the dump, and frequent burning with the smoke carried into the school by the prevailing winds. Night soil is dumped in the lagoon which is effectively fish free, but shellfish are harvested and eaten leading to a series of health problems.

In this study Ms. Douglas described a visit to Wewak and efforts to address these problems, which included arranging a meeting between appropriate government officers, NGOs, community leaders leading to the establishment of a key environmental group locally. This group has developed a series of activities including: starting of monitoring of soils water and air; collection of health data; identification of waste streams; and enhancement of grassroots participation.

SUMMARIES OF WORKING GROUP DISCUSSIONS AND PROJECT PROPOSALS

The participants and resource persons split into two groups and discussed issues raised during the workshop. Each group determined a set of problems that were considered as important for SIDS in the South Pacific, and prepared a number of recommendations and concept statements for possible projects to address the problems identified.

Both groups considered that landfill and solid waste management was a key problem. Aspects of the problem that were considered important included: land tenure; waste stream composition data; separation at source; recycling/reuse/reduce including composting and vermicomposting; finance/cost; equipment for collection and transport; public awareness; technical and human resources; appropriate use of incineration; water pollution; hygiene and disease; a lack of legislation; lack of training; competing priorities; low level producer responsibility with particular reference to packaging and the problems it produces in SIDS; need to change consumer product demands; availability of information throughout the region; training of trainers and of landfill site operational personnel; the need for waste management planning; landfill practice guidelines; government coordination and integration of activities; need for increased action at national regional and international levels.

One group considered wastewater as a key issue. Topics that needed addressing included waste from piggeries, back flows from rising groundwater; ineffective construction and inappropriate design of septic tanks. The other group also considered freshwater management an important issue, including contamination and treatment, and the establishment of appropriate sewage treatment facilities.

Financial constraints were a major cause of waste management problems in the region. Unplanned urbanisation was identified as a major cause of waste problems, and there is a real need for improved information dissemination. The lack of ratifications of the Waigani and SPREP Conventions was also noted.

Projects considered appropriate to address the waste management problems identified for the South Pacific SIDS are:

1. In-country landfill site management training incorporating development plans and a 'train the trainer' component. This work should encompass both new and existing solid waste disposal sites.
2. There is a need to establish working procedures/guidelines for the selection, installation, operation and maintenance of incinerators.
3. A project should be established to identify and make available in an appropriate form up-dated information on recycling activities, particularly

suitable markets for recycled materials. SPREP might have this as an on-going project.

4. A project should be developed to expand the use of composting in the region, including the promotion of domestic/household composting techniques, education and demonstration projects, including uses.

5. Provision of an environmental engineer for the Solomon Islands to design a landfill site adequate and suitable for the needs of the Solomon Islands, and to develop cost estimates, including capital costs, development costs, and maintenance costs and how they will change over time.

6. Fiji requires a project to assist with the development of waste minimisation strategies/options, including locally feasible composting options. An education program is needed to increase awareness of the problems of managing packaging waste, and appropriate legislation to support waste minimisation is also required.

7. Kosrae needs technical assistance for the development of an integrated waste management strategy. A consultant with strong practical waste management expertise is required, and the strategy developed could be used as a model for other states in FSM.

8. Vanuatu also requires assistance with the development of waste minimisation strategies, particularly how to establish effective separation operations, both at the source and at a centralised site. Assistance is also needed with appropriate legislation and to upgrade existing dumps.

9. In Western Samoa, there is an urgent need for an assessment of the present dump, with the development of a plan for upgrading the site to a controlled landfill operation. Waste minimisation strategies would also be very valuable in this country. The expertise is available locally to undertake this type of work, but financial resources are needed.

RECOMMENDATIONS ON WASTE MANAGEMENT FOR SIDS OF THE SOUTH PACIFIC

1. It is **recommended** that integrated waste management policies should be developed at suitable levels of governance (island, province, country) in all regional countries. These policies should be developed with input from public and government agencies, cover issues related to health, ecology, economic constraints, legal frameworks, educational programmes and land limitations. Financial issues should be included, and coordinating mechanisms of the policy must be established. Such policies must be reviewed regularly.
2. It is **recommended** that site management plans should be developed for all new solid waste disposal sites. These plans should include:
 - o best possible operations, with appropriate guidelines/standards;
 - o a financial strategy including landfill charges and other levies;
 - o human training needs;
 - o health and ecological standards;
 - o a strategy for regular monitoring; and,
 - o a public education and communication programme.For existing sites, plans should be developed for upgrading the sites to at least controlled tipping sites, and for proper closure and long-term use of the sites.
3. It is **recommended** that inventories of wastes, pollutants and hazardous wastes, and codes of practice be introduced for all industrial operations contributing to major waste problems in the South Pacific. These codes may be introduced from abroad or developed/modified as appropriate for local use. There is an urgent need for the dissemination of information on appropriate effluent standards applicable to industrial operations (including sewage treatment plants) in the region.
4. It is **recommended** that regionally based studies be initiated on waste issues of common concern in the South Pacific region (e.g., waste minimisation, waste separation, treatment and removal of unused chemicals) which should include the development of action options for island countries.
5. It is **recommended** that SPREP should continue to carry out a key role in coordinating the collection and dissemination of waste management information relevant to the South Pacific.
6. It is **recommended** that SPREP work with countries and companies to address the issues relating to waste problems caused in Pacific Island countries by product packaging. In this way negotiations to minimise the import of packaging wastes may be facilitated.
7. It is **recommended** that the current AusAID regional project on chemicals profiles, and the EU waste management education project should

be extended to cover all SPREP small island member countries. There is also a need for extension type activities in waste management, and these may be addressed within current environmental education activities.

8. It is **recommended** that guidelines and recommendations for the reuse of wastewater in South Pacific countries should be developed and widely distributed.

9. It is **recommended** that every effort be made by regional governments to improve the construction and maintenance of septic systems. Regional agencies could assist by disseminating information concerning improved performance of septic systems based on the experience in Fiji and the Solomon Islands.

10. It is **recommended** that regional governments give greater encouragement to home based water catchments/storage, especially in agricultural areas.

11. Workshops of this type which involve people from policy, technical and administrative backgrounds are very valuable and it is **recommended** that others should be organised to address relevant environmental issues and specific aspects of waste management. In future workshops, there should be early circulation of the documentation, more time for group discussions, and incorporation of brainstorming sessions to allow maximum use of the expertise of all participants. Speakers should, wherever possible, take advantage of recent technical media advances in making their presentations.

12. It is **recommended** that each participant ensure, on returning home, that some publicity is given to the issues discussed at the workshop and how these might be better addressed in their home countries.

CONCLUSION OF THE WORKSHOP

Following a concluding discussion of the working group reports and recommendations, the meeting unanimously adopted the Report of the Workshop, including all the recommendations listed above.

Mr. Kim Jitae closed the workshop on behalf of UNEP. He emphasised the necessity of involving all sectors of the community in improving waste management.

Mr. Robinson Fugui, speaking on behalf of the participants, thanked the organisers and resource persons. He stated that the participants welcomed the opportunity to look at waste issues from a wider perspective, and to see the relevance of recent innovations to countries of the South Pacific.

Mr. Andrew Munro, speaking on behalf of SPREP, thanked all those who had assisted with the planning and running of the workshop. He indicated that SPREP and UNEP are hoping that this would be the first in a series of environmental management workshops to be run over the next 3 years.

Mr. Kim Jitae and Mr. Andrew Munro then presented certificates to all the participants.

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APPENDIX 2. WORKSHOP PROGRAM

12 May 1997 Monday

- 08:30-09:00 Registration
- 09:00-10:00 Inaugural Session
Environment Australia
UNEP
SPREP
- 10:00-10:30 Purpose and Structure of the Workshop
Prof. John Morrison
- 10:30-11:00 Tea/Coffee Break
- 11:00-12:00 Regional Overview of Environmental Management
Global Programme of Action for the Protection of Marine
Environment from Land-Based Activities
Mr. Andrew Munro
- 12:00 - 13:00 Lunch
- 13:00 - 14:00 Overview of Waste Management in SIDS; Policy and Legal
Framework - Prof. John Morrison
- 14:00 - 14:30 Waigani Convention
Dr. David Mowbray, Mr Ian Fry, Mr. Andrew Munro
- 14:30 - 15:30 Financing Strategies to Promote Environmentally Sound
Waste Management - Dr. Meg Keen
- 15:30 - 16:00 Tea/ Coffee Break
- 16:00 - 17:00 Promotion of Public Awareness and Education on Waste
Management including Production and Consumption
Patterns - Mr. Bill Grant

13 May 1997 Tuesday

- 08:30-10:00 Introduction to Integrated Waste Management
Prof. John Morrison
- 10:00-10:30 Tea/Coffee Break
- 10:30-12:00 Waste Reduction, Recycling and Reuse
Mr. Doug Holmes
- 12:00-13:00 Lunch
- 13:00-14:00 Factors to be Considered when Evaluating Collection and
Transfer Practices for Solid Wastes Arising in South Pacific
Island Countries - Mr. Norman Thom
- 14:00-15:30 Composting and Vermicomposting of Municipal Solid
Wastes - Mr. Norman Thom
- 15:30-16:00 Tea/Coffee Break
- 16:00-17:00 Country Case Studies
Government Representatives (Nauru, Niue, PNG, Vanuatu)

14 May 1997 Wednesday

- 08:30-09:30 The Incineration of Solid Wastes
Mr. Norman Thom
- 09:30-10:00 Tea/Coffee Break
- 10:00-11:00 The Management of Hazardous Chemical Wastes Arising in
South Pacific Island Countries - Mr. Norman Thom
- 11:00-12:30 Wastewater Treatment Focusing on Recycling, Reuse and
Sanitation Methodology - Prof. John Morrison
- 12:30-13:30 Lunch
- 13:30-14:30 Pollutant Release and Transfer Registers
Australia's experience with PRTRs and potential value of
PRTRs to Pacific Island Countries
Dr. David Mowbray and Mr. Gareth Rees
- 14:30-15:30 Sanitary Waste Treatment Methodology Focusing on Effective
Landfill Treatment Method - Prof. John Morrison
- 15:30-16:00 Tea/Coffee Break
- 16:00-17:00 Country Case Studies
Government Representatives (W. Samoa, Micronesia,
Solomon Islands)

15 May 1997 Thursday

- 08:30-10:00 Country Case Studies
Government Representatives (Cook Is., Fiji, Kiribati)
- 10:00-10:30 Tea/Coffee Break
- 10:30-12:00 Health and Environmental Aspects of Waste Management in
SIDS - Mr. Kim Jitae
- 12:00-13:00 Lunch
- 13:00-15:00 Working Group Exercises
- 15:00-16:00 Preparation of Working Group Reports
- 16:00-17:00 Presentation of Working Group Reports

16 May 1997 Friday

- 8:30-12:00 Study Tour
- 12:00-13:00 Lunch
- 13:00-15:00 Conclusion & Recommendations
- 15:00-15:30 Tea/Coffee Break
- 15:30-17:00 Distribution of Questionnaires and the Draft Report of the
Workshop - Adoption of the Report
- 17:00-17:30 Closing Session - UNEP

APPENDIX 3.

WASTE MANAGEMENT WORKSHOP FOR SMALL ISLAND
DEVELOPING STATES IN THE SOUTH PACIFIC

OPENING ADDRESS

Dr. Suvit Yodmani
Director

UNEP Regional Office for Asia and the Pacific

Mr. Mark Hyman of Environment Australia
Ms. Neva Wendt of SPREP
Prof. John Morrison, Consultant to the Workshop
Ladies and Gentlemen

It is a great privilege and pleasure for me to be present at this timely Workshop on Waste Management for Small Island Developing States of the South Pacific. I bring special greetings from Ms. Elizabeth Dowdeswell, Under-Secretary General of the United Nations and Executive Director of UNEP.

Ladies and Gentlemen,

Five years after the groundbreaking "Earth Summit" at Rio de Janeiro, the global environment has continued to deteriorate and significant environmental problems remain deeply embedded in the socio-economic fabric of nations in all regions. This is the conclusion reached by UNEP's first Global Environment Outlook report which was launched at the 19th Session of UNEP's Governing Council earlier this year.

The GEO-1 report points out that one third of the world's coastal regions are at high risk of degradation, particularly from land based activities. Currently about 60 per cent of the global population lives within 100 kilometres of the coastline and more than three billion people rely on coastal and marine habitats for food, building sites, transportation, recreation or waste disposal.

The report goes on to add that the impacts of current consumption and production patterns and associated waste generation, particularly on personal health and well being, are high on the priority list of both North America and Western Tonga and of concern to countries in other regions.

In releasing the GEO-1 report, UNEP's Executive Director rightly remarked that "Solutions to environmental problems do not come from awareness alone. They have to be relentlessly sought after and striven for" She went on to add that "Rio was a process: an unprecedented basic framework was agreed upon and many important commitments were

made, but some vital issues remained to be set in place. UNEP's Global Environment Outlook report confirms that there still remained an unfinished agenda".

Ladies and Gentlemen,

As we are all aware, the environmental problems of the Small Island Developing States (SIDS) have gained increasing attention in recent years. In Agenda 21, the International Community recognized Small Island Developing States (SIDS) as a special case for environment and development. More specifically, Chapter 17/24 of Agenda 21 states that. "SIDS are ecologically fragile and vulnerable. Their small size, limited resources, geographic dispersion and isolation from markets, place them at a disadvantage economically and prevent economies of scale. For Small Island Developing States, the ocean and coastal environment is of strategic importance and constitutes a valuable development resource". Their small land area means that these states are effectively coastal areas.

The Global Conference on the Sustainable Development of Small Island Developing States, which was held in Barbados in 1994, adopted a "Programme of Action for the Sustainable Development of Small Island Developing States" (hereafter referred to as the Barbados Programme of Action). The recommendations of the Barbados Programme of Action incorporate the principles enunciated in Agenda 21, taking into account the strategies and commitments of the countries party to the United Nations Framework Convention on Climate Change, the Convention on Biological Diversity, the United Nations Convention on the Law of the Sea, and relevant Regional Seas Conventions.

UNEP recognizes the urgent need to take action in support of the sustainable development of SIDS through the implementation of the Programme of Action. To this end, UNEP is giving priority to translating the Barbados Programme of Action into mechanisms that can help SIDS put in place policies and strategies to achieve sustainable economic and human development. This it does most effectively through a SIDS Task Force established by UNEP in 1996.

In addition to this, UNEP has incorporated the special needs and vulnerabilities of SIDS into its 1996-97 Work Programme which was adopted at the eighteenth session of the UNEP Governing Council in May 1995. More specifically in its Decision 18/34 on SIDS, the Governing Council of UNEP encouraged an integrated approach to addressing the issues of relevance to SIDS.

Ladies and Gentlemen,

We cannot be complacent anymore and need to work in partnership with non-governmental organisations, community-based organisations and women's, youth and public interest group programmes in collaboration with local municipal authorities to speed up the pace of environmental

action, to set priorities, to provide an early warning system and to support informed decision - making at all levels. UNEP counts on each and everyone of you to play your part, however small, in safeguarding the future of our Planet Earth. After all it is the cumulative effect of many small initiatives at the local level which will have a marked influence in minimising or solving environmental problems, regional or otherwise.

In conclusion, I wish to place on record the excellent partnership arrangement that ROAP has successfully forged with Environment Australia and the South Pacific Environment Programme, resulting in the convening of this important regional workshop.

My thanks are also being extended to Prof. John Morrison who will act as consultant to this workshop and to the resource persons, too numerous to name, who will each share with you their experiences in their different areas of expertise.

Finally, I wish to thank Mr. Phil Ibbotson of ANUTECH for assisting us with the organizational aspects of the Workshop.

Thank you.

APPENDIX 4.

OPENING SPEECH FOR THE SPREP/UNEP
WASTE MANAGEMENT WORKSHOP

Mark Hyman,
Environment Australia

I would like to begin by welcoming all participants to Canberra for the Waste Management Workshop for Small Island Developing States. This is an opportunity to share experiences and discuss options for environmentally sound waste management in our region.

Governments at all levels are increasingly being confronted with the issue of how to manage the growing pile of waste that is being generated by our society. Perhaps it is worth thinking for a moment about why the generation of waste is an environmental problem and how big that problem is.

Waste Management

It is generally acknowledged that the traditional approach of just dumping waste in the ground or in rivers and oceans is no longer acceptable because of its adverse impact on the environment. We are conscious of this in a country such as Australia, where we have large areas of land and a comparatively small population. But I realise that many countries in the Pacific region face this environmental problem in a much more acute way, where land is unavailable or unsuited for landfill construction, and where the environmental impact of some kinds of wastes both on land and on coastal waters is already very apparent.

- From a waste management perspective, the dumping of material that still has a useful life or could be recycled into other products represents a waste not only of the material itself but of all the energy, labour and money that went into the original production of that material. We are realising more forcibly with each passing year that we cannot expect to treat our natural resources as limitless.
- The generation of waste also characterises many of the things that we see as contributing to environmental ills, such as 'don't care' attitudes, society's strong consumer mentality, and the lack of value given to the environment. The generation of waste is perhaps the most powerful symbol and indicator we have of unsustainable consumption.
- New, ecologically sustainable approaches to resource production and use need to be developed and implemented which minimise the amount of waste produced in the first instance and which minimise the environmental impact of the disposal of waste that cannot be avoided. And

we need at the same time to develop ways of handling the immediate problem of the waste streams that are with us now. We certainly cannot afford to wait for perfect solutions; but we must continue to attack the problem at source as well as managing it on a day to day basis.

- Governments, industries and communities of the Small Island Developing States have the potential to initiate a range of measures to manage waste in their region. I would expect that different countries, with different industrial , social and political structures, will come to different conclusions about the approach and importance of waste management measures adopted.
- Industry can be both environmentally and economically efficient. More and more, we are recognising that the two go hand in hand. In order to manage our growing waste, production must and can be cleaner and efficient.
- Recycling waste or reuse of resources or products are an obvious, and relatively simple approach that many companies have already embraced. Waste management approaches include recycling but go far beyond this. They seek to increase efficiency and introduce technologies and practices that prevent waste production.

When defining parameters and developing mechanisms to manage waste, there are a number things that need to be done. We need to identify a clear picture of the long term goal of waste minimisation; we need to understand the real environmental costs of waste generation; we need to know how much of what kinds of wastes are being generated; we need the most appropriate means of manufacturing, collecting and recycling products to minimise environmental impacts; and we need to select the best options for actually managing what waste streams remain after preventive action has been taken. These sorts of factors need to be clearly articulated and understood by all parties if we are to achieve sustainability.

Environmental Management in the Region

Over the next five days, I anticipate that productive discussion and outcomes will be a result of this workshop. The forum will provide an opportunity to exchange information and share experiences, as well as explore common needs and priorities in the region.

I note that a wide range of issues will be covered by the workshop; both hazardous and non-hazardous wastes; financing; recycling; a variety of waste management technologies and options; the use of pollutant release and transfer registers to generate good information; public awareness and education; and downstream issues such as water quality impacts of waste generation. This represents a comprehensive agenda and I am sure that there will be many opportunities for us all to learn from each other and to explore the particular topics that are important to each of us.

APPENDIX 5.**OPENING SPEECH BY THE REPRESENTATIVE OF THE
SOUTH PACIFIC REGIONAL ENVIRONMENT PROGRAMME (SPREP)**

Neva Wendt
Project Manager, Capacity 21
Head, Environmental Education, Information and Capacity-Building

Introduction

On behalf of the Director of the South Pacific Regional Environment Programme (SPREP), Mr Tamarii Tutangata, I am pleased to be present at the opening of this Regional Workshop on Waste Management for Small Island Developing States in the South Pacific. This is the first workshop in a series of Environmental Management Seminars with which SPREP will be associated with one of our former founding fathers, the United Nations Environment Programme (UNEP). Discussion is currently underway between SPREP and UNEP and donor organisations for this forthcoming series of training activities to be held over the next four years. Suggested subject areas of direct relevance to Pacific island countries include:

- Mainstreaming the Environment in National Planning,
- Coastal and Marine Resource Management,
- Environmental Education and Information,
- Environmental Legislation and/or Management of Land and Fresh Water Resources

Training in each of these subject areas, as well as the theme for this current Workshop on Waste Management, it is hoped will strengthen the capacity of the small island developing states of the Pacific to better manage their environment. These training areas have been identified in SPREP's recently revised Action Plan for Managing the Environment of the South Pacific Region 1997 - 2000. The mandate for this revised action was given to SPREP at the Ministerial segment of the Ninth SPREP Meeting held in Tonga, 27 - 28 November, 1996, following deliberation by senior officials from the Environment Departments of our 26 member governments and a process of extensive in-country consultation and input.

Vision for SPREP

The new SPREP Action Plan which will take us to the year 2000, outlines the vision for SPREP as:

'a community of Pacific island countries and territories with the capacity and commitment to implement programmes for

environmental management and conservation. This SPREP community shares responsibility for implementation of the Action Plan, facilitated by its Secretariat'. (1)

The Action Plan consolidates acknowledged areas of strength and focuses on building national capacity to address the issues of common concern. It stresses the importance of national implementation, carried out by the countries themselves, with the SPREP Secretariat performing a role as facilitator or co-ordinator. You will note the emphasis placed on national capacity building and implementation and the importance placed on SPREP, not as an organisation in itself, but as the Secretariat assisting SPREP members which together form a community of Pacific island countries and territories. You, as representatives of the Environment and related Departments of Pacific island countries, are SPREP, assisted by your Secretariat which is aiming to build upon past training activities to strengthen your environmental management skills.

SPREP Focus

The member governments have called upon SPREP, through the Action Plan to focus a comprehensive range of regionally-coordinated and nationally implemented activities under the following five programmes:

1. Biodiversity and Natural Resource Conservation
2. Climate Change and Integrated Coastal Management
3. Waste Management, Pollution Prevention and Emergencies
4. Environmental Management, Planning and Institutional Strengthening
5. Environmental Education, Information and Training

Activities within three of these programme areas are incorporated into this current UNEP Waste Management Workshop. Programme 3 (Waste Management, Pollution Prevention and Emergencies) is obviously covered as the subject area, together with elements of Programme 4 (Environmental Management, Planning and Institutional Strengthening) through assisting national environmental management and national capacity building and Programme 5 (Environmental Education, Information and Training) through provision of the information that will be forthcoming over this week and especially, through the training which you are all involved in.

These areas of focus for SPREP have been identified through processes that date back to the early 1980s. At that time the 22 Pacific island countries and territories that make up SPREP's membership produced their national State of the Environment (SOE) Reports. Some of these reports took only a very cursory glance at their environment but those were early days, when environmental issues were newly on the agenda in most countries of the world. In fact, a number of Pacific island countries at that time did not have Environment Units, nor even an officer whose job was specifically environmental management. These early State of the Environment Reports, together with 13 topic reviews, were presented to the

Conference on the Human Environment held in Rarotonga, Cook Islands in 1982. At that stage, the Pacific was well in advance of many other countries of the world in having identified their environmental issues. It was soon recognised too, that most countries were coming up with the same list of issues and that this similarity lent itself to environmental management being addressed on a regional basis - hence the establishment of SPREP and its Action Plan, together with a regional State of the Environment Report which served as SPREP's mandate till the early 1990s.(2)

State of the Environment (SOE) Reports were again produced in 1991-2 by fifteen Pacific island countries (Cook Islands, Fiji, Kiribati, Federated States of Micronesia, Nauru, Niue, Palau, Papua New Guinea, Marshall Islands, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu and Western Samoa). Many of these were produced as country reports to UNCED and in association with the National Environmental Management Strategy (NEMS) process. Obviously in the 10 years between these two SOE reporting exercises, the concept of 'environmental protection and management' had become more firmly on country agendas and there was a greater concern for, and awareness of, issues. The differences between the 1982 and 1992 State of Environment reports show that 'when similar topics are addressed, the percentage of countries expressing concern and a need for action has increased.....As well there has been a clear shift in emphasis emerging towards problems associated with population pressure and urbanization.'(3) From an associated survey of 13 Pacific island countries, 'all expressed concern about:

- (i) the need to establish protected areas or gene pools to preserve biodiversity;
- (ii) pollution of reefs, lagoons and other coastal areas;
- (iii) management of solid waste in urban areas; and
- (iv) disposal of sewage in urban and industrial areas.
and most expressed concern about:
- (v) the growing scarcity of land;
- (vi) lack of effective land-use controls;
- (vii) contamination of scarce groundwater;
- (viii) improper management of liquid wastes (including petroleum products, pesticides, and other non-sewage toxic substances);
- (ix) intensification of agriculture (including shortened fallow, monoculture, and similar cropping practices that cannot be sustained);
- (x) overfishing of inshore areas (including reefs and lagoons); and
- (xi) need for alternative (nonpetroleum-based) sources of energy.

Additionally, all national reports expressed concern regarding the inadequacy of their government policies of or practices, for:

- land-use planning (especially coastal zone management);
- environmental monitoring (of resource use and pollution or degradation);

- educational programmes to improve public awareness of environmental risks; and
- the proper pricing of resources to recover all costs (including environmental damage rents and other externalities) from national allocation of scarce land, water, trees, and beach areas.' (4)

Last year (1996) a list of 'hot' issues was identified by member governments who participated in the Regional Consultation on State of the Environment Reporting Meeting held in Suva, Fiji, 18 March, 1996. Further deliberation over the appropriateness of these 'hot' issues as SPREP's priority areas for focus, was undertaken by Pacific island countries as part of the SPREP Action Plan Review during 1996. In devising this initial list of 'hot' issues, the list of nationally important issues agreed upon in 1982 and 1992 were tested in terms of sensitivity and impact on key resources.(5) The steps taken in examining each issue were:

1. What are the human activities and natural processes that are affecting each environmental resource (if any)?
2. What is the geographic scale of the effect?
3. What is the magnitude of the effect?
4. What is the overall assessment?
5. How will this change over the next 10 years given current development and other trends in the Pacific region?

'Hot' Environmental Issues

The 'hot' environmental issues thus identified were:

- Deforestation (including agrodeforestation)
- Land degradation (erosion)
- Depletion of oceanic/coastal resources
- Loss of biodiversity
- Climate change/sea level rise
- **Waste management (urban)**
- **Population growth**
- **Environmental education**
- **Institutional support**

The highlighted issues are pertinent to this workshop and are all inter-related.

Waste Management (Urban)

As you are all aware, waste disposal is a common problem recognised by all countries within the region. It is especially associated with disposal of solid and liquid wastes, particularly as a result of increased urbanisation and growing population pressures. With limited land areas around many urban centres, and with reefs, lagoons or inshore fisheries particularly vulnerable to pollution, most Pacific islands report that they experience difficulty with waste disposal. As well, rising 'standard of living expectations', result in

greater importation of packaged consumer goods adding to the amount of nonbiodegradable waste being generated. Pollution from industrial waste and sewage, and disposal of toxic chemicals are significant contributors to marine pollution and coastal degradation. There are obvious challenges for planners in siting waste disposal facilities. There is also an ever-present threat of toxic and hazardous waste disposal being brought to the region from developed countries who sometimes regard some of our remoter islands as potential disposal sites.

'With inadequate sanitation systems for the disposal or treatment of liquid wastes, high coliform contamination in surface waters and in groundwater near urban areas is common. Various incidents have also been reported of pollution by toxins from industrial waste, effluent from abattoirs or food processing plants, by biocides, and polluted effluent from sawmills and timber processing areas.' (6)

Population Growth

The net population growth of the region is high with natural rates of population increase well over 2 per cent. Population pressures on some of the atolls are extremely high, and becoming more so especially as a result of rural-urban migration as people move from outer atolls to urban areas such as Betio in Kiribati and Ebeye in the Marshall Islands. Rapid population growth obviously places pressure on existing land resources, puts pressure on existing in-shore fisheries resources, increases the need for freshwater supplies, and increases the need for waste disposal facilities. There are also significant social implications from rapid population growth as more social infrastructure (such as schools) are required in urban areas together with an increased demand for employment.

Environmental Education and Awareness Raising

Environmental education and awareness raising is being addressed by organisations like SPREP and the increasing number of environmental Non-government Organisations around the region. The importance of educating people and raising awareness of the need for better environmental management and protection practices, including waste management is well appreciated, but the task of providing resource materials for the formal and non-formal education sectors is enormous and available resources are limited. In the formal education sector, environmental education is difficult to incorporate into an already full curriculum which places emphasis on examinable subjects as children compete for a limited number of scholarships. Increasingly, through the efforts of organisations like SPREP, teachers are being introduced to ways of incorporating environmental themes into their existing lessons, but progress is slow. Most teaching material is derived from developed countries, containing few issues that are specific to the Pacific. So there is a need for greater production of relevant material which, for best acceptance in the non-formal sectors, needs to be produced in local languages. The theme of Pollution and Waste Management is given extensive coverage in

teacher training material currently used in SPREP's education and awareness raising activities. Classroom activities and lesson plans for teachers have been developed to teach children the importance of striving for a non-polluted environment. Perhaps our children as future adults will be more aware.

Institutional Support

There are increasing demands being placed on the small Environment Units around the Pacific, many of which are greatly understaffed and are not given priority when staffing levels are being determined. Prior to 1993, several of the smaller island countries did not have even one person whose task was specifically environmental management and protection. Today, this situation has been reversed but there are still too few people carrying very heavy work loads and being expected to work on a wide variety of issues due to the all encompassing aspects of environmental matters. As economic development increases, there is a greater need for environmental impact assessment of development activities and greater demands on environment units. What is needed are stronger links and more information sharing between economic and environmental planners, together with additional capacity building and training opportunities.

'Government administration processes in many Pacific countries still have a strong economic and financial focus; environmental considerations are rarely given that weight which is vital in the sustainable development planning process. We have declared our commitment to integrate environmental considerations with economic and sectoral planning and policy making and to formulate resource utilisation policies in accordance with the precautionary principle. But we need to adjust our planning and management systems to integrate considerations such as population trends, consumption patterns, health and nutrition concerns, educational standards and requirements, the availability of both traditional and innovative technologies, financing considerations, and the complementary roles of public and private sector organisations.' (7)

Environmental issues are too important to be left outside the mainstream of the decision-making process. There is an obvious need to balance the call for increased economic development against maintenance of the region's environmental quality and achievement of sustainable development. It is possible to have both and attempts are being made to address this in SPREP's new Action Plan.

Waste Management, Pollution Prevention and Emergencies

The SPREP Action Plan Programme 3: Waste Management, Pollution Prevention and Emergencies has the objective of minimising pollution and wastes and improving preparedness for pollution emergencies. The Action Plan also outlines a number of expected outputs with clearly stated performance indicators. No longer are we working within a broad mandate,

but now there are explicitly stated goals which SPREP will be assisting its member governments to strive for over the next four years.

A major output envisaged for the waste management area is:

'Improved national and regional capacity to prevent, minimise and manage pollution and waste'. (8)

through the following means:

- training personnel in agencies responsible for handling and management of medical, toxic and hazardous wastes;
- developing an inventory of all forms of wastes by source category;
- developing national management policies and related legislation for the minimisation and environmentally sound handling and disposal of all forms of wastes;
- obtaining and building up infrastructure for handling and disposing of solid wastes, waste water and sewage;
- raising public awareness of waste management issues, including population linkages; and
- ensuring that fresh water supplies are protected.

There are also a number of other outputs envisaged in the Waste Management and Pollution Prevention sector of the SPREP Action Plan, including:

- coordinating marine pollution emergency responses;
- implementing principles of the Waigani Convention (for which SPREP will be the Secretariat once it enters into force) associated with the transboundary movement of hazardous wastes; and
- developing national and regional strategies to minimise sea-based pollution.

This workshop is aimed to build your capacity and your confidence to undertake these tasks. You have been given this responsibility on behalf of your governments. It is not a small task but one that we hope, following this week of training, you will be better equipped to undertake. The expertise provided by collaboration between ANUTECH, UNEP and SPREP, we hope will be the forerunner of other collaborative arrangements to assist you to protect and manage your fragile environments. SPREP is appreciative of the opportunity to be associated with this training activity which, as was stated at the outset is one in a proposed series of Environmental Management Seminars which are being developed to better equip you to undertake your large task as your countries' and the region's environmental managers.

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2. *Report of the Conference of the Human Environment in the South Pacific*, Rarotonga, Cook Islands, March, 1982, SPC, New Caledonia, 1982.
3. R. Thistlethwaite and G. Votaw. 1992. *Environment and Development: A Pacific Island Perspective*. ADB/SPREP, Manila, 1992, pp.203-205.
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5. The sensitivity tests are those used by the ADB/UNEP-EAP/AP in the development of a sub-regional model (refer Piddington, K 1996. Report to UNEP-EAP/AP on developing a uniform format for State of the Environment reporting in the Asia/Pacific region (and related matters), 12 January 1996.
6. *The Pacific Way: Pacific Island Developing Countries' Report to the United Nations Conference on Environment & Development*, SPREP, SPC, Noumea, New Caledonia, 1992, pp. 32.
7. *Ibid.*, p.51.
8. *Action Plan for Managing the Environment of the South Pacific Region 1997 - 2000*, *op. cit.*

APPENDIX 6.

CASE STUDIES PRESENTED BY COUNTRY PARTICIPANTS

COOK ISLANDS CASE STUDY

Tuingariki Short
Ministry of Works, Environment and Physical Planning

Preamble

Solid waste management on Rarotonga is similar to many other island nations. Solid waste is transported by road to one of two small landfill facilities. Residential waste is either collected by the government collection service or delivered privately. The government service is contracted out to a local waste hauler, who provides a weekly service to most of the Island's residences. Many residents utilize a steel 44 gallon drum at the entrance gate to their property for the collection and storage of household refuse. Commercial waste is delivered to the landfill facility either privately or by a sole commercial hauler on the Island.

Municipal refuse is currently disposed of at the Nikao and Matavera landfill sites, both of which have limited future disposal capacity. These sites are inadequately engineered and lack appropriate environmental control systems. No liner systems, leachate or landfill gas collection systems have been installed in the landfills. Site operations require significant enhancement and modification. Environmental degradation of the surrounding atmosphere, soil and underlying groundwater will almost inevitably occur at these sites. Existing landfill sites on the Island also present similar environmental problems.

The current waste generation volume entering the municipal wastes stream is estimated to be 4.75 tons per day, comprising approximately 40% residential and 60% commercial. Organic (32%) and glass (24%) comprise a significant portion of the waste stream, followed by plastics (12%), and metals (10%). Upper estimates for population and tourism growth indicate that the waste generation volume in 2005 could increase to over 10 tons per day.

Hazardous and designated wastes exist on the Island in relatively small quantities. There is minimal public awareness of the potential hazards of these materials. Current storage, handling and disposal of these materials is inappropriate.

Current solid waste disposal is a primary concern. Recommended improvements include three main elements: short term improvements to existing operations, the construction of a technologically and environmentally appropriate landfill facility and the phased environmental remediation of abandoned landfills.

A major part of this project has been to site a new landfill on the Island, which has included the analysis of over 20 potential sites around the

Island. Following analysis, a site has been selected, which will be located within a secluded valley in Arorangi, on the west side of the Island. The valley is inland of the coastal area, behind the national prison and within an area which has been impacted by ongoing quarrying operations. This location is also favourable since a recycling centre and a septage treatment pond can also be located within the valley. The quarrying operations can also continue to excavate the quarry sidewalls, providing additional areas for future expansion of the landfill facility.

The proposed landfill site has a surface area of approximately 1 hectare, and an estimated volume of 60,000 cubic metres. The site layout is shown on Figure 6-2. Based on various assumptions and the incorporation of the recycling program (described below), the estimated life of the landfill is approximately 18 years. Significant additional landfill expansion capacity exists in the quarry, possibly for the next 100 years. Environmental protection systems are incorporated in the landfill design to protect the environment. These include:

- **Subgrade Drainage System** - to mitigate hydrostatic groundwater build-up beneath the liner;
- **Composite Landfill Liner** - to provide containment of leachate and landfill gas within the landfill;
- **Leachate Collection System** - to allow for the collection and disposal of leachate;
- **Landfill Gas Collection System** - to collect and dispose of landfill gas;
- **Groundwater Monitoring Wells** - both upgradient and downgradient of the landfill site to allow the monitoring of groundwater chemistry.

A security gate and weighbridge will be provided at the quarry valley entrance to screen and weigh incoming loads, and a small site office and equipment storage shed will be located at the landfill. Landfill operations will be performed by a landfill bulldozer/compactor. The landfill facility is proposed to open in October 1997.

Technical assistance will be provided during the landfill start-up phase, providing education and training on landfill systems technology, landfill operations and procedures and environmental monitoring.

No EIA is considered to be needed for the proposed landfill facility provided that the management measures in the initial environmental evaluation (IEE) are followed. This is considered an Asian Development Bank (ADB) Category B project.

There is strong desire and public support for the development and implementation of an effective waste reduction and recycling program on the Island. Waste volume reduction reduces the volume of waste being land filled resulting in direct landfill cost savings and reduced land needs. Recycling also results in energy and resource conservation.

A waste reduction and recycling program will be developed and progressively implemented on the Island to effectively reduce the volume of materials landfilled. Target waste reduction and recycling goals are to achieve a 30% waste reduction following initial start up (1997), a 40% waste reduction after 2 years of implementation (by 1999), and a sustainable 50% reduction by the year 2003. Implementation of the program will significantly increase landfill life and provide income from the sale of recyclable materials.

The main component of the recycling system will be the development of a small recycling facility located adjacent to the landfill facility in Arorangi. The centre will occupy approximately 1.5 acres and will contain the following equipment:

- Recycling shed
- Recycled Material Storage Bins
- Hazardous Waste Storage Area
- Buy-Back Centre
- Site office
- Front-end loader
- Flatbed truck
- Utilities

An IEE will be performed for the recycling centre during the initial design phase of the project. At this stage, the recycling centre is considered to be an ADB Category B project.

The program will concentrate primarily on the waste reduction/recycling of organic, glass, alloy and steel components and plastics. This will include the development of drop-off programs, source separation programs and commingled kerbside collection.

Technical assistance will be provided during the project implementation phase to establish the overall recycling program. This will include the development of public education and awareness programs, provision of training to management and operations personnel, development of recycling centre-operation systems and devising programs to increase recycling efficiencies.

Many types of hazardous and designated wastes exist on the Island, including medical waste, asbestos, batteries, oils, acids, cleaning fluids, paints, inks, agricultural chemicals, solvents, degreasers, lubricants and other chemicals. Public awareness of the public health and environmental impacts of improper storage, handling and disposal of these wastes is minimal. Wastes are re-used or burned indiscriminately, or discharged directly into the landfill sites or drainage systems on the Island.

Technical assistance will be provided as part of the project to improve the overall handling, storage and disposal of hazardous and designated wastes on the Island. This will include completion of a hazardous waste assessment, recommending methods to improve waste storage, handling and disposal, providing education and training and preparing guidelines for the introduction and enforcement of environmental control regulations. A

hazardous waste screening program will also be established, to allow segregation and storage of hazardous and designated wastes at the recycling centre.

Recommended project components and associated base capital cost estimates (1995 prices) are summarized in the table below.

Project Component	Estimated Base Cost (US\$)
1. Rarotonga Collection Treatment and Disposal	
• Land	158,400
• Civil Works	1,477,740
• Equipment and Materials	397,980
• Engineering	429,000
• Physical Contingencies	276,540
• Price Contingencies	219,780
Total Component Cost	2,959,440
2. Rarotonga Recycling Centre	
• Land	79,200
• Civil Works	231,000
• Equipment and Materials	192,060
• Engineering	52,800
• Physical Contingencies	57,090
• Price Contingencies	49,698
Total Component Cost	661,848
3. Rarotonga Existing Site Remediation and Closure	
• Land	0
• Civil Works	243,540
• Equipment and Materials	0
• Engineering	151,140
• Physical Contingencies	47,388
• Price Contingencies	41,128
Total Component Cost	482,196
4. Aitutaki Landfill and Collection	
• Land	39,600
• Civil Works	802,098
• Equipment and Materials	231,000
• Engineering	297,000
• Physical Contingencies	165,000
• Price Contingencies	134,442
Total Component Cost	1,669,140
5. Technical Assistance for Project Implementation	
• Raroronga Landfill Start-up and Environmental Program Development	38,525
• Recycling Strategy Development	82,050
• Hazardous Waste Program Development	159,100
• Physical Contingencies	19,092
• Price Contingencies	12,959
Total Component Cost	191,151

FIJI CASE STUDY

Nacanieli Bulivou Suva City Council

Fiji consists of some 520 islands and islets lying between 15°S and 22°S latitude and 177°E and 180°E longitude. Only about 100 of the islands are permanently inhabited. The total land area is estimated at about 18,300 km² and the population is about 775,000. The Fiji group has a tropical oceanic type of climate with mean monthly temperatures ranging from a minimum of 20°C in July to a maximum of 30°C in January. Rainfall averages about 2750 mm annually over the whole group but there is a marked variation on the larger islands where the presence of mountain ranges leads to a rain shadow effect and hence 'wet' and 'dry' zones, with the wet or windward sides facing the prevailing southeast trades and the dry or leeward sides in the north and west.

The urban and rural populations by ethnic origin are given below.

RACES	URBAN		RURAL		TOTAL	
	1996	1986	1996	1986	1996	1986
FIJANS	161,824	107,780	233,175	221,525	394,999	329,305
INDIANS	166,851	144,533	169,728	204,171	336,579	348,704
OTHERS	29,456	24,712	11,621	12,654	41,077	37,366
TOTAL	358,131	277,025	414,524	438,350	772,655	715,375

The urban average growth rate of urban movement was highest among Fijians at 4.1% with Indians 1.4% and others 1.8%.

Suva City

The capital city, Suva, is located on the southern part of Viti Levu. It extends to the surrounding districts, i.e., Suva rural, Lami Town, Nausori Town and Nausori rural - the whole area being called Greater Suva.

In administrative terms, Greater Suva is divided into five areas, each with its own administrative authority. - Suva City Council, Suva Rural Local Authority, Lami Town Council, Nausori Town Council and Nausori Rural Local Authority.

Suva City Garbage and Refuse Collection and Disposal Service

No study of the finances of municipal waste processing can be considered complete without an appreciation of the refuse collection services.

Garbage collection and disposal are carried out by the Council's Health Services Department. Enclosed compactor trucks are used and the

commercial sectors are serviced daily while the other residential sectors are serviced three times a week. Collection of garden refuse and other general refuse (trade waste is excluded) is contracted out to private contractors. All streets within the city boundaries are serviced once a week by contractors. All refuse entering the Lami dump is weighed by the weighbridge and the data are recorded.

Revenue at the dump site is collected from:

- i) Fees received from garbage collection by rural areas;
- ii) Fees received from dumping and wasting.

The revenue collected from garbage disposal is given below.

1993	1994	1995	1996	1997 (BUDGETED)
\$56,579	\$81,615	\$87,629	\$120,000	\$130,000

General expenditure includes the salaries of two staff wages and forty four (44) workers, plant hire, cost of cover materials, tools, uniforms, cleaning materials and miscellaneous expenses.

The actual costs and budgeted costs for waste services are given below.

1993	1995	1996	1997
\$394,381 (Actual)	\$457,761 (Actual)	\$503,430 (Budgeted)	\$526,230 (Budgeted)

The 1995 Suva City Council Health Services Department Financial Report showed that the budgeted refuse collection cost in the Suva City area was \$457,761. The total weight of domestic and commercial waste handled during 1995 was 12,298 tonnes. This gave a mean collection cost of \$37.22 per tonne.

AUTHORITY	POPULATION	COST OF REFUSE & DISPOSAL COLLECTION ONLY		REFUSE TONNAGE	COST PER TON
		1995	1996		
SCC	81,659 (2% Growth Rate)	457,761	503,430	12,298	37.22

Other Resources Available

No. of 7 ton trucks	=	8
No. of compactor	=	6
No. of labourers	=	38
No. of staff	=	2
No. of trucks	=	3
No. of D-8 bulldozer	=	1

Some information has been collected on the composition of the waste stream entering the Lami dump. Data from 1992 is given below (weight%).

Material	Sample 1	Sample 2	Sample 3	Average
Metal	13.9	11.7	17.3	14.3
Glass	5.5	4.5	11.0	7.0
Vinyl/plastic	7.4	7.8	10.1	8.4
Leaves	3.0	1.4	4.0	2.8
Vegetable residues	31.9	18.6	14.8	21.8
Animal Residues	4.9	0.6	0.4	2.0
Wood	0.6	0.0	0.0	0.2
Coconut residues	1.9	12.9	6.3	7.0
Fibre	3.0	4.4	3.8	3.7
Paper	27.9	34.6	31.0	31.2
Rubber	0.0	0.0	0.2	0.1
Eggshell	0.0	0.0	0.2	0.1

The Lami dump has been a source of public concern for many years, but it is hoped that a new sanitary landfill at Naboro, some 15 km out of the city, will be opened within the next few months.

KIRIBATI CASE STUDY

Taulehia Pulefou
Ministry of Environment & Social Development

The Republic of Kiribati consists of 33 coral islands and atoll reefs and occupies an Exclusive Economic Zone area of 3.5 million km² in the Central Pacific. Most of the islands are located in the dry belt of the equatorial climatic zone with mean daily temperatures ranging from 26 to 32°C. The 33 islands and reefs have a total land area of approximately 820 km² which results in a sea to land ratio of 4000:1.

The total population of Kiribati was estimated at about 77,600 in the 1995 census, with about 32,356 or 41% of the total population living on South Tarawa, the main island, an increase from the previous census when it was 36.4%. When the modest growth of all the other island groups in Kiribati is taken into account, it is clear that South Tarawa continues to be the main centre of attraction for the nation's residents, putting increasing stress on its limited land, ecosystems and resources generally.

One of Kiribati's major concerns is to improve the management of waste and the control of pollution, particularly on South Tarawa. With such limited space and a vulnerable resource base (limited soils, narrow water lens, well-used lagoons and exposed foreshore), there is concern that if nothing is done to ensure proper disposal of solid waste and sewage, degradation of the environment will become of critical concern.

Already, many of the community health problems now evident in South Tarawa are attributable, to a great extent, to the contamination of water supplies and water shortages. Despite efforts to keep it clean, some sections of the Tarawa lagoon are still contaminated. This is due, in part, to people continuing to use the beach for defecation rather than the toilet blocks which were constructed to discourage the practice but which are inadequately maintained and frequently blocked. A salt-water sewerage system is in operation, but there are too few connections to the system by private owners, too many leakages, and too much discharge of sullage onto the ground.

Solid waste disposal is a major concern, given the susceptibility of groundwater and marine resources to pollution. There is uncertainty regarding the availability of land for safe landfill sites; a lack of disposal facilities for hazardous waste; increasing use of imported non-biodegradable products; the nature and origin of waste and its environmental impact; and a lack of legislation controlling toxic and non-biodegradable waste.

Of particular interest, Kiribati is now currently concerned, especially, with contaminated wastes from various existing bodies such as Shipping,

Civil Aviation, Quarantine and Health (Central Hospital) departments. All these departments have no facilities available or proper methods to dispose of their wastes. In fact the Health department has one but it was not well maintained with lack of trained personnel to carry out operational activities and is now left unused. In so doing, their waste all ends up in the sea, landfill sites or onto the land which creates pollution to both groundwater and to the marine resources and eventually affects human health.

At the present time, two Councils, namely, Betio Town Council (BTC) and Teinainano Urban Council (TUC) are responsible only for municipal waste collection excluding contaminated waste, which is the responsibility of the departments concerned. There are insufficient vehicles and inadequate management resources to provide a satisfactory collection service to the public, despite the inclusion of fees for the service in the Council poll tax. Different fees are charged for government, domestic, and commercial customers.

On the other hand Kiribati has no adequate legislation dealing with waste minimisation and the disposal of waste and nothing at all covering hazardous waste. Nor is there any legislation dealing generally with marine pollution from land based sources, except where this affects harbours and ports.

With the assistance of UNEP and SPREP, however, a final draft of the Environment Bill 1996 is now ready for Government approval and Parliamentary approval. This process will take time before it can be brought up to Parliament due to the fact that it has to be thoroughly reviewed by the Attorney General's office in order not to conflict with other existing acts.

It is recommended, as one of Kiribati's needs, that having an incinerator will, of course, reduce the problem that is now becoming prominent especially with its contaminated wastes. In fact, trained personnel from each Council are also needed to maintain the incinerator operation and should have substantial knowledge of mechanical problems. It is intended that two incinerators will be sufficient and be operated by both Councils at Betio and South Tarawa as part of their daily activities and means of income.

These incineration facilities will then be available for the disposal of combustible hazardous waste primarily from medical facilities, but also including waste oil and diesel from ships, aircraft and quarantine departments. Coordination between these departments and the Councils as well as the environment unit is also very essential.

I hope that during this workshop we will come up with plans and recommendations that may help those Pacific countries we represent with solutions to the various problems that are now currently encountering.

KOSRAE CASE STUDY - SOLID WASTE MANAGEMENT IN KOSRAE

Norlin E. Livaie
Kosrae Division of Environmental Health

Introduction

Kosrae is the easternmost island in the Federated States of Micronesia and second largest island, lying at 5°N latitude and 163°E longitude. Kosrae is a single island State of 42 square miles with the mountains rising to a maximum elevation of 2,064 ft. Rivers and streams carry sediments from the mountains towards the shore, creating alluvial plains that average about one mile in width. Human development and settlement is located along the coastal lowland area. The current population of Kosrae is approximately 7,350 with over 50% of the population under the age of 16. Relatively abundant rainfall (180 - 250) inches per year, warm air and sea water temperatures of 80°F average daily high for each. Dense tropical forest covers most of the island, from the high volcanic peaks and river valleys of its interior to the coastal lowlands and mangrove forests of its shoreline. Three natural harbours notch this coastline.

Current Solid Waste Disposal and Management

Solid waste disposal in Kosrae is a major problem. The increased consumption of imported goods over the last decade, in addition to inadequate solid waste management systems, has caused the island's rivers, mangrove areas, and reef flats to become the dumping grounds for garbage.

This waste is not just an unsightly mess, it is also potentially toxic to both humans and fish. Tin cans, batteries, motor oil, styrofoam cups, laundry soap bags and plastic packaging are just a few of the many items that can cause harm to Kosraeans and the fish that are so important to their well-being.

As a small tropical island, Kosrae is threatened even more by solid waste problems than areas with larger land masses and broader economic bases. Because of the island's steep mountain interior, there is a lack of suitable solid waste disposal sites located away from water supplies and coastal fishing areas. In addition to island geography, economic restraints on developing a modern waste disposal pick-up system and site facilities have caused solid waste problems to reach crisis proportions.

Another serious threat from solid waste disposal is the accumulation of toxic chemicals in the island's waters. Burning solid waste that contains plastics, batteries and metal creates toxic chemicals in the remaining ash. Heavy rainfall, the shallow water table and sandy soil on the island allow the toxic chemicals in this ash to wash into the island's rivers, harbours and

reef areas. Examples of dangerous chemicals in solid waste disposal ash include dioxin, lead, benzene, mercury, acrylonitrile and cadmium. These toxic chemicals are poisonous and can harm humans and fish in many different ways. Many of these chemicals have been found to cause cancer. Often, problems from toxic chemicals develop over a long period of time from contact with these poisons in the island's food, water and air.

As the population of Kosrae continues to grow, consumption of imported goods and the volume of solid waste generated from these goods will also increase. The development of a comprehensive solid waste management strategy that can improve the current systems of collection and disposal of solid waste using environmental and waste management technologies appropriate to Kosrae is necessary. Without a strong commitment from island leadership to support the planning necessary for such a strategy, the problem of increased generation of solid waste will become even more critical into the 21st Century.

Current Solid Waste Disposal

Household Waste:

Each household in Kosrae manages its own household waste. Some households use the municipal dumps while others utilize traditional waste management strategies, including burying, burning, and dumping waste in tidal areas. Pigs are fed with appropriate food scraps, but little else is separated out. Most of today's clothing, containers, packaging, and household items are made with chemicals produced artificially in chemical factories. Traditional waste disposal strategies are not adequate for dealing with waste that is non-biodegradable and potentially toxic.

Municipal Dumps:

Each municipality has open solid waste dump areas. These areas are located along roadways, and in some cases (Malem) along the primary circumferential road. The municipal dumps are not marked, not cleared or trenched, and are not operated or maintained by the municipality in charge. There are no restrictions on where to dump certain kinds of refuse in the dump (oil, batteries, pesticide containers, etc.).

Hazardous Waste Disposal

Petroleum, Oil and Lubrication:

Disposal of petroleum, oil and lubrication is one of the most critical concerns of solid waste management on the island. The generation of waste oil comes from transformer oil, used crankcase oil, used oil filters, battery acid, hydraulic oil, radiator coolants and degreasing solvents. Kosrae has no adequate system of disposal for these petroleum wastes. Used motor oil from automobiles is usually drained into the highly porous soil of the island, causing pollution of the water table, rivers and reef areas. Junk cars

are abandoned in the bush, and auto waste oil is left in them to leach into the soil. Runoff from roadways causes tar to drain into the waters of Kosrae. The Kosrae Utility Authority dumps oil and diesel produced as waste products from the electric generators into the nearby river which feeds directly into Lelu Harbor.

Pesticides:

Malathion is a highly toxic pesticide that is frequently used in Kosraean agriculture. Also, ant and roach killer is used regularly in many Kosraean homes. There are no specific waste disposal practices to dispose of empty pesticide containers properly.

Hospital Waste:

The hospital utilizes inadequate disposal strategies for contaminated hospital waste. Although there is a burn hole behind the hospital for contaminated waste (such as syringes and used bandages), conflicting reports from hospital staff indicate it is not used consistently. Some staff members interviewed said all the waste is taken to the Public Works dump adjacent to the High School. No separation of contaminated hospital waste from general waste is done.

Public Works

Tofol Dump:

Public Works operates an open dump adjacent to the High School in Tofol. This dump is used for the nearby municipality, the government administration complex, the high school and the hospital. Some households also utilize this dump for their garbage. Sporadic burning has occurred at the dump by the public. Recently, Public Works has placed a staff person at the dump during government working hours to direct dumping activities and control the burning of waste. This has proved effective only during working hours. Most of the dumping of rubbish occurs after working hours and current efforts at controlling dumping and burning activities have not proved effective. Public Works has had no control over the sporadic and unplanned burning at the site. This burning has occurred during school hours, and often a thick black smoke has risen from the dump and covered the high school while students were present. This practice is unacceptable and must be stopped immediately.

Waste Oil:

Public Works burns its waste oil in a simple incinerator. The process is slower than production of waste oil. Consequently, many 50 gallon barrels full of waste oil are at the Public Works yard waiting to be disposed of. A second incinerator is being developed to increase the Department's burn capacity. This incinerator method has only been used by Public Works for the past 6 months. Prior to that, waste oil was drained into the

surrounding bushes. Also, when public requests were made for empty 50 gallon barrels, they were given to the public full of oil and told to dispose of the oil in order to obtain the barrel.

Problems with Current Waste Activities

Purchase-Consume-Dispose:

The waste cycle of purchase-consume-dispose has become a modern day reality for much of the world. In Kosrae, with the constant supply of capital with which to purchase products, and the convenience of throw-away packaging made of plastics and paper products, the amount of solid waste has increased drastically in the last decade. With the increase of products like disposable diapers, canned foods and styrofoam cups, the island's beaches, mangrove forests and reef flat are fast becoming polluted and unsightly.

Littering:

Littering is a major problem in Kosrae. Although there are laws against littering, most Kosraeans do not comply with these regulations. Garbage is thrown alongside roads, homes and businesses by the majority of the population. Littering also occurs in rivers and tidal areas. This problem is not just unsightly - more serious problems exist because of littering. The heavy rainfall in Kosrae causes a high moisture content in the waste which in turn causes the waste to putrify faster. This rotting attracts insects, rodents, and dogs and cats. Dogs, rats and insect infestation from littering can become a serious threat to human health. Children are extremely at risk when garbage is available for them to play in. They can be exposed to broken glass, tin cans and toxic chemicals.

Burying and Burning:

Solid waste that is buried or burned can cause surface and ground water contamination. Hazardous waste from batteries, cleaning supplies and other toxic chemicals can leach out of the waste and make its way to nearby water, causing severe damage to fish stocks and their habitats. Toxic chemicals produced from burning plastic (dioxin and mercury for example) concentrate in shellfish and reef fish. Consumption of contaminated fish can be harmful. The Tofol dump is very near the mangrove swamps and rivers that lead directly into Lelu Harbor. The leaching of hazardous chemicals into the Harbor is of critical concern. Fumes and smoke from smoldering fires at waste disposal sites are extremely toxic to humans. The burning of plastics, metals, pesticide containers and cleaning solutions causes the discharge of lethal chemicals. At the Tofol dump site, burning occurs sporadically and unplanned. Often, the adjacent high school is in session during burning and students and teachers are directly exposed to toxic and dangerous vapours from smoke.

No Collection System:

Collection of solid waste is virtually non-existent in Kosrae. Two Municipalities provide some pick-up to their local dump sites, but the programs are sporadic and inefficient.

Lowered Value and Use of Adjacent Land:

The uncontrolled siting of dumps can have a significant effect on the value of adjacent lands. Contamination of land and water can cause land values to decrease rapidly. Unsightly garbage dumps can create unattractive sites that cause people to avoid development near solid waste sites.

Development of a Comprehensive Solid Waste Management Strategy

It is critical that Kosrae develops a Comprehensive Solid Waste Management Strategy as soon as possible. Damaging effects to public health and the island's ecosystems will continue to occur if effective disposal strategies are not developed and implemented. As is the case with many other small islands, the three main issues for an effective strategy are:

- 1) finding suitable site locations away from water sources;
- 2) appropriating funding for equipment and operation expenses; and
- 3) strengthening public awareness and support of proper techniques for waste disposal.

In addition to these problems, existing dump sites that have already caused environmental impacts and health hazards need to be properly managed or appropriately shut down.

Goals and Objectives:

The goal of a Comprehensive Solid Waste Management Strategy is to improve the current systems of collection and disposal of solid waste by using environmental and waste management technologies appropriate to Kosrae.

The following are the objectives to achieve this goal:

- 1) Determine who shall have responsibility for the development, operation and management of a solid waste disposal system on the island;
- 2) Review current laws and regulations for solid waste dumping and location of vehicle wreckage and littering, and develop an implementation strategy for effective enforcement;
- 3) Develop plans for the treatment and disposal of solid waste. Include plans for managing areas already used as dump sites, and the handling and disposal of hazardous waste;

- 4) Select island sites appropriate for solid waste disposal facilities capable of handling hazardous waste as well as general trash;
- 5) Develop a public education campaign;
- 6) Determine possible funding sources.

NAURU CASE STUDY - WASTE DISPOSAL IN NAURU

David Scott
Nauru Phosphate Corporation

Introduction

A number of pollution and waste management issues are under review in Nauru including:

1. Developing an intergrated Waste Management Plan
2. Waste reduction campaign
3. Recycling
4. Sewage collection and treatment
5. Land fill management
6. National rubbish collection and disposal

Of these, the one considered most urgent for Nauru is National sewage collection and treatment. Accordingly this has been chosen for the workshop case study.

Background

Nauru has a population of over 10,000 with no sewage treatment plant. Some areas have reticulation and in these areas raw sewage is disposed through outfalls directly onto the reef. Where there is no reticulation, sewage is collected from septic tanks and tankered to a central disposal point, again feeding directly onto the reef.

Issues

1. All sewage, including the tankered waste, waste from the Nauru Phosphate Corporation (NPC) residential area, the CBD and the hospitals, discharges untreated to sea at the outer edge of the reef. Any floating material washes back onto the foreshore.
2. The desalination plant intake is within the sewage affected area. This plant uses a low temperature vacuum process.
3. Marine ecology has been extensively damaged by nutrients in the waste over a long period.
4. In other residential areas, overflows from septic tanks leach through the permeable soil into the aquifer. This water is used for secondary consumption such as toilet flushing and has a high faecal coliform level.
5. Untreated sullage water is discharged into soak pits further contaminating the aquifer.

6. The contaminated aquifer also has a detrimental effect on the marine ecology of the reef.

Geography

Nauru is a remote island lying approximately 55 kms South of the equator at 0.31' South and 166.56' East. Its nearest neighbour, Ocean Island in the Kiribati group is 300 kilometres east while Melbourne is some 400 kms to the south west.

The island and its surrounding reef is 21 sq km in area, and is split into two geographic regions, topside where the mining operation is located and bottomside, a flat coastal strip where the majority of the population live. There are no rivers but there are a number of brackish lakes and a small enclosed lagoon in the district of Buada, probably at the location of the volcanic crater.

Average temperatures range between 30 - 38°C and rainfall, although heavy, is irregular with frequent periods of drought. Lying in the doldrums, winds are light easterly for eight months with stronger westerly for the remainder of the year.

Geology

The Island is an isolated extinct volcanic peak rising from the bed of the Pacific Ocean which, over the centuries, has submerged and re-surfaced a number of times. During the periods of submersion, coral pinnacles formed at its summit over which marine deposits were laid. The coral pinnacles dolomitized with the coral turning into magnesium limestone and the marine deposits into phosphate rock. Inaccessible coral pinnacles left behind after mining now cover 4/5 of the island giving it a moonscape appearance.

History

The first recorded visit to the island was made by Captain Fearn of the American whaling ship Hunter in 1789. It is said he was so impressed by the natives and the beauty of the island that he named it Pleasant Island. Later the island was annexed by Germany and, as was traditional with that administration, the island reverted to its native name of Nauru (Naoero).

The purity of the phosphate deposits was first identified by Sir Albert Ellis. In 1899 he was shown a piece of rock from Nauru which was used as an office door stop. The rock was thought to be petrified wood but he correctly identified it as 80% pure phosphate, the raw material used in fertiliser manufacture. His company, Pacific Phosphate, were actively seeking new reserves of phosphate and he visited Nauru and nearby Ocean Island where he found large deposits of the mineral.

Mining first commenced in 1907 under an agreement between Pacific Phosphate and the German Government. After the First World War mining continued under a joint commission administered by Australia, New Zealand and the UK. In 1969 Nauru gained independence and the mine operation was sold to the Nauru Government who formed the Nauru Phosphate Corporation to continue mining operations.

Government

One of the smallest independent republics in the world, Nauru has a native population of only 6500 which is split into 12 tribes. The island is also split into 12 districts each having its own MP who form the elected legislature with a Westminster-style Cabinet presided over by the President who is also Head of State.

The total island population is currently over 10,000, the additional persons being mostly migrant workers and their dependants.

Mining

Mining operations consist of excavation, crushing, drying, storage and loading of phosphate rock. Initially phosphate was won by pick and shovel using mainly Chinese labour working between the pinnacles. Mechanical excavation by clamshell bucket and hydraulic excavators now replaces hand labour.

Crushers reduce the rock in size to approximately 20 mm down. It is then dried in a rotary, oil-fired kiln and stored in a 120,000 tonne bin ready for export.

Loading

The absence of a natural harbour meant ships had to lie offshore. Originally rock products were taken out in small lighters. The first shipment of 1,917 tons was exported on the 6 July 1907. Loading was slow, weather-dependant and dangerous and a number of ships were lost on the reef while loading.

Production was much increased when in 1933 the first pair of ship loading cantilevers was constructed. Export capacity was immediately boosted to over 400,000 tonnes per annum with loading rates of over 3,000 tonnes per hour. These first cantilevers were destroyed by a German raider early in the Second World War and were rebuilt in 1949. A second pair of cantilevers was commissioned in 1962 when production capacity was increased to over 2,500,000 tonnes per annum.

Shipping

Nauru is surrounded by a narrow coral reef which falls off directly into deep water. Water depths of over 600 metres are recorded within 600 metres of the shore. As a result, a system of deep water moorings is used to secure ships. The inner buoys lie just off-shore in 30 metres of water secured by staples to the reef. The outer buoys lie anchored in 600 metres of water. This mooring system can handle shipping up to 42,000 tonnes displacement or 192 metres long and 28 metres wide, there being no draught limit. Loading phosphate or unloading containers is weather-dependent and is unsafe in greater than 15 knot winds or periods of heavy swell.

A small, shallow, artificial harbour serves a fleet of flat-bottomed vessels which handle containers and service shipping. These small vessels are stored on land and lifted from the harbour by electric overhead cranes.

Considerations

1. Cost of development. A sewage treatment plant designed for the current EP of 10,000 will have a high cost for both operation and construction. Although Government and NPC are prepared to assist financially, the estimated budget of \$2.5 million is prohibitive.
2. Choice of treatment technology. There are a number of treatment plants available. The final choice must accommodate available funds and local conditions including limited land area, lack of reticulation, salt and brackish water flushing and industrial waste disposal.
3. Energy consumption. Small footprint high-energy plants must be compared to low-energy treatment such as lagoons. Although Nauru may have surplus energy capacity at present, increasing power demands will soon erode this margin.
4. Ongoing maintenance. High technology plants require high levels of maintenance with associated on-going high costs.
5. Expertise. Choosing the plant most suitable for Nauru requires impartial study by consultants well-informed in disposal plant technology and problems specific to Nauru.
6. Future expansion. Population growth will require flexibility of design to allow for future expansion.
7. Use of treated product. Nauru has a need for bio-mass to assist in the rehabilitation of the Island. At present this resource is wasted. Also use of waste water for irrigation particularly following rehabilitation.
8. Reduction of sewage. Use of composting toilets, use of selective flushing volumes.

Conclusions

Tipping raw sewage into the ocean is environmentally unacceptable, affecting the health of the population and the reef. It also wastes a resource that could be used as bio-mass for rehabilitation of the Island.

Nauru needs assistance to formulate a sewage treatment policy, select and construct a treatment plant urgently thereby reducing pollution, improving public health and releasing a resource required for rehabilitation of the devastated mined areas of the Island.

NIUE ISLAND CASE STUDY - WASTE MANAGEMENT

Holo U. Tafea
Department of Health

Geography

Niue consists of a single upthrust coral atoll which, over many thousands of years, has emerged in stages from the ocean as a result of volcanic activity. It is approximately 480 km east of Tonga, 930 km west of Rarotonga and 660 km south-east of Western Samoa. Niue is known as the largest and highest coral atoll in the world. It is oval shaped with approximately land area of 259 sq km, 22 km long and 16 km wide. The people live in 13 villages, situated on a main perimeter road. Alofi is the port and administrative headquarters of government and is the largest populated village.

The Land

The atoll is formed by three terraces, the rim from the low terrace being some 28 metres above sea level while the rim of the upper terrace is some 69 metres above sea level. The island is characterised by a rugged and rocky coastline, featuring steep cliffs, caves, deep chasms and blow-holes. There is no surface water on Niue, but artesian bores (underground water) enable a subterranean reservoir of fresh water to be tapped for domestic and agricultural purposes. Therefore almost all households are fully dependent on artesian bores, rather than any other available sources.

Population

The total population is 2,300 taken from the last census. Niueans are New Zealand citizens. The government has a population development scheme encouraging Niueans to return, as well as business people to invest in Niue.

Waste Management

Under this heading, are single waste issues existing in the island.

(1) *Septic Tanks*

Septic tanks have been used in Niue for a very long time, and the number is increasing as new houses and extensions are built. A treatment plant is not available on the island, however it is another alternative that requires consideration. There is no standard specification for construction of these septic tanks, since septic tanks were built, only a few years ago, the issue has been addressed and little was formulated into the Niue Building Code. Sewage matter is a concerning issue in reference to the protection of the underground water lens. Our soils are known to be very porous, which leads to possible movement of this sewage into the water lens.

At the present moment this sewage is dumped at the lower end of the airport, on the open pit which is less than a kilometre from the seaside.

(2) Dumping Sites

There are seven dump sites on the island, which are all monitored by the Health Department under my supervision. Monitoring of these sites involves spraying rat-poison and weed control. The sites were limited solely to old unused Makatea (limestone) pits, which are located near the rims to protect the underground water lens. Dumping on any other land is prohibited under the national law. However, illegal dump sites are found elsewhere, e.g., roadsides, individual homes (backyards) and a few natural caves.

Of the seven dumpsites mentioned above, one has been found to be very difficult to monitor - the one in the town area (Alofi). The users, mainly in the town area, dump anything into the site, leading to flies and other health problems, and monitoring is very difficult. However, with those above problems perceived, plus the financial constraints, it has been found very difficult to control. At the moment a proposal has been made to Cabinet to operate only two dump sites, one for the north and one for the south, hopefully to apply controlled tipping methods. The collection service is under the private sector, under the supervision of Health Department (myself).

(3) Household Waste

Household waste is an issue that needs to be defined clearly, as in our homes, we found other waste that required disposal in a proper manner. This waste is a potential threat to the underground water lens as well as providing breeding and harbouring places for mosquitoes and other vectors. In general all household waste was dumped at the dump site. As mentioned earlier the dump site in the town area was found very difficult to monitor, where dead animals, rotting meats, fish bones and baby napkins were found. Signs were installed at the dump sites, as well as announcements in the local media, but response was very limited.

(4) Waste Oil

At the moment there is no proper method for disposing of the waste that is found in the private enterprises, commercial usages, power house and in the community (individual homes). Most of these wastes were emptied in the town dump site, while some oil is used for marking sports fields. The issue has been address to the above users as well to the community on health education level, but the achievement is very limited, which is a concerning to the Health Department. The supervisor of the Power House was advised to return all waste oils to the 44 gallon empty drums, to await disposal when in large quantity.

(5) Batteries

Car and truck batteries have still no proper method for disposal, old or unused batteries having been found everywhere on the island. Late last

year, when I returned from the workshop in Apia, I tried to collect old batteries from around the island but this was not very successful as the public insisted on compensation for their batteries. However, we are still trying to convince the public and the council of each village to give their cooperation.

(6) Medical Waste or Hospital Waste

All medical or hospital waste is dumped and burned in the open area in the Health Department compound. There is no proper burning place, and this waste is prohibited from being dumped at the dump site. The area poses a health risk to health workers who are working every day in the compound. However, last week before I left for this workshop, two Australian consultants I met in Niue, assured me and the government of Niue that under AusAID, an incinerator was now approved for the Health Department. I would like to express my sincere gratitude on behalf of the Niue Government for this generous donation from the AusAID to the Department of Health.

(7) Plastic Bags (and Disposable Baby Napkins)

For a few years now these items have been a concern to the community and the Department of Health as they are found lying around on the roadside, at individual burning places and many dump sites around the island. They create health problems, increasing flies and rodent populations, as well litter. The issue has been addressed in a few meetings but policy and regulation have not been formulated by the government, to ban importation of these items.

(8) Pesticides

Pesticides/Weedicides/Chemicals.

Chemicals of different kinds mentioned above are found in the island, for agriculture and health purposes and at other times for use by the public. These chemicals are often used but mainly gramoxone (paraquat) for killing weeds on taro plantations. Without proper knowledge as to whether these chemicals are safe or not (mainly paraquat that heavily used at the moment - is this a bio-degradable chemical?), we cannot assess which may have a chance to seep through to the water lens.

There is a committee formed under the Pesticides Act 1992 which controls the type of chemicals which are imported. The disposal of old pesticides is still an issue awaiting finalisation under a project with SPREP.

(9) Waste Metals

The accumulation of waste metals is not serious on the island, only in one specific area and for one specific marine organism but the public is aware of this ciguatoxin poison. Empty cans are being satisfactorily looked after by the public sector.

Summary

The Health Department recognises the need to improve Niue's environmental management, especially as it directly affects our community health standards. The Department has agreed to assist by:

- (i) Immediately improving the waste management system, currently in operation by recycling as much solid waste, composting all the biodegradable organic waste rather than cart it to the dump site to be burned.
- (ii) Recommending the purchase of a high-temperature incinerator for the safe disposal of infectious and dangerous hospital or medical waste, (including disposable baby napkins).
- (iii) To collaborate with the Environment Unit to conduct a Waste Management Public Awareness Campaign. Warning the community of the dangers of polluting our water lens, marine resources and locally-grown produce, as well as warning them of the risk associated with burning plastics (including disposable baby napkins).
- (iv) Ensuring that the Pesticide Committee helps to control the type of pollution which is coming into the island, especially that which remains here in the environment as serious health risks e.g agricultural chemicals.
- (v) Ensuring that an acceptable quality of drinking water is provided to all households (the Department will continue to monitor bore water samples in its Water Quality Testing Laboratory.)
- (vi) Ensuring that approved and properly-constructed septic tanks are installed in all new premises (the use of open pit latrines (W/S/L) needs to be discouraged).
- (vii) Monitoring the radiation levels in food and water and up-grading the Health Education Program to include all aspects of environmental management.

Objectives of the Health Department

If Niueans are to enjoy the benefits of good health and long productive lives, then the Government will need:

- (i) To provide, promote, establish and maintain community health through health care, by working with individual families and the community with special emphasis on the welfare of mothers and children, the elderly and the handicapped.
- (ii) To monitor its waste management and to do everything within its powers to reduce the level of pollution, both globally and locally.

On behalf of the Government of Niue and the Department of Health, I would like to thank (*Fakaue Lahi*) the UNEP/ROAP for the invitation to participate in this significant workshop. I also thank Environment Australia and SPREP for their close collaboration with UNEP/ROAP in conducting this training for Small Island Developing States in the South Pacific. I believe that we are fortunate to attend this significant workshop, so that knowledge and experiences we share will be beneficial to our small islands. God Bless, Thank you.

PAPUA NEW GUINEA CASE STUDY - WASTE MANAGEMENT IN PAPUA NEW GUINEA

Leo Mandeakali
Department of Environment and Conservation

Introduction

Papua New Guinea (PNG) is a small country in terms of population with a large land area encompassing some 462,000 square kilometres. The capacity of the land to support a very large population is, however, extremely limited as much of land is extremely steep and water logged. PNG has a population of approximately 4.6 million comprising a heterogeneous Melanesian community.

PNG, like any third world country, is currently going through a stage of the development process associated with the rapid increase in development activities, urban and population growth and the importation of manufactured products.

These have contributed to an increase in the generation of waste that affects the livelihood of people and other biotic communities. They have also contributed to the problems involving the sustainability of natural resources and our fragile environment.

Waste Management Issues, Practices and Problems in PNG

Environmental Planning and Management

Waste collection, handling, transportation, treatment and final disposal options must all be evaluated in terms of costs, benefits, technology, risks and environmental and social impacts. With new technology, public interest and participation, growth of recycling markets and possible decrease in economic constraints, attitudes and approaches to waste disposal have changed rapidly. Safe and efficient waste disposal options are now available worldwide, and our increasing interest in environmental quality highlights the importance of a responsible and efficient waste management.

Existing Solid Waste Management Practices in PNG

There are currently six (6) different ways of disposal of solid waste in PNG: dumping on land; dumping in water; ploughing into soil; feeding animals; recovery or recycling and incineration.

i. Dumping on Land or Tips

The most widely recognized practice in disposing of solid waste is dumping on land, i.e., in rubbish dumps while the other five practices are

less pronounced. Dumping on land also tends to be the cost-effective means of safely disposing of municipal waste.

Dumping of waste in rubbish dumps or dumping on land is currently the most common practice in PNG, in both rural and urban settlements or communities. They are commonly referred to as rubbish dumps and are usually located at the edge of the towns, cities and any settlements that are serviced by local government authorities and city authorities. Aside from regular services provided by agencies such as the local government councils, the village settlements, out stations, schools and rural based aidposts, private houses and industrial activities dispose of their waste in voluntarily designated open pits which are usually located not far from the waste generation source. The bulk of the waste that ends up in such tips or pits is solid waste with no regard for its chemical constituents, nature or its quantity. Also, there is no systematic determination on the handling and transportation of waste or how the various types of waste are to be disposed. Burning on these dump sites to reduce volume is common, but it pollutes the air with black acrid smoke.

Solid waste disposal and management of rubbish dumps in PNG vary between small towns, bigger towns and cities because of the differing quantities and types of waste entering the dump sites each day or week. These are principally determined by population size and the number of activities operating in that locality.

It is vitally important to note here that there is quite a distinct variation between a modern sanitary landfill and the commonly known rubbish dump or pit or tip as is known in PNG. PNG is yet to design a sanitary landfill and the proposed code will address the specifics of this approach. The current practice described above is the 'old' practice which involves open air burning, no bundings or linings at the bottom, no fencing, inadequate compaction and generally does not have an effective system to control and dispose of the waste efficiently.

ii. Dumping in Water

Dumping of waste in running water or rivers and streams is mostly on an adhoc basis but in a few instances, such as in Kundiawa, the waste is tipped down cliffs and into a small creek which eventually flows into the Simbu river, while in some coastal towns and stations, waste is dumped along the shoreline and in the sea. This practice is commonly used by individuals and private organisations. However, most authorized municipal waste collectors prefer dumping on land.

iii. Ploughing into Soil

This practice is confined only to small communities especially in agricultural areas and sometimes for nurseries in landscaping and botanical gardens. Waste leaves, branches, stems, fruits and other agricultural produce are ploughed into the soil. Sometimes waste foods and street

sweepings are also disposed of in this manner. Often individuals carry out this practice in their backyard for flower beds and for backyard gardening.

iv. Feeding Animals

Waste meat scraps and bones from abattoirs and other food waste from restaurants and military mess facilities are collected to feed dogs and pigs. For example in National Capital District (NCD), the dog farm benefits from such waste foods. Apparently, certain human scavengers feed on this waste food such as in the Baruni rubbish dump in the NCD.

v. Recover or Recycle

Not all solid waste is recyclable nor can it be recovered. There are limited markets available for specific solid waste that can be recovered for use as it is or for recycling. For example, a few markets exist in Lae and Port Moresby for buying scrap metals like aluminium, stainless steel, copper, lead and bottles.

The small industries in Port Moresby buy all aluminium products, stainless steel, wire, copper, brass and most non-ferrous metals which are then sent to Australia and are recycled there. Small industry buys these recyclable metals on an adhoc basis, and therefore there is no consistency in buying. Individuals, of their own accord, bring in waste to small industries in Gordons.

vi. Incinerators

There are a few small incinerators and furnaces operating in PNG. Some of the known incinerators are used by the Porgera Gold Mine and Moresby General Hospital which burn drugs and other clinical waste. A small furnace is also used by small industries for melting aluminium but sometimes it is used for the burning of confidential documents by banks. Civil Aviation uses one incinerator for burning all international waste from respective flights. However, none of the municipal waste authorities such as the local government councils and town authorities use incinerators to dispose of and minimize waste. Incinerators are relatively expensive to be afforded by public agencies. The incinerators currently used in PNG can contain only a certain amount of waste and waste types, e.g., clinical waste.

Nevertheless, there are still waste materials and residues which require long-term management. It should also be noted that not all these practices are applicable to control all types of waste.

Management Constraints and Issues

PNG, like many other developing countries, is trying to attract investment in the process towards being industrialised. Unlike developed countries where the onus is now on industry to adopt and implement a

waste minimisation policy, PNG is trying to formulate guidelines to address the negative impacts of industry and development. One of these negative impacts is the vast amount of waste that is generated. There is a great lack of properly planned and effective sanitary landfill waste management systems placed in all the town and city authorities in PNG.

The following are some common existing waste management problems and constraints that municipal town authorities in PNG face whilst attempting to implement waste management plans effectively.

1. Ineffective Waste Management Program

planned off-site and on-site waste management programs. Being without these plans they face the daunting task of trying to come to terms with the associated problems and constraints that are highlighted here. Waste collectors and operators are not adequately trained and this is essential to achieve improved standards of performance. It seems there is no proper engineering design and adequate time screening of site selection.

2. No control on the waste generation at sources to minimize waste.

3. Fast development of towns and industries.

The increased waste generation makes planning more difficult and hard to cope.

4. Funding limitations.

Municipal authorities are usually limited with funding to fully implement all the best designs in waste management. The dump sites are usually costly to operate, e.g., NCD Council alone can entail some millions of kina.

5. Impact of Technology

Whatever technology applied will have an impact on the social and economic situation.

6. Land tenure problem is paramount as most areas outside towns and cities are customary land.

7. Energy limitation in both energy and raw materials

8. It appears that most of the tips lack long-term landuse plans once they are decommissioned after use.

9. No systematic and/or management record or any data on hours worked, tonnage collected, number of service stops, length of route for all the tips.

10. Labour constraints - maintenance of work load, capacity of vehicles, loading position.

Waste Management

Relevant Legislation

There are 5 pieces of legislation in PNG which are relevant to waste management.

(i) The Environmental Planning Act (Chapter 370) (EPA).

This Act provides for an environmental impact assessment of development projects which are likely to cause significant environmental and social impacts to be carried out for the purpose of identifying environmental and socio-cultural issues associated with the development activity. It also requires development of proposals for what should be done to minimise negative impacts and maximise benefits to the affected communities.

The EPA requirement may be applicable to new areas identified for landfill waste dumps. Environmental impact assessment of new areas is necessary and important to identify issues that will form the basis of a waste management plan that is economically, socially and environmentally sound.

(ii) The Environmental Contaminants Act (ECA) (Chapter 368)

The ECA provides the regulatory mechanism for regulating the importation, distribution, use and discharge of contaminants into the environment. The ECA has provisions for regulating littering, breaking of glass, and general regulation of discharges from waste dumps into the environment. These regulations are aimed at permitting only discharges at acceptable levels of substances which may be detrimental to human health and the quality of the environment.

(iii) The Water Resources Act (Chapter 205) (WRA)

This Act provides the regulatory mechanism for controlling discharges of contaminants into natural water within acceptable levels that will not have detrimental effects on human health and the sustainability of resources.

(iv) The Public Health Act (PHA)

This Act provides the mechanism for regulating and controlling domestic refuse, the establishment of refuse point, and covers health, sanitation, cleaning, scavenging and disposal of waste.

(v) The Amended Organic Law on Provincial Government, 1995.

This Act provides the mechanism and gives law-making powers to local governments to set up by-laws to cover the municipal waste management.

Other Issues

Waste management is becoming an increasing problem in PNG urban areas, institutions and in areas where development activities are mostly located in rural areas.

In recognising the increasing waste management problems in PNG, the Department of Environment & Conservation has proposed to work in a collaborative manner with relevant stakeholders like the municipal town authorities, industries, institutions and other government agencies who may be involved in waste management.

The joint working group intends to address the problems and improve the current practices, including how best to design new or proposed waste management sites using the best available means or technology within the available resources.

One achievement this year was the development of a specific code of practice for a sanitary landfill for solid waste management. It is now being drafted.

The code tends to view solid waste management as a process involving control and management of waste at source or generation, storage, collection, transfer and transport, processing and the final disposal of waste in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetic and other environmental conditions, and that will lead to improved public attitudes.

The intention of this code is to help improve the current waste management practice, i.e., open pits or tips which often do not conform to sanitation and public health requirements.

It is anticipated that this code, when implemented, will assist PNG to, at least, manage its solid waste to an acceptable level and to cope with the fast development and the subsequent increase in waste generation.

SOLOMON ISLANDS CASE STUDY

S. Robinson Fugui
Chief Health Inspector

Geographical Information

The Solomon Islands lie between longitudes 153°30'E and 162°30'E and latitudes 5°10'S and 12°45'S. The Solomon Islands are a widely scattered archipelago of mountainous islands and low lying coral atolls, stretching some 1,667 km in a south-easterly direction from Bougainville in Papua New Guinea to the Santa Cruz Islands bordering Vanuatu.

The total land area of the Solomon Islands is approximately 28,369 sq km and the total sea area is approximately 1,632,964 sq km. The population is approximately 394,460 (1996 Population projection), with a growth rate of 3.5% annually. The main races (1986 National Census) are:

Melanesian	94.0%
Polynesian	4.0%
Micronesian	1.4%
European	<1.0%
Chinese	<1.0%
Others	<1.0%

English is the official language, however Pidgin-English is the lingua franca. There are about 90 vernacular languages. According to the 1986 census, 95% of Solomon Islanders are Christians while 5% still adhere to traditional beliefs.

The land consists of 6 main islands - Choisuel, New Georgia, Santa Isabel, Guadalcanal, Malaita and San Cristobal. The capital, Honiara, is on Guadalcanal. There is an average temperature of 27.6°C, and an average rainfall of 2,034 mm. There are two forms of land tenure - customary and registered.

The main exports are: fish and fish products, copra, cocoa, palm kernel, palm oil, timber logs, sawn timber and gold. For the Health sector, the chief endemic disease is malaria. The Government recognizes that education is the right of all citizens and attempts to ensure that primary, secondary and tertiary education is available to all, thereby ensuring that manpower training is conducted with the view of up-grading professional and technical skills of citizens in response to the country's demands.

Environmental Control Measures

Attempts at introducing some waste management measures into the country through the Environment and Conservation Division (ECD) in

conjunction with other line Government Agencies and the SPREP have always been futile in past years. The impeding factors or constraints are varied and these include lack of political commitment at the national level and, more over, the financial difficulties experienced by Government in implementing relevant programs as identified in the NEMS. Apart from the NEMS programs devised in 1993, the Environmental Bill, though in its advanced stage, still needs to gain Government support. It is in these programs and the Environment Bill that the appropriate strategies can be found. At present the ECD has neither a specific nor systematic environmental approach or control measures in place, regardless of its continuing effort to see the enactment of the Environmental Bill.

Further details of the proposed components planned to address the waste management issues in the country as stipulated in the various NEMS programs and the Environmental Bill are as follows:

NEMS Programs

1. Improved solid waste disposal programs.
Collection and disposal.
Management of solid wastes.
Management of landfills and garbage pits.
2. Waste disposal education.
Education comparing programs.
3. Strengthen the monitoring of industrial wastes.
Strengthen the capabilities for monitoring pollution.
Planning a practical monitoring program.
4. Education program on the proper use and control of chemicals.
Educate persons involved in the usage of hazardous chemicals of their inherent dangers and correct procedures for safe storage and handling of chemicals.

Environment Bill

Part III

This is one of the main parts of the Bill and focuses on the control of development and Environment Impact Assessment. To control and minimize the level of negative impacts of development projects on the environment, all these projects should be subjected to EIA procedures. Any development described as 'Prescribed development' in the second schedule should have an EIS prepared for it and submitted with a development application to the Director, ECD for consideration and further advice.

Part IV

A number of provisions have been made in this Bill under various sections of Part IV to address the problems of waste disposal and pollution

control in the country. Of central importance to these sections is the requirement that no person or occupier of any premises and prescribed premises should discharge waste or emit noise, odour, heat and electromagnetic radiation into the environment. Non-compliance with any of these provisions, the result of which may interfere with the health, welfare, convenience, comfort or amenity of any person carries a prison sentence of 12 months or a fine of ten (10) thousand dollars or both. It is a requirement that all prescribed premises should have a licence to discharge waste from the Director, ECD.

Case Study - New Rubbish Disposal Area for Honiara

Existing rubbish disposal site

The refuse disposal site presently used is located in Ranandi at a distance of about 5 km from the centre of the town of Honiara. The mode of operation is basically open dumping with the infrequent covering of refuse with soil. As a result flies and foul odour are common complaints from residents living nearby.

The nearest house to the dump site is situated in the south at a distance of 100 to 150 metres, while a soap factory is located less than 50 metres to the west. A plan is needed to redevelop the Ranandi area as the refuse site has to be closed soon. In 1990 it was estimated that the site was capable of receiving refuse and soil cover of a further 2 metres. However, an area expansion of the ground is likely to cause an adverse impact on the surrounding residential and industrial areas.

In the past, a considerable amount of refuse was deposited in Burns Creek, which flows adjacent to the disposal site. Water pollution caused by this disposal practice can be reduced by excavating the refuse that has been deposited in the creek and redepositing it over the dumping ground, although general water pollution problems associated with the disposal of refuse in the swampy area cannot be eliminated.

Quantity of solid waste generated

There is no quantitative data on the amount of waste generated per day in Honiara, but it has been estimated in a WHO report that the per capita daily generation rate of household waste is 0.5 kg/person/day, the total quantity of commercial and office waste was estimated to be 20% of the total household waste, and the density of waste was 550 kg/cu.m as discharged at the source and 300 kg/cu.m as compacted for disposal. Based on these assumptions it was estimated, in 1990, that waste was generated at a rate of 22.5 ton/day. Its volumes as discharged and as compacted were estimate to be 68.2 cu.m/day and 40.9 cu.m/day respectively. The total volume of landfill required to operate for 20 years was estimated to be 835,200 cu.m.

Evaluation of future landfill sites

In 1987 two potential sites were proposed: one at Mbetikama and the other at Mount Austin. However, the Mbetikama site was later considered to be unfit for the landfill site as it was located too close to the airport, and birds attracted by refuse in the disposal site might interfere with the landing and take-off operations of aircraft. The Mount Austin site was disqualified later because a cemetery was planned for development in the area.

A study in 1990 investigated two further sites: one in the White River Basin and the other at Mamara. The White River site is located in the Western part of Honiara within the Honiara Town boundary, while the Mamara site is situated at about 10 km west of Honiara. The Mamara site was considered unsuitable because the area was generally swampy with a creek running through it and it would be difficult to control water pollution. The White River site indicated that the site has a relatively long life expectancy and cover soil could be extracted on site. However a geological investigation indicated that the site was located on a permeable geological formation of limestone and sandstone with coral debris and without a protective measure, the underlying aquifer would be contaminated by the land fill leachate. As a result, two springs, located at a lower elevation near the site and presently used by the downstream community of the White River settlement, might be contaminated. To minimize the likelihood of leachate, it was recommended that clay needs to be transported to the site and spread to a thickness of at least 50 cm to form an impermeable liner. The leachate can be collected, temporarily stored in a retention basin and recycled by spraying over the landfill area. This leachate recycling process would reduce its strength by the absorption capacities of the refuse deposited. This site was previously the preferred option, however, the land has recently been designated for a housing sub-division.

Investigations found that the permeable geological formation prevailed in the entire area of Honiara as well as west of Honiara, including the Mamara site. Examination of flood and landslide potential maps shows that there are some areas in the Guadalcanal Plains where flood potential would be quite low. From land registration records a 75 ha area of government-owned land was identified as a potential landfill site to the South of Black Post. Detailed site investigation, particularly the extent of clay deposits, still needs to be undertaken. The method of sanitary landfill operation to be employed at the site is likely to be the area method, with clay bunds around the site to protect it from being completely inundated during high water periods. Assuming that two layers of refuse are to be deposited in the area, approximately 20 ha of the site would be required for a sanitary landfill operation of 20 years. The required amount of cover soil is estimated to be 40,000 cu.m. This cover would need to come from the surrounding hills. At the time of the 1990 study, the White River site was the preferred option because of the high cost of transport to this site. The problem posed by the current dump site at Ranandi remains unresolved as there is a lack of policy directives within the responsible Government institutions.

VANUATU CASE STUDY - IMPROVEMENT ON PRESENT SYSTEM OF COLLECTION AND DISPOSAL OF WASTES

Tonny Ata
Port Vila Municipal Council

Introduction

Port Vila is the national capital of the Republic of Vanuatu situated between latitude 13 degrees and 22 degrees South, longitude 166 degrees and 172 degrees East in the Pacific Ocean. Vanuatu, comprising more than 100 islands, with 80 inhabited, was formally called New Hebrides and was a Condominium - jointly administered by Great Britain and France. Independence was granted in July 1980 so the country is fairly young and has to get used to not relying too much on the mother countries. Port Vila is the larger of two main urban centres in Vanuatu located on the island of Efate in the centre of the country. The other is Luganville on the island of Santo in the north of the country. Port Vila town has an area of 26 square kilometres and a population of over 30,000 with a growth rate of 3%.

Although the population of Vanuatu and its urban areas may seem small compared to other countries, consideration should take into account the country size, economy, cultural background and foreign influence. The Port Vila Municipality is the local authority in the urban area and responsible for the administration of the urban area, therefore, matters that are concerned with the social welfare and well-being of its responsibility are the environment and health of the administered area which includes the collection and disposal of all municipal waste in the urban area.

State of the Environment

With such a background as mentioned above and the life style adopted by the Ni-Vanuatu especially in the urban areas, the local authorities and the National government have all taken waste management as a top priority in the country. Also, with the ever-increasing urban drift, special attention has been given to the need to control and manage waste collection and disposal.

Port Vila Municipality has acquired a sanitary landfill through a loan from the World Bank which has now been in use since August 1996. From the same loan the council was able to get a track loader plus spare parts for use at the landfill and a depot built to be used for office and maintenance at the site. The landfill is 8 kilometres away from the town and about 4 kilometres away from the nearest settlement. The trench method is used at this site which is hilly. Waste is dumped in the trenches, spread out, compacted and covered with soil by the loader at the end of the day. The medium used for trapping of leachate is clay which is abundant, one major reason why this site was chosen. Treatment of leachate is done in oxidation

ponds. Staff at the landfill are all trained by landfill design engineers from New Zealand as part of the loan.

I have also been to New Zealand as part of the training to visit various landfill sites, recycling and transfer stations and also to look at composting plants. One of the major projects of the Asian Development Bank in the South Pacific Countries is to look at the infrastructure of the main urban centres. Therefore Port Vila has been considered for a Japanese grant for extra vehicles and equipment for waste management. Part of the grant will be used to upgrade the existing operations and maintenance facilities.

Control of Solid Waste Management

a) Port Vila Municipal Council collects all municipal waste while the light industries and other private companies are responsible for their own. This waste is taken directly to the tip. For the municipal waste the Sanitation Section within the Municipality Environmental Health Unit, which I head, is in charge of the collection as follows:

- Household refuse is collected 3 days a week on Mondays, Wednesdays and Fridays.
- Green waste collection is usually done on Tuesdays and Thursdays.
- Commercial waste from restaurants, fast food/take aways and bins put up by the council is done throughout the week.

b) As previously mentioned, the collection vehicles often break down due to expansion of area being serviced. The council is using 3 trucks at the moment namely; two (2) lift back Isuzu Dump trucks (10 cubic metres) and one (1) Toyota compactor (7 cubic metres). A Volvo lorry is often used during the breakdown of one of the above mentioned vehicles but this is not encouraged.

Port Vila domestic waste is put at road sides on the day of collection and picked up by garbage trucks and transported directly to the disposal site. Daily collection time is from 7.30 am to 3.00 pm.

To solve the problem of shortage of vehicles used for waste collection, the Municipal Council has given a contract to a private company to pick up the green waste every day until the whole urban area has been covered. However towards the middle of this year each citizen will be required to be responsible for their own green waste.

c) Solid Waste Collection

<i>Service area sq.km</i>		<i>Waste coverage</i>	
Residential	18	Direct collection	- 80%
Commercial	3	Private	- 15%
Industrial	2	Arranged	- 5%
Government	2		
Other	1		

Physical Characteristics % by Volume

Component	
paper	- 10
plastic	- 6
organic (green)	- 40
glass/ceramic	- 4
metal	- 3
wood	- 30
textile	- 5
other	- 2

d) Solid Waste Disposal

About 15 tons of waste is disposed of daily and 300 tons per month. The waste is not separated either at source or at the landfill site. An Action Plan has been developed to meet the increasing refuse generated. Some major problems that are faced by the council at present are:

- increase of the urban population
- squatting or unauthorised development
- increase of area to be serviced
- shortage of garbage trucks.

Vanuatu lies in the tropics which makes it a beautiful place to visit but also provides headaches for the local authorities because of the weather. In these parts when temperatures can exceed 30 degrees centigrade, garbage deteriorates and green waste ferments very quickly. Therefore, domestic waste has to be collected on time which is often not done due to breakdown of vehicles leading to waste accumulating at roadsides. Stray animals such as dogs, cats and chickens tear and drag rubbish everywhere which is unsightly and exudes an offensive odour. On the other hand lush vegetation, encouraged by wet seasons, has to be cleared, collected and disposed of in due time. When this rubbish is not collected it is often set on fire by people.

There is very little industry , mainly light industry, such as

- meat canneries

- brewery
- beverage factories
- biscuit factory
- wire factories
- iron roofing-sheet factories
- slipper factories

Outline of the Action Plan

Objectives:

- To introduce the separation of waste
- To encourage recycling of recyclable material
- To encourage participation from citizens and private companies in waste management
- To achieve a clean Port Vila environment.

Targets and Goals:

- Improve the collection system
- Reduce the amount of waste disposed of in landfill
- Improve the condition of the environment.

WESTERN SAMOA CASE STUDY - OVERVIEW OF WASTE MANAGEMENT IN WESTERN SAMOA

Fetoloai Yandall-Alama
Department of Lands, Surveys and Environment

Ladies and Gentlemen, this paper aims to provide a general view of the status of waste management in Samoa but firstly, a very brief description of Samoa's physical and social geography.

Samoa consists of two main islands, Savaii and Upolu and two other smaller inhabited islands, Apolima and Manono. The island of Upolu holds the capital Apia and is 1,115 sq km compared to Savaii's 1,700 sq km. Of the two islands, Upolu is the more populous one. The Apia urban area holds a population of 40,000 from a total population of 162,000 (1991 Census). The islands are of volcanic origin and the major land use practice is for agriculture. Land ownership is divided into four categories. 81% of land is customary owned, 11% is Government owned, 5% is under a trust estate and 3% is freehold land.

Waste Management

Solid Waste

Very little is known about the amount of solid waste being generated on a national scale as the Government's collection program only covers the urban area by the use of contracting companies. Rural areas are left to dispose of their own waste with guidelines provided by the Department of Lands, Surveys and Environment (DLSE). Collected urban waste is transferred to our fairly new landfill site which was opened in early 1993. The site is located inland and has an area of 100 acres. The access road into the landfill has caused several problems when heavy rains occur. The Department of Lands, Surveys and Environment is at the moment preparing to reconstruct a more solid all-weather road to make work more efficient at the landfill. DLSE still, however, needs to look into providing a liner to help control leachates. There is a high possibility that groundwater is contaminated.

The landfill site is an open dump area with dumping commencing from the lower end of the area moving towards higher elevation. It is planned this way so that it can be covered or layered by soil. Right now, the problem is compaction. We need machinery that does not break down every so often and is available when required. Our work, therefore, is sometimes dictated by the availability of the Public Works Department's machinery as private machinery is a lot more expensive. Waste at the dump is separated in some fashion but not efficiently. The rear area is for sewage. This area is covered with soil every day. We then have another site for organic industrial waste such as that from the breweries. Another site is for big car bodies and metal. We also have a buried storage system for

hazardous waste. Those that are buried within this area are asbestos waste and waste which was left over from a timber company. This waste is stored in containers and sealed drums.

We also have in place a hospital waste designated site. This is filled with used syringes and other general hospital waste. The site is a dug out pit which is also supposed to be covered but no work has been done on the area. The largest site is for general domestic waste which ranges from packaging to plastic bottles and several tin cans. Again the idea is to compact and layer with soil.

Sewage Disposal and Hospital Waste

Sewage disposal is still a growing concern in Samoa. There is no public sewerage system and most private homes are served by on-site septic tank systems which are emptied by the Public Works Department if required. These are then emptied to the landfill site at a designated area. Our Government is at the moment awaiting approval from the ADB to construct a reticulated sewage system to be installed in the Apia township. The hospital sewage treatment plant was replaced in 1992 by a new and effective facility (Imhoff tank) although at times maintenance and management has caused difficulties. Infectious waste is taken to the hospital incinerator and general waste is taken to the landfill site also at a designated area.

Hazardous Waste

Toxic and hazardous waste still needs to be properly monitored and controlled. There is a section within the landfill that also caters for the storage of such waste but it is obvious that most other hazardous waste, such as agricultural products, lab chemicals and used car batteries may be dumped in people's backyards. Car batteries need to be collected for proper storage at some stage soon.

Collection Service

The Government's collection program is done by a private company. The service is free of charge to all urban households. The service is done in three zones where these zones are either serviced twice a week or three times a week. The daily service covers the main township as well as the area leading up to the National Hospital. The problem with the service is the fact that some trucks are open trucks and this can lead to spillage. One other problem is that the service is not always on time or on schedule. The DLSE does have a monitoring system in place where an officer routinely checks the daily route of the pick-up service. Other areas are only monitored if households report the inefficiency of the service. It is then our job to investigate and then file reports on the matter.

Separation and Recycling

The concept of waste separation is still in its early stages. Workshops have been conducted in selected villages to make people more aware of the benefits of separating waste. Schools are also being introduced to separation methods and the Department of Lands, Surveys and Environment has taken the initiative to provide separation bins to one particular school compound as a pilot project. It is our belief that separating waste at source can lead to a more manageable separation practice at the landfill.

Recycling activities have still not yet picked up in Samoa. The quality and quantity of waste products required at these companies does not provide a good enough market to stay operational. One great loss is the Aegis Oil company owned by Tony Hill. He had operated a waste oil refinery company by collecting waste oil from several garages in Samoa as well as bringing in used oil from American Samoa. However the import tax on this as well as the quality and quantity of the waste oil he was receiving was not enough to keep the company afloat. It is a great tragedy when one's initiative does not get much support from local people and especially from Government. To be able to revive the existence of recycling companies in Samoa, the Government must support such enterprises in any way possible.

Waste Policy

Through the mechanism of Samoa's National Environment Management Strategies, four policies were finalized in 1996. One of these was the 'National Waste Management Policy' which has now gone to Cabinet for approval and adoption.

DLSE Act

Under Division 8 of the Department of Lands, Surveys and Environment Act, our Environment Division has the authority to fine those who litter in public places as well as litter on private property without the owner's consent. We usually get several calls to this type of 'over the fence' disposal method. However, it can get to a point where we are stuck in the middle of neighbourly dispute. Our main problem in this area is the fact that we do not enforce this bit of the legislation. Our response is mainly a 'reactive response', i.e., only when complaints come into the office.

Constraints

The major constraints to effective management of waste by the responsible Government Department are :

- Government budgetary limitations
- Manpower within the Division of Environment to focus on the issue of waste alone.

Conclusion

Samoa does not have a success story in the waste issue, what we do have is a continuous struggle in managing our waste. However, Samoa does have the potential to manage its waste in a more controlled manner.

WEWAK...A CASE FOR INTEGRATION

Carole Douglas
Greenline Group, Manly.

Location: District capital township East Sepik Province, PNG.

- . Air and sea access...no road link to other major centres

Geography: Wewak Hill, surrounded by coastal wetlands.

- . Mangroves
- . Tidal lagoons
- . Sago swamps

Population: 35,000 (doubled since 1980)

- . Mixture of local villagers, settlers, itinerant workers

Development Issues:

- . Urbanisation...people from outlying villages seeking work, access to services - health/education
- . Land management...logging, stormwater, roads, agriculture, overseas investment proposals - lack of EIAs
- . Tourism...high costs...infrastructure not in place
- . Health and education...malaria, pollution related illness, poor services, falling literacy rate, school fees

Waste Management:

Solid Waste

Private contractor picks up daily in commercial area, 2 x week in residential, settlements take care of own rubbish - animal feed, bury, burn, dump in bushland, mangroves, lagoon

Many residents bury and/or burn household waste

Generally "hazy" at the edges...lack of clear rules, information

Town market rubbish dumped/burned in nearby lagoon

No official sorting or recycling...some individual initiatives...

Markets far away (Lae)...some "deals" with contractor

Sewage

Township on septic tanks - overloaded systems - seepage

Settlements on bucket (night soil) system - 200 emptied 2 x week into lagoon at dumpsite

Also pit latrines still in use at local level - nobody knows actual numbers.

MONGNIOL RUBBISH DUMP

Wewak's official dump site

Situated in Mongniol Community for past 35+ years. Earlier practice of soil covering and bulldozing stopped 15 (?) years ago due to lack of money and equipment.

Waste is now dumped and burned.

IMPACTS

1. Health

Prevailing wind takes toxic smoke directly into school. High absentee rate amongst staff and students due to respiratory illness. Local settlers also affected.

Changes in nature of rubbish results in increased pets breeding - mosquitoes, vermin-disease carriers

Increase in gastro intestinal illness due to contamination of water and seafood

Encroaching dump site reducing quality of life for Lumi Camp settlers.

Health risk to unprotected waste workers

. *all evidence anecdotal only - no data collected to support claims*

2. Environment

Soil, air and water pollution - can be easily seen and smelled

Destruction of mangroves, loss of fish and other species (no more prawns)

Increased nutrient...algal growth

Lagoon does not fully flush - sewage and rubbish just moves up and down with tides.

. *no testing or monitoring in carried out for faecal coliforms, etc, or heavy metal contamination in filter feeders.*

3. Economy

Contaminated waste creates problems for local Lumi Camp settlers who are dependent on scavenging (mainly bottles and cans) for livelihood. Cannot afford to send kids to school.

ISSUES

1. Communication

Despite many attempts the Mongniol Community School's headmaster is not heard by authorities - unsure of channels.

Locals complain that sewage workers do not wear protective clothing.

Lack of community awareness or education campaigns

Planning/infrastructure

. Lack of waste management strategy

. Lack of worker training

. Lack of clearly defined roles and responsibilities

Intervention

Held a Clean Up the World meeting to discuss waste issues. Facilitated by Carole Douglas.

Despite the fact that it was held on the day that Julius Chan stepped down 15 people attended the meeting and representing:

- . the school - the headmaster
- . the settlement - local elder
- . the Environment NGOs - Director, East Sepik Local Environment Foundation
- . the Women - ESCOW - East Sepik Council of Women
- . Government, Town Development Commission - Parks and Gardens, Sanitation, Planning, Health
- . youth - local student
- . community - general public

Outcomes

The first time that the stakeholders had ever met to share the issues - the first time that the community could be heard by the government. Major discussions centred around community issues. The meeting resolved to:

Plan . Form a Peak Environment Group to lobby for change
 Action . Nominate NGO and government reps to invite (cross) representation and arrange first meeting.

Plan . Develop a research project to monitor water, soil, air quality
 Action . Planning department to investigate funding opportunities

Plan . Collect health data form local community, school, hospital and health clinic
 Action . Health Inspector to set up system

Plan . Identify waste stream
 Action . Determine roles and responsibilities - Parks and Gardens to instigate process - possible use of local settlers (Hold the knowledge)

Plan . Grassroots Participation
 Action . ESCOW to design project - have access to funding

Meeting held: 26th March 1997

Gabriel Molok and Vincent Sale will keep us informed of progress