

**SOPAC**

**PACIFIC ISLANDS APPLIED GEOSCIENCE  
COMMISSION**

**AND**

**WORLD HEALTH ORGANIZATION  
(WHO)**

**REPORT**

**PACIFIC WATER SAFETY PLANS PROGRAMME**

**FOLLOW UP MISSION 2**

**WATER SAFETY PLANS**

**TONGA**

**24 - 28 September 2007**

**An AusAID Funded Project**

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## PACIFIC ISLANDS APPLIED GEOSCIENCE COMMISSION

To : Manager Community Lifelines, Director SOPAC, Deputy Director  
SOPAC,  
SOPAC, Water Sector.  
From : Davendra Nath  
Date : 01/10/07  
Subject : Tonga-Water Safety Plans –Follow Up Mission 2

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### **Tonga Water Safety Plans –Follow Up Mission 2**

**Mission Dates: 24 -28 September 2007**

#### **Introduction**

The mission to Tonga was jointly fielded by the Director, Pacific Islands Applied Geosciences Commission (SOPAC) and the WHO Representative, South Pacific following the request from the Tonga Water Board (TWB) through the SOPAC focal point for Tonga, the Ministry of Lands and Natural Resources, Ministry of Health and Tonga Trust. The Follow up mission 2 was arranged to introduce the Hydrogen Sulphide paper Strip Test (H<sub>2</sub>S) in the urban and rural communities to monitor the drinking water quality with least cost and time.. The team comprised of the Project Officer Mr. Davendra Nath, of SOPAC and the technical experts from Institute of Applied Science /University of the South Pacific Ms Asihka Dayal.

The main drinking water source in urban areas in Tonga is ground water from borehole extraction and for rural areas rainwater and ground water. Due to the hardness of the ground water, Togans supplement their ground water supply with household rainwater catchment systems using Ferro- cement tanks which are liable to contamination. Bottled water is also extensively used for those who can afford. For Nuku'alofa supply, water is pumped to six reinforced concrete storage tanks located on the adjacent hill and allowed to run under gravity through the main distribution pipelines. Production of the well fields has steadily increased to 5.1 ML/day in 1991. The calculated average domestic consumption is around 90 l/person/day. It is stated that the consumption is artificially low due to the inadequate capacity of the distribution system.

The villages on Tonga tapu are equipped with one or more wells and water is pumped to an overhead storage tank which then flow under gravity through pipe system to individual houses. The rural system servers about 100 to 500 people and there is no chlorination of the water. The tower water tanks are difficult to clean and repair. Responsibility for water supply distribution, operation and maintenance in urban areas is of Tonga Water Board and of village committees in rural areas. Monitoring of drinking water quality is carried out by the Tonga Water Board in urban areas and by the Ministry of Health in rural areas. Urban water supply for the capital

Nuku'alofa comes from 35 boreholes in the Mataki- Eua and Tongan well fields to the south-west of the city where it is pumped from the bores and collected in large concrete tanks and gravity fed into house connections throughout the city. There is not much conventional treatment and only chlorination is done prior to consumption.

Data from Ministry of Health suggests that there has been an increase in water related diseases since 1996. Reported cases of diarrhoea and gastro-enteritis have increased from 2281 to 3667 (almost a 33% increase) over a four year period. In urban Nuku'alofa, the Tonga Water Board conducts monthly water quality analysis from fixed sampling points at wells, water tanks, and in the distribution system, and analyses samples from urban areas. All samples in the capital and the other urban centres are tested for salinity, total and faecal coliform, and residual chlorine.

### **Purpose/Objective**

- Conduct meeting with the steering committee, lead agency and other stake holders
- Review the completed Water Safety Plans .Monitoring Plans and Standard Operating Procedures for Nuku'alofa urban and the rural water supplies.
- Collect data on disease trend and water supply system.
- Assist in the training for the preparation of H2S test with the Ministry of Health lab and field staff, Tonga.
- Participate in the workshop organised by Tonga Trust for public awareness programme under water safety plan.
- To meet Tonga Trust and discuss on the contract for the preparation of IEC materials and public awareness programmes.
- To meet with the WHO country liaison officer-Tonga and Ministry of Health official and discuss on the rural WSP programme.

All the objectives as stated above were fully met with the maximum attendance of the participants in both the workshop. There was a good cooperation and networking from the stakeholders. The organisation who participated were Ministry of Health, Tonga Water Board, Tonga Trust, Department of Environment, Ministry of lands Survey and Natural Resources, Red Cross, Ministry of Education.

## List of People Met

<b>NAME</b>	<b>POSITION</b>	<b>ORGANISATION</b>	<b>CONTACT</b>
Dr.Litili Of anoa	Director of Health	Ministry of Health, Tonga	moh@kalianet.to
Teifoto Mausia	Principal Health Inspector	Ministry of Health	tmmausia@yahoo.com
Simi Silapelu	President	TANGO	tango_nukualofa@yahoo.com
Mary Fakahau	Snr Medical Scientist	Ministry of Health	maryfakahau@yahoo.com.nz
Sione Fakaosi	C.E.O	Tonga Trust	sfakaosiw@yahoo.com
6.Dr.Raynold Ofanoa	Medical Officer	Environmental Health Section, Ministry of Health	rofanoa@health.gov.to
Linisi Lavemai	Coordinating Officer	Tonga Water Board	llavemai@yahoo.com.au
Taniela Kailahi	Project Engineering Officer	Tonga Water Board	nelakailahi@yahoo.com.au
Alfred Vaka	Project Officer	Tonga Trust	a.vaka@tcdt.to
Mele Talahiva Fine	Snr Education Officer	Ministry of Education	hivfin@yahoo.com
Kelepi Mafi	Principal Geologist	Min of Lands/Survey and Natural Resources.	geology@kalianet.to
Dr Pratap Jayavanth	WHO Country Liaison Officer	World Health Organization	Jayavanthp@wpro.who.int
Saimone Helu	C.E.O	Tonga Water Board	twbhelu@kalianet.to

## **Executive Summary**

The one week Follow Up Mission 2 was from 24 – 28 September 2007 as per the annexed programme. (Annex 1). The mission was headed by Davendra Nath, Project Officer, Water Safety Plans Programme from SOPAC and one expert from Institute of Applied Science/University of the South Pacific (IAS/USP) Ms Asihka Dayal.

The official request was made by the Director of SOPAC via letter to the Tonga focal Point for SOPAC Dr. Sione Hala Tuituia, Secretary of Lands Survey & Natural Resources & Surveyor General. An official request was also sent to Mr. Saimone Helu, the chairman of the steering committee and Tonga Water Board. The team worked with Tonga Water Board (TWB), Ministry of Health (MOH) and Tonga Community Development Trust (TCDT).

The purpose of the mission was to assist and review the Water Safety Plans programme for the urban, rural and tank systems in Tonga tapu and to assess the three systems and formulate the improvement schedules with cost analysis. During the mission a number of government and non-government officials were met. A wrap up meeting was conducted with the steering committee for the Water Safety Plans programme and the future activities were discussed.

The mission was successful as all the officials were met and the objectives of the mission were achieved. The officials of Tonga trust were met and commitment was received to do the proposed tasks on the preparation of IEC materials and raising public awareness in relation to the WSP. The Tonga trust needs assistance in this regards as they produced some materials which needs improvement. Officials of the Ministry of Health were met and discussions were focussed on the field testing of drinking water using the H<sub>2</sub>S procedures involving lab and field officers and on the utilization of funds from WHO country allocation in relation to WSP programme. The environmental section of MoH Tonga agreed to put a procedure in place with the preparation, dissemination of bottles and recycling after cleaning.

## **Preparation for the Mission**

Preparation for the mission was made with the involvement of WHO and IAS/USP for the funding of an expert to train Ministry of Health Staff in Tonga for the H<sub>2</sub>S test procedures. Funds were also made available from WHO for the consumables for training. Arrangement was made with Dr Raynold from Ministry of Health Tonga, for one day H<sub>2</sub>S test training for Health staff. Ministry of Health Tonga was encouraged to net work with Tonga Trust which was organising the three day community awareness workshop. The participation of Health Inspectors was necessary to learn of the field testing and result recording and interpretation. A pre- mission meeting was held with WHO/SOPAC and IAS/USP to acquaint with the work plan for the week.

Under the WHO contract IAS/USP also took consumables such as lab chemicals and equipments for the training use. The clearance for this items were obtained by the Ministry of Health, Tonga and a letter was also produced, signed by Director of IAS/USP Prof Bill Aalbersberg

## Daily Activities

Daily activities occurred as planned with the assistance of the officials of Tonga Trust, Ministry of Health and Tonga Water Board. The programme for the week long mission is attached as per annex 2.

### 23 September, 2007 -Sunday

A special arrangement was made with Dr Reynold and Lab Technician Ms Telesia to Visit the Viola Hospital Lab to ascertain that necessary items and space was available for the H<sub>2</sub>S test training. Dr Raynold picked us at about 1400 hrs with Telesia and we manage to inspect the Ministry of Health Lab and organise for the training.

### 24 September, 2007 - Monday

On Monday the Hydrogen Sulphide Paper Strip Test (H<sub>2</sub>S) training commence after the opening ceremony By Dr Liliti Ofanoa who affirmed his support for the training which he regarded as crucial in public health improvement. There were ten participants for the training from Ministry of Health lab technician and the Environmental Health Officers. (Refer to the Annex 1) Both the old and new lab was use for this training and as their location was next to each other no obstacle was seen. Secondly both the labs were well equipped but the old lab is more spaces and it was suggested that it could be utilised as the water lab in order to eliminate cross contamination.



Participants for the one day workshop on H<sub>2</sub>S testing with Medical Director, Ministry of Health, Tonga



The trainer from Institute of Applied Science/University of the South Pacific Ms Ashika Dayal very efficiently trained the lab staff after some theory session on the benefits of the H<sub>2</sub>S testing. The media was prepared and each lab participant prepared the paper strip in the controlled environment in the Lab.



Asika Dayal, IAS/USP trainer with Ministry of Health Lab Staff preparing The H<sub>2</sub>S paper strip and the sampling bottles.



Asika Dayal (trainer) explaining the use of H<sub>2</sub>S sampling materials to Ministry of Health Staff.

The H<sub>2</sub>S bottles (glass and plastic) were prepared during the training and the Health



Inspectors present used the bottles in the evening session to collect some samples. (Refer to annex 3 for the trainers report)

The importance of setting appropriate procedures for issuing and collection of the used bottles was stressed and the Health Inspectors role was important in this area. Record keeping and data interpretation was necessary to inform the community to take corrective actions for their drinking water supply.

The consumables, lab apparatus and bottles were handed to Ministry of Health so that the quality control programme can commence in the rural area under the jurisdiction of MOH.

### **25 September, 2007 Tuesday**

On Tuesday attended the three day training of trainers workshop organised by Tonga Community Development Trust. The workshop commenced at 0900hs after the official opening by the CEO Tonga Water Board Mr Saimone Helu. There were about 25 participants from the organizations and the community members. (Refer to Annex: 2 for participant list). Also present in the opening ceremony were WHO Country Liaison Officer Dr. Pratap Jayavanth and President of the Tonga Trust. Ministry of Health staff Dr. Raynold and the Environmental Health officers were also present. (Refer to the Annex: 1 for the three day workshop program). The workshop was conducted in local language and where necessary clarifications to question were made by Davendra Nath Water Safety Plans Officer and Ashika Dayal from IAS/USP in reference to Water Safety plans and H2S testing procedures. The participants were interested to learn about the linkages and use of WSP and H2S for the improvement of rural drinking water quality. The resource persons for the first day were from Tonga Water Board who focused on the importance of the WSP and H2S and its use in the rural community.



The participants at the three day workshop organised by Tonga Trust for the Public Awareness programme for the Water safety Plans Programme.

## 26 September, Wednesday

The second day of the workshop focussed on the H<sub>2</sub>S testing and Water Safety Plans. Asika Dayal informed the participants on H<sub>2</sub>S procedures – sampling of water using the prepared bottles, inoculation, interpretation and recording of results. Ten pouches containing the prepared H<sub>2</sub>S test bottles were distributed to the participants with the survey forms. The participants were informed on the corrective actions and the protocol in liaising with the community

In the evening session a field trip was taken to assess the Tokomalolo and Red Cross Tank water supply system for the introduction of the water safety plans procedures. The participants were required to identify the risk in the system and to draw a map of the system. The community and the school used this system was also visited. The trip was organised by Tonga Water Board and a bus was hired to take the participant for the field trip.



Pictures showing an unprotected borehole and tree leaves on roof catchment



Pictures showing field trip to a Rural supply system and TWB resource person explaining the mapping of the water supply for compiling the Water Safety Plan.

## **27 September - Thursday**

The morning session focused on the Water Safety Plans where the participants worked in three groups and mapped the water supply. They also identified the risk and using the butcher paper they presented their findings. They were informed on the importance of assessing and ranking the risk for the catchment, storage and treatment and distribution. First all the information has to be collected and later using the WSP template the Water Safety Plans and improvement schedules to be compiled.

The participants also learned the importance of collecting data on drinking water by using the H<sub>2</sub>S test and using it for the corrective measures for the system. The participants were distributed the WSP template and H<sub>2</sub>S toolkit. The toolkit contained a pouch with ten prepared H<sub>2</sub>S test sampling bottles (glass and plastic), the sanitary survey forms and clip folders.

There was discussion on the procedures to obtain and return H<sub>2</sub>S bottles to the Ministry of Health and the assistance of Environmental Health officers in this process. It was necessary to follow the community protocols to bring about the improvements and avoid estranged relations.

In the afternoon session Kelepi Mafi from Lands Survey and Natural Resources presented his paper on the Water Resource bill and informed on the need for the elimination of pollutants from the natural water source.

The closing ceremony was chaired by Saimone Helu with the distribution of certificate of participation. Mr Saimone Helu thanked the participants and all the stakeholders and stressed the importance of networking and collaboration in order to achieve the objectives of the WSP programme.

## **28 September – Friday**

At 0900 hrs the team participated in a wrap up meeting with the steering committee chaired by Saimone Helu, CEO of Tonga Water Board. The meeting was informed that Ministry of Health to work more closely with Tonga Water Board and the steering committee in regards to the WSP programme. It was affirmed that Tonga Water Board and Tonga Trust collaborated well and organised a successful workshop. The president of TANGO Mr Simi Silapelu informed that there are other NGOs apart from Tonga Trust and he encourages that their services should be utilised as well. Mr Simi Silapelu agreed to provide further details to SOPAC on these NGOs. Davendra informed the meeting that all activities under the work plans has been completed it is necessary to complete the monitoring plans and the SOPs as well. Taniela and Timoty from TWB agreed to work on this and send a draft for review so that NZ-Drinking Water Assessors can be available for assistance before the end of the year. Mr Helu was given a hard copy of Follow up Mission 1 report for reference. He remarked that he would appreciate if some further training is given to an appointed Tonga Water Board staff to specialise on Water Safety Planning activities.

A meeting was held with Tonga Trust Director Mr Sione Fakaosi and Alfred Vaka on the Public Awareness and IEC material contract. Mr Sione outlined his proposed

programme. He did produce some IEC materials which were not of the standards. After some discussion he agreed that a lot of work has to be done and assistance is required from SOPAC for hard copies of the reference materials if available. Mr Sione was requested to work with the education officer for the awareness work in schools.

### Key Findings and Recommendations

Key Findings	Recommendation	Action
1. The steering committee agreed to work together for the water related programme	Steering committee requested for more cooperation from Ministry of Health.	Saimone Helu/ and Kelepi Mafi /Dr Raynold
2. To engage Ministry of Health field staff to use H2S method of testing in Rural areas.	To set a procedure for H2S testing, data recording and corrective measures.	Ministry of Health
3. Training of Lab Staff, one EHO and one water operator on WSP	WSP programme to allocate resources and training options	Tonga Water Board/Government/SOPAC
4. Training of the water committee for the rural areas as they operate the rural supplies.	Training of the water committees and managers is necessary.	Ministry of Health/steering committee/Tonga Trust
5. There is great need for the improvement of Borehole system in Rural areas	Secure pump sheds, head cover drainage, exclusion of animals.	Tonga Water Board/ Govt/Ministry of Health
6. The TWB is under financial constraint and improvement of the reticulation system is impracticable	Funds should be allocated to improve the reticulation system	TWB/Govt/steering committee/donor agencies
7. Chlorination of the rural tank supplies is necessary as more people consume rain water.	Chlorination procedure and chemicals to be made available for rural supply by Ministry of Health.	TWB/Govt/ Ministry of Health
8. Public awareness on the Water Safety Plans is necessary to change the attitude of the community	Development of IEC materials and workshop for the target community	Tonga Trust/ Ministry of Health
9. Improvements to the Rain Water cement tanks is necessary as many people use rain water for drinking in urban and rural areas	Tanks should be upgraded and risk of contamination removed. First flush device should be used with regular cleaning of the tanks.	Community/Ministry of Health/Tonga Trust/Red Cross
10. Water Safety Plans should be made for the three major system	The steering committee should complete the three different Water Safety Plans.	Steering committee. NZ experts Ministry of Health/TWB

ANNEX: 1

**Work plan for Tonga Follow - Up Mission 2**  
**24 – 28 September, 2007**

**Venue: Nuku'alofa, Tonga**

<b>Day/dates</b>	<b>Session</b>	<b>WSP Activities</b>	<b>Facilitators/Team</b>
Monday -24 Sept	8.30 am 9.00 am 10.00 am 11.30 pm 2.00 pm	Meeting with MoH -Tonga Staff and WHO Staff The H2S Training commences at Viola Hospital. Opening and introduction  Training Theory  Lab Work  Lab Work	MoH/WHO -Tonga  SOPAC  MoH/Trainer  Trainer/IAS/USP
Tuesday 25 Sept	9.00 am 2.00 pm	Tonga Trust Workshop commences (refer to Workshop programme)  Participation in the workshop	Tonga Trust WSP Steering Committee  SOPAC/ IAS-USP
Wednesday 26 Sept	9.00 am 2.00 pm	Workshop Participation (H2S test) (refer to workshop programme)  Field trips- WSP	Tonga Trust/ WSP-Steering committee  SOPAC/IAS-USP
Thursday 27 September	9.00 am 2.00 pm 3.30 pm	Workshop Participation (WSP)  Water Resource Bill Closing of workshop	SOPAC/TWB/Steering Committee
Friday 16 March	9.00 am 2.00 pm	Review of WSP Monitoring plan and SOPs with Tonga Water Board. Wrap up meeting with steering committee and others consulted  Finalize mission report and distribution to counterparts.	SOPAC/ steering committee

Resource Persons- Tonga Water Board /WSP-steering Committee  
 - Tonga Community development Trust (TCDT)  
 - SOPAC- Pacific Islands Applied Geo-science Commission  
 - IAS-USP – Institute of Applied Science/ University of the South Pacific.

- Ministry of Health/ WHO- Tonga

**Institute of Applied Science /University of the South Pacific**  
**(IAS/USP)**  
**Training on Preparation of H<sub>2</sub>S strips for water testing**

Monday 24<sup>th</sup> September, 2007

Learn how to make H<sub>2</sub>S Strips

8.30am - Introduction

9.00am - Theory on Simple H<sub>2</sub>S test

9.15 am - Safety issues regarding use of chemicals

9.20 am - Practical procedure for making H<sub>2</sub>S test kits

9.30 am - Weighing of chemical /mixing / autoclaving

10.00am - Morning tea

10.30 am - Set tubes in Trays for sterilizing under UVLight

11.00am - Labelling & marking 10mL on the tubes/bottles

- Pour media onto filter pad and cut into 4

12.00 - Lunch

1300 Preparation of H<sub>2</sub>S tubes/ Inoculation

Tuesday Half Day

Day 2 – Checking of the results and data recording

**WATER SAFETY PLAN AWARENESS WORKSHOP**

**25<sup>th</sup> – 27<sup>th</sup> September 2007**

**Tonga Trust -Nuku'alofa, Tonga**

<b>TIME</b>	<b>Tuesday 25<sup>th</sup></b>	<b>Wednesday 26<sup>th</sup></b>	<b>Thursday 27<sup>th</sup></b>
<b>9: 00 am</b> <b>9:30 am</b>	<p><i>Opening and Welcome Speech</i>–</p> <ul style="list-style-type: none"> <li>* Saimone Helu – CEO Tonga Water Board</li> <li>* SOPAC/WHO Team</li> </ul> <p><b>Session 1: Introduction to Water Safety Plan</b></p> <ul style="list-style-type: none"> <li>✓ What is Water Safety Plan               <ul style="list-style-type: none"> <li>* Regional</li> <li>* National</li> </ul> </li> <li>✓ Primary Objectives of Tonga Water Safety Plan</li> </ul>	<p>Recap from Day 1</p> <p><b>Session 5: H2S Test for Water Quality</b></p> <ul style="list-style-type: none"> <li>✓ Hydrogen Sulphide or H2S Test</li> <li>✓ H2S Sampling Procedure/Report Form</li> <li>✓ Reading and Interpreting H2S Test Results</li> <li>✓ H2S Test Sample               <ul style="list-style-type: none"> <li>↳ <b>Group Discussion</b></li> </ul> </li> </ul>	<p>Recap from Day 2</p> <ul style="list-style-type: none"> <li>✓ <b>Field Trip</b> <ul style="list-style-type: none"> <li>• Mataki'eua</li> <li>• Rural Water Supply</li> <li>• Water Catchments Tank</li> <li>• Mapping the supply</li> </ul> </li> </ul>
<b>10:00 am</b>	<p><b>Cont. Session 1: Introduction to Water Safety Plan</b></p> <ul style="list-style-type: none"> <li>✓ Concept and Principals of Water Safety Plan</li> <li>✓ How does Water Safety Plan work</li> <li>✓ Roles of each committees               <ul style="list-style-type: none"> <li>* Water Safety Steering Committee</li> <li>* Sub – Committee</li> </ul> </li> <li>↳ <b>Group Discussion</b></li> </ul>	<p><b>Session 5: cont'd</b></p> <p>H2S Test</p> <ul style="list-style-type: none"> <li>• Roles of lab and field staff</li> <li>• Roles of community managers</li> <li>• Community protocol</li> </ul>	<p><b>Risk assessment and Management strategies- Development exercise</b></p> <ul style="list-style-type: none"> <li>✓ Risk Identification</li> <li>✓ Risk priority</li> </ul>
<b>10:30</b>	<b>MORNING TEA</b>		
<b>11:00 am</b>	<p><b>Session 2: Urban Water Safety Technical Problem</b></p> <ul style="list-style-type: none"> <li>✓ Prolong Leakages within the Distribution Line</li> <li>✓ Illegal Connection could lead to gross contamination</li> <li>✓ Gross connection of rain water and tap water could leads to contamination of drinking water</li> <li>✓ Aquifer contamination from animal or human waste</li> </ul>	<p><b>Session 5 cont'd</b></p> <ul style="list-style-type: none"> <li>• H2S Test</li> <li>• Labelling of bottles and pouches</li> <li>• Bottle recycling</li> </ul>	<p><b>Model Water Safety Plans Development exercise.</b></p> <ul style="list-style-type: none"> <li>✓ Design/format</li> <li>✓ Risk management</li> <li>✓ Improvements</li> <li>✓ Responsibilities</li> </ul>



	✓ Aquifer contamination from surface influence ☞ <b>Group Discussion</b>		
<b>12:30 pm</b>	<b>LUNCH</b>		
<b>1:30 pm</b>	<b>Session 3: Rainwater Catchments Tank</b> ✓ Water Catchments Tank ✓ Testing of Water Quality ✓ Maintenance and repair tasks ✓ System Components and design ✓ Contaminants in rainwater systems ✓ Water Treatment ✓ Protecting collected rainwater from contamination ☞ <b>Penal Discussion</b>	<b>Session 6: Water Safety Plans</b> ✓ Steps for community Based Solutions of Water Safety ✓ <b>Field Trip</b> 1. Tokomalolo Rural Water Supply 2. Red Cross Water Catchment Tanks	<b>Session 7 : What is Water Resource Bill and Policies</b> • Tonga Water Resource Bill and Policies • Water Conservation • Current Projects/Activities on Integrated Water Management in Tonga • <b>Panel Discussion</b>
<b>2:30 pm</b>	<b>AFTERNOON TEA</b>		
<b>3 – 4:00 pm</b>	<b>Session 4 : Rural Water Safety and Health Impact</b> ✓ WHO Water Quality Guidelines ✓ Health Impacts – e.g. diseases Water Quality Guidelines and Monitoring	<b>Field Trip Continued- risk assessment and survey of the water supply system</b>	<b>AWARD OF CERTIFICATE</b>  <b>Workshop Evaluation</b> <b>CLOSING</b> <b>Participants speech</b> <b>GM, TWB</b>

### **Session Summary**

Session 1: *Introduction to Water Safety Plan* – Simione Silapelu (TANGO) & Taniela Kailahi (TWB)

Session 2: *Urban Water Safety Technical Problem* - Linisi Lavemai (TWB)

Session 3: *Rainwater Catchments Tank* - Simione Silapelu (TANGO) & Alfred Vaka -TCDT  
 ☞ Panel Discussion – Simione Silapelu (TANGO), Alfred Vaka (TCDT), Taniela Kailahi (TWB), Isileli Fakailoatonga (MOH)

Session 4: *Rural Water Safety and Health Impact* – Isileli Fakailoatonga (MOH)

Session 5: *H2S Test and Water Quality* - Isileli Fakailoatonga (MOH)

Session 6: *Water Resource Bill and Policies* – Kelepi Mafi (MLSNR)

☞ Panel Discussion – Sione Fakaosi (TCDT), Linisi Lavemai (TWB), Kelepi Mafi (MLSNR), Isileli Fakailoatau (MOH)

Session 7: *Community Based Water Safety* – Viliami Mahe (DOE)

Closing Ceremony: Closing remarks and distribution of Certificates, - Mr Saimone Helu

### **Participant List (Criteria for selection)**

1. Villages with current water safety problem (Technical/Health)
2. Representative of different districts
3. Trainers
4. Cement tank builder (resource – code for construction)

**Speakers for upcoming events:**

1. CEO – TWB
2. SOPAC/IAS/USP
3. WHO

**ANNEX 2**

**Participants at the “Preparation and Use of H2S Test Strips for Water Testing” Conducted at the Vaiola Hospital, Tonga on 24<sup>th</sup> September, 2007**

<b>Participants</b>	<b>Position</b>	<b>Contacts</b>
Telesia Apikotoa	Medical Scientist	<a href="mailto:t_apikotoa@yahoo.com">t_apikotoa@yahoo.com</a>
Mary Fakahau	Sn. Medical Scientist	<a href="mailto:maryfakahau@yahoo.com">maryfakahau@yahoo.com</a>
Latu Soakai	Sn. Medical Scientist	-
Fele’unga P Vaka’uta	Lab Technician GR1	<a href="mailto:feleungavakaauta@yahoo.com">feleungavakaauta@yahoo.com</a>
Senisaleti T Pasikala	Lab Technician GR2	<a href="mailto:senisaleti_pasikala@yahoo.com">senisaleti_pasikala@yahoo.com</a>
Filimone Fili	Lab Technician GR2	-
Reynold Ofanoa	MOEHS	<a href="mailto:rofanoa@health.gov.to">rofanoa@health.gov.to</a>
Te’efoto Mausia	Supervising Public Health Inspector	tmausia@yahoo.com
Isileli Faka’iloatonga	Health Inspector	<a href="mailto:fakailoatonga@health.gov.to">fakailoatonga@health.gov.to</a>
Sela A Fau	Health Inspector GR2	<a href="mailto:fausela@yahoo.com">fausela@yahoo.com</a>
Taunisila Falani	Health Inspector GR1	-
Dr. Littli Ofanoa	Director of Health	<a href="mailto:moh@kalianet.to">moh@kalianet.to</a>

**ANNEX: 2****WATER SAFETY PLANS EDUCATION AND AWARENESS WORKSHOP  
25- 27 September 2007  
Tonga Trust****PARTICIPANT LIST**

NAME	POSITION	ORGANIZATION
Linsi Lavemai	Manager ,Water Supply	Tonga Water Board
Taniela Kailahi	Project Engineering Officer	Tonga Water Board
Simi Silapelu	President	TANGO
Azania Newton	Conservation Officer	Dept of Environment
Elisbeth Veikoso	Climate Change officer	Tonga Red Cross Society
Moala Tumiki Lutui	Trainee Health Officer	Ministry of Health
Faise Tauhola Palei	Sanitation Officer	Ministry of Health
Molimoli Pole	Trainee Health Officer	Ministry of Health
Mele Talahiva Fine	Snr Education Officer	Ministry of Education
Tevita Nusi	Town Officer	Totamotonga
Epalahame L Taukeiaho	Town Officer	Tokomololo
Kelekoilio Nevaleti Melekoila	Town Officer	Lapaha
Mau Pese Mausio	Plumber	Ministry of Health
Apai Moala	Snr Geological Assistant	MLSNRE
Siliva Lomalo	Water maintenance Officer	Ministry of Health
Sela Akolo Fau	Health Inspector	Ministry of Health
Sione Nonu	Snr Geology Assistant	MLSNRE
Teefoto Mausia	Principal Health Inspector	Ministry of Health
Dr Raynold Ofanoa	Medical Officer	Ministry of Health
Utesoni Taungalu	Health Inspector	Ministry of Health
Isileli Fakailoatonga	Health Inspector	Ministry of Health
Lyaii Ika	Trainee Health Inspector	Ministry of Health
Sailopa Vea	Trainee Health Inspector	Ministry of Health
Sonasi Huihulu	Trainee Health Inspector	Ministry of Health

ANNEX: 3



***SOPAC***



**TONGA MISSION TRAINING REPORT**  
**Hydrogen Sulphide (H<sub>2</sub>S) Paper Strip Test**

**SEPTEMBER, 2007**

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## **Introduction**

The 'Pacific Water Safety Plans Programme' began in late 2005 under AusAID funding to WHO and SOPAC. This two-year joint programme will pilot Water Safety Plans in at least four Pacific island countries. Tonga is among the four countries selected from ten eligible.

Tonga is largely rural with the majority of its 100,000 population living in villages. Tongatapu is the main island and includes the national capital, Nuku'alofa. The Tonga Water Board has responsibility for the piped water supplies in Nuku'alofa (pop 30,000) and three other island group 'capitals'. The Ministry of Health (MOH) is responsible for systems outside of these urban centers, and for monitoring drinking water quality nationwide. Boreholes with electric or diesel-powered pumps feed untreated water through piped systems in almost all Tongatapu communities. Eighty percent of households use rainwater to supplement their piped supply.

Untreated or improperly treated drinking water may contain micro-organisms of fecal origin that are pathogenic. Usually the presence of coliforms in water is indicative of contamination of fecal matter making it microbiologically unsafe for consumption.

In 1975, Allen and Geldreich showed that the presence of coliforms in water was associated with hydrogen producing bacteria. In 1982, Manja et al. developed a simple hydrogen sulphide (H<sub>2</sub>S) paper strip test method that screened for bacterial contamination of water that had a good agreement with the standard Most Probable Number (MPN) and membrane filtration methods. The H<sub>2</sub>S test strip is a "screening test" or a presence/absence test for pathogenic bacteria. The advantages of this test is that it is inexpensive, no sophisticated equipment is required for its preparation and incubation, is easy to use in field and is simple for non-technical people to understand.

The main aim of this training was to ensure that the personnel at Ministry of Health (MOH) are well trained and equipped with all necessary items required in the preparation of H<sub>2</sub>S test kits.

## **Funding**

The World Health Organization funded the training at the Vaiola Hospital, Tonga and also provided lab ware and consumables required to prepare the hydrogen sulphide tubes.

## **Dates and Venue**

The training was held on 24<sup>th</sup> and 25<sup>th</sup> September, 2007 at the Viola Hospital, Nuku'alofa, and Tonga.

## **Trainer and Participants**

The training was conducted by a staff (Ashika Dayal) of Institute of Applied Science, USP. Davendra Nath of SOPAC was also present as an observer.

A total of 12 participants (6 laboratory technicians, 4 health officers and 1 medical doctor) all from the Ministry of Health participated throughout the training. Refer to ANNEX 2 for a detailed participant list

### **Program Outline**

The programme was outlined in such a way as to enable the participants to grasp all the basic techniques required to sterilize, prepare, inoculate, interpret and record results of H<sub>2</sub>S.

For a detailed outline of the program refer to ANNEX 1

### **Purpose of Mission**

The main aim of this mission was to train the laboratory personnel at the Vaiola Hospital, Nuku'alofa, Tonga. To enable them to produce H<sub>2</sub>S tubes with confidence.

The objectives of the mission were as follows:

- to train the personnel on proper washing and sterilization procedures
- to correctly prepare the H<sub>2</sub>S media
- to prepare the H<sub>2</sub>S tubes using all aseptic techniques
- to train the personnel on the correct inoculation procedure of H<sub>2</sub>S tubes
- to learn to interpret and document results

### **Workshop Outcome/ Achievements**

Overall the mission was successful as all the objectives on the agenda were achieved.

The 12 personnel of MOH Tonga are now well trained and confident in the preparation and use of H<sub>2</sub>S test kits.

The MOH laboratory is now equipped with all the lab ware, consumables and equipment needed to prepare H<sub>2</sub>S test kits. The laboratory was supplied with 100 prepared H<sub>2</sub>S test kits, 150 unprepared plastic tubes with caps, 144 glass bottles( narrow mouthed MaC Cartney bottles), 100 pouches, enough chemicals to prepare 1000-2000 H<sub>2</sub>S test kits, absorbent pads, automatic pipettes, 1ml tips, scissors, forceps, 500 petri dish, 20 folders. A detailed list of lab ware and consumables supplied is attached as ANNEX 3.

All equipment required for H<sub>2</sub>S were checked and were found to be in working condition. The laboratory has both a UV light ( a old UV light cabinet in which one of the bulbs needs to be replaced and a new laminar flow cabinet which also has UV lighting) which can be used for the sterilization of plastic tubes and a autoclave for the sterilization of glass bottles. The old autoclave that is currently in use has a set temperature of 121°C however the duration of sterilization can be manipulated. This autoclave can be used for H<sub>2</sub>S media sterilization by reducing the time of sterilization to 7½ minutes. The new autoclave which is not in use at present has the capacity for different temperatures and time manipulation.

Apart from the H<sub>2</sub>S workshop I also attended the Water Safety Plan Awareness Programme where I was present as an observer and answered all queries raised by the community representatives related to H<sub>2</sub>S. An idea presented by the participants for the awareness programme was to use the



media, especially the TV as visual aids may provide easy understanding of the issue. If possible include H<sub>2</sub>S test in the education system as laboratory practical or as a project for Form 5 or Form 6. Also to involve the community such as the youth groups and women groups to help in the cleanup campaign of tanks and community.

Attended the field trip organized on Wednesday, 26<sup>th</sup> September that gave an insight on the type of water supplied on the island.

Attended the meetings with the personnel of Tonga Trust and the Tonga Water Board to discuss the achievements and the failures of the workshops

### **Recommendations**

The newly constructed microbiology laboratory at the Vaiola Hospital has some new equipment donated by Japan. However due to the constricted laboratory space, these equipment have not yet been installed. Everything from the old microbiology laboratory is slowly being setup in the new building, to allow for renovation of the old building. However there is uncertainty whether the old building is being renovated for the laboratories or for patient wards. The old laboratory was quite spacious, with enough working benches and enough space for all the equipments. Hence it is recommended that the old microbiology laboratory still be used after renovations, for example, the new autoclave and other new equipment could be installed there.

The cross contamination in the new laboratory is also a concern as both clinical and water analysis is carried out in the same space. The laboratory focuses mainly on clinical work. Analysis of water is done as the need arises. Their main analysis of water is testing for coliform using the 3 tube MPN method since they only have 3 tube MPN table instead of the 5 tube MPN method as recommended by the WHO guidelines. Refer to Annex 5 for the 5 tube MPN table.

The laboratory was supplied with 144 narrow mouthed Mac Cartney glass bottles. While preparing H<sub>2</sub>S test kits it was noted that the absorbent pads touch the mouth of the bottles. This could become a source of contamination. It is suggested that wide mouth Mac Cartney bottles be used in future and narrow mouth bottles could be used for Clinical work.

It was observed that the laboratory does not fully utilize the resources it has for the production of H<sub>2</sub>S test kits. A 500mL prepared H<sub>2</sub>S media, prepared by IAS in 2004 was still found stored in the fridge. This prepared media should be discarded however if the lab sees the need for its use it is highly recommended that its effectiveness be tested before using it.

The laboratory keeps no record of dispersal and recovery of H<sub>2</sub>S tubes. It is suggested that the Health Inspectors take up this responsibility since the laboratory staff are quite busy with their assigned work. The recovery of the used tubes is important as it can become a health hazard if it is misused especially among children or youth. For a highly contaminated sample the

colour of the sample turns black something similar to the colour of the soft drink coke.

It was noted that the pouches distributed have no indication of whose property it is. It is suggested that a sticker with MOH address and phone contact together with a health hazard or toxic sticker be placed on the pouch so that if the pouch is misplaced it can be returned to its rightful owner. Similarly, the results sheet can be modified to include MOH contact.

There seems to be miscommunication or lack of awareness between government and NGO's as who supplies the prepared H<sub>2</sub>S test kits. According to MOH there has not been much demand for these test kits.

An idea presented by MOH was to send one of its staffs to IAS laboratory for attachment in order to learn the aseptic techniques, other methods of water testing

### **Conclusion**

Overall the Tonga mission was a success as the objectives were achieved. The laboratory staffs are well trained in all aspects of H<sub>2</sub>S kit preparation as well as in interpretation and recording of data. The MOH laboratory is also well equipped with all the necessary lab ware, consumables and equipment required for the preparation of H<sub>2</sub>S test kits. However, from the evaluation it was found that the duration of the training was very short as the coverage of the day was a lot.

### **Acknowledgement**

The co-operation of the staff of Ministry of Health is kindly appreciated, in particular Dr.Reynold Ofanoa, Medical Health Officer and Mr. Te'efoto Mausia, Supervising Public Health Inspector. The support and encouragement of Dr. Liliti Ofanoa, the Director of Health is also greatly appreciated.

## **ANNEX 1**

### **Training on Preparation of H<sub>2</sub>S strips for water testing**

Monday 24<sup>th</sup> September, 2007

Learn how to make H<sub>2</sub>S Strips

- 8.30am - Introduction
- 9.00am - Theory on Simple H<sub>2</sub>S test
- 9.15 am - Safety issues regarding use of chemicals
- 9.20 am - Practical procedure for making H<sub>2</sub>S test kits
- 9.30 am - Weighing of chemical /mixing / autoclaving
- 10.00am - Morning tea
- 10.30am - Set tubes in trays for sterilizing under UV light
- 11.00am - Labeling & marking 10mL on the tubes/bottles
- Pour media onto filter pad and cut into 4
- 12.00 noon - Lunch
- 1.00pm - Preparation of H<sub>2</sub>S tubes
- Sample collection and inoculation
- Interpretation of results
- 4.30pm - End of Day

## ANNEX 2

### Participants at the “Preparation and Use of H<sub>2</sub>S Test Strips for Water Testing” Conducted at the Vaiola Hospital, Tonga on 24<sup>th</sup> September, 2007

Participants	Position	Contacts
Telesia Apikotoa	Medical Scientist	t_apikotoa@yahoo.com
Mary Fakahau	Sn. Medical Scientist	maryfakahau@yahoo.com
Latu Soakai	Sn. Medical Scientist	-
Fele'unga P Vaka'uta	Lab Technician GR1	<a href="mailto:feleungavakaauta@yahoo.com">feleungavakaauta@yahoo.com</a>
Senisaleti T Pasikala	Lab Technician GR2	senisaleti_pasikala@yahoo.com
Filimone Fili	Lab Technician GR2	-
Reynold Ofanoa	MOEHS	rofanoa@health.gov.to
Te'efoto Mausia	Supervising Public Health Inspector	tmausia@yahoo.com
Isileli Faka'iloatonga	Health Inspector	fakailoatonga@health.gov.to
Sela A Fau	Health Inspector GR2	fausela@yahoo.com
Taunisila Falani	Health Inspector GR1	-
Dr. Littli Ofanoa	Director of Health	moh@kalianet.to

#### Officials Contacted

##### Tonga Water Board

Mr. Saimone Helu  
Mr. Linisi Lavemai  
Mr. Timote Fakatava  
Mr. Taniela Kailahi

##### Tonga Community Development Trust

Mr. Sione Fakaosi  
Mr. Alfred Vaka

## ANNEX 3

### List of Chemicals

Peptone from meat	1kg
Di potassium hydrogen phosphate trihydrate	50g
Ammonium iron (III) citrate (green)	50g
Sodium thiosulphate	150g

### List of Consumables

Prepared H <sub>2</sub> S tubes (Plastic)	100
Unprepared H <sub>2</sub> S tubes (Plastic)	150
Mc Cartney bottles (Glass)	144 (1 box)
Duran bottle	3 x 250mL
Pipette tips 1mL	1000
Pipette 1mL	2
Mc Cartney bottles	144 (1 box)
Measuring cylinder	4 x 100mL, 3 x 10mL
Scissors	10
Forceps	10
Absorbent Pads	2 boxes (400)
Petri dish	1 box of 500
Spatula	3
Weighing boat disposable	50
Face masks	15
Training material notes	

## **ANNEX 4**

### **Activities of the week**

#### 24<sup>th</sup> September, 2007

Met Dr. Raynold at 8.30am who introduced us (Ashika & Davendra) to the laboratory staff (Mary; Snr Medical scientist & Telesia; Medical Scientist - Micro). They gave a guided tour of the laboratory and showed us all the instrument and labware they had.

Setup and prepared everything for the workshop.

Workshop opened by Dr. O'fanoa (Director MOH) at 10am.

A brief theory was presented on the use, preparation of H<sub>2</sub>S test strips, followed by a practical session of sterilization of H<sub>2</sub>S tubes using UV light and autoclave for glass bottles, media preparation and preparation of H<sub>2</sub>S test strips and inoculation of samples in the prepared tubes.

Example was also given on how to interpret results and fill in the data sheet.

Seven technicians from MOH were trained on preparation, inoculation and interpretation and recording of results. Four Health Inspectors were trained on sample collection, inoculation, interpretation and recording of results.

Dr. Raynold was present with the participants throughout the day.

#### 25<sup>th</sup> September, 2007

Arrived at 8.30am at the Vaiola Hospital to interpret the results of the previous day's tests. Helped the participants to interpret results and answered all the queries they had.

At 11am joined Mr. Davendra at the Friendly Island Hotel where a workshop on Water Safety Plan was being conducted.

Was present as an observer at this workshop.

#### 26<sup>th</sup> September, 2007

Trained participants on sampling, inoculation, interpretation and recording of results.

Went on a field trip to observe the rural and urban water supply systems.

Rural – borehole, rainwater tank storage

Urban – cement catchment

#### 27<sup>th</sup> September, 2007

Was present at the workshop as an observer.

Answered all the queries and concerns the participants had in relation to the H<sub>2</sub>S testing.

Certificate presentation was done by Mr. Saimone Helu (Tonga Water Board)

28<sup>th</sup> September, 2007 9.15am

A roundtable meeting was conducted with Mr. Saimone Helu, Mr. Linisi Lavemai, Mr. Taniela Kailahi (Tonga Water Board), Mr. Sione Fakaosi, Mr. Alfied Vaka (Tonga Trust) and Mr. Simione Silapelu (TANGO).

Great support towards the water safety program was shown by these people.

Some of the achievements of the workshop were discussed

Some of the concerns and improvements in regards to the water supply plan were also discussed, for example the channel of communication between the Government and NGO's needs improvement. Requested if TWB and TT could be informed of all the water related projects that are supported by WHO/SOPAC e.g. were not aware of the H<sub>2</sub>S training at MOH.

A wrap up meeting also conducted with Mr. Siene Fakaosi and Mr. Alfred Vaka of the Tonga Trust at about 10.30am. The contract was looked over; basically everything stated under Activity 1 has been covered except for the school activity.

Activity 2 is to begin as soon as possible.

Awareness program to be done in Eastern/Western, Northern and Central divisions together with schools involvement.

Posters / leaflets are yet to be made.

A decision needs to be made whether to have a poster competition on a national level or just in schools.

A report, budget, proposal to be done and sent



## ANNEX 5 MPN (Most Probable Number) Table – 5 tube method

MPN index and 95% confidence limits for various combinations of positive results when 5 tubes are used per dilution (10mL,1.0mL,0.1mL)

TABLE 9221-IV. MPN INDEX AND 95% CONFIDENCE LIMITS FOR VARIOUS COMBINATIONS OF POSITIVE RESULTS WHEN FIVE TUBES ARE USED PER DILUTION (10 mL, 1.0 mL, 0.1 mL)\*

Combination of Positives	MPN Index/ 100 mL	Confidence Limits		Combination of Positives	MPN Index/ 100 mL	Confidence Limits	
		Low	High			Low	High
0-0-0	< 1.8	—	6.8	4-0-3	25	9.8	70
0-0-1	1.8	0.090	6.8	4-1-0	17	6.0	40
0-1-0	1.8	0.090	6.9	4-1-1	21	6.8	42
0-1-1	3.6	0.70	10	4-1-2	26	9.8	70
0-2-0	3.7	0.70	10	4-1-3	31	10	70
0-2-1	5.5	1.8	15	4-2-0	22	6.8	50
0-3-0	5.6	1.8	15	4-2-1	26	9.8	70
1-0-0	2.0	0.10	10	4-2-2	32	10	70
1-0-1	4.0	0.70	10	4-2-3	38	14	100
1-0-2	6.0	1.8	15	4-3-0	27	9.9	70
1-1-0	4.0	0.71	12	4-3-1	33	10	70
1-1-1	6.1	1.8	15	4-3-2	39	14	100
1-1-2	8.1	3.4	22	4-4-0	34	14	100
1-2-0	6.1	1.8	15	4-4-1	40	14	100
1-2-1	8.2	3.4	22	4-4-2	47	15	120
1-3-0	8.3	3.4	22	4-5-0	41	14	100
1-3-1	10	3.5	22	4-5-1	48	15	120
1-4-0	10	3.5	22	5-0-0	23	6.8	70
2-0-0	4.5	0.79	15	5-0-1	31	10	70
2-0-1	6.8	1.8	15	5-0-2	43	14	100
2-0-2	9.1	3.4	22	5-0-3	58	22	150
2-1-0	6.8	1.8	17	5-1-0	33	10	100
2-1-1	9.2	3.4	22	5-1-1	46	14	120
2-1-2	12	4.1	26	5-1-2	63	22	150
2-2-0	9.3	3.4	22	5-1-3	84	34	220
2-2-1	12	4.1	26	5-2-0	49	15	150
2-2-2	14	5.9	36	5-2-1	70	22	170
2-3-0	12	4.1	26	5-2-2	94	34	230
2-3-1	14	5.9	36	5-2-3	120	36	250
2-4-0	15	5.9	36	5-2-4	150	58	400
3-0-0	7.8	2.1	22	5-3-0	79	22	220
3-0-1	11	3.5	23	5-3-1	110	34	250
3-0-2	13	5.6	35	5-3-2	140	52	400
3-1-0	11	3.5	26	5-3-3	170	70	400
3-1-1	14	5.6	36	5-3-4	210	70	400
3-1-2	17	6.0	36	5-4-0	130	36	400
3-2-0	14	5.7	36	5-4-1	170	58	400
3-2-1	17	6.8	40	5-4-2	220	70	440
3-2-2	20	6.8	40	5-4-3	280	100	710
3-3-0	17	6.8	40	5-4-4	350	100	710
3-3-1	21	6.8	40	5-4-5	430	150	1100
3-3-2	24	9.8	70	5-5-0	240	70	710
3-4-0	21	6.8	40	5-5-1	350	100	1100
3-4-1	24	9.8	70	5-5-2	540	150	1700
3-5-0	25	9.8	70	5-5-3	920	220	2600
4-0-0	13	4.1	35	5-5-4	1600	400	4600
4-0-1	17	5.9	36	5-5-5	>1600	700	—
4-0-2	21	6.8	40				

\* Results to two significant figures.

**ANNEX 6**  
**Some photos of the workshop**



Participants of the Hydrogen Sulphide training in Tonga



The Vaiola Hospital in Nuku'alofa, Tonga



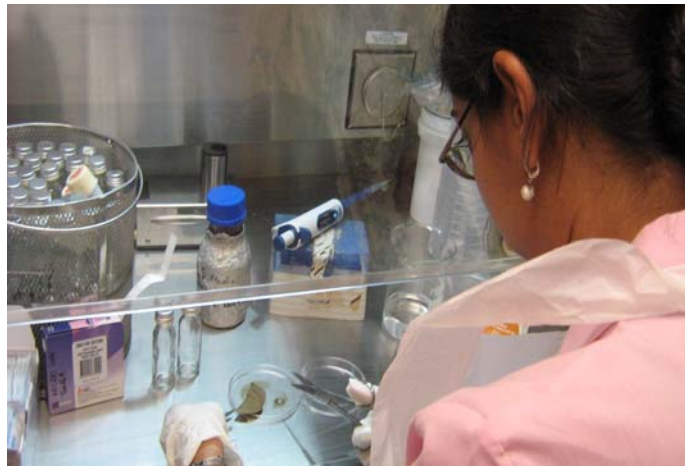
The new wing of the Vaiola Hospital constructed in March 2006



Entrance to the new laboratory



Inside the new laboratory



Preparation of H<sub>2</sub>S strip test kits



Preparation of H<sub>2</sub>S strip test kits





Attentive participants at the workshop



Staff doing some clinical work in the microbiology laboratory



The old UV cabinet



The new laminar flow



The autoclave in use



The new autoclave yet to be installed



The hot air oven



The 35°C incubator



The loop incinerator



The new borehole pump



Old borehole pump



Elevated tanks



Cement rainwater tanks