

**Community-Based Water Quality
Monitoring (WQM)
for Panama Rural Health and
Water Programs**

Consultancy Report
(July 1997 - January 1998)

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Community-Based Water Quality Monitoring for Panama Rural Health and Water Programs (July 1997 - January 1998)

Executive Summary

The International Development Research Centre (IDRC) developed and implemented a training program on water quality monitoring for sanitary inspectors of the Ministry of Health (MINSa) and members of community water committees (*juntas administradoras de agua*). Based on the results of previous IDRC funded research projects, the program introduced into the country the use of simple and inexpensive microbiological testing techniques for drinking water that can be carried out at the community level and by local people. Two training workshops, one for Ministry personnel and another for members of community water committees were held in July 1997. Pilot local water testing programs were then implemented in various rural communities. The initiative was carried out in collaboration with the water division of MINSa and the Panamanian NGO FUNDIAH. Both organizations agreed to monitor the community pilot programs and assist IDRC in a follow-up visit six months after the initiation of the local programs.

Field visits were made in January 1998 to eight participating communities. The following conclusions were drawn from field observations, interviews with community water quality inspectors, and discussions with MINSa and FUNDIAH officials who have followed the implementation of the local monitoring programs over the last six months.

- ***Communities are willing and able to monitor the quality of their drinking waters.*** The local monitoring programs that were established followed proper protocols for testing, interpreting results, and planning and executing the necessary corrective actions.
- ***Local programs can provide increased monitoring coverage at a minimum cost.*** The pilot initiative demonstrated that remote communities are able to carry out regular monitoring of water systems without the need for high transportation costs nor expensive membrane filtration kits.
- ***Local programs can result in improved communications between MINSa and rural water administration committees.*** The water division of MINSa is already in the process of developing data sheets and strategies to share information with the community inspectors and monitor quality control of local water testing programs.
- ***Local programs can reduce risks of disease transmission.*** Several examples were reported in which community inspectors used the water quality tests to identify and eliminate sources of contamination, thereby reducing the risk of disease transmission via drinking water.
- ***Community water quality inspectors found their work to be fulfilling.*** Many inspectors

went beyond what was expected of them, extending their services to neighbouring communities, guided by a sense of social responsibility.

- ***A local water quality monitoring program is more likely to succeed when the water administration committee is functioning properly and has the full backing of the community.*** Only one case was found during the follow-up visits where the water administration committee did not have the backing of a significant segment of the community. MINSA personnel indicated, however, that there are a number of water administration committees in the country experiencing organization and representation problems among the 1,500 community water systems under their responsibility. In such cases, the administration committee should be strengthened before introducing a local water quality monitoring program.
- ***The role of community water quality inspectors should be validated by MINSA.*** Many community inspectors encountered initial scepticism from other community members and even government officials when they reported positive results (contaminated water samples). Validating the role of the community WQ inspector is an important activity that MINSA should carry out. The Ministry's sanitary inspectors should make a point during their regular community visits to show support for the role that the local water quality inspector is playing, as well as reemphasize in community meetings the importance of household and environmental hygiene and water quality testing.

1. Background

1.1 Purpose

The International Development Research Centre of Canada (IDRC) began to fund research in 1984 on simple and affordable microbiological testing methods to assess the safety of drinking waters. Results from laboratory and applied research in Asia, Africa and Latin America demonstrated that bacterial tests which detect the presence or absence of indicator bacteria in a water sample can be used in a reliable and affordable manner by community technicians to ensure a good quality of water in their community systems. The Ministry of Health of Panama (MINSA) requested the assistance of IDRC in early 1997 to develop and implement a training program for community water committees and MINSA personnel in the use of water quality monitoring techniques that can be carried out at the community level. The initiative consisted in organizing and giving two training workshops in Panama, and providing technical support in the planning and implementation of four pilot community water testing programs in selected rural areas of the country. This work was funded by the World Bank through a consultancy contract with IDRC. The terms of reference are included in Appendix A3.

1.2 Relevance

As part of its support to the Rural Health Project and the work of the Emergency Social Fund (FES) of Panama, the World Bank is financing a large number of rural and peri-urban piped water systems, possibly reaching over 1,500 systems within the next five years, and benefitting more than 100,000 families. The operation and maintenance of the aqueducts will become the responsibility of local village and neighbourhood water committees. The long term sustainability of the systems will depend largely on the capacity of MINSA to prepare and train the local committees to take over this responsibility, and also in its ability to supervise and provide the technical support needed.

In terms of program supervision, MINSA is in the process of establishing a network of decentralized laboratories under its Rural Health Project to monitor water quality and water-borne diseases country-wide. Rigorous and systematic testing needs, however, will outreach the capacity and financial resources available. This is particularly true for hundreds of rural communities where access is difficult. For this reason, MINSA hopes to apply water testing techniques which can be carried out on-site by the water committees themselves. This community-based monitoring approach is expected to reduce costs and promote collaboration between community organizations and MINSA, allowing for increased coverage and a more efficient response to ensure the safety of drinking waters throughout the country. The approach will also strengthen local capacity to manage and maintain the community water systems.

1.3 Funding and Executing Institutions

The work accomplished was a collaborative effort between different institutions, both in terms of co-funding and organization. The World Bank funded IDRC to carry out the training workshops and a monitoring visit of selected community programs after six months of operation. IDRC's financial contribution consisted in developing the technical content that was covered in the workshops and adapting the training manuals for the specific audiences of the workshops. MINSA was responsible for organizing logistics and supplying basic laboratory equipment for the workshops, as well as closely monitoring four selected pilot community programs. PAHO supported the participation of 30 MINSA officials in the first training workshop. And, the Canadian Embassy in Panama, through its Canada Fund, financed the participation of 30 members from rural communities in the second workshop, as well as the preparation of field kits for water quality testing (one kit for each of the communities attending). The Canada Fund also provided funding to the organization FUNDIAH (Fundación para el Desarrollo Integral de los Asentamientos Humanos) to coordinate the organization of the community workshop, the participation of community members, and the follow-up of community programs.

2. Tasks

The following sections describe the work accomplished by the IDRC team, the team's observations and recommendations. Both MINSA and FUNDIAH have prepared their own independent reports outlining their involvement and their own assessment of the initiative³.

2.1 First Visit: Training Workshops

A 14 day visit to Panama was carried out between 14-27 July 1997. During this visit, the two training workshops were implemented (the first with MINSA personnel and the second one with community members and local NGOs). The detailed itinerary of the visit is presented in Appendix A4.

First Workshop: MINSA personnel, 16-18 July 1997.

This was a 3-day workshop to train MINSA sanitary field inspectors, laboratory technicians from both the Central and rural laboratories, and other ministry officials. A total of 30 participants attended the workshop. Participants were introduced to basic concepts of microbiological testing, the transmission of water and sanitation related diseases, sources of water contamination, and treatment and prevention measures. Practical training was provided on the preparation of test bottles, collection and processing of water samples and interpretation of test

³ For MINSA see: Carlos Copri (Enero 1998), "Informe General, Supervisión y Evaluación del Monitoreo de la Calidad del Agua Potable en Comunidades Rurales y de Dificil Acceso", Ministerio de Salud, Departamento de Control de Calidad del Agua, División de Agua, República de Panamá.

At the time of writing this report, FUNDIAH was in the process of drafting their own report to the Canada Fund in Panamá.

results. The following tests were covered: presence/absence tests (H₂S, P/A and P/A plus MUG); and, quantitative tests: ColiStrip and ColiPlate. The detailed agenda is presented in Appendix A2.

A health communications expert from MINSA also attended the workshop and videotaped several sessions. This activity is part of a ministry wide project aiming to improve the communication skills and messages being conveyed by MINSA field staff to communities. The expert met with the trainees on a couple of occasions before the day's beginning of workshop activities and instructed them on several communication issues. He also carried out an evaluation on comprehension and retention levels of the main messages given during the workshop. His quick analysis of a questionnaire applied to the participants at the end of the workshop indicated very positive results. A request has been made for the copy of the evaluation report but has not yet been received.

Second Workshop: Community and NGO members, 21-25 July 1997.

A second 5-day workshop was then held with selected representatives of community water committees and NGOs from all the provinces of the country. Participants were introduced to basic concepts of microbiology, the transmission of water and sanitation related diseases, sources of water contamination, and treatment and prevention measures. Practical training was also provided on the preparation of test bottles, collection and processing of water samples and interpretation of test results. Other activities included: discussions on the planning and implementation of a local monitoring programme suitable to their own community; and the preparation of a field kit for each community. This kit consisted of a home-made incubator and sufficient "ready-to-use" P/A and H₂S test paper strips for a six-month pilot community project. Five MINSA trainees from the earlier workshop also participated during this second session to assist in training community representatives and worked with them and participating NGOs in planning possible local monitoring programs. A total of 26 participants from 19 different communities were trained. A detailed agenda for the workshop is presented in Appendix 2.

The active involvement from community participants was very high throughout the workshop. A significant amount of time was spent answering questions about the tests and the theory behind them, and discussing issues of relevance to the participants' own communities. This was a very positive and rewarding experience, as the trainees were genuinely eager to learn and understand the messages presented, while at the same time thinking about how to apply the material learned in their own communities. The same health communications expert from MINSA attended this workshop and videotaped many of the sessions. He did not carry out an evaluation questionnaire as in the first workshop, but instead encouraged the participants to organize themselves into small groups and prepare a vignette expressing the knowledge acquired during the workshop that was felt most important and how they would communicate it back to other members of their own communities.

During the evenings of the third and fourth nights, the participants decided to form two groups and each prepared, a vignette which was presented at the end of the workshop. One of the

groups was composed mainly of members from the most remote and isolated communities of the country, and the other from members of communities that were not too far from urban centers. This division was reflected in the themes that each group chose to highlight during its presentation. The former group gave emphasis to the existing poor water supply conditions and diarrheal diseases in their communities, and the need for alternatives to treat the water. The latter group emphasized the need for improving the management of their existing water systems. Both groups stressed the need for better organization within the community itself and better communication with the sanitary field inspectors and MINSA. Both groups also emphasized the link between water quality and health. Based on these community presentations, our main goals for the workshops seem to have been met. We also carried out an interactive evaluation and review exercise based on questions and answers on the main technical points covered in the workshop. This exercise indicated to us that the main technical messages had also been received and understood correctly by the participants.

Other Activities During the First Visit:

Field trips to community water supply systems. The day after the first workshop, we carried out a field visit to two community water systems in order to get a feeling for the conditions of operation of community water supplies. We were accompanied by a representative of FUNDIAH and a sanitary inspector from the ministry. This inspector had recently been assigned to the area, so he was unfamiliar with the conditions of the water systems in the communities we visited. The two rural communities were about one to two hours away from Panama City. The first community was served by a gravity system with a storage tank or small reservoir fed also by gravity from a stream intake that was within the boundaries of a national park. The tank was clean and the water flowing into it was clear. The water in the tank had been chlorinated at some point in the past. The chlorine feeder laid empty and upside-down on the side of the tank. We took three 10 mL water samples (two H₂S and one P/A) from the intake to the tank. All three samples turned out to be positive, most probably from contamination by the feces of wild animals. The second water system visited was 30 min. further west on the Transamerican Highway. The water source from this system came from a river. The sanitary inspector told us that the intake had just been reconstructed as there had been a problem with high sediment loads. This intake fed by gravity a slow sand filter, which in turn fed three community piped water systems. The structure of the slow sand filter appeared to be in good shape. The problem was that the sand for the filter had never been put in, and laid in mounds around the filter structure, now well packed by the passing of time. We took four water samples (two H₂S and two P/A). All four samples turned out positive within 24 hours, even the small volume 10 mL H₂S sample, with incubation on our hotel balcony. This indicates heavy contamination of the water. There was no chlorination system.

Radio interview. After the end of the second workshop, we were interviewed on a country wide rural health radio program that is run by MINSA. The interview lasted about 6-8 min. in which the workshops were discussed, as well as the role of IDRC, and some words of advice to

rural residents about their drinking water and what they should do to ensure that it is safe to drink.

2.2 Follow-up: Community Visits

Subsequent to the workshops, FUNDIAH and MINSA agreed to assist and closely monitor four of the participating communities in the implementation of local water quality monitoring programs. These four "pilot communities" were selected based on their proximity to Panama City, to facilitate monitoring visits by both MINSA and FUNDIAH. The community programs were monitored for a period of 6 months. The purpose was to use the experience gained from the community programs to guide MINSA in planning and optimizing a training and implementation model that could then be applied in other rural and peri-urban areas of the country. During this phase, IDRC was to provide technical support and guidance as required. This included a follow-up visit to pilot and non-pilot communities in mid January 1998 to assess the progress of activities and provide on-site technical support to MINSA, FUNDIAH and the community water quality technicians. The following sections present the findings of the follow-up visit by the IDRC team to Panama. The visit took place from 11-19 January, 1998.

3. Outcomes

3.1 Progress of Activities

At the time of our follow-up visit, three out of the 19 communities that participated in the training had not received their monitoring kit (home-made incubator plus reagents and supplies). Lack of time during the July community workshop did not allow a small group of 6-8 communities to prepare their own kits then. Unfortunately, three of the most remote communities were among this group. These were the communities of Celmira Gariché in Chiriquí, Mariato Malena in Veraguas, and Buena Vista in Panamá Este. Their difficult access prevented both FUNDIAH and MINSA from delivering the complete kits during the six months that followed the workshop. For one of these communities, FUNDIAH attempted two months ago to reach the trainee. However, being the rainy season, their 4-wheel drive vehicle left them 10 km away from the community. After a wet and muddy walk, they reached the community only to find out that the trainee was not home. He was away working in a neighbouring village. The lack of a telephone had prevented them from making earlier arrangements. This highlights the difficult access and communication with some communities and the need for locally-based programs. Since it was the dry season during our January visit to Panama, we were able to visit two of these remote communities and deliver the kits. MINSA will be visiting Buena Vista shortly, the only community that remains without a kit.

In addition to these two remote communities, we visited the four "pilot communities" closer to Panama City, and two additional ones in more remote areas. A total of 8 communities were

monitored. In all of these, we also handed the trainees a certificate of participation. The relevance of this certificate will be discussed in later sections. Again, up to the day of our visit, neither FUNDIAH nor MINSA had been able to distributed the certificates to the trainees, once again highlighting the normal difficulties in communication between Panama City and the various rural communities.

Of the 8 communities visited, two were only just receiving their testing kits, five had been monitoring successfully the quality of their water supplies for six months, and one had been unable to do any water testing. The following observations can be made at this point:

- The two trainees receiving their kits during our visit were two of the most outspoken and enthusiastic participants during the workshop. Both indicated some disappointment for the delay but were not discouraged and were eager to begin testing drinking waters. Both are likely to implement a proper monitoring program in their communities, as their cohorts in the other five communities have done.
- The programs and achievements in the five communities doing water testing are discussed in the next sections. All five communities shared a common characteristic, they all had a viable water administration committee which had the full backing of their community.
- The community that failed to implement any type of water testing, on the other hand, was also the only place visited where the trainees reported strong divisions between members of the community, and where the water administration committee did not have the backing of the whole community. Several families had opted for not paying water fees and disconnected themselves from the community system. These families were collecting water from nearby streams (see report on El Limón, Capiro in App. A1).

3.2 Community Monitoring Programs

Brief reports for each of the communities visited are presented in Appendix A1. Each report is presented as a case example providing evidence of different types of accomplishments by the *water quality community inspectors*⁴ and the monitoring programs. The main observations are summarized below.

Performance. In the five communities with a water testing program, all five community inspectors appeared to follow correctly the basic procedures taught in the workshop. Specifically:

⁴ This is the term that has been assigned to the trainees by MINSA. It translates into Spanish as "*inspectores comunitarios de la calidad del agua*" (see Copri, 1998).

- All were able to describe proper disposal procedures for the contents of used test bottles or tubes.
- All kept records of test results.
- All were aware of the proper incubation temperature range for the tests.
- In reviewing and discussing their own experiences based on their records, they all recounted proper procedures followed when encountering positive samples. That is, they:
 - re-sampled and tested the water supply
 - informed the water committee and the people responsible
 - planned and executed mitigation or remedial actions
 - re-tested the water to check the results of corrective actions

Consistency of test results was found in all cases. For example, negative results were commonly encountered with piped systems that had chlorination or a protected water supply. Positive results often lead to the discovery of sources of contamination of the water supply, and when remedial actions were taken, re-testing showed negative results. Duplicate samplings gave in general the same results (both positive or both negative). In at least two instances, the water and sewerage authority, IDAAN, re-sampled sites found contaminated by the community inspectors, and their own testing corroborated the local results (see report on Caimito in App.1 & report on Altos de los Martínez in Copri, 1998).

Local Generation & Use of Information. The community monitoring programs were successful in generating information and action by the local people. In all five communities, examples were found on the use of water quality data by the local inspectors to reduce risks of disease transmission. These are summarized below:

- In Barriada La Santeña (La Chorrera), samples from the piped water system consistently gave negative results indicating that the water is safe to drink. A group of seven families not connected to this system were using a dug well as a water source. The local technician tested the well water and found it highly contaminated. The seven families were advised to boil their drinking water. The technician also used the test results to convince the families of the need to connect themselves to the piped system. The group thus requested assistance from MINSA's regional office to obtain water pipes. At the time of our visit, four of these families had already received the pipes and connected themselves to the distribution system. The remaining three families expected to be connected by early February.
- Las Pavas (La Chorrera) has a piped water system with chlorination which serves most of the community. Monthly monitoring of the system has consistently produced negative results for contamination. A recent case of hepatitis in a young girl led the two WQ inspectors of the community to test the water source that the family was using. This was

an unprotected shallow well also used by three more families. The water in the well was found to be highly contaminated. The local inspectors took upon themselves to trace the source of contamination. They discovered that during heavy rains there was direct runoff falling into the well. None of the families have any sanitation facilities and the defecation sites were located near the homes at a higher elevation than the well. This led the technicians to conclude that direct fecal contamination from the defecation sites into the well was possible via surface runoff. The community has requested assistance from MINSA to allow these families to connect themselves to the piped system. The water committee also requested the community head to forbid the use of the open well, and instructed all people in similar circumstances to boil their drinking water. No additional cases of hepatitis have occurred since then. The families are now using water from neighbours connected to the distribution system and/or from a more distant artesian well which has been tested and found safe for human consumption.

- La Florida (Capira) has a gravity-fed piped system with no filtration nor chlorination. However, the community storage tank is cleaned and disinfected on a regular basis (almost every month). The local technician has found positive and negative samples in different points of the distribution system. He used these results (positive and negative test tubes) to give talks to community members to remind them of the importance of cleaning the storage tank and to convince them of the need for regular chlorination of the piped system. The community recently requested the regional office of MINSA for a chlorine dosing system.
- In Caimito (Chiriquí) the community has an excellent operating distribution system. The local technician began monitoring the system six months ago and has found no contaminated samples. The water supply consist of a drilled well with an electric pump which feeds a storage tank. Water in the tank is chlorinated and is then distributed by gravity to community households. The curiosity of the local technician led him to go and test the water in a neighbouring community. He found the water in the piped system highly contaminated. He informed the local water committee and was told that the monitoring responsibility was with the water and sanitation authority (IDAAN). The technician went to inform the sanitary inspector for this region. IDAAN carried its own testing and confirmed the contamination of the water in the system. They traced the problem to the non-chlorination of the system. Poor training of the local water committee on chlorination procedures had led the person responsible, a year or so ago, to add a heavy slug of chlorine. The community reacted to this excessive dose by forcing the water committee to stop chlorination altogether. Based on this new bacterial sampling, chlorination of the system was re-started, the local operator received refresher instructions and a chlorine comparator to ensure chlorine dosages are adequate. Re-testing of the system indicated that the contamination problem was solved. Through this incident, the local municipal authority (corregimiento) reached an agreement with the *water quality community inspector* of Caimito to monitor the two neighbouring communities. The municipal authority lends him a bicycle once a month so he can go and sample these two other systems. This extended monitoring has been carried out for the

last two months. All tests have indicated no contamination problems.

- In San Carlitos (Chiriquí) the local technician began a random sampling in his community to get an idea of the overall water quality. He found contaminated samples at the water tap of a household. He used the tests to trace the source of contamination. The distribution system consists of three main lines. Samplings on two of these lines consistently showed negative results (no contamination). Positive samples were narrowed down to the third line. The water committee is planning to carry out additional samplings in two water taps of different households connected to this line. If they indicate contamination, they will then proceed to flush and disinfect the entire line.

Stronger Links Between Water Quality and Health. The above examples indicate that the workshop trainees were able to acquire new skills and used them to promote a new awareness in their communities on the close link between health and the safety of drinking water. Another example was found in the community of Las Pavas. During our visit, the local inspector volunteered the comment that now when he or many of the community people go to work in their fields, they take along a bottle of drinking water. They have tested the streams and water holes they customarily used and found them to be contaminated. This community has no sanitation facilities and the soil in the area is largely clay. The contamination of streams by human and animal feces during the rainy season is very likely. This is an interesting example in which local monitoring permitted the testing of waters outside the distribution system and resulted in reducing yet another risk of disease transmission. The quality of drinking water at the place of work is just as important as the water quality in the home. This is particularly true when households lack sanitation facilities and people work in nearby fields. In this situation it becomes necessary to break such a pathogen transmission loop (defecation near house --> stream contamination --> drinking water from stream --> defecation near house -->).

Reach. An unexpected outcome of this initiative was the willingness and interest of the local water quality inspectors to go to neighbouring communities and test the waters there. The local inspectors felt this was their moral duty since they had friends and family in the other communities. This was the case for Las Pavas and Caimito. Copri (1998) reports a similar case in Altos de los Martínez. The local inspectors from Celmira and Mariato (who just received their kits) also indicated it was their intention to monitor the water systems in neighbouring communities. Two instances were also reported in which people from nearby communities had heard about the water testing and came to request the local inspector to test the water supply back in their communities.

Local Ingenuity. Another unexpected outcome was the design by FUNDIAH of a plastic version of the home-made incubator. This incubator, made from a used plastic container, some insulation, a thermometer and a light bulb with a dimmer, was found easier and faster to build than the wood version that was introduced during the workshop. Photographs of this new version are presented in the Appendix. According to Don Mario Pérez Herrera (its inventor), the

incubator can be built for less than US\$18 in Panama.

4. Sustainability

A number of issues regarding the sustainability of the initiative were discussed with the community inspectors and personnel from MINSA and FUNDIAH. These are summarized below.

Building a Program. The pilot community programs have shown that local people are able to carry out water testing, and that such testing produces a safer water supply. They also demonstrated that local community inspectors are willing to coordinate activities closely with MINSA personnel. This gives the ministry the opportunity to carry out their planned decentralization activities while increasing the level of communication with remote communities, as well as the quality of the end product, safe drinking water.

The water division of MINSA has begun, of its own initiative, to look for additional funding in order to gradually increase the number of community water quality inspectors. Plans for this coming fiscal year are to train more sanitary inspectors from MINSA and members from at least five more communities, while continuing their monitoring and technical support of the 19 communities trained in July. The division has also developed a reporting form summarizing water quality data and quality control indicators of the community monitoring program. This form would be filled out jointly on a quarterly basis by the community WQ inspectors and MINSA's sanitary inspectors. The information collected will be fed to a central database under development. It will allow the ministry to assess the status of community programs, as well as collect water quality data country wide. The water division is also moving towards integrating the purchase of reagents for the bacterial tests into their operating budgets. Cost-sharing strategies for the re-supply of test materials to community inspectors are also being examined (these are discussed below). In summary, MINSA is taking specific steps to gradually build on this pilot experience as financial and human resources allow.

Program Costs. In line with current decentralization policies, the costs of community monitoring programs should be shared between the government and the communities. So far the following model is emerging.

Start-up Costs: For this initiative, these costs were supported by the World Bank, PAHO, MINSA, and the Canada Fund. These costs included the training of MINSA personnel and the community inspectors, as well as the community kits. The water division of MINSA is seeking additional funding from donor agencies to train inspectors of more communities. The training would now be carried out by MINSA personnel as opposed to IDRC consultants.

Labour: In the 19 communities thus far, the local inspectors do not receive any remuneration for their work. Some have asked MINSA about the possibility of some

form of remuneration to cover at least the transportation costs for doing the sampling. The position of the Ministry has been that this is a matter to be addressed by each individual water administration committee. Our community visits indicated that this position was acceptable to the technicians. In some cases the water quality technician is also the system operator and already receives a salary from the water committee. The technicians in this situation did not mind the added task of water quality monitoring. In other communities, the personal satisfaction in making a contribution to ensure the health of the community was justification enough for doing this work on a voluntary basis.

Community inspectors asked us what to do when people come to request that their water be tested. We referred the decision again to the local water administration committee. In several instances they have been dealing with this situation very successfully. For example, the local inspector from Caimito now borrows the bicycle from the municipality once a month to do the samplings of two neighbouring communities. In Las Pavas, the local technicians voluntarily tested (free of charge) an artesian well serving a single family in his community because the house was too far from the distribution system. Both, the water committee and the family considered that the investment needed to be connected to the system was too high. The water was found safe to drink. This prompted a second family having an artesian well on their property to request that its well be tested. This family was also connected to the community piped system. The water committee refused to do the testing unless they were paid by the family. The reasoning was that the water committee can now guarantee the quality of the water in the community system. Doing only one test on this particular well might prompt the family to stop using the community supply if the well water is found safe. This meant less revenue to keep the community system running (eg., electricity for the water pump) because of one less paying user, and the possibility that the well may become contaminated in the future or during other times of year. All very sound considerations.

Materials & Supplies: The H₂S test seems to have been well accepted and very successfully used by the community inspectors. This is the simplest and less expensive test. The cost of a starter community kit with only this test can be about US\$60, consisting of a home-made incubator (US\$15-20), a thermometer, 30 test tubes with paper strips, and an additional batch of paper strips to last for at least 6 months of testing. The test is also the easiest to re-supply given that test tubes can be re-used on-site, requiring only a supply of prepared paper strips (light and compact).

The community inspectors we visited were doing an average of 6-8 tests per month. Depending on the number of paper strips that are prepared in a laboratory in any one batch, the cost of each paper strip can range between US\$0.05-0.10, not counting labour. In all the communities we visited, we asked the local inspectors if the water administration committee would be willing to pay US\$1 per month to get more paper strips to continue the water testing after their existing supply had finished. They all believed this cost was reasonable and did not foresee any problems with the committee accepting to pay this amount.

This offers a number of cost-sharing alternatives for MINSA to explore. The Ministry could assign 1 to 2 person-days per month (exact numbers need to be refined) in each of its rural water quality laboratories to produce the paper strips needed in each region. These labour costs could be the contribution of the Ministry, while the costs of reagents and supplies could be charged to the communities. Alternatively, MINSA can explore full cost recovery with production in-house or through a small-scale enterprise. In either situation, MINSA could re-distribute batches of prepared paper strips in small, sealed bags with instructions on how to re-use the test tubes to ensure sterile conditions before using. The distribution can be made on a quarterly or semi-annual basis by their own sanitary inspectors during one of their normally scheduled visits to the communities. Distribution costs would therefore be nil.

Validating the Role of the Community WQ Inspector. Copri (1998) in his report to MINSA correctly points out the expressed need by several community inspectors for some sort of credential that substantiates their newly acquired skills and knowledge. Several community inspectors were met with scepticism from other community members and even government officials when they reported positive results (contaminated water samples). It should be recognized that the community water quality technicians are faced with the demanding task of introducing something that is new to the community, as well as to regional officers of IDAAN and MINSA. Not only are the testing techniques new to these people, but also the fact that these can be carried out by local members of the community. It is very important to give as much moral support as possible to the community inspectors during these initial stages.

In this sense, the delay in distributing the workshop certificates was very unfortunate. We distributed 10 certificates during our visits. We suggest that both MINSA and FUNDIAH coordinate more closely their activities related to this project and initiate procedures for the rapid distribution of the remaining certificates. Beyond this, there are also a number of steps that can be taken to facilitate the work of the community inspector. These should include a letter to all regional offices of MINSA and IDAAN explaining the program and the role and responsibilities of the community technicians. MINSA's sanitary inspectors, when visiting a community in one of their regular rounds, should also give a copy of this letter to the water administration committee and to the local WQ inspector. Ideally, the local inspector should also be presented to the community by MINSA's sanitary inspector, and his/her role and responsibilities explained in a community meeting. The sanitary inspectors should also try to encourage the local health personnel and school teachers to coordinate demonstration talks with the community inspector. About half of the community inspectors interviewed said they were willing to go to schools to make demonstrations and talk about the need for environmental hygiene and safe drinking water. It is a good opportunity for health education which should not be wasted.

Strengthening the Community Water Committees. During the workshops and community visits, we were impressed by the enthusiasm of the trainees and their commitment to help their communities. Even though both are important elements, they are not sufficient to ensure success. As demonstrated by our visit to Limón, if the water administration committee is not functioning properly and lacks the backing of the community, a local water quality monitoring

program will not succeed. We only encountered one such example, but MINSAs personnel told us that there are several administration committees experiencing problems among the 1,500 community systems under their responsibility. In such cases, it would be preferable to first strengthen the administration committee before introducing a local monitoring program. The effectiveness of a local monitoring program is based on the community's trust and respect of the local WQ inspector and the corrective actions recommended by the committee.

5. Conclusions

The following statements can be made based on our field visits to the various communities and discussions with MINSAs officials who have followed the implementation of the community monitoring programs so far.

- The communities that participated in this initiative are willing and able to monitor the quality of the water in their community water supplies.
- The local monitoring programs that were established followed proper protocols for testing, interpreting results, and planning and executing corrective actions when necessary.
- Community-based monitoring programs offer the following advantages:

Increased monitoring coverage at minimum cost. The pilot initiative demonstrated that remote communities are able to carry out regular monitoring of water systems without the need of high transportation costs nor expensive membrane filtration kits.

Improved communications with rural communities. The water division of MINSAs is already in the process of developing data sheets and strategies to share information with the community inspectors and monitor quality control of local water testing programs.

Reduced risk of disease transmission. Several examples were reported in which the local inspectors used the water quality tests to identify and eliminate sources of contamination, thus reducing the risk of disease transmission through drinking waters.

- The community water quality inspectors found their work to be fulfilling and many went beyond what was expected of them, extending their services to neighbouring communities, guided by a sense of social responsibility.
- Many community inspectors encountered initial scepticism from other community members and even government officials when they reported positive results

(contaminated water samples). Validating the role of the community WQ inspector is an important activity that MINSA should carry out. The Ministry's sanitary inspectors should make a point during their regular community visits to show support for the role that the local water quality inspector is playing, as well as reemphasize in community meetings the importance of household and environmental hygiene and water quality testing.

Appendix A1. Community Reports

Barriada la Santeña, Chorrera - Panamá Oeste Jan. 14, 1998

Community WQ inspector: Erick Escarriola, well and pump operator



Photo: Erick Escarriola receives workshop certificate from Andrés Sánchez (IDRC)

The Community and its Water Supply. Barriada la Santeña is easily accessible by paved road and is about 1 hour drive West of Panama City. It has about 80 families. Two wells provide water to about 60 families via a piped distribution system. Water from the old well is pumped into a storage tank. From there it flows by gravity to the households. The old well contributes about 20% of the water to the system. The new well is 240 feet deep. It was built a couple of years ago by the Southern Command. A 5 hp turbine pumps the water directly into the distribution system.

Notes and Observations.

Monitoring is being done on a regular basis since the July workshop. Erick takes 3 to 4 samples per month in triplicate (both for H₂S and P/A). He tests the water from the new well (at the pump's exit), the water coming out of the storage tank (water from the old well), and a couple of random samples: one from the distribution system and another from dug household wells that serve the families not

connected to the system. During our meeting with Erick we suggested to him to reduce the number of replicate samples to one per site with re-testing when positive results occur. We then reviewed with him his test records.

Samples from the new well consistently gave negative results, indicating that the water was safe

to drink. People in the community do not like chlorination, so they welcome the possibility to check if the water is safe or not. The water from the older well and tank has produced positive results on a couple of occasions. Both times, the water storage tank was cleaned and chlorinated. Subsequent re-testing produced negative results.

A group of seven families not connected to the piped system were using a dug well as a water source. Erick went to test the well water and found it highly contaminated (>100 indicator bacteria/100 mL). He advised the seven families to boil their water before drinking. He also used the test results to convince them that they needed to connect themselves to the piped system. Prior to this incident, people were not convinced about the poor quality of the water and preferred to keep using their dug well to avoid paying water fees. The graphic presentation of positive (contaminated) samples (water in test tubes turning black) convinced them that indeed the water was not safe to drink. Erick and the president from the administration water committee requested assistance from MINSA's regional office in obtaining water pipes. At the time of our visit, four of these families had already received the pipes and connected themselves to the distribution system. The remaining three families expect to be connected by early February.

In our conversations with Erick, it was clear that he had retained the main messages from the workshop. He made a presentation and demonstration to the community and the water administration committee about what he had learned during the workshop. He established a regular monitoring program with support from the water committee. Positive samples are followed up by re-testing, notifying the corresponding authorities and the people affected, planning and implementing remedial actions, and verifying the outcomes of such actions.

The president of the water administration committee believed that paying about US\$1 per month for the re-supply of materials (paper strips) for the H₂S test would not present a problem to the committee.

Community WQ inspectors:

Alfonso Rodríguez, President, Water Administration Committee

Teodolinda de la Cruz, Secretary, Water Administration Committee



Teodolinda de la Cruz receives workshop certificate from Andrés Sánchez (IDRC)

The Community and its Water Supply. El Limón is located about 1.5 hours drive away from Panama City. The last 10 km is a dirt road of difficult access. It is an agricultural community, founded 80 years ago and composed of 22 families. The nearest health clinic is two hours away walking. There is a regular hourly bus service to the community from 7 AM to 6 PM. The water source for the community is a natural spring located inside a National Park. There is no human activity surrounding the water source. The source feeds by gravity a couple of storage tanks. The water system does not include filtration. In theory it is supposed to have a continuous chlorine dosing unit installed. Prior to our field visit, MINSA personnel told us that they were profiting from our visit to re-install this chlorination system.

Notes & Observations. The community had been notified of our visit a week in advance, and was invited to a general meeting by the sanitary inspector from the Ministry. We arrived about 8 AM to Doña Teodolinda's house, where she and a couple of older women were waiting for us. Don Alfonso, the president of the water committee, had to go to Panama City to take care of some personal business. His son, José Rodríguez, arrived soon after. He is the Chair (*fiscal*) of

the water committee. While we were waiting, one woman arrived complaining about having the meeting in Teodolinda's house yard. She lived in the lower part of the village and would have much preferred if the meeting had taken place in a more central part.

While we were waiting for the rest of the people to gather, I began to chat with Doña Teodolinda. When she and Don Alfonso came back from the workshop they organized a community meeting in which they presented what they had learned and demonstrated the testing procedures. She commented that many people did not believe what they said, neither that one could get ill by drinking clear water. People do not like chlorination. The village had a continuous chlorine dosing unit installed in the upper storage tank about 8 months ago. The operator was adding too much chlorine and people did not like it. One night someone removed the unit from the tank and took away some parts that made its re-installation impossible. Women listening to the story also complained that the chlorine killed their flowers. Several women in the village grow flowers and plants to sell in the city. Teodolinda is one of them. She explained to the others that all they have to do is keep the water overnight in an open container before watering the flowers and the chlorine will disappear. She commented that there were a lot of divisions and conflict within the village. A group of six families had stopped paying their water fees and disconnected themselves from the community piped system. She also mentioned that she did not have access to the water testing kit that they had prepared during the workshop. Don Alfonso keeps it in his house. They had both decided it was not worthwhile to test the water since during our visit to the community in July, Barney and myself had taken some samples which turned out positive. Given that they still had no chlorination unit, they expected to get positive results at the tank. So why bother? With this reasoning and the scepticism of the community about what they had learned, they had not done any water testing since July, deciding to wait until MINSA came back to re-install the chlorinator.

During this visit we were being accompanied by Carlos Copri (MINSA's official responsible for the Ministry water quality testing laboratories) and Miguel Pérez (the Ministry's sanitary inspector for the region). They profited from the community gathering to explain the purpose of the training workshop held in July, and the role of Teodolinda and Don Alfonso as community water quality inspectors. We also went over the water quality tests and gave them a demonstration, corroborating and reinforcing the information the local inspectors had given them in their earlier talk. Those who attended the meeting seemed interested and receptive. A group of about 15 people agreed that it was important to chlorinate the water, provided that not too much chlorine was added. Miguel Pérez had sent earlier some of the missing parts needed to put the chlorinator back in operation. The water committee had decided to re-install it in the lower tank, closer to the community to prevent vandalism. We walked to this tank with the community group in order to carry out the installation. When we got there it turned out that one piece of equipment had again disappeared and the installation would not be possible. More promotion work seems necessary.

Community WQ inspectors: Ovia! Corcho
Ceferino Gonzáles



Ceferino Gonzales and Ovia! Corcho receive workshop certificates from Andrés Sánchez (IDRC) and Barney Dutka (NWRI)

The Community and its Water Supply. Las Pavas is located about an hour drive on a dirt road from the Transamerican Highway, West of Panama City. There are about 65 families in the community. It has a piped water system with chlorination. The system serves 37 of the 65 families in the community. The water source for this system is a drilled well (100ft deep). Water is chlorinated on-line at the exit of the well and is then pumped into a 10,000 gallon storage tank. Distribution to the households is done by gravity from the storage tank. The system is one year old. The tank is cleaned every month. People pay a water fee of US\$ 5 per household per month, and tend to pay on time. If they fall behind in their payments, the water committee cuts the service to the household if no agreement has been reached on repayment after a month. The money from the water fees is used as follows: US\$110/mo. for diesel to run the turbine, US\$50/mo. to pay the operator, and US\$25/mo. for the repair fund.

Notes and Observations. About 27 families are not connected to the system. Some don't want to be connected because they have artesian wells or springs near their homes and prefer not to pay for the water. Others live far away or in locations where the water from the storage tank

cannot reach by gravity.

Ovial and Ceferino have carried out water tests on nine different occasions since the July workshop. Six of the sites tested gave negative results, and three sites gave positive results. We reviewed with them the stories behind their test records. Monthly monitoring of the distribution system has consistently produced negative results for contamination (five monthly tests, two at the well and three after the storage tank). This is not surprising given that the well is sealed, the water is chlorinated and the storage tank is regularly cleaned.

The first positive sample came from Ceferino's own house. He tested the water in a stored container in his kitchen. His family now drinks water directly from the tap.

A recent case in hepatitis in a young girl led them to test the water source that the family was using. This was an unprotected shallow well which served three more families. The water in the well was found to be highly contaminated (1 mL sample turned positive within 18 hours). Ovial and Ceferino took upon themselves to trace the source of contamination. They discovered that during heavy rains there was direct runoff falling into the well. None of the families have any sanitation facilities and the defecation sites were located near the homes at a higher elevation than the well, leading the technicians to conclude that direct fecal contamination from the defecation sites into the well was possible via surface runoff. The community requested assistance from MINSA to allow these families to connect themselves to the piped system. They have not received an answer yet. The water committee also requested the community head to forbid the use of the open well, and instructed all people in similar circumstances to boil their drinking water. No additional cases of hepatitis have occurred since then. The families are now using water from the taps of neighbours connected to the distribution system and/or from a more distant artesian well which has been tested and found safe for human consumption.

Ovial and Ceferino also tested free of charge another artesian well serving a single family because the house was too far from the distribution system. Both, the water committee and the family considered that the investment needed to connect the household to the system was too high. The water was found safe to drink. This prompted a second family having an artesian well on their property to request that its well be tested. However, this family was also connected to the community piped system. Ovial and Ceferino refused to do the testing unless they were paid by the family. The reasoning was that the water committee can now guarantee the quality of the water in the community system. Doing only one test on this particular well might prompt the family to stop using the community supply if the well water is found safe. This meant less revenue to keep the community system running (eg., electricity for the water pump) because of one less paying user, and the possibility that the well may become contaminated in the future or during other times of year.

Another positive water sample came also from water stored uncovered in a container in the household of a family that had recently disconnected itself from the piped system. The family wanted to avoid paying water fees. The head of the household got mad at Ceferino when he was informed of the test results. He believed it was a ploy from the water administration committee

to force him to re-connect himself to the distribution system. Ceferino remarked that this is an isolated incident. People in the community tend to cooperate and are satisfied with the water supply.

Ceferino also mentioned that they have given two talks to school children (8 years old and over) and children's parents. People are getting the messages. Many people ask him or Ovia about the test results from the distribution system on a regular basis. Also, after the hepatitis incident and their testing, many of his friends now take water from their homes when they go to their fields to work, believing it is safer than the water from streams.

Both, Ovia and Ceferino considered that paying about US\$1 per month for the re-supply of materials (paper strips) for the H₂S test would not present a problem to the water committee.

La Lagarterita, Chorrera - Panamá Oeste

Jan. 15, 1998



Meeting with Don Mandonio Yangues at La Lagarterita: left to right: Andrés Sánchez, Madonio Yangues, Ceferino Gonzales and Carlos Copri (MINSA).

Before travelling to Las Pavas, Ceferino asked us to meet him in La Lagarterita. It turned out that he was forcing a meeting between us, MINSA officials accompanying us, and Don Mandonio Yangues, who is head of both, the water and the health committees for his community. Even though Ceferino lives in Las Pavas, he works in La Lagarterita. He tested the

water in the distribution system of this community and found it to be highly contaminated. When he informed the water committee about the test results, people did not believe him and questioned his qualifications, skills and knowledge. This community is more affluent than Ceferino's.

Ceferino was profiting from our visit to convince Don Mandonio about the validity of his test results. He also requested Carlos Copri of MINSa to consider the possibility that the Ministry to give some form of identification to community water quality inspectors so that they are not dismissed so easily by others. We talked with Don Mandonio about the tests, Ceferino's training and the water quality of the distribution system. People are not happy with the system. It is 26 years old. The water storage tank is very rusty. People do not like the taste of the water. Many families prefer to use water from the nearby lake. Ceferino has also tested this water and found it even more contaminated. A new tank has been built but it has not been put on line because some families are opposed to it. From the discussions that were held, it seems possible that part of the water taste problems may be due to salt water intrusion into the aquifer from which the water is extracted. However, the water storage tank is not cleaned regularly, and the system is not chlorinated. The 26 year old pipes probably have rather thick biofilm layers, which may contribute to taste problems.

Ceferino's interests in having our meeting with Don Mandonio were many. First he is concerned that people take water from the lake for drinking. Last year, cases of cholera were reported in another community located beside this same lake. Secondly, he feels that the water committee of this community should get more involved in trying to improve the quality of the water in their system. For this, he needed first to have recognition for his technical skills so he can then get people to attend a community meeting and get them to plan how to approach the government for assistance in dealing with the water problem of the community.

Community WQ inspector:

José de los Reyes Morán



José Moran receives workshop certificate from Barney Dutka (NWRI) and Andrés Sánchez (IDRC)

The Community and its Water Supply. La Florida has a population of 293 inhabitants, with 67 families in total. Most are served by a gravity-fed pipe system with no filtration nor chlorination. The water storage tank is cleaned and disinfected on a regular basis (almost every month). The community has no electricity.

Notes and Observations. José was the president of the administration water committee in 1994. Right now he heads a committee for improved housing, and acts as the local community water quality inspector. He has found positive and negative samples in different points of the distribution system. He used these results (positive and negative tubes) to give talks to community members to remind them of the importance of cleaning the storage tank and convince them of the need for regular chlorination of the piped system. The community recently requested the regional office of MINSAs for a chlorine dosing unit.

The water committee functions very well and has the full backing of the community. Since there are no pumping costs associated with the system, water fees are very low, US\$0.50 per family per month. If people do not pay, water service is cut off after three months, and the family is fined US\$0.05 per month, until it pays the amount owed and re-connects itself into the system.

The community has a general meeting every three months. During this meeting, the water committee reports back to the community on the status of things.

In our conversations with José, it was clear that he had retained the main messages from the workshop. Upon his return, he made a presentation and demonstration to the community and the water administration committee during a general meeting. He has established a regular monitoring program with support from the committee. Positive samples are followed up with re-testing, notifying the corresponding authorities and the people affected, as well as recommending the people to wash their storage containers and boil their water. Since there is no electricity, José incubates the test samples in the kitchen near the *fogon* (kitchen fire). This seems to have worked so far. He has conducted a number of 1 mL H₂S tests, always performing a control test for the boiled dilution water. He is also beginning to train a younger person on water quality testing and hopes to share the work with him in the near future.

José considers that paying about US\$1 per month for the re-supply of H₂S paper strips is reasonable and would not present a problem to the committee.

Community WQ inspector: Aniceto Castillo



Don Aniceto receives workshop certificate from Barney Dutka (NWRI) and Mario Pérez (FUNDIAH)

The Community and its Water Supply.

Caimito has a well operated distribution system. The system was built about one and a half years ago through funding from FES. The water is pumped from a drilled well into a 22,000 gallons storage tank where it is chlorinated before being fed by gravity to the households. There are 174 households connected to the distribution system. The water fee is US\$1 per month per household. About 25 households use private wells.

Notes and Observations.

Don Aniceto is no longer the president of the water administration committee but remains as the local water quality inspector. He began monitoring the system six months ago and has found no contaminated samples. His curiosity led him to test the water in the neighbouring community of El Rincón. He found the water in that piped system highly contaminated. A 10 mL water sample turned positive within 15 hours. He informed the local water committee and was told that the monitoring responsibility was

with the water and sanitation authority (IDAAN). He also learned that the water in this system was not being chlorinated. Don Aniceto went to inform the sanitary inspector for this region about his test results. Initially, IDAAN greeted him with scepticism, but nonetheless carried out its own testing and confirmed the contamination of the water in the system. They traced the problem to the non-chlorination of the system. Poor training of the local water committee on chlorination procedures had led the system operator, a year or so ago, to add a heavy slug of chlorine. The community reacted to this excessive dose by forcing the water committee to stop

chlorination altogether. Based on this new bacterial sampling and some pressure by IDAAN, chlorination of the system was re-started, the local operator received refresher instructions and a chlorine comparator to ensure that chlorine dosages are adequate. A couple of months later, Don Aniceto tested again the water from this distribution system. The tests came out negative, indicating that the contamination problem had been solved.

Through this incident, the local municipal authority (corregimiento) reached an agreement with Don Aniceto to monitor the two neighbouring communities (El Rincón and Anastasio) in addition to his own. The municipal authority lends him a bicycle once a month so he can go and sample these two other systems. This extended monitoring has been carried out for the last two months. All tests have indicated no contamination problems. He is performing a couple of tests per month per community (a total of six tests per month). He sees this extra work as his social responsibility, given all the effort that was spent in training him and providing him with the tools to do it. He also wanted to give talks in the communities, specially to those people who are using private wells as a water source, but given the scepticism he found in El Rincón, he felt that he needed first some form of identification that proved he is qualified to talk about water quality.

Coinciding with the other community inspectors, he considers that paying about US\$1 per month for the re-supply of H₂S paper strips is reasonable and would not present a problem to the water administration committee.

Community WQ inspector: Candido Cubilla



Don Candido Cubilla receives workshop certificate from Andrés Sánchez (IDRC) and José Felix Dutary (FUNDIAH)

The Community and its Water Supply. San Carlitos has a total population of 942 inhabitants, of which 642 are youths and adults, and 300 are children under 16 years of age. This is according to the census just carried out by Don Candido which he did as part of his new job of community water quality inspector. There are 180 families connected to the distribution system. Their source is ground water, which is pumped into a 26,000 gallon storage tank. Water in the tank is chlorinated and then distributed by gravity to the households. The tank is cleaned every two to three months. According to Don Candido, people in the community are used to chlorinated water. He has a chlorine comparator and regularly checks the chlorine levels at the tank and in different points of the distribution system. The water fee is US\$2.50 per month per family. The money collected is used to pay for the electricity to run the pump, and pay the operator and the chlorine consumed. Don Candido is no longer the president of the water

administration committee. Every year the president is changed. He has always been involved in one way or another with the water supply of the community. He was the person that originally negotiated with FES the construction of the distribution system. Right now he is happy to be the water quality inspector.

Notes and Observations. In our conversations with Don Candido, it was apparent that he had retained the main messages from the workshop. His records were not very clear however, so we

spent some time going over them. Upon his return, he made a presentation and demonstration to the community and the water administration committee during a general meeting. He has established a regular monitoring program with support from the committee.

Don Candido began a random sampling in households to get an idea of the overall water quality. He found contaminated samples at the water tap in one section of the community. He then checked the storage tank and found no contamination there. He concluded that contamination was occurring in the distribution system. He used the tests to trace the source of contamination. The distribution system consists of three main lines. Samplings on two of these lines have consistently shown negative results (no contamination) over the last three months. Positive samples were narrowed down to the third line. This third line only serves four households. The water testing has only been done at the tap of the first household in the line. Test results over the last three months at this tap have been consistently positive. No health problems have been recorded in these households. Don Candido is not too worried but advised the four families to boil their water before drinking. The water committee is planning to carry out additional samplings in two different water taps of households connected to this line. If they indicate contamination, they will then proceed to flush and disinfect the entire line in the coming month.

Don Candido considers that paying about US\$1 per month for the re-supply of H₂S paper strips is reasonable and would not present a problem to the water administration committee.

Community WQ inspector: Miriam Batista, secretary, water administration committee



Miriam Batista receives workshop certificate from Mario Pérez Herrera and José Felix Dutary (FUNDIAH)

The Community and its Water Supply. Lack of time during the July community workshop did not allow a small group of 6-8 communities to prepare their own kits then. Unfortunately, three of the most remote communities were among this group. Celmira was one of them. This was the community farthest away from Panama City, on the border with Costa Rica, one of the reasons why neither FUNDIAH nor MINSa were able to deliver the complete testing kit during the six months that followed the workshop. In this visit, we were finally bringing Miriam her kit.

The community has 300 families. The water distribution system is one year old. So far only 117 houses have connected themselves to the system. The rest need money to get connected. The system uses a river as a water source and has a slow sand filter, a 20,000 gallon storage tank, and a continuous chlorination unit. This filter, chlorination unit and storage tank actually serve four communities: San Pedro, Celmira, San Isidro Arriba, and Quebrada Grande. Four different conduction lines leave the storage tank to serve each of the communities. There is a joint water administration committee, but every community also has their own internal committee. Both local and central committees alternate their meetings at the end of each month.

Notes and Observations. MINSA's sanitary inspector does visit the community four times a year. Miriam was happy to receive her testing kit. She said that the sanitary inspector had visited them last month and she accompanied him to do the water testing. She would have loved to have the kit then so she could compare results. When the inspector comes back in three months time, she will be ready. She plans to carry out monthly tests at the tank's exit and in the distribution systems of all four communities (a couple of samplings at the tank and a couple per community for a total of 10 samples per month). We reviewed the different steps in preparing the samples, performing the tests and disposing of used test bottle contents. She also believed that US\$1.00 per month to replenish the supply of paper strips was reasonable.

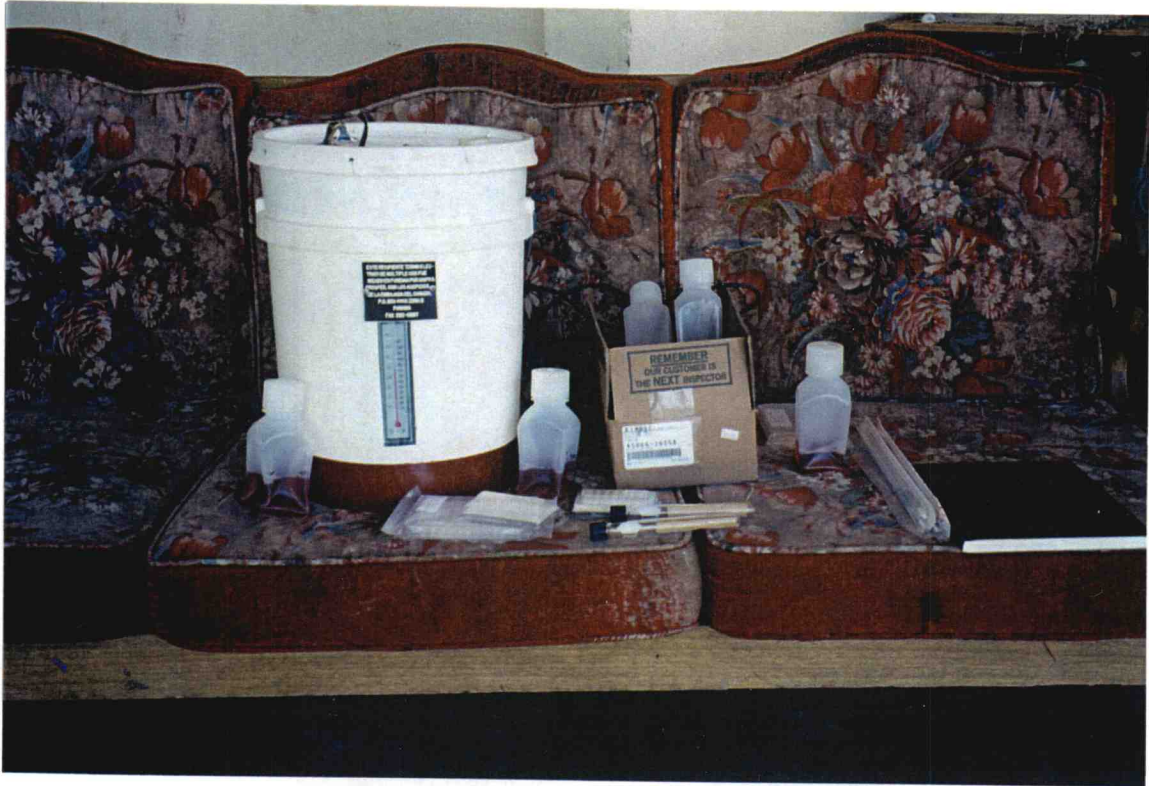


In this visit we also supplied Miriam with a new version of the home-made incubator. This incubator, made from a used plastic container, some insulation, a thermometer and a light bulb with a dimmer, was found easier and faster to build than the wooden version that was introduced during the workshop. Photographs of this new version are presented below. According to Don Mario Pérez Herrera (one of the inventors), the incubator can be built for less than US\$18 in Panama.

Don Mario Pérez Herrera (FUNDIAH), one of the inventors of the plastic home-made incubator.



Close-up view of the plastic home-made incubator (Panama 1998)



Testing kit supplied to Celmira (incubator, ready-made P/A and H₂S test tubes and bottles)

Community WQ inspector: Manuel González



Manuel González receives workshop certificate from Andrés Sánchez (IDRC)

The Community and its Water Supply. If Celmira was the most distant community from Panama City, Mariato was the most isolated one. We were also bringing Manuel his water testing kit. FUNDIAH attempted two months ago to reach him. However, being the rainy season, their 4-wheel drive vehicle left them 10 km away from Mariato. After a wet and muddy walk, they reached the community only to find out that Manuel was not home. He was away working in a neighbouring village. The lack of a telephone had prevented them from making earlier arrangements.

This time it was the dry season. However when we arrived to Mariato we found again that Manuel was working in a neighbouring village. We enlisted his son and went to find Manuel. The community has no electricity. Today the temperature was 39°C in the shade. It gets a bit cooler during the night, but the incubator should work properly without electricity. The community has no doctor either. The nearest health clinic is about 1.5 hours away by

car. During the rainy season the community becomes virtually isolated as the roads get too muddy and/or flooded. This highlights the difficult access and communication with some communities and the need for locally-based water quality monitoring.

Notes and Observations. Manuel was surprised when we arrived at his place of work with his son and the water testing kit. He was building a home for a local family in the neighbouring community of Limón. We chatted briefly with him since he had fresh cement mixture that he

could not allow to dry. He was happy to get the water testing supplies. One of his first comments was that he intended to monitor the water quality not only of Mariato but also of the neighbouring communities since MINSA's sanitary inspector often found very difficult to get to the community.

Manuel and Miriam (from Celmira) were two of the most outspoken and enthusiastic participants during the workshop. Both indicated some disappointment for the delay in getting their test supplies but were not discouraged and were eager to begin testing drinking waters. Both are likely to implement a proper monitoring program in their own communities and the neighbouring ones.

Appendix 2: First Workshop Agenda, 16-18 July 1997

Trainees: Rural sanitary inspectors, laboratory technicians from both Central and rural laboratories, and other officials from MINSA. A total of 30 trainees participated in the workshop.

Purpose: The workshop was intended to provide participants with the technical background and skills necessary to prepare and carry out simple and inexpensive microbiological water quality tests for use in community-based monitoring programs of drinking water.

Location: Ministry of Health, Panama City

Day 1: Introduction

1. Inauguration Ceremony
2. Description of workshop and meeting the participants
3. What do bacteria look like? How big are they?
4. Distribution of bacteria in water (homogeneous vs. heterogeneous distributions)
5. Drinking water sources and their possible contamination
6. Bacterial indicator systems (Which, Why & What they can do)
7. Description of three indicator systems: H₂S paper strip method, the P/A test and Coliplate.

Day 2: The Presence-Absence (P/A) test

1. Preparation of P/A culture media - emphasis on different types of test containers; implications of different positive test results (eg. 100 mL vs. 20 mL tests); and samples of negative and positive test results
2. Incubation and bacterial growth: incubation methods and temperature ranges
3. Coliplate & Colistrip: Explanation on the use of these tests (Why and When); Inoculation of Coliplate and Colistrip plates (practice)
5. The P/A test (practice)
6. Alternatives for sterilizing water and prepared culture media

Day 3: The Hydrogen Sulphide (H₂S) Paper Strip test

1. Preparation of culture media and paper strips (practice) - emphasis on different types of test containers; interpretation of different positive test results (eg. 100 mL, 10 mL and 1 mL tests); and samples of negative and positive test results
2. Preparation of paper strips vs. preparation of test bottles or tubes; small sample volume tests; methods to reduce dependency on regular laboratory visits
3. Sample collection procedures (water taps, wells, buckets, streams, and chlorinated water samples)
4. Data recording
5. The H₂S test procedure (practice)
6. Alternatives available when test results indicate fecal contamination of water
7. Reading and interpreting results from P/A, H₂S and Coliplate tests
8. General review and exam on course material to ensure that trainees retained basic concepts and procedures

Appendix 2 (Cont.): Second Workshop Agenda, 21-25 July 1997

Community Water Committees and NGOs

Trainees: Members of community water committees and NGO personnel involved in water supply and sanitation projects. A total of 30 trainees from 19 different communities participated in the workshop.

Purpose: The workshop was intended to provide participants with the technical background and training necessary to initiate a community program for monitoring the quality of drinking waters.

Participants also prepared a basic testing kit, including a home-made incubator and sufficient supplies to carry out water testing in their own communities during a 6 month period.

Location: Ministry of Health, Panama City.

Day 1: Introduction

1. Inauguration Ceremony
2. Description of workshop and meeting the participants
3. What do bacteria look like? How big are they?
4. Distribution of bacteria in water (homogeneous vs. heterogeneous distributions)
5. Drinking water sources and their possible contamination
6. Bacterial indicator systems (Which, Why & What they can do)
7. Description of three indicator systems: H₂S paper strip method and the P/A test

Day 2: The Hydrogen Sulphide (H₂S) Paper Strip test

1. Preparation of culture media and paper strips (practice) - emphasis on different types of test containers; interpretation of different positive test results (eg. 100 mL, 10 mL and 1 mL tests)
2. Preparation of paper strips vs. preparation of test bottles or tubes; small sample volume tests; methods to reduce dependency on regular laboratory visits
3. The H₂S test procedure (practice)

Day 3: The Presence-Absence (P/A) test

1. Preparation of P/A culture media - emphasis on different types of test containers; implications of different positive test results (eg. 100 mL vs. 20 mL tests)
2. Incubation and bacterial growth: incubation methods and temperature ranges
3. The P/A test (practice)
4. Alternatives for sterilizing water and prepared culture media
5. Quality control procedures and tests for confirming that contamination is from fecal origin

Day 4: Practice

1. Making a home-made incubator
2. Sample collection procedures (water taps, wells, buckets, streams, and chlorinated water samples)
3. Processing of water samples
4. Data recording
5. Alternatives available when test results indicate fecal contamination of water

Day 5: A Local Monitoring Program

1. Planning a local monitoring program
2. Reading and interpreting results from P/A, H₂S and Coliplate tests
3. General review, exam, and evaluation of workshop
4. Vignettes by groups of trainees on how to promote monitoring and control of water quality in their communities
5. Closing Ceremony

Appendix 3: Terms of Reference (TORs) for Consultancy Contract between IDRC and the World Bank:

A consultancy between 1 July 1997 and 31 January 1998 is needed to carry out the following specific tasks:

- (i) advise the Panamanian Ministry of Health (MINSAs) and the Canada Fund on the procurement of the necessary laboratory equipment, reagents and supplies for two training workshops and community WQM starter kits;
- (ii) liaise with the Panamanian coordination officer to ensure that the logistic arrangements are satisfactory and that the necessary materials, space and other tools will be available;
- (iii) carry out a 3-day training workshop with 20-30 officials from MINSAs, including 10-20 technicians from MINSAs's decentralized and central laboratories, to teach techniques in community-based water quality monitoring, emphasizing pragmatic, cost and efficiency issues as well as the importance of water quality to health;
- (iv) carry out a 5-day training workshop for a maximum of 30 representatives from community water committees and selected NGOs, in techniques for testing water quality and implementing local monitoring programs; and,
- (v) assist MINSAs and community technicians in the monitoring of local water quality testing programs in pilot communities and provision of technical support during the first 6 months following the training workshops.

Appendix 4: Travel Itinerary

First Visit: 14-28 July 1997 (Training Workshops)

IDRC team: Barney Dutka, Andrés Sánchez, and Juan Aurelio Millañir

14 July	Travel to Panama
15 July	Meetings MINSA, Canadian Embassy & preparations for first workshop
16-18 July	First workshop, MINSA personnel
19 July	Field visits to community water systems
20 July	Preparations for second workshop
21-25 July	Second workshop, Community water committees and NGOs
26 July	Rest
27 July	Travel from Panama
28 July	Report preparation

Second Visit: 11-20 January 1998 (Follow-up Community Visits)

IDRC team: Barney Dutka and Andrés Sánchez

11 Jan.	Travel Canada-Panama
12 Jan.	Planning of visits & setting of Agenda, meeting with FUNDIAH
13 Jan.	Meetings with MINSA, FUNDIAH & Canada Fund
14 Jan.	Field Visits: El Limón, La Santeña
15 Jan.	Field Visits: Las Pavas, La Florida, & travel to David, arriving after midnight
16 Jan.	Field Visits: Celmira, San Carlitos, & Caimito, and travel to Santiago
17 Jan.	Field Visits: Mariato, & travel to Panama City
18 Jan.	Report preparation
19 Jan.	Travel from Panama

Appendix 5: Workshop Participants

The participant's list for MINSA personnel has been requested but not yet received. The participant's list for the second workshop is attached.

**LIST OF RURAL COMMUNITIES
WORKSHOP ON WATER QUALITY MONITORING
CANADA - PANAMA**

<i>TOWN</i>	<i>COMMUNITY</i>	<i>PROVINCE</i>	<i>PARTICIPANT</i>
PRODESO/Pecará	Santiago	Veraguas	Hernán Soto
Pantano	Santa Fé	Veraguas	Pedro Abrego
Altos de Ortega	Santa Fé	Veraguas	Natividad Concepción
PRODESO	Río Piedra	Veraguas	Arcanio García
Altos de los Martínez	Santiago	Veraguas	Jesús Valdez
Chorrillo	San Francisco	Veraguas	Alejandro Toribio
PRODESO/Pecará	Santa Fé	Veraguas	Santiago Soto
PRODESO	Santiago	Veraguas	Aracely Achile
El Corcovado		Herrera	Candido Murrillo
	San Félix	Chiriquí	Minjo Gallejo
Enepita	Tolé	Chiriquí	Cayetano Marianos
COPROSA	Mariato/Montijo	Veraguas	Manuel González
Celmira Gariché	Bugaba	Chiriquí	Miriam Batista
Alto Bayano	Chepo	Panamá	José Flores
Caimito	Dolega	Chiriquí	Aniceto Castillo
San Carlitos	David	Chiriquí	Candido Cubilla
Ollas Arriba	Capira	Panamá Oeste	Luis Batista
Nazareno	Chorrera	Panamá Oeste	Carlos Bibarack
Las Pavas	Chorrera	Panamá Oeste	Ovial Corcho
			Ceferino González
El Limón	Capira	Panamá Oeste	Teodolinda de la Cruz
			Alfonso Rodríguez
Barriada la Santeña	El Espino/Chorrera	Panamá Oeste	Erick Escarriola
Buena Vista	Pacora	Panamá Este	Eliecer Ortega
La Florida	Capira	Panamá Oeste	José Morán
Altos de los Martínez	Santiago	Veraguas	Pacifico Madrid