

South Pacific Regional Environment Programme

Report on the
**National Environmental Pollution
Awareness Workshop**

Tuvalu

Held in **Funafuti, Tuvalu**

On 11 - 13 May 1993

Apia, Western Samoa

December 1993

Foreword

Rapid and uncontrolled urbanisation, development and population growth cause pollution of land, freshwater resources, estuarine, coastal and marine waters and atmosphere. Public health is also affected through contaminated domestic water supplies, shellfish, and recreation areas. Wastes that are improperly managed or disposed of result in situations which gravely affect the human and natural environment.

Pollution is no longer only a problem of developed countries. It has also left its mark in the Pacific islands. As more countries gain political independence, they must develop their own economies and so are turning to manufacturing industries, mining, agriculture and tourism to do this.

Advanced technology is introduced with these industries. New machinery and manufactured products are introduced onto islands, changing the types and amount of waste generated on land.

Island people who have lived in developed countries often return home and continue their life styles in their home country, including what they eat, wear and use. And this changes the waste generated. Unlike a decade ago, today's wastes are more bulky, undegradable, toxic, hazardous and difficult to dispose of by conventional methods or natural means. As most island nations lack suitable land for disposal, more waste means it can no longer be dumped anywhere and anyhow. This is now the most common pollution source for the land and marine environments in the Pacific.

Regional pollution studies show that the land, sea and atmosphere of most Pacific countries are already polluted, and that land-based pollution accounts for most waste loads. Pollution is also a common concern in most countries' National Environmental Management Strategies (NEMS). Most countries have pollution, yet few fully realise the dangers of not taking remedial action now.

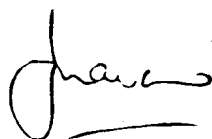
The South Pacific Regional Environmental Programme (SPREP) has developed a Regional Pollution Prevention programme to address the problem. Pollution awareness, through regional and national workshops, is a vital component. These workshops pave the way for implementing other components of the programme.

A series of national workshops were planned for the region in 1993/94, starting in six NEMS countries. Three have been held to date: in Niue, Kiribati and Tuvalu. This report describes the event at Tuvalu, and is also designed as a training manual for anyone wishing to conduct similar training.

This workshop aimed to:

- ♦ introduce the subject of pollution to government decision-makers and administrators and non government organisations
- ♦ show the current state of their natural and human environment;
- ♦ visit potential pollution sources and identify problem areas; and,
- ♦ recommend how pollution could be avoided, prevented or minimised in their country.

SPREP acknowledges the role of the United Nations Development Programme (UNDP) in providing the funds for these workshops and this publication, and Apiseta Eti and Wesley Ward for helping to publish the report.



Vili A. Fuavao

Director

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Introduction

The National Environment Pollution Awareness Workshop conducted at Funafuti in Tuvalu on 11 - 13 May 1993 came about as a result of the assembling of environmental priorities within countries of the South Pacific under the National Environment Management Strategy (NEMS) Programme. The identification of the lack of proper waste management and pollution control measures were regarded as priorities that had to be addressed.

Hence the development of the South Pacific Regional Programme's NEMS Programme, a project funded solely by the United Nations Development Programme (UNDP), and consisting of a series of workshops within the six countries in which the project is to be implemented, namely; Kiribati, Marshall Islands, Niue, Tokelau, Tuvalu and Western Samoa. The first of these workshops was held in Niue in October 1992, and was followed by one in Kiribati in March 1993. The present one, therefore, is the third of such annual National Environmental Pollution Awareness Workshops to be conducted by SPREP and the first of its kind in Tuvalu.

The aims and objectives of the workshops are to help government officials, NGOs and the public understand their environment, identify various land and sea-based pollution sources and lead to an awareness of the kinds and amounts of wastes that are generated and their effect on the environment - physical, biological, economic and social. Perhaps more importantly, to make recommendations as to how to maintain good health.

During the programme a workshop approach to training prevailed, so that participants were expected to take the leading role most of the time. Lectures followed when needed. The topics covered during the three days were designed to ensure that the aims and objectives of the workshop were achieved.

Opening Comment

by F. Tipu, Secretary to the Government of Tuvalu

This three-day workshop is part of an action plan of NEMS to provide the Tuvalu Government with technical assistance in the training and education of the public concerning the effect of pollution on the environment and to indicate ways and means of combating it. Another objective of the workshop is to train the participants, for the knowledge gained must be imparted down to the grass roots level if the NEMS is to be successful.

The NEMS - National Environmental Management Strategy - is a project within SPREP's programmes which has the following objectives:

1. To identify the current state of the environment within six chosen countries in the South Pacific.
2. To assist these six countries to prepare their own NEMS to safeguard their environment through sustainable development.
3. To provide technical assistance and promote the capacity of self-sufficiency within these governments so that they may carry out the task without outside assistance.

This workshop, therefore, fulfils the three objectives and is designed specifically for the prevention of pollution in Tuvalu. As participants, you will first be trained to identify various sources of pollution on land and within your coastal waters. In addition, you will be taken around the island to get a close look at the state of your environment, and on the final day you will be asked to make recommendations as to how the environment might be improved, protected or sustained. Your recommendations will be put to the Environment Unit Office of the Prime Minister (OPM) for possible inclusion in the NEMS which is about to be prepared by John Lane and Alefaio Semese. You will therefore have an important role to play as you will be part of the team preparing our own NEMS Action Plan. Training of this nature has been successfully carried out in Niue and Kiribati late last year and in March of this year respectively. Both countries are now finalising their NEMS Action Plan.

Last, but by no means least, I would like to point out the generosity of the UNDP in providing the necessary funds through SPREP for the implementation of NEMS through its PIMS-UNDP Project Programme. The workshop will be conducted in English, but everyone is welcome to speak Tuvaluan. The intention is to get your view-points across in whatever language you are most comfortable with.

I wish you all a pleasant workshop.

Welcoming Address

by L. C. Tulega, SPREP

On behalf of the South Pacific Regional Environmental Programme and the Government of Tuvalu, may I start by welcoming you most warmly, especially those of you who are here for the first time. Many of you have travelled a considerable distance to get here, not only the participants, but also a number of the instructors for the workshop. I hope you will all find your stay here both valuable and enjoyable.

Funafuti is pleased to be able to host this National Environmental Pollution Awareness Workshop which has been organised under the auspices of the South Pacific Regional Environmental Programme and the Tuvalu Government. As some of you will know, the need for a pollution awareness workshop was identified at a meeting of all Environment Officers of NEMS countries held in Western Samoa in December 1992. Participants at the meeting were invited to identify areas of immediate environmental concern in their own countries, and waste management and pollution were the two areas common to all countries. Hence, this workshop has been structured to make government officials and the public conscious of their environment, to make them able to identify the likely pollution sources existing around them, and to help them assess the amount of pollution that would be generated by these sources and their overall effect upon the environment.

It is anticipated that your trip around the island that is being arranged for Thursday will give you a closer view of the waste management, collection, storage and final disposal methods being employed in Tuvalu. At the same time, you will be shown likely pollution sources and their contribution towards the pollution of the surrounding environment.

Finally, the most important part of the workshop comes at the end of the last day, when you will be asked to make recommendations about how the current state of the environment could be improved and protected from pollution. As the honourable chief guest said earlier, your recommendations will be put to the Environment Unit of the Prime Minister's Office for possible inclusion in the Tuvalu NEMS which is about to be prepared by John Lane and Alefaio.

Once again, I welcome the instructors and participants to Funafuti, and wish you a successful workshop.

Thank you.

Workshop Proceedings

Day 1: Morning Session

1.0 SPREP's and NEMS' Role and Objectives in the South Pacific

by L. C. Tulega, SPREP

(Before going into the details of the subject matter, the participants were asked to introduce themselves to the others, one by one. This done, the session started.)

The presentation began with a brief overview of the establishment of the UNEP within the UN mandate; how the idea for SPREP was conceived; its establishment as an arm of the South Pacific Commission, and its emergence as an autonomous organisation, the third regional body in the South Pacific.

NEMS was then put into perspective as a part of SPREP's programme, with funding from UNDP, to address the formulation of National Environment Management Strategies for six chosen countries (all of them small island groups) in the South Pacific, namely; Kiribati, Marshall Islands, Niue, Tokelau, Tuvalu and Western Samoa. Its objectives, therefore, were:

1. To identify the current state of the environment within the six countries mentioned.
2. To assist these countries in preparing their own National Environment Management Strategies to safeguard their environment through sustainable development.
3. To provide technical assistance and promote the capacity within these governments to enable them to carry out the task without outside assistance.

Typical examples of NEMS commitment include the number of consultancies carried out in various countries to determine the countries' state of environment and the consultants engaged to assist them in drawing up their own strategies. The funding by NEMS of the Environment Officer within the Tuvalu Public Service is another example of such commitment.

The NEMS philosophy is to work with the people and the government as a catalyst; the government will then be in a position to develop appropriate policies and implement the activities. To prove this point, the participants were told that they have an important role to play, since in the course of the workshop they would be taken around the island to see closely the state of their environment and on the last day would be asked to make recommendations on how the state of the environment may be improved and protected. Their recommendation would then be put to the Environment Unit of the Office of the Prime Minister for possible inclusion in the NEMS.

The generosity of UNDP in funding the NEMS project is acknowledged and appreciated.

2.0 Introduction to Pollution

by L. C. Tulega, SPREP

The aim of this paper was to highlight the link that exists between people and their behaviour; between the environment and pollution. Human beginnings were referred to - both the theory of evolution and the creation story from the bible - and the two qualities shared by all humankind; the instinct to survive and the desire to better themselves.

Humans displayed a tendency to wander in search of better living conditions and environment for themselves and their families. As a result of this, they were often brought together in groups to begin small settlements which finally grew into towns and then became cities.

Often the settlement sites were well-chosen, mostly along streams and river banks or on the coasts for ease of transportation, water supplies, good agricultural land, protection from enemy attacks, ease of access and a means of disposal for their wastes. These things were given priority in the choice of sites, and the other resources offered by the sites, such as good fishing grounds, availability of fire-wood presence of wild-life etc, were often of secondary importance.

However, it was always taken for granted that fish and other resources would always be plentiful, and that the land and water would remain clean through the natural cycle. But when people began to settle together in greater numbers and experienced growth in the economy through agricultural, industrial or mining activities, such as the "cotton boom" or the "gold rush", things changed.

As towns grew, there were needs for alterations and expansions. There were needs to expand public amenities, needs for economic growth and needs to provide socially as well as economically for the growing populations. As a result there were developments in industry, in commerce and in other activities also, often at a very fast and uncontrolled pace.

In these modern times, increasing development and the associated changes are causing major problems. The "concentration effect" of increased development results in bigger harbours and larger ships, bigger processing plants, canneries and so on, and means increases in production and consequently greater waste disposal problems. The human concentration caused by urban drift means that sewerage schemes designed in colonial days are no longer adequate in many places to cope with the increasing population: squatter settlements built overnight create further problems - pollution problems. One last feature of the concentration effect is the impact on substantive farming. The hills surrounding urban centres, which were once left fallow, are now being used because of urban drift and increased pollution. As a result, cultivation on steep slopes, together with the use of fertilisers and with high rainfall, may cause severe erosion and pollution from agricultural "run-off".

2.1 Origins of pollution

The participants were informed that pollutants are waste materials released into the environment, usually, though not always, as a result of human action. Industry, automobile exhausts and wood and coal domestic fires all release pollutants into the air, many of them potentially harmful: the famous 1952 smog in London killed more than 4000 people in just five days. Industry and agriculture dump large quantities of pollutants onto the land and into waterways. Some are transported long distances - DDT, for example, has been found even in Antarctic snow. Others are lethal: in the 1960s, 41 people died and a further 70 became seriously ill after eating fish caught in Japan's Minamata Bay, which had been contaminated by mercury released in industrial wastes. By 1975 mercury poisoning had been confirmed in 798 people and was suspected in another 2800. The food we eat can be contaminated as a result of the ways in which it is produced, processed or stored.

Some chemicals, such as pesticides and agricultural fertilisers, are deliberately introduced into the environment. Their beneficial effects, however, are accompanied often by undesirable side effects if they persist in the environment for too long, or find their way into parts of the environment for which they were not intended. For example, although the nitrate used in agricultural fertiliser is not itself poisonous, intestinal bacteria can convert it to nitrite, which affects the transport of oxygen by the blood. High levels of nitrite in drinking water can cause respiratory difficulty and even death in infants.

Natural sources produce pollutants such as wind-blown dust, the particles and fumes that accompany forest fires and volcanic activity, and mineral deposits that are washed off hill-sides and enter waterways. These, and some of the pollutants produced by human activities, are unavoidable. Nevertheless, if their concentrations in the environment are high enough, they, too, can damage health.

2.2 Effects of pollutants

Pollutants can cause respiratory disease, acute intoxication and adverse reactions in sensitive individuals. The latter occur particularly in the developing foetus, and in the very young, the old and the diseased: the London smog, for example, proved particularly lethal for those who were already suffering from respiratory problems such as bronchitis. Sometimes, symptoms such as breathing difficulties, eye irritation, skin rashes and intestinal upsets appear immediately after exposure. Smog, best known for its occurrence in Los Angeles, and caused primarily by photochemical reactions with waste products from automobile exhausts occurring in the atmosphere, is responsible for eye irritation and asthma attacks in susceptible people.

Other, chronic, effects occur only after long exposures. These are often difficult to predict, and are caused by the slow build-up of chemicals in the body or the gradual accumulation of damage to human tissues. Some chemicals can cause abnormalities in the foetus or the genetic transfer of defects to offspring. Many chemicals can cause cancer, but usually only after several years of exposure.

One of today's major health problems is that the causes of some major diseases, including some forms of cancer, are not known. They may well be related to contaminants in the air, the water or food. More research is needed to establish the true links between these contaminants and the onset of disease.

3.0 Pollutant Sources

by N. Lifidamu, Consultant

In introducing the paper, Navitalai stressed that this training was in the form of a workshop and not a seminar. Hence, participants were expected to participate and contribute. Since they were all Tuvaluans, that alone made them experts in their own situation.

To illustrate the point, he divided the participants into three groups, after giving them each paper and pen, and invited them to write down all the likely sources of pollution to be found in Funafuti. Each group was able to produce a list containing a number of sources of land, water and air pollution.

A representative from each group was then invited to present the group's list to the other participants, giving reasons for their particular choice of pollution sources. Each was expected to explain what substances coming from the land, water or atmosphere would give rise to pollution.

Navitalai concluded by answering questions from the participants and summed up the proceedings with a brief lecture on the likely sources of pollution existing in Tuvalu, and the expected daily loads of pollutants that come from them. Data for this had been obtained from a study of the area during the previous week.

The interesting aspect of this session was that, for the first time, most of the participants began to see pollution and pollutant loads in clear perspective and to think about how they, themselves, could assist their environment.

Day 1: Afternoon Session

4.0 SPREP Convention and Protocols, and other Conventions

By LC. Tulega, SPREP

The aim of this session was to highlight the fact that pollution prevention is not merely something that SPREP thinks up overnight, but is a global regional and national concern. The Rio meeting was referred to as an example of global concern for the environment, with a place in Agenda 21 specifically for wastes and pollution. The Convention for the Protection of Natural Resources and Environment of the South Pacific Region, Noumea, 1986, commonly known as the SPREP Convention, makes provision for commitment from signatories regarding - apart from other environmental concerns - pollution from vessels, from land-based sources, from sea-bed activities and from air-borne pollutants. It also addresses the disposal of wastes, the storage of toxic and hazardous wastes, the testing of nuclear devices and mining and coastal erosion.

International conventions, such as the London Convention, the Lome Convention and the Basel Convention contain provisions for the protection of the environment, and in cases of emergency protocols exist requiring the cooperation of signatory countries in combating pollution emergencies.

All this, therefore, shows the extent of the concern about the environment and shows why Tuvalu itself should also be concerned. Hence, this workshop was aimed at making people aware of the universal extent of concern about pollution; a concern already manifesting itself in Tuvalu. For this reason, the people of Tuvalu should learn more about it through workshops and seminars and be able to find their own means of preventing or controlling it.

Participants were made conversant with some standards that have been used internationally in monitoring water quality. Among these were the WHO drinking water bacterial standards, the EEC raw water standard and the swimming water and shellfish standards. Water containing levels of contaminants above those prescribed in the standard must be treated with suspicion.

After this session, participants were expected to have a fair idea of the nature of pollution, how it is derived and the reasons for the concerns about it. The day's activities, therefore, were preliminaries for the next day's sessions.

5.0 Water Pollution Sources

By N. Lifidamu, Consultant

This session aimed to show participants how to identify water pollutant sources existing in Tuvalu. In the first part they were asked to identify the likely sources of pollution of their fresh and coastal waters, using the same groups that had been formed in the morning session.

In the second part they were given a brief but lively lecture about pollution sources which normally occur in countries whose geography and environment is similar to that of Tuvalu. Tuvalu's current generation of waste water - in which domestic waste water is thought to be the main contributor to water pollution - was described, as was the practice of dumping solid and hazardous wastes into the sea, the second biggest problem. Also contributing to the water pollution process, but third in significance, was the discharge into the sea of waste water from mechanical workshops, power houses, oil installations and raw sewage.

Participants were informed that a pollutant could be measured by cross-checking the amount of known analytic parameters against the standards set for such parameters in water quality monitoring, using universally accepted standards. They were shown an item of equipment known as the DREL which was able to monitor such parameters, and told that a demonstration of its use would be held on Thursday, when samples of water would be taken and analysed during the tour around Funafuti. Thus they would see for themselves various pollutant sources on the island. The data collected would serve as a guide to the degree of pollution in samples taken from near the pollution sources and, with its interpretation, would form the basis of their recommendations in the second part of the workshop.

Day 2: Morning Session

6.0 Land Pollution

By LC. Tulega, SPREP

This session aimed to enable participants to identify easily the likely sources of land pollution. After briefly introducing the subject of the various sources of land pollution, including solid waste disposal, effluent from septic tanks, airport runways and pesticides as a constituent of agricultural run-off, Laisiasa spoke about the constituents of each waste stream generated. He then asked participants to identify what type of waste sources were present in Tuvalu.

When this was done, participants were shown how to calculate quickly the daily, weekly or annual solid waste load generated by using a WHO factor on a daily, weekly or annual basis, multiplied by the population: this method gave the volume of waste generated. The dangers of indiscriminately dumping solid waste on land were discussed, and the discussion referred to the poisoning by toxic chemicals of rodents and breeding pests which encouraged disease. Also referred to was the problem of overflow from septic tanks.

The session concluded with a discussion of the various options for waste disposal, including crude and controlled dumping, composting, barging waste out to sea and incineration. The discussion became quite lively, especially when participants attempted to decide which would be the best method for Tuvalu. They were informed that they would be better able to decide when they had seen the current method of waste disposal employed and could compare it with the other possibilities which had been outlined.

7.0 Pollution, Water Supply and the Food Chain

By N. Lifidamu

There are three ways in which pathogens, poisonous and toxic substances may gain entry into the body: through the mouth in the food we eat; through openings in the body resulting from cuts and wounds, and through the bites of insects and rodents which are carriers of disease.

On land, pollution resulting from the indiscriminate dumping of solid waste creates ideal breeding grounds for mosquitoes, flies, rats and so on - all carriers of known killer diseases. In the form of leachate from agricultural and industrial wastes, it may also contaminate ground water supplies and affect the entire water lenses of the islands. When contaminated, this water could cause ill-health to people, especially if used as their domestic water supply.

Pollution of coastal waters - depending on the degree of pollution - would either instantly kill all organisms, scare the organisms away from the affected area, or be taken in by them. The latter is normally the case, so that when people eat fish and shell-fish severely affected by pollution, sickness results. Incidents of death and illness caused by this sort of pollution were referred to as illustration, and participants were reminded that something similar could happen in Tuvalu if water supplies and coastal waters became polluted.

8.0 Environmental Problems in Tuvalu

By Alefaio Semese, Tuvalu Government

Participants were reminded that environmental pollution could be anthropogenically created or caused by nature. In Tuvalu, such human activities as constructing sea-walls, deforestation, filling up borrough pits with sea-bed sand, handicraft making, burning refuse and leaves and indiscriminate dumping or disposal of wastes could all cause environmental problems. On the other hand, problems could also be caused by natural phenomena such as cyclones, rises in sea levels and drought. Alefaio elaborated on each subject and was asked several questions, responding to the questions in Tuvaluan.

Half-way through the session, participants were asked to suggest means of preventing the occurrence of environmental problems in Tuvalu. The following were the major suggestions:

- Strengthening of the Tuvaluan culture and customary way of living, including greater emphasis on traditional diet;
- Adoption of a migration policy to control inter-island movement;
- Control of population growth through family planning;
- Use of local resources to live like Tuvaluans did 100 years ago;
- Control of development;
- Putting in place legislation to safeguard environment, people and other life forms from pollution;
- Enforcement of the Acts; and,
- Promotion of a vast public awareness and education programme.

Discussion Lead by Alefaio Semese

This was a very lively session, conducted entirely in Tuvaluan, and concentrating mainly on matters left untouched in the previous session. Also raised were some of the topics discussed the day before.

9.0 Communicable and Environment-Related Diseases in Tuvalu

By Matalo Tekinene, Health Inspector, Tuvalu Government

Pollution contributes much to the spread of diseases. Polluted water might also be contaminated, and thus cause such diseases as cholera, typhoid, dysentery, diarrhoea, eye infections or irritations. Diseases which may be caused by air pollutants include respiratory diseases, asthma, bronchitis and shortness of breath. Those already ill, the young and the aged may be very susceptible.

Water-borne diseases which may be caused by water pollution are skin diseases, intestinal worms and so on. Although the incidence of the above-mentioned diseases was not highlighted, participants were informed that they were quite prevalent throughout Tuvalu. However, two recommendations put to the participants that could be adopted nation-wide to prevent pollution of land, coastal waters and air in Tuvalu and thus safeguard the public's health were:

1. Putting in place building and sanitary services regulations or, better still, environmental health regulations.
2. Promotion of a nation-wide Environmental Health and Sanitation Awareness and Education programme, including pollution awareness.

10.0 DEVELOPMENT AND ENVIRONMENT

By John Lane, Consultant

The environment is everything around us, plants, water, soil air etc, and these link together to include people. Environment refers to everyone's surroundings and is important because it caters for human needs, and they in turn should care for it. It provides us with life, society and culture, economy, science and beauty.

Participants were reminded that Tuvalu was their home and because of its geographical structure and size is fragile and has limited resources, hence the need for practising sustainable development. This meant careful use and conservation of resources, so that there would always be enough to provide for basic needs, but abundant supplies for future generations. Despite economic development, the Tuvaluans could still maintain the important aspects of their island way of life.

In conclusion, it was pointed out that any development is good provided that it is integrated with other issues: if it is not, a lot of damage may occur and pollution may result. Pollution in turn may affect humans and their resources, their way of life and their aspirations for the future.

11.0 Environmental Impact Assessment

By N. Litidamu

Environmental Impact Assessment (EIA) is the assessment of the impact that a development project will have on the environment. The goal of EIA is to predict how a development project may affect the physical and human environment, and to minimise the impact. Participants were told why EIA should be carried out wherever possible. The reasons were that:

- *EIA provides a mechanism for consulting people who will be affected.*

EIA provides a formalised way of consulting the people who will be affected by a development before it happens. Such consultation helps avoid unwanted social and environmental effects that may not be obvious to developers and to the decision makers in government.

- *EIA is a good management tool.*

EIA can prevent embarrassing development failures, and can save both government and industry a great deal of money. Environmental management is especially important in South Pacific Island countries where there is not a lot of land or resources to allow for mistakes.

- *EIA is required from funding agencies.*

After decades of experience with projects that produce unwanted environmental and social consequences, most international loan and aid funding agencies now require EIA for projects that they fund.

- *EIA is a means of predicting and controlling undesirable consequences of rapid development.*

Because the world is changing so fast, the introduction of new technology and the opening up of societies to permit participation in the global economy, have brought major changes to the pace and extent of resource development and exploitation in the South Pacific. Natural resources are being used in much greater quantities than previously, with totally different technology, and produce is being exported rather than being used by the local population. One important consequence of this is that the previous "trial-and-error" process of human adjustment to the environment is no longer appropriate. As many countries in Europe, North America and Asia have learned, severe environmental problems may occur in a very short time, since the scale and speed of the developments mean that serious harm can be done even before the problem is recognised.

EIA, therefore, is a means of predicting and controlling the undesirable consequences of rapid development.

11.1 Sustainable development

Sustainable development refers to developing resources in such a way that renewable resources - such as fish and forests - have the chance to replenish themselves, while non-renewable resources - such as minerals - are extracted in a carefully managed way so as to allow the economic and social systems to adjust to the eventual end of the resource.

In the Pacific Island nations, traditional societies learned to live in balance with nature through long-term "trial-and-error" processes. They altered the natural environment - by burning vegetation or importing new species, for example - but they then achieved a settled relationship with the altered environment. This is the goal of sustainable development.

New forms of development, urbanisation, more intensive fishing and other resource exploitation, and many other introduced changes, have threatened this balance with nature. EIA provides a means of controlling development and determining if it is sustainable before the development begins.

12.0 Urbanisation and Overpopulation

By Mrs Penieli Metia, Executive Director, TUFHA

Tuvalu's population in 1973 was 5887; in 1979 it was 7349, an increase of 25 per cent. The 1991 census shows the population of Tuvalu as 9043, with the island of Funafuti alone comprising 43 per cent of the total. The overall population density of the last 10 years may have doubled by now. In 1979 it was 893 persons per square kilometre, and by 1991 it was 1627 per square kilometre. Nearly half the population in Funafuti (1274) are children, aged between one month and 14 years. Funafuti's population is 3576 and the size of its average family is nine.

After having been given a brief account of the status of the population on the islands of Tuvalu, and Funafuti in particular, participants were told that the normal outcome of continued rapid population growth is the depletion of natural resources and pollution, both of which lower the quality of human life.

An increase in the size of the population normally results in an increase in the consumption of resources. When this continues at a high rate over a long period of time, the result can be catastrophic for the environment. Overpopulation means a great loss in potential energy for productive purposes and results in a large amount of waste being added to the environment, thus increasing the likelihood of pollution. This is an environmental problem: if this generation continues to pollute the sea, the land and the air, what will be left for the children? Only waste?

17.0 Working Groups on Recommendations

By John Lane

The last session was allocated for participants to discuss the recommendations from the working groups emerging from the workshops and the island tour. The recommendations were to be forwarded to the Office of the Prime Minister for consideration and possible inclusion in the Tuvalu National Environmental Strategy.

The recommendations most common to all three working groups were:

1. A review of existing environmental sectors, such as public health and sanitation, paper supply, waste water, building codes and development regulations.
2. The formulation of appropriate legislation where it did not already exist.
3. The creation of posts within the public service and the training of qualified officers to supervise and enforce the regulations.
4. The promotion of a dynamic public awareness and education programme throughout Tuvalu.
5. The compulsory use of Environmental Impact Assessment as a tool for sustainable development in Tuvalu.
6. The implementation of a technical training programme.
7. Policy development on economic and other incentives, such as
 - reduction of loads at source
 - recycling of waste
 - alternative commodities
 - tax reduction
 - birth control
 - renewable energy
 - control on animal ownership
 - control on urban drift
8. Manpower training on environment

Immediate measures recommended were:

1. The replacement of imports of bottled beer by beer in aluminium cans which could be recycled.
2. The provision of a central site for a piggery, with a view to collecting all wastes for conversion to energy for lighting and cooking.
3. The immediate provision of financial and technical assistance to Funafuti Town Council to cater for its environmental programmes.
4. Autonomy for the Tuvalu Environment Authority, rather than inclusion within the Tuvalu Civil Service.

Annexes

Annex 1: Workshop Programme

Environmental Pollution Awareness Workshop - Tuvalu, 11-13 May 1993

TUESDAY 11 DAY 1

Morning Session

- 9.00-9.30 Official Opening (F. Tipu, Secretary to Government)
- 9.30-10.00 SPREP's and NEMS' Role and Objectives in the South Pacific Region
- Laisiasa Tulega (SPREP)
- 10.30-11.30 Introduction to Pollution - Laisiasa Tulega
- 11.30-12.00 Discussion - Alefaio Semese (Tuvalu Government)
- 12.00-1.00 LUNCH

Afternoon Session

- 1.00-2.00 Pollution Sources and Pollutants - Navitalai Litidamu (Consultant)
- 2.00-3.30 SPREP Convention and Protocol and Other Conventions Addressing Pollution
- Laisiasa Tulega
- 3.00-3.30 AFTERNOON TEA
- 3.30-4.30 Water Pollution Sources- Navitalai Litidamu
- Identification of Water Pollution Sources
- Measurement of Pollution
- Equipment for Measuring Pollution
- Interpreting Data Collected

WEDNESDAY 12 DAY 2

Morning Session

- 8.00-9.00 Land Pollution - Laisiasa Tulega
- Identification of Sources of Pollution
- Types of Pollutants
- Quantification of Loads
- Options for Waste Disposal
- 9.00-9.30 MORNING TEA
- 9.30-10.30 Pollution, Water Supplies and the Food Chain - Navitalai Litidamu
- 10.30-11.30 Environmental Problems in Tuvalu - Alefaio Semese
- 11.30- 12.00 Discussion - Alefaio Semese
- 12.00-1.00 LUNCH

Afternoon Session

- 1.00-2.00 Communicable and Environment Related Diseases in Tuvalu
- Mataio Tekinene - Health Inspector, Tuvalu
- 2.00-3.00 Development and the Environment - John Lane (Consultant)
- 3.00-3.30 **AFTERNOON TEA**
- 3.30-4.00 EIA as a Tool in Sustainable Development - Navitalai Litidamu
- 4.00-4.30 Urbanisation and Overpopulation: Their Contribution to Pollution
- Penieli Metia (Executive Director, TUFHA)

THURSDAY 13 DAY 3**Morning Session**

- 8.00-8.30 Briefing on Field Visit to Examine Likely Pollution Sources on the Island
- Navitalai Litidamu
- 8.30-9.00 **MORNING TEA**
- 9.00-12.00 Tour - Laisiasa Tulega
- 12.00-1.00 **LUNCH**

Afternoon Session

- 1.00-2.00 Discussion on Field Visit Findings - Navitalai Litidamu
- 2.00-2.30 **AFTERNOON TEA**
- 2.30-3.00 Strategy for Controlling Water Pollution - Navitalai Litidamu
- 3.00-3.30 Strategy for Controlling Land Pollution - Navitalai Litidamu
- 3.30-4.00 Pollution Monitoring Programme - Laisiasa Tulega
- 4.00-5.00 Working Groups on Recommendations and Presentation of Recommendations
- John Lane
- 5.00-5.30 **Closing - Mr F. Tipu - Secretary to the Government)**

Annex 2: Resource Personnel and Participants

Resource Personnel

Navitalai Litidamu	Consultant, SPREP
John Lane	Consultant, Government of Tuvalu/SPREP
Laisiasa Tulega	SPREP
Alefaio Semese	Government of Tuvalu

a. Government Participants

Juan Chares	Fisheries
Niko Apinelu	Fisheries
Kilateli Selulo	Meteorological
Seinati Willy	Meteorological
Meltoa Tanetia	Meteorological
Falealili Feagai	Medical
Mataio Tekinene	Medical
Soloseni Penitusi	Maritime School
Polau Kofe	Maritime School
Iakoba Italeli	Police
Willy Telavi	Police
Tapaeko Apisai	Public Works

b. Non-Government Organisation (NGO) Participants

Amasia Amitai	Ahamidiyya Muslim Association
Vavae Katalake	Ahamadiyya Muslim Association
Mamaga Taape	Bahai Faith
Sasagi Pulusi	Bahai Faith
Solomona Fepuali	Funafuti Town Council
Failoga Setema	Funafuti Town Council
Isa Paeniu	Jehovah's Witnesses
Oliuta Panapa	Tuvalu Church
Puafitu Faaalo	Tuvalu Church
Penieli Metia	Tuvalu Family Health Association
Mileta	Tuvalu Family Health Association
Siula Toloa	Red Cross Society

Annex 3: List of References, Documents and Handouts

Documents and References

Author

Coastal Environment in the South Pacific

SPREP

Oil Pollution: Its Potential Impact on the Environment of the South Pacific Region

SPREP/ICOD

Mangroves in the South Pacific

SPREP/ICOD

Coral Reefs in the South Pacific

SPREP/ICOD

Environmental Impact Assessment: The Key to Sustainable Development SPREP/UNEP

Handout Notes

Introduction to Pollution

L. C. Tulega, SPREP

Introduction to Pollution

N. Litidamu, Consultant

Water Standards Used in Water Quality Monitoring

L. C. Tulega, SPREP

Water Pollution Sources

N. Litidamu, Consultant

Environmental Impact Assessment: A Tool in Sustainable Development

N. Litidamu, Consultant

Controlling Land Pollution

L. C. Tulega, SPREP

Solid Waste Guideline

L. C. Tulega, SPREP

Controlling Water Pollution

N. Litidamu, Consultant

Pollution Monitoring

L. C. Tulega, SPREP

Annex 4: Handouts

Handout 1: Introduction to Pollution

People and environment

This paper talks about human beings, their life-style, their influence on the environment and their contribution to the pollution of that environment.

Let us start with human beings and consider their beginnings. There are two versions of human beginnings: one - the idea of evolution that scientists have put forward - says that humans are the result of slow changes that have occurred to life itself, and that they have developed very gradually from monkeys into the humans of today. The other is the creation story from the Bible, and is well-known throughout the world. In this version, God created the heaven and earth and all things thereon, and made humans the custodians of all things.

However, whichever version one believes, the fact remains that humans have at least one common quality - the instinct to survive and to better themselves. Hence, there is a tendency for them to wander in search of better living conditions and environment for themselves and their families. As a result, individuals and small groups came together to start small settlements which grew into towns and finally into cities. This is how today's cities developed.

Often the settlements were well-chosen, along streams or river banks, or on the coasts for ease of transportation, domestic water supplies, good agricultural land, protection from enemy attack, ease of access and a means of disposal for their wastes. These were given priority when choosing the site: the other resources offered, such as good fishing grounds, availability of fuel, wild life and so on, were of secondary importance. However, it was always taken for granted that the resources would be plentiful and that the land and water would remain clean throughout the natural cycles. But when people began to settle in greater numbers and experience growth in the products of agriculture, industry or mining, including such developments as the "cotton boom" or the "gold rush", things began to change.

As the towns grew, there was a need for expansion and further change. There was a need to expand public amenities, a need for economic growth and a need to provide socially and economically for the growing population. Consequently, there was development in industry, commerce and other areas, often at a very fast and uncontrolled pace.

In these modern times, increasing development and its associated changes are causing major problems. The "concentration effect" of increased development results in bigger harbours, larger ships, bigger processing plants and canneries, and means increases in production and greater problems of waste disposal. The concentration of humans caused by urban drift means that sewerage schemes designed in colonial days are no longer adequate in many places to cope with the increasing population, and squatter settlements built overnight create further problems - pollution problems. One last feature of the concentration effect is its impact on substantive farming. The hills surrounding urban centres, which used to be left fallow previously, are now forced to be used - because of urban drift and population increase. As a result, cultivation on steep slopes, together with the use of fertilisers and with high rainfall, causes severe erosion and pollution from agricultural "run-off".

Pollution

When can one say that land, water or air is polluted ?

Wastes of all sorts, whether domestic, industrial, commercial or agricultural, affect in some way the normal life of a river, lake, underground water source, estuarine or coastal water. When the influence is sufficient to render the water unacceptable for its best usage, it is said to be polluted.

Origins of pollution

Pollutants are waste materials released into the environment, usually - though not always - as a result of human action. Industry, automobile exhausts and domestic wood or coal fires all release pollutants into the air, many of them potentially harmful: the famous 1952 smog in London, caused by air pollution, killed more than 4000 people in just five days. Industry and agriculture dump large quantities of pollutants onto the land and into waterways. Some, for example DDT, are transported vast distances. Contamination may occur by mercury released in industrial wastes. By 1975, mercury poisoning had been confirmed in 798 people and suspected in another 2800. The food we eat can be contaminated as a result of the ways in which it is produced, processed or stored.

Some chemicals, such as pesticides and agricultural fertilisers are deliberately introduced into the environment. Their beneficial effects, however, are often accompanied by undesirable side effects if they persist in the environment for too long, or find their way into parts of the environment for which they were not intended. For example, although the nitrate used in agricultural fertiliser is not itself poisonous, intestinal bacteria can convert it to nitrite which affects the transport of oxygen by the blood. High levels of nitrite in drinking water can cause respiratory difficulties and even death in infants.

Natural sources produce pollutants such as wind-blown dust, the particles and fumes that accompany forest fires and volcanic activity, and mineral deposits that are washed off hillsides and enter waterways. These, and some of the pollutants produced by human activities, are unavoidable. Nevertheless, if their concentrations in the environment are high enough, they, too, can damage health.

Effects of pollutants

Pollutants can cause respiratory disease, acute intoxication and adverse reactions in sensitive individuals. The latter occur particularly in the developing foetus, and in the very young, the old and the diseased: the London smog, for example, proved lethal especially for those who were already suffering from respiratory problems such as bronchitis. Sometimes, symptoms such as breathing difficulties, eye irritation, skin rashes and intestinal upsets occur immediately after exposure. Smog, best known for its occurrence in Los Angeles, and caused primarily by photochemical reactions with waste products from automobile exhausts occurring in the atmosphere, is responsible for eye irritation and asthma attacks in susceptible people.

Other chronic effects occur only after long exposures. These are often difficult to predict, and are caused by the slow build-up of chemicals in the body or the gradual accumulation of damage to human tissues. Some chemicals can cause abnormalities in the foetus or the genetic transfer of defects to offspring. Many environmental chemicals can cause cancer, but usually only after several years of exposure. One of today's major health problems is that the causes of some major diseases, including some forms of cancer, are not known. They may well be related to contaminants in the air, the water or food. More research is needed to establish the links between these contaminants and the onset of disease. Health-related monitoring has a key role to play in elucidating the causes of many diseases.

The effects of chemicals and pollutants are evaluated by the International Programme on Chemical Safety (IPCS) and the results of this work are published as environmental health criteria documents. Experience and experimental studies are used to suggest guidelines or standards to limit the environmental concentrations of those pollutants already known to cause adverse effects on human health and the environment.

It is important to monitor the levels of pollutants in the environment and in people to ensure that recommended levels are not exceeded. Two approaches are possible; environmental monitoring and exposure monitoring. In environmental monitoring, air, water and food are analysed at selected sites. This provides information about the levels of contaminants in the environment. Exposure monitoring is designed to provide information about levels in the body, and to correlate these with other levels in the environment. Exposure monitoring often involves taking blood or other samples from the body to investigate the accumulation of pollutants or the biological changes produced by them.

Handout 2: Pollution Sources and Pollutants

Types of Pollutants

- **Physical**

Solid and liquid wastes

Solid waste disposal is a common problem associated with the increase in population. As towns and cities grow, people either pollute the air by burning a large amount of the rubbish generated, or pollute the land by sending tons of garbage to the disposal sites.

Noise pollution

This can be a problem in areas where factories are located, traffic is heavy and there are development (construction) sites. Excessive noise can cause hearing problems, disturbance to sleep, nervousness, hypertension and disruption of the peaceful enjoyment of life, thus degrading the quality of life.

Thermal pollution

This is also common in towns and cities where water is used as a coolant. It has been proved that a very small change in temperature has a marked effect on most living organisms in rivers and oceans. Hence, warm waters from such cooling systems will have a marked effect on the environment.

- **Chemical**

Chemical pollutants may be either in solid or liquid forms and become dangerous to the environment and to humans if their concentration is high. Chemicals are normally in compound form:

- Paints, especially antifouling paints used on marine craft are known to be serious ecological threats to marine life.
- Oil from ships which spills into the sea by accident causes problems to marine life. Used oil from mechanical garages pollutes both sea and land.
- Fertilisers are chemical compounds which contain substances like nitrates, phosphates and other elements referred to as plant nutrients.
- Pesticides are poisons used to kill or control pests; herbicides are used to kill weeds and insecticides to kill insects. They can be a threat to other forms of life.

- **Biological**

Micro-organisms such as bacteria can pollute the water environment. Bacteria of great concern are the bacteria found in sewage. Coliform bacteria are generally not harmful, but they are good indicators of faecal pollution which may contain pathogenic organisms for diseases such as typhoid and cholera. Fish poisoning organisms are also found in polluted water. There is also a lot of marine life which can be useful biological indicators of pollution. Some organisms will grow in great numbers when a special pollutant is in the water because it provides food for the organism. For example, high algae growth indicates an increase in the concentration of phosphate and nitrates in the water, resulting in eutrophication of the water.

- **Radiological**

Radioactive materials from nuclear power plants, hospitals and other research laboratories can escape from these places to their surroundings. Radiation is not considered by many to be a problem, because of the small amount of exposure. However, it could become a serious problem in the future as the demand for its uses increases due to population growth. The larger the population, the more waste is generated and the more serious the problem of disposal becomes.

Possible environmental pollution issues facing small island nations

• *Population growth and urbanisation impact*

Rapid growth and unbalanced distribution of population may be an underlying problem due to urban drift. Many serious environmental problems, some of which are highly visible, occur in urban areas or their immediate vicinity. Urban and peri-urban population growth rates are high and in most cases outstripping the development and planning of infrastructure. Consequently, these problems may occur:

- Ground water depletion and pollution through the percolation of sewage and effluent from domestic wastes.
- Competition for land and shanty settlements.
- Garbage and sewage disposal.
- Overfishing of reefs and lagoons.
- Loss of traditional eating habits and higher incidence of malnutrition and nutrition-related non-communicable diseases such as diabetes and heart diseases.

• *Solid waste and bulky waste disposal*

Scarcity of land for landfill sites, lack of facilities for the disposal of hazardous wastes and an increasing dependence on non-biodegradable products may contribute to solid waste pollution. Neighbouring islands - for example, Johnston Island - and ocean areas are being used for the disposal of wastes, including hazardous wastes.

• *Fuel*

If there is no fuel source in the country, it may become heavily dependent on expensive imported fossil fuel for commercial energy, such as that used in motor vehicles, aviation, generators and marine vessels. This can lead to problems of air pollution. Waste oil dumped indiscriminately can pollute waterways. The high cost of cooking fuel, such as kerosene and the scarcity of firewood may lead to increased consumption of raw or only partly cooked food.

• *Rise in sea level*

There is a fear that low-lying islands may become uninhabitable as a result of global warming and an associated rise in sea level due to an increase in air pollution.

• *Health and sanitation*

Contamination of water and shortage of water supplies may be experienced in small island nations such as Tuvalu if people are not careful with water sources. Many health problems are associated with water quality and quantity. Coastal waters and beaches can be polluted by sewage outfall and people defecating on the beach.

• *Water supply and waste water*

Fragile ground water resources may be over-used and polluted, leading to health problems. Alternative sources of water, such as rain water catchments, should be considered.

• *Breakdown of traditional subsistence food production system*

The shift of diet from traditional to imported foods which are high in sugar, salt and fats, and low in vitamins, minerals and fibre, brings about the increasing incidence of malnutrition in children and nutrition-related, non-communicable diseases such as diabetes, stroke and heart diseases among adults. Dependence on imported items also results in the loss of knowledge of traditional products and an increasing loss of foreign exchange.

Handout 3: Water Standards Used in Water Quality Monitoring

To ensure that water used for drinking purposes and the water around us can sustain life, water standards have been set and have to be met by all those involved in industries using water. The most widely used standards are:

- Raw water classification standards
- Drinking water standards
- Swimming water and shellfish standards

Raw water classification standards

The classification of raw water for drinking water can sometimes be useful in indicating under what conditions a water source may be used, or whether it should be used at all for public supply purposes. For other waters it could indicate the degree of pollution of the particular water sampled. In any such classification the bacteriological content of the water plays a dominant part and the two principal analyses used to denote bacterial quality are:

- The **total coliform** count, which estimates the numbers of bacteria of the coli-aerogenes group in a sample, these being of both faecal and non-faecal origin.
- The **faecal coliform** count, which estimates the numbers of "E" Coli bacteria in a sample, these being a particular strain of bacteria within the coli-aerogenes group which are definitely of faecal origin.

Hence, the total coliform count denotes the likelihood of sewage pollution, and the faecal coliform count confirms any pollution as being of human or animal origin. Also, the number of such bacteria present per unit of volume (usually 100 ml) indicate the degree of pollution.

In the early editions of the WHO European Standards (1958, 1963, 1968 and 1971), now withdrawn, an attempt was made to classify raw waters according to their degrees of bacterial contamination, as shown in the table below. Four classes of water were identified and labelled I-IV, of which the most heavily polluted, IV, having over 5000 coliform bacteria per 100 ml, was described as a "source to be used only when unavoidable".

Table 1: Classification of raw water according to bacterial numbers (as proposed in the WHO European Standards)

Classification	Total coliform bacteria per 100 ml	Faecal coliform bacteria per 100 ml
I Bacterial quality applicable to disinfection treatment only	0 - 50	0 - 20
II Bacterial quality requiring conventional methods of treatment (coagulation, filtration, disinfection)	50 - 5000	20 - 2000
III Heavy pollution, requiring extensive types of treatment	5000 - 50000	2000 - 20000
IV Very heavy pollution, unacceptable unless special treatments designed for such water are used; source to be used only when unavoidable	Greater than 50000	Greater than 20000

An EC Directive of 1975 continues a similar classification, but for surface water only. Three categories of surface water are designated, A1, A2 and A3, and the bacterial guide levels set for each are the same as for the WHO categories I, II and III respectively. Mandatory chemical limits for toxic substances are also set and these correspond with the mandatory limits set for toxic substances in drinking water in those instances (the majority) where reduction by the normal treatment process is unlikely to occur.

Drinking water standards (physical and chemical)

The most widely used standards before 1983 were the WHO International Standards for drinking water, first published in 1958 and revised in 1963, 1968 and 1971. These have been further revised and were reissued in a new form in 1983, now entitled Guidelines for Drinking Water Quality. The 1971 standards are reproduced since they have formed the basis for many national standards. The WHO also published European Standards, the latest in 1970, but these no longer apply, as they are merged into the 1983 Guidelines. Within the European Community (EC), an EC Directive issued in 1980 on the quality of water intended for human consumption applies to member states.

Other standards of importance are those used in the USA, formerly issued by the US Public Health Service, now superseded by the Drinking Water Regulations published by the US Environmental Protection Authority (EPA) in 1977. The old US Public Health Service Standards were first issued in 1913, and the 1962 revised version of them was reflected in many of the provisions of the second issue of the WHO Standards in 1963.

Many other countries have their own national standards, most of which are based on the WHO Standards of 1958, 1963 or 1971, with only slight modifications to allow for local in-country conditions.

Swimming water and water for shellfish culture standards

Suitability of water for swimming

In assessing the suitability of water for recreational use, clearly it is important to define the type of recreational activity that will be involved. The microbiological quality of water is of little importance in relation to fishing or boating activities, and it is only where there is intimate human contact with water, as in swimming, that the health hazard may be serious.

There have been several studies since the 1950s, particularly in the USA, demonstrating that appreciably higher rates of illness can be expected in smokers than in non-smokers. The illnesses can be grouped into eye, ear, nose and throat, gastro-intestinal, skin irritations and other illnesses.

Bathing water quality is almost always judged on the content of coliform organisms, an assessment which is only likely to be related to the incidence of gastro-intestinal infections. There is no WHO Standard for bathing waters, but the EC Standard is:

Table 2: EC Standards for Bathing Water

	Guidelines	Imperative
Total coliform/100 ml	500 (80 % sample)	10,000 (95 % sample)
Faecal coliform/100 ml	100 (80 % sample)	2,000 (95 % sample)
Faecal streptococci/100 ml	100 (90 % sample)	---
Enteroviruses	PFu/10 litres	0

Suitability of water for shellfish culture

The microbiological criterion for shellfish water quality has been accepted by international agreement to be a median MPN for total coliforms of not more than 70/100 ml and not more than 10 % of samples normally exceeding an MPN 230/1000 ml sample for the 5- test tube.

This standard has proved to be reasonably satisfactory. However, recent investigations proved that the criteria should be changed and the medium faecal coliform value should not exceed MPN 14/100 and not more than 10 % of samples should exceed an MPN of 43/100 ml.

USA shellfish standards

Standards for shellfish growing (culturing) waters:

Approved: Median E/Coli > 14/100 ml (with 10 % > 43/100 ml)

Restricted: Median E/Coli > 140/100 ml (with 10 % > 430/100 ml)

UK shellfish table

In the UK water quality standards are not used, since it is felt that the relationship between the bacteriological quality of the water and the quality of the shellfish is so variable. Instead, shellfish is judged on the bacteriological content of the flesh.

Table 3: UK Water Quality standards as shown by Contamination of Shellfish

E.Coli/ml flesh	% Clean	Comments
0 - 5	100 - 80	Satisfactory
6 - 15	70	Suspicious
16 +	< 60	Unsatisfactory (sale prohibited or consumption not recommended)

Handout 4: Water Pollution Sources

Pollution, in the context of this discussion, refers to the introduction of toxic or harmful materials to the environment by the activities of people. But the environment, including living creatures, can be affected by natural processes. An isolated pool in a mangrove forest may contain so much rotting organic material that the dissolved oxygen is used up by bacteria; fish may die and the water becomes brown and has a bad smell. Fish in the open sea, including tuna in the Pacific, may concentrate the toxic metal mercury, which occurs naturally in seawater in very small quantities.

In most countries the four most important sources of water pollution are sewage, industrial effluent, storm and urban run-off and agricultural run-off. Water can be polluted by the introduction of material which is not itself toxic but is still damaging to the environment; for example, the addition of silt to a river or the sea may kill some plants or animals.

Pollution occurs at varying levels. Small amounts of some pollutants in seawater may be measured and their effects confirmed by close scientific investigation. Other more toxic or more concentrated pollutants may devastate the environment, causing the death of marine species and perhaps that of the people eating them.

In the Pacific, barrier reefs are common. Barrier reefs enclose lagoons which have limited exchange of water with the open sea. So pollutants released into the lagoons may build up to dangerously high concentrations. Some of the important common pollutants are:

Villages, towns and resorts

The most common type of pollution in areas of high population is caused by sewage; human faeces and urine in water which is later released into the sea. Sewage may be treated, but this is expensive and requires areas of land for the construction of ponds and treatment plants. In sewage treatment works, much organic material settles as sediment, passing the remaining liquid through gravel filter beds which may remove more suspended organic material.

Whether treated or not, sewage released into the sea will tend to increase the quantity of micro-organisms and nutrients, particularly nitrates (NO) and phosphates (PO), in the surrounding water. This will encourage the growth of bacteria which use much of the dissolved oxygen in the water. The degree of pollution may be measured by the consumption of oxygen or the biological oxygen demand (BOD): the higher the BOD, the more polluted the water.

Here is a description of what is likely to happen at various distances from a sewer outlet pipe. Close to the outlet there is a large amount of bacteria and the oxygen is used up (the water has a high BOD). Very few marine animals can live in such polluted water. At increasing distances away from the outfall, the oxygen and the number of different species of animals return to normal levels. Sewage may also carry other pollutants, including detergents, which may cause foaming and reduce the ability of water to hold dissolved oxygen. Bacteria and viruses can contaminate seafood caught in the areas near outfall or river mouths and cause outbreaks of gastro-intestinal and other diseases. Bathers are exposed to micro-organisms on the beach or in the water.

Industries

Several types of industries, including engineering plants, fish and food processors, discharge their wastes directly into coastal waters. Serious industrial pollutants are cyanide and heavy metals - copper, lead, zinc and mercury. Some of these metals are particularly dangerous because they are cumulative; ie even a small amount in water will, over a long period, become more concentrated in the flesh of marine animals. Large carnivorous fish may gain, even higher concentrations by biomagnification and become extremely toxic to humans.

Although less toxic, oil is a serious pollutant released by some factories and ships. Oil forms a thin film on the surface of the water and can kill corals and other marine life. Whereas adult fish may be able to swim away and avoid the toxic area, larvae and less mobile creatures may be killed or experience changes in their feeding or reproductive cycles. It is important for an island nation like Tuvalu, where the people depend heavily on the marine resources from its EEZ, to ensure that coastal waters and beaches are not polluted.

Mining and forestry

Mine wastes often contain metals which are toxic to plant and animal life. These wastes and considerable quantities of silt are often washed by rain into nearby rivers and coastal areas. The major effects of silt are that it kills plants by reducing the amount of sunlight penetrating the water; it kills fish by damaging their gills, and kills corals by smothering them.

Forest trees are continually being cut down for local use and for export. Areas which have been cleared of trees are subjected to land erosion where soil is washed away by rain and produces silt pollution in the rivers and the sea.

Agriculture

The clearing of land on slopes for growing crops often creates erosion problems similar to those discussed under "Mining and forestry". The most serious problem with agriculture is created by the use of pesticides. These are poisons used to kill pests: herbicides are used to kill weeds and insecticides to kill insects.

Problems occur when pesticides are washed away by rain into rivers and coastal waters. Some pesticides can also become concentrated in the flesh of high level fish through biomagnification.

Saltwater intrusion to underground sources is common in atolls and can create drinking water problems.

Reef

Disturbance of coral reefs from activities such as the blasting of boat channels has been linked with fish poisoning, notably ciguatera. Ships wrecked on the reefs cause physical damage to the reef and this has also been linked with ciguatera fish poisoning.

Handout 5: Solid Waste Pollution Sources and Final Disposal

Pollution sources

• Domestic

Increasing population, especially in urban areas, contributes to increasing amounts of solid wastes generated from domestic activities. These must be properly disposed of so that health and the environment are not affected. These wastes are biodegradable and non-biodegradable. Large volumes of biodegradable items, such as most household garbage, are generated, so they take time to decay and rot through natural processes. Non-biodegradable materials such as plastics, rubber, metals and other materials do not rot or decay. These materials quickly fill dump sites and give rise to over-loaded dumps where land for dumping is scarce, so creating a considerable eyesore.

• Industrial

Fossil fuels began as forms of plant and animal life, which died and decayed, some in time becoming oil. Today, this oil, extracted in far-away lands, is brought to our islands to run machines such as cars, trucks, boats, planes and electric power plants. Many motorists carry out their own servicing and repairs, changing their own engine oil and inappropriately disposing the used oil, thereby creating a severe pollution problem. Sump oil dumped onto the ground will find its way into a drainage system and eventually pollute waterways. Burning used oil, either openly or in an incinerator, will not only pollute the air, but also create a high concentration of lead in the fumes, which will be hazardous to humans.

Bulky wastes, such as derelict vehicles, machines and other metal wreckage are common sights in many industrial and residential areas. They are not only an eyesore, but can be a source of pollution.

• Agricultural

Pesticides are used to kill things that we don't want around us, and are often over-used in many island nations. Some pesticides are very stable, remaining unchanged in the environment for a long time. When washed away by rain into rivers and coastal waters, they are harmful to the young stages of marine species. Some pesticides can also become concentrated in the flesh of high level fish through biomagnification. Residues can also be found in edible root crops.

The heavy use of fertilisers can also have the same effect, and underground water can be easily polluted if care is not taken with the use and storage of fertilisers.

Other strong chemicals are powerful weapons which may be used for or against forms of life. But what affects one form of life also affects others and the results are not always desirable. The biggest danger is that strong chemicals may be misused, or accidentally spilled or drunk.

• Deforestation

This has a great effect on the environment and on humans. According to WHO, most of the deforestation occurs in the developing countries of the tropics, with an average loss estimated at 11 million hectares per year. Problems associated with deforestation are:

- The effects on the natural process of air purification
- Soil erosion, resulting in poor quality soil
- Changes in rainfall
- Flooding
- Loss of shade and shelter
- Contribution to global warming

Some options for the final disposal of solid waste

There is very little land available for landfill sites in most countries in the South Pacific, and most, if not all, do not have proper disposal facilities for hazardous waste. There is also increasing dependence on non-biodegradable products which fill up the disposal sites, reducing their life span. As a result, the use of neighbouring islands and ocean areas as waste disposal sites is becoming prevalent: Johnston Island and smaller islands in Tokelau are examples.

There are various methods of refuse disposal which can be practised by a community, depending on the availability of resources and the amount of refuse. Commonly used methods are:

- **Open dumping** is the most frequently used method, and one of the cheapest if dumping sites are available. The refuse is usually burnt to reduce the volume and minimise flies. It is unsatisfactory in many ways: because of the problems such as a lack of adequate soil cover to keep away flies and rats, the refuse is often exposed, becoming an eyesore and giving out an offensive smell.
- **Sanitary landfill**, also known as "cut and cover", was developed to improve on the unsanitary open dump. It involves the distribution of refuse in layers alternating with earth fill. Soil cover is used to prevent dogs and rats from excavating the buried refuse. Mechanical equipment is used to distribute the refuse and soil.
- **Composting** is piling organic material - especially garbage and yard cuttings - and then covering with soil and allowing the material to decompose either aerobically or anaerobically for some time. The decomposed material makes an excellent soil conditioner, and improves the quality of the soil for agricultural use.
- **Incineration** involves burning refuse at a very high temperature (1200 - 1800 deg F). This is a sanitary method of disposal and is appropriate for hospitals where dangerous and infected materials may form part of the refuse. However, the problem of air pollution and high costs may arise.

Handout 6: Environmental Impact Assessment

What is EIA ?

Environmental Impact Assessment (EIA) is the assessment of the impact that a development project will have on the environment. The goal of EIA is to predict how a development project will affect the natural and human environment and to minimise the effects.

Why do EIAs ?

- *To provide a mechanism for consulting people who will be affected.* EIAs provide a formalised way of consulting the people who will be affected by a development before it happens. Such consultation helps avoid unwanted social and environmental effects that are not obvious to the developers and to the decision-makers in government.
- *Because EIAs are a good management tool.* EIAs can prevent embarrassing development failures, and can save both government and industry a great deal of money. Environmental management is especially important in the South Pacific Island countries where there is not a lot of land or resources with which to make mistakes.
- *Because of international requirements.* After decades of experience with projects producing unwanted environmental and social consequences, most international loan and aid funding organisations, for example, the World Bank, now require EIAs for projects which they fund.
- *Because the world is changing so fast.* The introduction of new technology, and the opening up of societies to permit participation in the global economy, have brought major changes to the pace and extent of resource development and exploitation in the South Pacific. Natural resources are being used in much greater quantities than previously, with the use of totally different technology, and produce is being exported rather than being used by the local population. An important consequence of this new pace of development is that the previous "trial-and-error" process of human adjustment to the environment is no longer appropriate. As has been seen in many countries in Europe, North America and Asia, severe environmental problems can be caused in a very short time. The scale and speed of the developments mean that serious harm can be done even before the problem is recognised.

EIA and sustainable development

The term "sustainable development" has come out of obscurity to occupy centre stage in the planning process in most of the major economies of the world.

Sustainable development refers to developing resources in such a way that renewable resources (for example, fish and forests) have the chance to replenish themselves, and non-renewable resources (for example, minerals) are depleted in a managed way, so as to allow the economic and social system to adjust to the end of the resource.

In the Pacific Island nations, traditional societies learned to live in balance with nature through long-term, trial-and-error processes. They have altered the natural environment, for example, by burning or by importing new species, but they achieved a new, settled relationship with their environment. This is the goal of sustainable development.

New forms of development, urbanisation, more intensive fishing and resource exploitation, and many other changes introduced by the modern world threaten this balance with nature. EIA provides a means of controlling development and determining if it is sustainable before the development begins.

Governments need to adopt and encourage the use of the Primary Environmental Care (PEC) approach. PEC is a new tool for decision-making in designing and implementing new projects, developed as a methodology for promoting sustainable development at the community level. It is a process where local groups or committees organise themselves, often free from outside support, to apply their skills and knowledge in caring for their natural resources and environment while also satisfying their livelihood needs. This is similar to primary health care and complements primary health care by focussing attention on natural resource management as a means of promoting both health and a sustainable environment.

Handout 7: Controlling Land Pollution

Pollution is of great concern to many small island nations, not necessarily because levels are high, but because there is no monitoring place for the nation to learn whether there is a danger. It is therefore important that more accurate and more specific information on health and environment is available to provide a basis for more effective action.

Government is encouraged to formulate its own environmental legislation and policy with the help of international environmental agencies, and to ensure compliance with health and environmental standards. Since crude and indiscriminate dumping of solid and hazardous waste has proved to be the main cause of land pollution, legislation on waste management should be formulated and implemented. Such legislation could be called the Waste Management Act, and would have provision for the establishment of a body which manages the following:

- Waste collection and disposal
- Waste control zone
- Designation of waste control zone
- Control over disposal of waste within the waste control zone
- Licensing of disposal sites and conditions on waste disposal sites
- Licensing procedures
- Environmental Impact Assessment (EIA) of waste disposal sites

Health and environment cannot be solely the responsibility of government in policy formulation or implementation. New partnerships should be developed so that the issue of environment becomes the joint responsibility of all individuals and groups, NGOs, private sector, schools and the media. A waste management authority could be responsible for the following:

1. Site operational plan

Dumping sites should be identified and properly planned to ensure minimum negative impacts on health and environment. Major work at this stage will include:

- Site planning
- Preparatory work
- Site excavations
- Site drainage

2. Operational plan

- Collection of data
- Collection of waste
- Carriers of waste
- Hazardous waste disposal, control over impacts, documentation
- Discharge of water into water courses
- Discharge of waste into sea

3. Implementation and policing

- Provision of a Waste Management Network to implement and police the Act. All agencies and ministries whose work has some influence on the environment should review their norms, procedures and institutional structures, so as to optimise their contribution to health and the environment.
- Responsible actions should be taken at all levels, from individual citizens to the government, to reduce over-consumption and the generation of wastes, especially those with adverse effects on health and the environment.

4. Standard and code of practice

- It is important in the process of waste management to ensure that standards for different wastes produced by the community are set, and a code of practices formulated and implemented in the disposal operation. Such standards and practices, if properly implemented, should ensure that disposal does not pose a threat to our fragile environment.
- Incorporate health and environmental considerations, including standards and a code of practice, into all aspects of planning for new industry; cost-benefit analyses, siting, process design, transport of raw materials, information about products discharged into the air and water, waste generation and disposal.

5. Technical training programme

- Trained, competent officers to implement and police the Act.

6. Public awareness and education programme

- Improve the preparation of environmental workers and those in related fields to work with community groups in educating the general public about pollution problems and their role in minimising the effects. Involve schools in educating children to become agents of change, both in the home and the neighbourhood, with respect to health and care of the environment.

7. Monitoring and evaluation programme

- Management
- Implementation
- Technical
- Water quality
- Waste reduction, recycling or reuse of waste materials is to be encouraged or opportunities exploited by using participatory community-based schemes.
- Government is to set up programmes to slow down rapid urbanisation by restricting rural-urban migration or urban investment.
- Control of the importation and use of pesticides and fertilisers, greater use of integrated pest control combining traditional, biological and chemical methods, and the use of natural manure from composting. This will reduce the reliance on chemicals, lessen the risks of land pollution from agriculture, and lessen the risks from human exposure to chemicals.

8. Review of system

Give priority to research and development in the area of waste reduction and the use of biodegradable waste and investigate possibilities of using composting or other methods of waste disposal.

Solid waste guidelines

Refuse collection and disposal

1. Planning

- Funding
- Manpower and resources
- Management/maintenance

2. Storage

- Domestic - 1x3 cubic feet cylindrical container (minimum per dwelling) made of plastic or metal, with tight-fitting lid.
- Industrial/commercial - 2x3 cubic feet as above (minimum per premises).

3. **Collection of refuse**
 - Manually loaded on truck
 - Mechanically loaded
4. **Transportation**
 - Specially designed truck
 - Well-covered
5. **Final disposal**
 - Controlled tipping
 - Refuse spread in layers with covering material, eg soil
 - Machinery, eg bulldozer
6. **Bulky waste**
 - Recovery and separation of parts
 - Cutting up of parts to send overseas or dump in the sea
7. **Incentives**
 - Restriction of the entry of motor vehicles to the country
 - Use of public transport, buses, taxis, or of bicycles and walking
8. **Control of used oil from motor mechanic shops**
 - Collect all used oil in drums
 - Recycle or burn
9. **Left-over pesticides**
 - Collect in durable containers
 - Store in locked, well-ventilated place

Handout 8: Controlling Water Pollution

The fact that, in most places, fresh water is limited in both quality and quantity, indicate the need for comprehensive water management involving representative of all water users. One of the objectives of such management is to ensure that the best use is made of available supplies, including their protection from pollution. Good water management should be based on recognition of the importance of safe and sufficient supplies for health, and on the fact that fresh water is a scarce and finite resource. It is important to provide potable water to houses, and as important to collect and dispose of waste water.

It is essential, therefore, that proper legislation should be enacted by the government authority responsible for water resources, with the purpose of discouraging polluters and preventing the release of pollutants and the production of wastes. Such legislation should be called the Water Management Act.

Greater emphasis should be placed on the principle that polluters pay the cost of pollution damage and that they are charged the full health and environmental costs of the wastes they generate.

Better maintenance and repair of existing water systems can significantly increase the quantity and quality of water. Leaking water systems not only lose great quantities of water, but also allow pollutants into the systems, making the water unsafe for consumers.

For industrial activities, it should be a requirement that the producers of products involving hazardous wastes take responsibility for them from production to safe disposal.

Rainwater catchment systems for domestic water needs should be improved and the pumping of ground water should be restricted to periods of essential community needs, such as during prolonged drought.

A greater use of integrated pest control is advocated, combining traditional, biological and chemical methods. This will reduce the reliance on chemicals, lessen the risks of water pollution from agricultural run-off, and also lessen the risks to humans from exposure to chemicals.

An effective regulatory system is needed to control environmental pollution. Permits, licences and inspections by a regulatory authority are essential, as are adequate numbers of environmental officials.

Awareness of environmental issues should be increased among government officials, private enterprise and the public, and encouragement given to behaviour and environmental modifications which have beneficial effects.

Waste water guidelines

1. Sewage treatment

- Conventional * Primary, * Secondary and Tertiary (if possible)
- Sewage outfall - Outfall should be into the ocean, away from the reef. Water currents around outfall should be carefully studied and mapped so that outfall pipe can be placed where currents will disperse the effluent.
- Ponding - Oxidation ponds where land is available and proper discharge of effluents into water course.

2. Septic tank - Adequate soakage and not close to water course.

3. Water seal - To be properly constructed where water is available. No long drop privies and no latrines along the beach.

Handout 9: Pollution Monitoring

Why monitor?

The ultimate goal of environmental monitoring of all kinds, compliance, model validation and verification, and trends is protection of the environment, living resources and human health. Monitoring provides information that is useful in managing the environment, its resources, or the human activities affecting them. Environmental monitoring data document existing conditions and, if collected repeatedly, chronicle changes in these conditions. In the absence of knowledge of prior environmental conditions, monitoring establishes a starting point for future comparisons.

Monitoring is most beneficial when it results in more effective management decisions; decisions that protect or rehabilitate the marine environment, its living resources, and uses or resources that society considers important. For example, monitoring coliform bacteria as an indicator of human faecal contamination has been an effective public health measure for decades, triggering direct management actions to close beaches to swimming, or shellfish beds to harvesting, or to eliminate or improve the treatment of sewage discharges. Other uses of the monitoring results include:

- Providing environmental managers with a rationale for setting standards. When monitoring results show a clear change or trend, for example a reduction in fish stocks, public confidence in the decision maker's limitation on catches is enhanced.
- Constructing, adjusting, and verifying quantitative predictive models that can be the basic tool used in evaluating and selecting management strategies.
- Determining compliance with regulations and conditions set by permits.
- Providing the information needed to evaluate pollution abatement programmes.
- Early warning of future problems, whence they can be resolved more easily and at lower cost than if left unattended. Although monitoring cannot guarantee early detection of problems, it can reduce the probability of unpleasant surprises.
- Improving knowledge of marine ecosystems, their variability, and society's impacts on them. Managers can use this information to shift priorities and reallocate resources as needed to match the agency's resources with important, tractable environmental problems.
- Engendering a better understanding of the health of the marine environment. Decision makers and the public want answers to pressing questions. Is water quality getting better or worse? Are fish and shellfish increasing or decreasing in number? Is it safe to swim? To eat the fish? Are stress conditions for marine organisms increasing or decreasing in frequency, extent and duration?

Costs of not monitoring

The costs of not monitoring - or of monitoring ineffectively - include failure to obtain the information needed to assess environmental conditions, to validate and verify predictive models, and to chronicle changes in the environment resulting from natural variations, management actions, and pollution impacts. In short, the cost of not adequately monitoring is a serious shortcoming on our efforts to protect and restore marine environmental quality.

The economic, social and political costs of failing to detect and deal with environmental problems in the early stages can be enormous. Economically, correcting problems after the environment is seriously degraded adds to the costs. But some degradation may be irreparable: living resources may be so depleted and habitats so damaged that stocks of commercially and recreationally important species may never return to pre-degradation levels. Public health problems can arise, with attendant economic and social consequences. Public opposition and anger may increase with the sudden news that beaches are unsafe for swimming, or that fish and shellfish are unsafe to eat. Government agencies and their officials may be blamed for neglect or short-sightedness.

Limitations of monitoring

It is important not to overstate the usefulness of monitoring programmes. The marine environment is complex and variable. In coastal regions, separating impacts of human origin from natural variability is difficult. This difficulty and others do not argue against monitoring the marine environment, but they do make the case for realistic expectations, careful and critical experimental design, periodic evaluations, and a constancy of commitment.

Often the causes of environmental pollution, whether natural or human-induced, cannot be identified unequivocally even with data and information gathered from well-designed monitoring programmes. A recent example of the limitations of monitoring in effectively addressing public concerns is the issue of ocean dumping in the New York Bight. During the summer of 1988, stranded wastes on beaches, unusual deaths of dolphins, diminished fish stocks, and reports of lesions on the shells of crabs and lobsters elevated public suspicion that the culprit was the dumping of sewage sludge, the approved site for which had recently been relocated from 12 miles to 106 miles offshore. Despite an extensive of studies of ocean dumping in the New York Bight and the considerable monitoring being conducted, it was not possible to say without doubt whether the observed phenomena were due to ocean dumping or other causes.

Reflecting the public's concerns, Congress acted swiftly by passing the Ocean Dumping Ban Act of 1988. Although it can be argued that an improved or more extensive monitoring programme could have resolved the issue more effectively, the example points out the inherent limitations of monitoring in linking unexpected phenomena to their causes. The complexities of the problems, variability in natural systems, and the time needed to conduct research and acquire information on marine processes and systems make absolute determinations extremely difficult. Risk free decision making is an impossible goal. Monitoring programmes can narrow uncertainty, not eliminate it. They can contribute to understanding change and to ascribing causes to these changes, and their results are useful in weighing the benefits to society of management alternatives.

Pollution monitoring programme

Conventions, protocols, legislation and strategies are put into place because of the people's concern over the environment. However, the efficiency of these cannot be assessed unless there is some sort of monitoring and review system in place.

Objectives of pollution monitoring programme

1. To find out the condition of the environment (air, water, soil, organisms etc) at the present time, so that existing pollution problems can be:
 - identified and classified
 - assessed as to the severity and extent of the pollution
2. To provide a baseline that will allow the detection of future changes in the quality of the environment.
3. To provide managers in the environmental protection authority with a tool for managing, and determining how effectively they are managing, their operations and resources.

Planning monitoring programme

The planning and decision making for the monitoring programme should be done in partnership with various government departments and NGOs which have some concern about the environment. Their concern for and support of the programme is important.

Implementation

Monitoring is regular and systematic sampling of a location or series of locations over a period of time, generally years. This includes:

- Baseline monitoring: project-based monitoring done prior to a development.
- On-going or long-term monitoring: one which has a beginning but no end.
- Pollution monitoring: which involves the measurement of pollutants from a point source, eg outfall.

Monitoring will also indicate resources which are unaffected by pollution. Management can then institute measures to protect these resources in the future.

Where to monitor ?

Long-term monitoring is costly and therefore the number and location of sites are carefully selected to reflect national concerns and priorities. This may require the provision of a *Pollutant Source Inventory*, which ranks the sources or localities of pollutants in order of importance.

What to monitor ?

Water quality data need to be collected. This should include pH, temperature, colour, clarity, conductivity and dissolved oxygen, and, in addition, basic environmental data such as sampling time, weather conditions, tide stage and flow rate. This information will assist in understanding the reasons for fluctuations in the main parameters, which are the real object of the monitoring programme.

Sediment samples should be taken from fine sediment accumulation near major agricultural areas and tested for common groups of organochlorin pesticides. Only key pollutants should be selected for monitoring because of high costs and laboratory resources.

Marine and estuarine water can be routinely tested for heavy metals if laboratory facilities are available. Standard methods must be used for all aspects of the monitoring programme.

Provision for studies and possible research

Continuing studies and research into various types of pollutants and pollutant sources needs to be incorporated into the programme so that the monitoring authority is aware of the new development in our environment.

Review of mechanism

Provision should be made in the programme for it to be reviewed every few (say 3 - 5) years. However, the reviewers should try to ensure that changes to location or methods do not result in later data not being comparable, as this will defeat the purpose of the programme.

Annex 5: Workshop Recommendations

1. A review of the existing environmental, public health and sanitation, paper supply, waste water and building and development regulations.
2. The formulation of such regulations if not already in existence.
3. The creation of posts within the public service and the training of qualified officers to supervise and enforce the regulations.
4. The promotion of a dynamic public awareness and education programme throughout Tuvalu.
5. The compulsory use of Environmental Impact Assessment as a tool for sustainable development in Tuvalu.
6. The implementation of a continuous technical training programme.
7. Policy development on economic and other incentives:
 - reduction of work at source
 - recycling of waste
 - alternative commodities
 - tax reduction
 - birth control
 - renewable energy
 - controls on owning of animals
 - control of urban drift
8. Manpower training on environment

Immediate Measures

1. Reduction of imports of bottled beer and replacement by beer in aluminium cans which can be recycled.
2. Provision for a central site for a piggery, with a view to collecting all wastes for conversion to energy for cooking and lighting.
3. Immediate provision of financial and technical assistance to Funafuti Town Council to cater for their environmental programmes.
4. The Environment Authority for Tuvalu should be autonomous rather than becoming part of the Tuvalu Civil Service.

Annex 6: Course Evaluation Questionnaire

We have now come to the end of our workshop and you must have formed some opinions about its usefulness. The organisers have been very conscious of the need to make the programme both enjoyable and stimulating. It would help us in planning future workshops if we received feedback from you. Please complete this evaluation form and return it before you leave.

Q1. What did you think of the content of the programme?

Appropriate

Comment _____

Too Technical

Q2. Were you satisfied with the amount of new knowledge gained?

Yes

Comment _____

No

Q3. Were you satisfied with the amount of personal development achieved?

Yes

Comment _____

No

Q4. Did you find the field visits valuable?

Yes

Comment _____

No

Q5. Did you find the discussions helpful and appropriate?

Yes

Comment _____

No

Q6. Were the presentations by the resource people helpful and appropriate?

Yes

Comment _____

No

Q7. Were the video presentations helpful and appropriate?

Yes

Comment _____

No

Q8. Were your expectations for the workshop fulfilled?

Yes

Comment _____

No

Q9. Any other comments about the workshop?

Yes

Comment _____

No