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WORLD HEALTH ORGANIZATION

WESTERN PACIFIC REGION



ORGANISATION MONDIALE DE LA SANTE

REGION DU PACIFIQUE OCCIDENTAL

ENVIRONMENTAL HEALTH CENTRE (EHC)

REPORT

CENTRE

**WORKSHOP ON
DRINKING WATER QUALITY MONITORING AND
SURVEILLANCE FOR PACIFIC ISLAND COUNTRIES**

Suva, Fiji

6 - 10 December 1993

Kuala Lumpur, Malaysia

January 1994

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REPORT

**WORKSHOP ON DRINKING WATER QUALITY MONITORING
AND SURVEILLANCE FOR PACIFIC ISLAND COUNTRIES**

Convened by:

WORLD HEALTH ORGANIZATION

**WESTERN PACIFIC REGIONAL
ENVIRONMENTAL HEALTH CENTRE (EHC)**

Suva, Fiji
6-10 December 1993

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January 1994

NOTE

The views expressed in this report are those of the participants in the Workshop on Drinking Water Quality Monitoring and Surveillance for Pacific Island Countries and do not necessarily reflect the policies of the Organization.

This report has been prepared by the World Health Organization Western Pacific Regional Environmental Health Centre (EHC) for governments of Member States in the Region and for those who participated in the Workshop on Drinking Water Quality Monitoring and Surveillance for Pacific Island Countries, which was held in Suva, Fiji from 6 to 10 December 1993.

CONTENTS

	<u>page</u>
SUMMARY	
1. INTRODUCTION	1
1.1 Objectives	1
1.2 Participants and resource persons	1
1.3 Organization	1
1.4 Opening ceremony.....	2
2. PROCEEDINGS	2
2.1 Summary of country reports	2
2.2 Summary of discussions/activities	2
2.3 Evaluation	6
3. CONCLUSIONS.....	7
4. ACKNOWLEDGEMENTS.....	8
<u>ANNEXES:</u>	
ANNEX 1 - LIST OF PARTICIPANTS, REPRESENTATIVES AND SECRETARIAT MEMBERS.....	9
ANNEX 2 - WORKSHOP PROGRAMME	15
ANNEX 3 - LIST OF DOCUMENTS DISTRIBUTED DURING THE WORKSHOP	19
ANNEX 4 - SUMMARIES OF COUNTRY REPORTS	21
ANNEX 5 - SPEECHES AT OPENING CEREMONY	33
ANNEX 6 - RESULTS OF SANITARY SURVEY	37
ANNEX 7 - DISTRIBUTION OF DELAGUA TEST KITS	39

Key words

Drinking water quality - Monitoring and surveillance, Workshop

SUMMARY

Objectives of the workshop:

The objectives of the Workshop on Drinking Water Quality Monitoring and Surveillance for Pacific Island Countries were:

- (1) to assess the present situation with regard to drinking water quality monitoring and surveillance in Pacific island countries with particular emphasis on the major drinking water quality problems;
- (2) to develop model national standards and procedures for formulating and implementing national drinking water quality monitoring and surveillance programmes in both urban and rural areas including consideration of institutional responsibilities;
- (3) to delineate logistic/material needs for implementing national drinking water quality monitoring and surveillance programmes; and
- (4) to promote and to familiarize participants with the latest edition of the WHO Guidelines for Drinking Water Quality.

Summary of proceedings and conclusions:

The workshop was attended by 27 participants from 14 Pacific island countries and two representatives, one from the United Nations Development Programme, Suva and the other from the South Pacific Regional Environment Programme, Apia. The proceedings comprised country reports by the participants and technical papers by WHO staff and the consultant. A half-day field trip to Wailoku Treatment Plant in Kinoya, Suva was carried out to give the participants practical experience in sanitary surveys. Ten DelAgua bacteriological water testing kits were donated to the workshop participants by the Overseas Development Administration, United Kingdom, which also co-funded the workshop with the Government of Japan. Practical experience was also given to the participants in the use of these kits.

The participants were also familiarized with the contents of the new WHO Drinking Water Quality Guidelines of which Volume 1 was published just prior to the workshop and Volumes 2 and 3 will be completed in 1994.

The following conclusions were made as a result of the country reports and the workshop presentations and discussions:

- (1) Bacteriological monitoring of water supplies in the Pacific island countries should be directed at the detection of faecal coliforms rather than total coliform testing since the latter is indicative of soil contamination which is particularly difficult to interpret in rural unchlorinated, tropical water supplies.
- (2) Ordering of testing materials is a possible avenue of useful support by donor agencies as ordering procedures are difficult for Pacific island countries and considerable cost savings could be made by bulk orders.
- (3) Staff should be designated specifically for monitoring and surveillance duties in Pacific island countries.
- (4) It is essential that offices of both the operation and surveillance agencies collaborate on the formulation of interdependent monitoring and surveillance programmes. .../

(ii)

- (5) Legislation for drinking water quality for Pacific island countries should cover permissible levels of impurities that may be encountered. Frequency of sampling is not necessary to include in legislation as circumstances vary widely and frequencies cannot be usefully defined.
- (6) The new WHO Guidelines for Drinking Water Quality are a suitable basis for appropriate standards to be adopted in Pacific island countries.
- (7) Pacific island countries should prepare inventories of all the water supply schemes in the country before the implementation of surveillance programmes.
- (8) The bacteriological kit studied during the workshop is appropriate technology for use in Pacific island countries. It has advantages of ease of use and economy over equipment using membrane filters previously used.
- (9) Further training should be directed at national activities and will require further support from donor agencies in many cases. Another workshop for Pacific island countries should be held in two years' time approximately to evaluate progress.
- (10) The follow-up workshop should be planned to ensure that participants submit country progress reports with their application to participate. Their country reports should include a summary tabulated diagnostic of water supplies including the results of the application of the sanitary survey and system indicators presented at this workshop.

1. INTRODUCTION

The Workshop on Drinking Water Quality Monitoring and Surveillance for Pacific Island Countries was held at the Banyan Room, Travelodge Hotel in Suva, Fiji from 6 to 10 December 1993.

The workshop was jointly funded by the Japanese Special Programme of Technology Transfer Fund, Overseas Development Administration of the United Kingdom (ODA) and organized by the World Health Organization.

1.1 Objectives

The objectives of the workshop were:

- (1) to assess the present situation with regard to drinking water quality monitoring and surveillance in Pacific island countries with particular emphasis on the major drinking water quality problems;
- (2) to develop model national standards and procedures for formulating and implementing national drinking water quality monitoring and surveillance programmes in both urban and rural areas including consideration of institutional responsibilities;
- (3) to delineate logistic/material needs for implementing national drinking water quality monitoring and surveillance programmes; and
- (4) to promote and to familiarize participants with the latest edition of the WHO Guidelines for Drinking Water Quality.

1.2 Participants and resource persons

The workshop was attended by 27 participants from the Pacific island countries and two representatives [one from the United Nations Development Programme (Water Supply and Sanitation Programme), Suva and the other from the South Pacific Regional Environment Programme, Apia]. A list of the participants, representatives and secretariat members is presented in Annex 1. Dr B. Lloyd, WHO Consultant and Mr B. Fisher, Sanitary Engineer from the WHO Western Pacific Regional Environmental Health Centre (EHC) acted as resource persons for the workshop.

1.3 Organization

The workshop programme is given in Annex 2 and a list of documents distributed to participants and representatives during the workshop in Annex 3. Technical papers were presented by Dr Lloyd and Mr Fisher and participants presented their country reports. Summaries of the country reports are given in Annex 4.

Mr Fisher chaired the workshop sessions.

A field trip to Wailoku Treatment Plant in Kinoya, Suva was made to give participants practical experience of a sanitary survey.

1.4 Opening ceremony

The opening ceremony was attended by the Honourable Minister for Health, Fiji, Mr S. Naivalu and Dr S.T. Han, WHO Regional Director for the Western Pacific Region. Mr S. Naivalu gave a welcome speech to the participants and spoke of the importance of drinking water quality to the health of communities and expressed thanks to the joint sponsors of the workshop, namely, ODA, the Special Programme of Technology Transfer Fund of Japan and WHO. Dr Han in formally opening the workshop, stressed the value of adequate safe water and sanitation in the prevention of diarrhoeal diseases and called upon participants to develop realistic plans for the monitoring and surveillance of drinking water supplies for implementation on their return to their respective countries. He also thanked ODA and the Government of Japan for sponsoring the workshop and the Government of Fiji for hosting the workshop in Fiji.

The speeches of the Minister and the Regional Director are given in Annex 5.

2. PROCEEDINGS

2.1 Summary of country reports

The participants presented their country reports with emphasis on current practices in monitoring and surveillance activities chiefly with respect to institutional aspects, field and laboratory testing, sanitary surveys and legislation. The level of activities currently carried out varies widely in the Pacific island countries represented at the workshop. Most countries indicated severe problems in maintaining effective programmes because of constraints in sufficiency of trained staff, equipment and funding. Although legislation is often deficient or even totally absent, this was not seen as a major impediment to progress.

For further details of the country reports, summaries are presented in Annex 4 and the full reports are available at EHC. The participants from Cook Islands and Tokelau Islands did not provide written reports but made presentations on their countries' status.

2.2 Summary of discussions/activities

2.2.1 Summary of the first day

Following the opening ceremony, administrative briefing and introduction session, Mr Fisher presented a paper on general aspects of field testing of water supplies. He summarized the factors to be considered in designing a field testing programme and compared the various advantages and disadvantages of field testing in comparison with testing at a central laboratory. Bacteriological field testing in Pacific island countries in the past had been supported by various donor agencies but programmes had not been successful. Inadequate training in the use of the equipment and the lack of practical and effective testing programmes were cited as the main reasons both in the presentation and in subsequent discussions. It was emphasized that testing should be action-orientated i.e. action should be taken following an adverse test result.

The country reports by a participant from each of the 14 Pacific island countries were given as indicated in the programme (see Section 2.1).

2.2.2 Summary of the second day

The workshop commenced on the second day with three presentations by Mr Fisher. The first presentation covered recommended frequencies of sampling testing by surveillance agencies. As it is often not possible to carry out the desired programme because of financial, logistic or staffing constraints, various programme aspects related to priority setting were discussed. Sampling techniques and design of an urban drinking water quality monitoring programme were also discussed. A presentation on chemical and physical impurities in drinking water supply was then made in which the various possible containments were discussed. Because of increasing pressures on water sources caused by industrial wastes, deforestation of catchment areas, pesticides, insecticide, fertilizers, population increases and undesirable water treatment by-products, problems caused by impurities in drinking water are becoming much more evident in Pacific island countries.

The next presentation covered general aspects of cholera control with emphasis on prevention and treatment of this disease. Inclusion of cholera control in the workshop programme was prompted by the recent identification of a new serogroup of Vibrio cholerae designated as V. cholerae 0139. The key preventive interventions recommended are adequate sanitation, provision of safe water, food safety and health and hygiene education.

In the afternoon, Dr Lloyd dealt with the microbiological aspects of quality control under six headings. The first of these was faecal indicator theory in which the merits of thermotolerant faecal coliform bacteria were compared with the characteristics of the ideal indicator. It was suggested that thermotolerant faecal coliforms were globally the most useful single indicator in spite of several shortcomings. The second topic concerned the Enterobacteriaceae and it was pointed out that this family of bacteria included many types which were not useful indicators of faecal contamination and this had led to widespread misunderstanding about their value in water quality control.

To clarify the importance of coliform bacteria, the third topic dealt with the development and concentration of E.coli in the gut and the importance of E.coli as a human pathogen was emphasized. The site of infection of other important faecal oral pathogens was described. The fourth topic was concerned with the practical problem of speciation of members of the coliform group and it was emphasized that particularly in tropical rural areas, the total coliform group was not a useful water quality indicator. This led onto the fifth topic which demonstrated the difficulty of interpreting total coliform counts and the value and necessity of using thermotolerant counts at 44°C. This led logically to the final topic of the afternoon which was the formulation of selective isolation media and the importance of using International Standards Organization (ISO) methods. It was emphasized that other test procedures, such as the hydrogen sulfide detection method, developed and used in the region within the last five years, were seriously discredited as they gave rise to a high proportion of false positive results and should be abandoned.

The afternoon session concluded with a practical demonstration of media preparation and sterilization using the ISO approved formulation of Na-lauryl sulphate lactose broth. The publication on Drinking Water Quality in Rural Areas by Lloyd and Helmer (1991) was circulated in preparation for the work of the third day.

2.2.3 Summary of the third day

Mr Fisher introduced sanitary surveys using a series of slides which illustrated many of the important problems which must be addressed when carrying out a survey. In the second half of the morning, Dr Lloyd continued the theme and emphasized that a systematic approach to registering, scoring and reporting hazards was essential for the improvement of water supplies. He pointed out that surveys could be broken down into three types:

1. Source and resource surveys
2. Abstraction and treatment plants
3. Distribution systems

The frequency with which these should be undertaken in rural and urban areas was discussed and the new WHO guideline frequencies presented. This was followed by a presentation of a range of sanitary survey report forms beginning with the simplest type of rural supplies and moving towards more complex systems. It was pointed out that most developing country surveillance activities had failed because, as the country reports demonstrated, little inspection work was undertaken. It was noted that the procedures developed by Lloyd and Helmer provided a rapid and practical methodology by which sanitarians and inspectors could obtain reliable and systematic information on which to base remedial action strategies. These methods would be published in the WHO new guidelines in 1994. The morning session closed with a slide presentation in which participants were invited to identify sanitary hazards in pictures of sources, catchment areas, treatment plants and distribution systems.

The afternoon was spent visiting the Wailoku Treatment Plant which serves the major part of Suva. The opportunity was used to undertake a sanitary survey during the tour conducted by the Technician-in-Charge of the works. Following the guidelines set out in the morning, the participants were encouraged to follow a systematic procedure with acquiring general data about the plant capacity and staffing, followed by tracing and examining each stage of treatment, and ending with an examination of the monitoring records for operational control of the plant.

Although the plant was 20% overloaded it was agreed that the operation was generally of a high standard and the guide was warmly thanked and complimented on the status of the system.

A summary of the sanitary survey findings appears as Annex 6.

2.2.4 Summary of the fourth day

In the first session, the results of the previous day's treatment plant survey were summarized (Annex 6) and the hazard points noted. It was concluded that the highest priority action for the plant was to restore turbidity monitoring and hence control. This session was followed by the Cook Islands report.

The theme of sanitary surveys was continued in the third session and a case-study presented showing how a combined assessment of sanitary hazard scoring with faecal coliform grading could be used to prioritize remedial action in a large collection of tubewells. It was demonstrated that 94% of those facilities selected for rehabilitation were improved from grades C&D faecal coliform classes to grades A&B using surveillance data systematically.

It was emphasized that some hazards such as latrine proximity to tubewells were the cause of intense faecal pollution.

The final session of the morning was used to demonstrate the DelAgua kits. Faecal coliform analysis was carried out and the importance of aseptic technique and care of the kits was discussed.

The afternoon sessions commenced with a presentation on planning for surveillance implementation and this was used to introduce the working groups to the theme of action plans. The groups were encouraged to prepare their action plans under the following headings:

Action plans/Workplans preparation

1. Institutional responsibilities
Aspects to consider - Urban, rural, staff availability
2. Needs
 - equipment
 - staff
 - vehicle
 - training
 - legislation
 - values allowable
 - sampling frequency
 - parameters
 - what parameters to test
 - rural
 - urban
 - programme
 - other needs
3. Action
Identify one major action on return from workshop (that is a result of attending).

In the final session of the day, the groups returned to the plenary session and all participants presented a short statement of the actions they would implement on returning to their countries. The key points raised are summarized in the Conclusions.

2.2.5 Summary of the fifth day

In the first session, the bacteriological test results of the previous day were discussed. The sample of sea water tested had a faecal coliform count of 3 colonies per 50 ml and participants were able to observe the final result on the filter pad.

Following this discussion, the DelAgua test kits were distributed to the recipient countries as indicated in Annex 7. Participants were able to check all parts of the equipment and familiarize themselves with the testing methodologies.

In the second session, remedial action strategies were discussed and technical interventions presented, focusing on multistage filtration as an appropriate technology which has been developed with sponsorship from ODA in a series of research and development projects. The suitability of this technology in the Pacific island countries was discussed.

A case-study of the legislation regarding water quality monitoring in Papua New Guinea was then conducted. The existing regulations were passed into law in 1984 and several suggested improvements appeared necessary to render them more appropriate. It was felt by the participants that frequency of sampling for bacteriological analysis should not be included in the legislation as with small community supplies, sanitary surveys are more appropriate and circumstances vary considerably. Testing should be carried out as the occasion demands as advised in the WHO Guidelines Vol. 1. Several other items, e.g. lead, require revision of the standards to bring them into agreement with the WHO guideline values.

Dr Lloyd gave a presentation discussing various aspects of drinking water quality and health. It was emphasized that although water quality is important, it should not be considered in isolation, and quantity, service reliability, accessibility must also be included. It was not possible to state categorically which factor is the most important as circumstances vary but the results of several studies showed quantity supplied as the dominant factor (refer Annex 3, hand-out No. 4).

The final session covered an evaluation of the workshop and the workshop was closed after the Chairman had thanked the consultant, Dr Lloyd for his contribution and the country representatives for their active participation throughout the week.

2.3 Evaluation

Questionnaires on various aspects of the workshop were distributed to participants at the opening of the final day of the workshop and completed prior to the final session. Virtually all participants considered that the objectives of the workshop had been achieved and that the workshop had been worthwhile both to themselves personally and to their country programmes. All participants had learned new skills and concepts which could be applied to their work in their respective countries.

Participants felt that there were sufficient opportunities to exchange knowledge and experience with other participants. Several participants noted that more time should have been spent on group discussions and actual hands-on experience with the testing kits supplied in addition to the sessions allocated. Almost all participants however were well satisfied with the group and plenary sessions carried out.

The field trip was generally appreciated and it was noted that an additional visit to a rural scheme would have been welcomed by several participants. A longer workshop would have been able to include this.

The administrative arrangements were obviously under pressure from competing demands on the administrative staff and several participants were dissatisfied with ticketing and per diem payments.

Several participants felt that follow-up workshops and training activities should be held in their countries.

Participants generally gave high ratings to the working papers, their methods of presentation and the duration and scheduling of the different activities.

3. CONCLUSIONS

- (1) Bacteriological monitoring of water supplies in the Pacific island countries should be directed at the detection of faecal coliforms rather than total coliform testing since the latter is indicative of soil contamination which is particularly difficult to interpret in rural unchlorinated, tropical water supplies.
- (2) Ordering of testing materials is a possible avenue of useful support by donor agencies as ordering procedures are difficult for Pacific island countries and considerable cost savings could be made by bulk orders.
- (3) Staff should be designated specifically for monitoring and surveillance duties in Pacific island countries.
- (4) It is essential that offices of both the operation and surveillance agencies collaborate on the formulation of interdependent monitoring and surveillance programmes.
- (5) Legislation for drinking water quality for Pacific island countries should cover permissible levels of impurities that may be encountered. Frequency of sampling is not necessary to include in legislation as circumstances vary widely and frequencies cannot be usefully defined.
- (6) The new WHO Guidelines for Drinking Water Quality are a suitable basis for appropriate standards to be adopted in Pacific island countries.
- (7) Pacific island countries should prepare inventories of all the water supply schemes in the country before the implementation of surveillance programmes.
- (8) The bacteriological kit studied during the workshop is appropriate technology for use in Pacific island countries. It has advantages of ease of use and economy over equipment using membrane filters previously used.
- (9) Further training should be directed at national activities and will require further support from donor agencies in many cases. Another workshop for Pacific island countries should be held in two years' time approximately to evaluate progress.
- (10) The follow-up workshop should be planned to ensure that participants submit country progress reports with their application to participate. Their country reports should include a summary tabulated diagnostic of water supplies including the results of the application of the sanitary survey and system indicators presented at this workshop.

4. ACKNOWLEDGEMENTS

Thanks are expressed to the Japanese Special Programme of Technology Transfer Fund and the Overseas Development Administration of the United Kingdom for their generous financial support of the workshop.

The Government of Fiji is also thanked for their agreement to host the workshop and the Minister for Health, Mr S. Naivalu in particular for his contribution and presence at the opening ceremony.

LIST OF PARTICIPANTS, REPRESENTATIVES AND
SECRETARIAT MEMBERS

<u>Participants</u>	<u>Designation and address</u>
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WHO Consultant

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WORKSHOP PROGRAMME

Monday, 6 December 1993

- | | |
|-------------|------------------------------------------------------------------------------------|
| 0800 - 0830 | Participants assemble for registration in Banyan Room, Travelodge Hotel |
| 0900 - 0920 | Introductory remarks
Mr B. Fisher, Sanitary Engineer, WHO (EHC) |
| | Welcome address
Honourable Mr S. Naivalu, Minister for Health |
| | Opening Speech
Dr S.T. Han, WHO Regional Director for the Western Pacific |
| 0920 - 1015 | Photograph and morning tea |
| 1015 - 1025 | Introduction of consultants and participants
B. Fisher |
| 1025 - 1045 | Administrative briefing
B. Fisher |
| 1045 - 1100 | Introduction to workshop objectives, etc.
B. Fisher/Dr B. Lloyd, WHO Consultant |
| 1100 - 1130 | Aspects of field testing of water supplies
B. Fisher |
| 1130 - 1200 | Country reports
Participants |
| 1200 - 1330 | Lunch |
| 1330 - 1700 | Country reports
Participants |

Tuesday, 7 December 1993

- | | |
|-------------|----------------------------------------------------|
| 0900 - 0930 | Sampling frequency and procedures
B. Fisher |
| 0930 - 1000 | Chemical impurities in drinking water
B. Fisher |
| 1000 - 1030 | Cholera control
B. Fisher |

Annex 2

1030 - 1045	Morning tea
1045 - 1200	Country reports Participants
1200 - 1330	Lunch
1330 - 1420	Microbiological aspects of drinking water quality monitoring B. Lloyd
1420 - 1700	Microbiological water sampling and testing - practical

Wednesday, 8 December 1993

0900 - 0945	Country reports Participants
0945 - 1030	Sanitary surveys B. Fisher/B. Lloyd
1030 - 1045	Morning tea
1045 - 1200	Sanitary surveys (continued) B. Lloyd
1200 - 1300	Lunch
1300 - 1700	Field trip to Wailoku Water Treatment Plant, Suva

Thursday, 9 December 1993

0830 - 0900	Summary of field trip B. Lloyd
0900 - 0930	Cook Islands country report Participant
0930 - 0945	Morning tea
0945 - 1045	Sanitary survey (continued) B. Lloyd
1045 - 1200	Bacteriological testing - practical
1200 - 1300	Lunch
1300 - 1430	Planning of surveillance B. Lloyd

1430 - 1600	Working groups
1600 - 1625	Prescription for Health - Video Presentation
1625 - 1700	Action plan presentations

Friday, 10 December 1993

0900 - 0945	Bacteria tests
0945 - 1030	Distribution of test kits, familiarization and checking - practical.
1030 - 1045	Morning tea
1045 - 1115	Remedial action and engineering interventions B. Lloyd
1115 - 1200	Legislation case-study B. Fisher
1200 - 1300	Lunch
1300 - 1400	Water related diseases and health B. Lloyd
1400 - 1500	Final discussions and evaluation summary
1500	Conclusions and Closing

LIST OF DOCUMENTS DISTRIBUTED DURING THE WORKSHOP

Working papers

- | | |
|--------------------|---------------------------------------------------------------|
| WPR/RUD/EHC/2/93.2 | Aspects of field testing of water supplies
By Mr B. Fisher |
| WPR/RUD/EHC/2/93.3 | Sampling frequency and procedures
By Mr B. Fisher |
| WPR/RUD/EHC/2/93.4 | Chemical impurities in drinking water
By Mr B. Fisher |
| WPR/RUD/EHC/2/93.5 | Cholera control
By Mr B. Fisher |

Country reports

- | | |
|-------------------------|----------------------------------------------------------------------------|
| WP/RUD/EHC/2/93/INF./1 | Cook Islands
(No written submission) |
| WP/RUD/EHC/2/93/INF./2 | Federated States of Micronesia
By Messrs Andrew Munro and Robert Hadley |
| WP/RUD/EHC/2/93/INF./3 | Fiji
By Messrs Waisele Delai and Bhram Deo |
| WP/RUD/EHC/2/93/INF./4 | Kiribati
By Messrs Neeri Tiaeke and Taboia Metutera |
| WP/RUD/EHC/2/93/INF./5 | Marshall Islands
By Mr Abraham Hicking and Ms Diane Myazoe |
| WP/RUD/EHC/2/93/INF./6 | Niue
By Mr Holo Tafea |
| WP/RUD/EHC/2/93/INF./7 | Palau
By Mr Jerome Sakurai |
| WP/RUD/EHC/2/93/INF./8 | Papua New Guinea
By Messrs Lindsay Piliwas and Benjamin Jacob |
| WP/RUD/EHC/2/93/INF./9 | Solomon Islands
By Messrs John Korinihona and Moses Harisimae |
| WP/RUD/EHC/2/93/INF./10 | Tokelau
(No written submission) |
| WP/RUD/EHC/2/93/INF./11 | Tonga
By Messrs Filipe Koloi and Lelea Tuitupou |

Annex 3

WP/RUD/EHC/2/93/INF./12	Tuvalu By Mr Mataio Tekinene and Ms Peggy Uatimani
WP/RUD/EHC/2/93/INF./13	Vanuatu By Messrs McKenzie Kalotiti, Johnson Vuti and Michael Varisipiti
WP/RUD/EHC/2/93/INF./14	Western Samoa By Billy Bryce and Kuateman Tofilau

Publications and hand-outs

1. Drinking Water Quality in Rural Areas, B. Lloyd & R. Helmer.
2. DelAgua Water Test Kit and Manual (10 sets).
3. Water Monitoring Laboratory Operating Budget Projections - paper by Marshall Islands participant.
4. Fact Sheet - Quantifying the Health Effects of Water and Sanitation Projects - Water and Sanitation for Health Project - USAID.
5. Monitoring and Surveillance of Rural Water Supplies - Appropriate Technology, B. Fisher.
6. Water Supply Evaluation Report of Spring Water, B. Lloyd.
7. Water Supply Evaluation Report of Surface Water, B. Lloyd.
8. Water Surveillance and Improvement Programme, B. Lloyd.

SUMMARIES OF COUNTRY REPORTS

Current surveillance programmes

1. Cook Islands (oral presentation)

1.1 Responsibility

The monitoring of water supplies is the responsibility of the Ministry of Health.

1.2 Field testing

No field testing is carried out.

1.3 Laboratory testing

Sampling of the intake for the Rarotongan urban water supply is carried out monthly and tested at the laboratory at the main hospital.

1.4 Sanitary surveys

These are undertaken as the need arises.

1.5 Legislation

No legislation exists for water quality and the WHO guideline values are used for reference purposes.

2. Federated States of Micronesia

2.1 Responsibility

The State Environmental Protection Agency (EPA) is the authorized agency which is responsible for monitoring and surveillance of drinking water quality. When a violation of the regulatory standards has been detected during the monitoring process, the State EPA notifies the supplier or community to ensure appropriate remedial action. The main supplier is the State Public Works Department.

2.2 Field testing

The Regulations stipulate testing by standard United States Water Works Association test methods. However there are now many specific testing kits commercially available for field use. They have the advantage of ease of operation and hence cost, and their use is encouraged. Periodic checking by the EPAs helps ensure the accuracy of these procedures.

In addition, the frequency of testing required has been varied slightly from the WHO guidelines. Specifically the frequency has been relaxed for items which have no history of non-compliance within the Federated States of Micronesia.

Annex 4

2.3 Laboratory testing

At present, laboratory testing is carried out at the State level. Each State carries out this task to the requirements of the 1983 Regulations. Of necessity, work has been done within the capabilities of each State laboratory and staff. The EPA or its equivalent is the authorized agency which performs water quality monitoring.

Testing for coliform counts, turbidity and residual chlorine levels only are carried out on a regular basis. Testing is carried out in accordance with the American Water Works Association test methods.

2.4 Sanitary surveys

These are carried out by the Department of Health Services staff.

2.5 Legislation

Environmental protection legislation and drinking water quality regulations were inherited from the United States Trust Territory.

3. Fiji

3.1 Responsibility

Current programmes are shared between the water supply agency (Ministry of Works) and the surveillance agency (Ministry of Health).

3.2 Field testing

Sampling taken and tested in laboratories.

3.3 Laboratory testing

The Ministry of Health uses testing laboratories at the Ministry of Health Pathology Laboratory (bacteriological testing), the Ministry of Primary Industries Chemistry Laboratory (chemical testing) and the Laboratory of the University of the South Pacific on a private basis.

The Ministry of Works has a National Water Quality Laboratory which receives samples from selected sampling points throughout the country.

3.4 Sanitary surveys

These are carried out by the Ministry of Works with additional input on health aspects by health inspectors.

3.5 Legislation

No legislation exists on water quality standards monitoring and surveillance.

4. Kiribati

4.1 Responsibility

The responsibility for the monitoring of water quality is, at present, vested in the Ministry of Health, Family Planning and Social Welfare. However due to the shortage of laboratory technicians at the Tungaru Central Hospital, the Public Utilities Board is providing one of their staff to carry out sampling and testing using the hospital laboratory. This is a temporary solution.

4.2 Field testing

The Public Works Department Water Engineering Section, uses a Rapid Defined Substrate Method in the field to determine the suitability of water sources in the outer islands (rural areas). The method is commercially known as the Colilert. The method has been formerly approved by the United States Environmental Protection Agency (USEPA) and field tested in the United Kingdom. The result of the test has shown no statistically significant difference between results obtained by the method and the conventional membrane filtration procedure for total coliform and E. coli.

The Ministry of Health, Family Planning and Social Welfare uses Millipore and Hach kits for field testing.

Field testing in the outer islands is done at irregular intervals.

4.3 Laboratory testing

The Tungaru Central Hospital maintains a fully equipped laboratory. There is an urgent need for additional laboratory technicians to be recruited and trained.

4.4 Sanitary surveys

Sanitary surveys are not done on a routine basis. They are carried out when there is need for it. In rural areas, surveys are done by several agencies: the Water Engineering Section of the Public Works Department, and the Environmental Health Section of the Ministry of Health. For urban situations, the Public Utilities Board also undertakes sanitary surveys.

4.5 Legislation

There are no national standards for drinking water quality in Kiribati. The WHO guideline values are used as a reference.

Annex 4

5. Marshall Islands

5.1 Responsibility

The Republic of the Marshall Islands Environmental Protection Agency (RMIEPA) operates two testing laboratories, one on Majuro, the other on Ebeye. The costs of the monitoring programme are met by the water supplier, Majuro Water and Sewage Company (approximately US\$20 000 per year).

5.2 Field testing

No field testing is carried out.

5.3 Laboratory testing

The RMIEPA operates two water testing laboratories, one in Majuro and the other in Ebeye. These laboratories monitor drinking water in Majuro and Ebeye on a daily basis and any other supplies from private systems or on outer atolls on request. All major microbiological and chemical tests can be carried out.

5.4 Sanitary surveys

The RMIEPA water quality monitoring programme combined with the sanitation programme, inspect water supplies on a monthly basis. Particular attention is paid to schools, restaurants, treatment plants and public areas such as waste disposal facilities.

5.5 Legislation

Title 63 Chapter 13 Subchapter 11 Section 5.2 of the Trust Territory Environmental Protection Board regulations sets out the water quality standards required to be met by water suppliers.

6. Niue

6.1 Responsibility

The Health and Public Works Departments are responsible for drinking water quality monitoring and surveillance.

6.2 Field testing

Field testing is not required in Niue because of its small size.

6.3 Laboratory testing

There is a laboratory equipped for bacteriological water testing within the Department of Health. Samples are provided from the various sources at three monthly intervals.

6.4 Sanitary surveys

Sanitary surveys are carried out at six monthly intervals or on an emergency basis.

6.5 Legislation

There are no water quality standards in the current legislation of Niue but the WHO guideline values are used.

7. Palau

7.1 Responsibility

The Palau Environmental Quality Protection Board (EQPB) is the environmental regulatory agency for Palau. The EQPB has a staff of 13 persons, a limited budget and limited resources. EQPB has an executive officer, an assistant officer, an environmental engineer, two environmental technicians, a laboratory supervisor, three laboratory technicians, a staff attorney, an education specialist, a mechanical/boat driver and two clerical workers.

7.2 Field testing

Testing of the water supplies is carried out entirely in the EQPB laboratory.

7.3 Laboratory testing

EQPB has a laboratory certified by USEPA for water microbiological (coliform) testing functions.

This laboratory is USEPA certified for coliform and faecal coliform analysis. The membrane filter and most probable number/multiple tube fermentation methods are used. The analyses are performed in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater".

7.4 Sanitary surveys

Sanitary surveys are performed on a periodic basis by the Palau EQPB. The regulations require each system to have a sanitary survey at least once every five years, but EQPB generally visits all the systems on at least an annual basis. Surveys consist of an inspection of the water system including the source, transmission lines, treatment plants, storage tanks, and distribution lines. The operation and maintenance of the system is also looked at, and the population served by the system is updated. Recommendations are made on how to better operate and maintain the water system.

Annex 4

7.5 Legislation

The EQPB has the authority to promulgate and enforce regulations to protect public health and the environment, including the promulgation of drinking water quality regulations as well as other environmental protection programmes. A Public Water Supply is defined as a system of piped water for human consumption which serves 15 or more service connections or 25 or more persons at least 60 days a year. EQPB has established drinking water regulations which include maximum contaminant levels and monitoring requirements for a variety of drinking water contaminants.

Under the regulations, each public water supply is responsible to assure that all required water sampling and testing takes place. In practice, the EQPB is performing all the monitoring for all the public water supplies.

8. Papua New Guinea

8.1 Responsibility

Water Board came into existence in September 1982 and was charged with the duty of coordinated planning, design, construction, management of, and charging for water and sewerage facilities throughout the country.

For rural areas and peri-urban settlements not served by municipal systems, installations, operations and quality control are responsibilities delegated to Health Departments under the National Water Supply and Sewerage Act 1986. Water that is supplied shall be adequate in quantity and of a quality for consumption.

Water quality monitoring and surveillance of both urban and rural water supplies is the responsibility of Health Inspectors, Water Resources Inspectors and those officers gazetted and authorized under certain legislation.

8.2 Field testing

The hydrogen sulfide test has been used in the past as a field test of bacteriological water quality.

8.3 Laboratory testing

Water quality testing is done at the Central Public Health Laboratory for bacteriological tests. Chemical testing is done at University of Papua New Guinea and University of Technology. The National Department of Health is now upgrading facilities to cater for chemical analysis at the Central Public Health Laboratory.

8.4 Sanitary surveys

Sanitary surveys are included in the initial assessment of the viability of installing a water supply. These include the location and use of sanitary facilities, likely pollution to water sources, such as traditional burial grounds, sites for disposal of refuse will have to be gazetted.

The frequency of the monitoring and evaluations of the installed systems are or will be determined by the policies of each provincial water and sanitation committees.

8.5 Legislation

Legislation for this sector comprises:

(i) Water Resources Act 1982

This Act is administered by the Water Resources Board. The Act provides for the protection of a natural resource and make provisions for the management of National Water Resources and responsibilities to manage it. These responsibilities include examination of problems and making plans in respect of:

- the allocation and quality of water;
- control of erosions on the banks of rivers and shores, etc.;
- the conservation of water;
- needs of fisheries and wildlife and recreational use of water, etc.

(ii) Environmental Contaminant Act 1978

This piece of legislation is administered by the Department of Environment and Conservation. Among other provisions, the Act relates to the prevention, abatement and control of environmental contamination.

(iii) Public Health Drinking Water Regulation 1984

Regulations under the Public Health Act provide for:

- water quality standards;
- standard for raw water standards for drinking water;
- sampling and analysis of raw water.

This piece of legislation is administered by the Health Department. Health inspectors are empowered under the Public Health Act to enforce the legislation. The same officers are also gazetted to enforce legislation of the Environmental Contaminant Act and Water Resources Act.

9. Solomon Islands

9.1 Responsibility

The Environmental Health Division of the Ministry of Health and Medical Services should be involved in monitoring and surveillance of drinking water quality. This Division is basically responsible for all public health matters in the country. The Hydrology Division of the Ministry of Natural Resources is doing a monitoring exercise on the groundwater in the Guadalcanal Plains for evidences of any salt water intrusion.

Annex 4

The Honiara water supply system is the only system in the country that has a set monitoring and surveillance programme implemented on it and this is being executed by the Environmental Health Section of the Honiara Town Council in collaboration with the Water Unit of the Ministry of Transport, Works & Utilities which is solely responsible for the provision of water services in the urban areas in the country. There is no monitoring and surveillance being done on the rural water supplies and those water supply systems in the provincial centres.

9.2 Field testing

No field testing is carried out as no field equipment is available.

9.3 Laboratory testing

Water samples that require bacteriological analysis are referred to the Medical Pathology Laboratory at the Central Hospital in Honiara while those for chemical analysis are sent to the Chemical Laboratory of the Hydrology Division within the Ministry of Natural Resources where they do some basic chemical tests.

9.4 Sanitary surveys

Sanitary surveys are carried out only when there is evidence of recent contamination of a water supply.

9.5 Legislation

There is no legislation in Solomon Islands pertaining to drinking water quality.

10. Tokelau (oral presentation)

This very small country of only 1 000 population carries out no monitoring of water supplies which are virtually all from rainwater catchments. Instances of reported diarrhoeal diseases are very uncommon.

11. Tonga

11.1 Responsibility

The Ministry of Health and the Tonga Water Board work together on monitoring and surveillance of drinking water quality in Tonga.

11.2 Field testing

There is no field testing carried out in Tonga.

11.3 Laboratory testing

The Central Laboratory of Vaiola Hospital carries out bacteriological samples provided by the Ministry of Health in collaboration with the Tonga Water Board. As the main function of this laboratory is to assist the medical activities of the hospital, frequency of sampling is controlled by the capability of the laboratory.

Health inspectors of the Public Health Section supervise taking of water samples and in the case of outlying islands, the Tonga Water Board organizes same day transportation to reach the Central Laboratory and direct flights are available for this task.

Currently the Tonga Water Board require results of bacteriological tests to be included in its monthly meetings.

11.4 Sanitary surveys

These are carried out as the situation demands, e.g. disease outbreaks, consumer complaints, adverse bacteriological results.

11.5 Legislation

The WHO Drinking Water Quality Guidelines are used.

12. Tuvalu

12.1 Responsibility

The Public Health Unit is responsible for water quality monitoring and surveillance activities.

12.2 Water testing

No water testing is carried out as an ongoing activity.

12.3 Sanitary surveys

Sanitary surveys are carried out by the Public Health Unit when the need arises on a individual request.

12.4 Legislation

There is no legislation relating to drinking water quality in Tuvalu.

Annex 4

13. Vanuatu

13.1 Responsibility

The Department of Health under the Ministry of Health and Rural Water Supply is the National Coordinating Agency of all water supply development in the country. The Government decentralization policy has enabled the water supply services to be managed by local authorities, districts and the community level.

However, other nongovernmental organizations (NGOs) also carry out minor water supply programmes/projects such as water tank construction. There is a great need for a much better coordination on all water supply developments by the Department of Preventive and Rural Water Supply Services and the NGOs concerned to ensure a well managed programme in the future. Drinking water quality monitoring and surveillance programmes are insignificant. Thus, all drinking water quality in Vanuatu are still questionable as regards safety.

13.2 Field testing

No field testing is currently being carried out for bacteriological quality. Chlorine residual tests were taken in the Port Vila Municipality with some bacteriological tests being taken when the chlorine residual test shows inadequate residual levels. These tests were taken at various distribution mains and streets connections. This Urban Water Supply is operated by the Ministry of Public Works.

13.3 Laboratory testing

The Municipality Environmental Health Officers collect water samples periodically and send them to the Public Health Laboratory in Vila for bacteriological testing. Often the results are not made known because of poor cooperation of the laboratory.

In the districts, the District Environmental Health Officers do not carry out water sampling for bacteriological tests except when suspecting a contaminated system. Water sampling is then sent to Vila for testing. Due to the geographical and communication problem, such samples often arrive in Vila very late.

13.4 Sanitary surveys

Due to both financial and geographical difficulties, the District Environmental Health Officers in the five Administrative Centres only carry out sanitary surveys on the existing water supply systems together with other programmes.

13.5 Legislation

Vanuatu does not have national drinking water quality standards but uses the WHO Water Quality Guidelines.

14. Western Samoa

14.1 Responsibility

The Health Department is responsible for setting the water quality standards and the Western Samoa Water Authority is responsible for maintaining these standards.

14.2 Field testing

No field testing of water supplies is being carried out at the present time.

14.3 Laboratory testing

Testing of samples taken is carried out at the laboratory at the Apia Hospital.

14.4 Sanitary surveys

These surveys are carried out on an irregular basis with increased activity during disease outbreaks and when discharge of insecticides, fungicides, weedkillers or industrial wastes threaten the quality of drinking water.

14.5 Legislation

The Water Act of 1965 governs the activities of drinking water quality monitoring and surveillance programmes. National drinking water quality standards are prescribed in this Act as those given in the current WHO guidelines. This Act also makes it an offence to throw or pour any pollutant into any water or watershed being a part of or taken or used for supply in water to any waterworks. Other provision in the Water Act provides for regular inspection of factories to determine whether any pollutants flow from within these factories into any source of drinking water.

SPEECHES AT OPENING CEREMONY

Welcome address by the Honourable Mr S. Naivalu, Minister for Health, Fiji

The Chief Guest, the Regional Director of WHO Western Pacific Region, Dr Han;
Distinguished Guests;
Ladies and Gentlemen; and Participants:

I am honoured in having been invited to be here with you for the official opening of this regional workshop on "Drinking Water Quality Monitoring and Surveillance" for Pacific island countries. Such a meeting or workshop is commendable indeed particularly when it is possible to bring together expertise from different countries of the region for a good common cause. I am sure that the week's deliberations will be of immense benefits to governments of the region, the private sector and citizens alike.

On behalf of the Ministry of Health and the Fiji Government, I take this opportunity to first of all welcome our Chief Guest Dr Han, our WHO Regional Director and to extend to him and his office the Government of Fiji's sincere appreciation and deep gratitude for their commitment to their very own slogan of "Health for All" by the year 2000. In fact Dr Han has been a very busy guest of the Fiji Government for the last few days and will continue to be so until he departs from these shores.

To our regional participants I also most warmly welcome you all on behalf of the Ministry of Health and the Fiji Government. To some of you this may be your first trip to Fiji and to others, this may be your second or third. But I hope that you will make the most to enjoy yourselves during your short stay and that it will be both rewarding and pleasant.

Fiji, and I believe like your very own country in this Western Pacific Region, has been working hard continually within available resources to provide ultimately to all its citizens a safe source of water supply for all domestic users. This will be a continuing effort and I must again thank the WHO for its untiring assistance and guidance throughout the years. I hope and trust that this trend will continue in our Western Pacific Region in the years to come and even beyond the years 2000.

Water Quality Monitoring and Surveillance which will be deliberated upon within the next five days is an essential components of total Safe Water Management. The need to carry this out most effectively and efficiently is more critical now with industrial pollutions and the use of chemicals as soil conditioners and weedicides. In other areas where there is a stepped-up effort by governments to increase agriculture productions, e.g. cattle farming, piggeries, abattoirs etc. there should be an equal effort in promoting environmental health so that the risk to polluting any source of drinking water supply source is minimized or prevented.

I believe that the workshop also intends to familiarize the participants with the new drinking water quality guidelines and the different technologies of implementing surveillance programmes. Last but not the least it will provide a forum of information exchange and experiences of existing programmes in individual countries. So as the dust settles after the week's deliberation, I'm sure that everyone of you will have been enriched with gained knowledge and new experiences which you will take back to your respective countries.

Annex 5

May I wish you all a very successful week of deliberations and an enjoyable stay on our beautiful shores and before I conclude may I on behalf of the Fiji Government thank and congratulate the joint sponsors of the workshop, the Government of Japan, the Overseas Development Administration of the United Kingdom and the WHO.

Thank you.

Opening speech by Dr S.T. Han, WHO Regional Director for the Western Pacific

Honourable Minister for Health, Mr Solomon Naivalu;
Honoured Guests;
Participants;
Ladies and Gentlemen:

I am pleased to welcome you to this five-day Workshop on Drinking Water Quality Monitoring and Surveillance for Pacific Island Countries.

It is estimated that 875 million cases of diarrhoeal diseases occur worldwide every year. Nearly five million of these episodes end in death, with most of the fatalities being children. These numbers are already very high. The real costs, however, are seen in the experience of human misery, lost opportunities and lower productivity which accentuate the ill effects of poor water and sanitation. These are the main causes of waterborne disease transmission.

Marked reductions in waterborne diseases can be achieved by providing safe drinking water and adequate sanitation. Many chronic heart and kidney problems are associated with long-term consumption of water of poor chemical quality. Adequate water supply and sanitation are thus considered to be very important components of primary health care and are basic necessities for the achievement of "Health for All by the Year 2000".

Efforts of countries to improve the quality of drinking water have increased in recent years. However, the incidence of waterborne diseases remains high in many areas of the countries represented here today. Initially, a water supply may provide safe water. However, there are many factors that can render the water supplied unsafe for drinking. It is thus important to monitor the water quality at all parts of the system on a regular basis, if possible. It is highly desirable that a realistic monitoring and surveillance programme is developed which is commensurate with the capabilities and available funds of the country. A solution has to be adopted whereby monitoring is carried out by two methods: (1) Regular sampling and testing of water supplies should be undertaken to determine the physical, chemical and bacteriological quality of the supply, together with (2) sanitary surveys involving a site inspection and evaluation of the equipment, facilities and practices associated with the system. These two components complement each other and will be the focus of discussions in this workshop.

Recently the WHO Guidelines for Drinking Water Quality have been revised. They provide guideline values so that countries can define standards suitable for their own prevailing environmental, social, economic and cultural conditions. The guidelines give details of alternative control procedures and monitoring and surveillance principles. During the workshop, it is intended to review the changes that have been made in relation to Pacific island country monitoring programmes. Additionally, overall country needs in terms of human resources and equipment will be assessed. We hope that on your return to your respective countries, you will be able to propose and implement improved procedures for the monitoring of drinking water supplies that will lead to safer water and decreased incidence of waterborne diseases. During the workshop, opportunities will be provided to present and discuss problems and solutions associated with your current programmes and thus gain from each other's experiences.

Before I conclude, I would like to acknowledge the support of the Government of Japan and the Overseas Development Administration of the United Kingdom, or ODA, in holding this workshop. The Government of Japan has provided funds as part of its special programme on technology transfer.

I wish you all a fruitful and pleasant week attending this workshop.

I now declare this workshop open.

Thank you.

RESULTS OF SANITARY SURVEY

SANITARY SURVEY TYPE 2:
TREATMENT PLANT WAILOKU, SUVA, FIJI
Date of visit: 8th December 1993

		HAZARD	
		YES	NO
1	GENERAL DATA:		
	TYPE OF PLANT: COAGULATION - FILTRATION		
	PLANT CAPACITY		
	DAILY PRODUCTION	*	
	OPERATION		
	STAFFING		*
	STAFFING LEVEL 14:		*
	NIGHT SHIFT:		*
	TRAINING:		*
			*
			*
2	QUALITY CONTROL RECORDS		
	UP TO DATE:		*
	CHLORINE RESIDUAL:		*
	JARTEST FOR ALUM:		*
	TURBIDITY MONITORING:	*	
	ALUM. RESIDUAL:	*	
3	ABSTRACTION:		
	INTAKE MONITORS		
	INTAKE SCREEN		
	INTAKE FLOATING BOOMS		
4	PRETREATMENT CHEMICAL DOSING		
	1) CUSO4 for algal control: necessary?	*	
	2) SODA for pH control		*
	3) ALUM. flash mixing		*
	COAGULATION / SEDIMENTATION		
	2 CENTRE FLOCCULATORS:		
	BOTH OPERATIONAL		*
	RETENTION TIME (1/2 HOUR)	*	

Annex 6

		HAZARD	
		YES	NO
5	RAPID SAND FILTERS NO.8 ALL OPERATIONAL MANUAL BACKWASH CONTROL UNIFORM AIR SCOUR/BACKWASH MUD BALLS CRACKING OF SANDBED FILTER OUTLET PROTECTED (Glass window)		*
6	FINAL CHEMICAL TREATMENT pH CORRECTION TO: 8.1 - 8.2 CHLORINATION DOSE 1 mg/L FREE RESIDUAL 0.8 mg/L Manual CHLORINE RESIDUAL RECORDER Manual only.	?	*
7	STOCKS OF REAGENTS ALUM: 6 months: Good SODA: 6 months: Good CUSO4: Necessary?		*
8	OVERALL SAFETY PERIMETER FENCING: Good GENERAL CLEANLINESS: OK AUTOMATIC SHUT DOWN FOR CHLORINE GAS: Negative pressure IN-HOUSE TRAINING: Yearly: Good STAND-BY GENERATORS: Yes		*
9	SUMMARY OF PROBLEMS: TOTAL 1) OVERLOAD OF PLANT 2) TURBIDITY MONITORING UNRELIABLE 3) ALUM. RESIDUAL NOT DONE 4) CUSO4 NOT NECESSARY 5) OVERLOAD OF SEDIMENTERS 6) CHLORINE RESIDUAL RECORDING (Manual)	6	*
10	RECOMMENDATIONS HIGH PRIORITY: REPLACE TURBIDITY METER AND CHECK FINAL TURBIDITY RECORDS ARE _____ MEDIUM PRIORITY: WHEN CHLORINE RECORDS INSTALLED CHECK OPERATIONAL AT NEXT VISIT: INSTITUTE ALUM RESIDUAL MONITORING.		

DISTRIBUTION OF DELAGUA TEST KITS

The following countries received the DelAgua Bacteriological Test Kits for drinking water:

	<u>Country</u>	<u>Number of kits</u>
1)	Cook Islands	1
2)	Federated States of Micronesia	1
3)	Fiji	2
4)	Niue	1
5)	Papua New Guinea	1
6)	Solomon Islands	1
7)	Tokelau	1
8)	Tonga	1
9)	Western Samoa	<u>1</u>
	Total:	10
		=