# AQUAtox 2000

# International School Network on Water Toxicity

TECHNICAL REPORT
for IDRC Awards Unit and the
Ecosystem Approaches to Human Health Program Initiative

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# ACKNOWLEDGEMENTS

To all those that with patience and a smile guided,
supported, encouraged, inspired, motivated,
tolerated me and kept believing in me: THANK YOU!

You all know who you are!

Silvia

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# INTRODUCTION

This is the final technical report for my internship with the IDRC for the period July 1998 to September 1999, in which I worked with the Ecosystems Approaches to Human Health Program Initiative in the design, development, implementation and overall coordination of the activities related to the AQUAtox 2000: International School Network on Water Toxicity.

This report describes the objectives of the initiative, its design, its implementation. It also presents some of the achievements thus far, a brief summary of the rate of school participation and the media coverage the project has attracted. It also includes the voices and the images of the Ecuadorean, Mexican and Cuban AQUAtox 2000 schools which were visited. Students express their impressions, expectations and the meaning the project has to them. I highlight the initiatives and formats that each school has given to the project in their own settings. Finally, I provide some reflections and thoughts about my experience as a coordinator of the project.

# THE PROJECT: BACKGROUND

## *IDRC and Water research*

Access to safe drinking water is a basic human need that remains unmet for millions of people worldwide. According to the World Health Organization (WHO), more than 1.4 billion people around the world consume water that is unsafe because of contamination with potentially harmful microorganisms or toxic substances.

For many years, research and dissemination activities supported by IDRC have promoted innovative and cost-effective ways to ensure the safety of drinking waters in developing countries and remote communities around the world. Water testing techniques have been developed to allow the participation of communities in monitoring the quality of their own drinking waters. Local water testing has led to an increased awareness of the causes of contamination and helped promote more hygienic water handling practices. Projects have introduced reliable and simple monitoring techniques that serve as an early warning system to communities, allowing them to plan and implement remedial actions on their own. The latest chapter in these efforts was created by the IDRC program Ecosystem Approaches to Human Health (or Ecohealth for short).

## *From WaterTox to AQUAtox 2000*

In 1997 the Centre created the **WaterTox Network**, which is part of the *"Integrated Approaches to Safe Drinking Water"* project (003329). Composed by scientists from Argentina, Canada, Chile, Colombia, Costa Rica, India, Mexico and Ukraine, this network is engaged in applied research to develop a cost-effective alternative for assessing water toxicity of waters. The objective is to standardize and inter-calibrate a series of simple and reliable tests. This project responds to the necessity of countries in the South to carry out regular monitoring of raw and treated waters using simple techniques for water quality control. This holds especially true today when we face the increasing use of chemicals in human activities such as in industry and agriculture, all this coupled with the often lax enforcement of regulations.

The **AQUAtox 2000: International School Network on Water Toxicity** project is part of this larger initiative. The project was born to reach a wider audience through students around the world and demonstrate the importance of water quality monitoring and how it can be done with simple tools. In partnership with a number of organizations, the Centre created a network of young students 9 to 14 years of age to take part in an effort to measure water pollution around the world.

Through "hands-on," in-school experiments students see before their eyes the practical

contributions of scientific research to a more sustainable future. The network links young students and schools from different countries with scientific experts working in water quality laboratories in the North and the South.

## *OBJECTIVES OF AQUAtox 2000*

The project was designed to encourage the protection of the environment through applied environmental studies. More specifically, the objectives of this project are:

- to help students understand --through practical scientific experiments-- how important it is to protect water resources in their own communities and the world;
- to involve young students in thinking about environmental protection, sustainable, and health, as well as the social implications in the communities and the world;
- to develop and implement an electronic network of young student researchers, providing an international forum for dialogue about environmental issues and priorities;
- to give science teachers and students an opportunity to carry out a project that is practical, crosses scientific disciplines, and relates to the health of humans and ecosystems;
- to raise awareness among Canadians about the importance and use of research for development, and the role of IDRC in this endeavour.

This activity was conceptualized as a pilot project to last a year. In some cases it has been conducted as part of introductory science programs, and in other cases as an extracurricular activity for teachers and students who are committed to environmental sciences and research, as we will see in more detail in the case studies. Groups of students, under the guidance of their teachers or leaders of extracurricular scientific activities, have made use of bioassays to measure the toxicity of samples taken directly from their local environment.

The results of the experiments and any other activity related to the project are to be shared with all the network participants using an interactive web site designed and set up especially for this purpose. In this light, the project was aimed in principle at schools where students have access to the Internet. However, we have accommodated a number of schools that do not have access to computers and are doing amazing work. They send their results via regular mail. The only regrettable aspect of this is that these students do not have the opportunity to profit from directly exchanging and interacting with the other network participants. Nonetheless, they are participating in a project that has relevance to their localities.

# THE TOOLS: development of material

## THE TESTS

As mentioned above AQUAtox 2000 is part of IDRC's efforts to promote monitoring of water quality, and thus we wanted to replicate to some extent the exercise of WaterTox at the school level. We selected the following three bio-assays that make use of a relatively simple and inexpensive set of equipment, and are based on the way biological organisms react to a given treatment.

### *ONION BULB GERMINATION*

The test relies on the germination of the bulb of the common onion, *Allium sativa*. A series of six bulbs (about the size of small pearl onions) are placed over the test tubes containing the sample to be measured. One series is prepared with pure water, as a control sample. The bulbs are withdrawn from the test tube after 72 hours, and the length of their roots is measured with a metric ruler. The average root length from the test sample is compared with that of the control sample. Root growth inhibition is used as an index of toxicity.

### *GERMINATION OF LETTUCE SEEDS*

This test is similar to the preceding one. The bottoms of small shallow containers are covered with absorbent paper (paper towels, filter paper, etc.), moistened with the sample to be tested, or with pure water as a control sample. In each container, twenty lettuce seeds are deposited. At the end of 48-72 hours, the containers are opened, and the root growth from each seed is measured using a metric ruler. The average sample length is compared to that of the control seeds, and root growth inhibition is estimated and used as an index of toxicity. Despite the similarity between these two plant tests, the results in fact differ for several toxic compounds.

### *TOXIC EFFECT ON FRESH-WATER HYDRA*

Many fresh water organisms are highly sensitive to chemical pollutants, and several of these are used to measure water toxicity. This bio-assay uses the reaction of the freshwater hydra (*Hydra sp*) to toxic compounds as an index of water pollution. Hydra cultures are very easy to maintain, which makes them an especially useful organism. A stereo microscope is necessary to perform the test. The hydras are placed in groups of three in small plastic containers, and are observed every day for 96 hours. The hydra takes on highly specific characteristics (shapes) in the presence of toxic substances, and thus provides a very easy-to-assess index of toxicity.

The three bio-assays described above measure chemical pollution in water. As we know, however, water pollution often arises in the form of microbes or viruses. This is in fact a chronic and serious problem in many developing countries. IDRC has already investigated the problem of so-called "fecal" pollution and ways of measuring it. We believe it would be useful to add this measure of pollution to the work of the AQUAtox 2000 network, and to include a very simple test:

### *HYDROGEN SULPHIDE ($H_2S$)*

Microbiological contamination of fecal origin can be assessed by using "sentry" microorganisms that are normally present in the intestinal tract of vertebrates. These bacteria produce hydrogen sulfide (the gas with the odor of rotten eggs) as a by-product of its digestive process. In order to check for the presence of these sentry bacteria in water, we put it in contact with a strip of absorbent paper impregnated with a nutritive substance and an indicator that turns black upon contact with hydrogen sulphide. The test is performed in a sterilized glass bottle (for example, a fruit-drink bottle with a screw-on cap). The water sample (10 or 20 ml) is introduced into the bottle, and is then incubated at 32°C for 24-72 hours in order to allow the bacteria, if there are any, to grow and to tint the water black.

The original procedures for these tests were scientific protocols used in water quality laboratories. In order to be used by the students we had to adapt them to a school level with the assistance of and in consultation with the scientists that developed them as well as a curriculum consultant. We also drew upon the in-house technical expertise to develop the material. Since I was an integral part of the designing team, I had to take both theoretical and practical training to become conversant with the tests. The laboratories of the St. Lawrence River Institute in Cornwall and the Centre Saint-Laurent in Montreal lent their facilities and staff for my training. (See trip reports attached)

Once the tests were selected, we moved on to think about the most suitable vehicle to deliver the knowledge. We chose three main tools: an EXPERIMENTAL MANUAL, an EXPERIMENTAL KIT, and a WEB- SITE. The development of all the three tools was simultaneous as they were complementary parts of a whole. The project was designed to reach audiences that would have English, French and Spanish speaking, reading and writing capabilities, and thus the material is available in all three languages.
Before proceeding to the translation, the material for the experimental kit and the web would undergo many reviews by the collaborating scientists, the consultants, and the Centre experts. This made the development process three times as long. Later, the translated material had to be proof-read and carefully reviewed.

## *THE MANUAL*

While thinking about the experimental kit as one of the tools for the network, it became apparent that teachers and students would need training to effectively use the material, and that the tests on their own would not be sufficient to suit the interests of such a wide array of people and contexts. We thought that it is important to provide teachers with a flexible tool that could be adapted to the different subjects taught at school. We proposed activities that offer a number of learning opportunities relating to the scientific research process, environmental conservation and international relations. Teachers and extra-curricular activity leaders will be able to take advantage of many facets offered, including:

- **The Scientific Method**: designing an experiment, observation and recording of results, basic interpretation of experimental data, preparing an experiment report;
- **Botany**: germination of seeds and bulbs, plant growth, photosynthesis, sensitivity of plants to pollution;
- **Zoology:** the life cycle of an invertebrate (*Hydra*), of its food source (*Nauplia*), its feeding habits, reproduction, conservation, etc.
- **Microbiology**: the biology of *E. coli*, the concept of intestinal flora, the sentry organism, contamination of drinking water, bacteria culture, basic chemistry;
- **Ecology:** the ways in which water and the environment in general can become polluted by industrial and household wastes, the concept of acceptable levels of toxic compounds in the environment, measuring pollution, organizing laboratory work;
- **Statistics**: the basic concept of average values, biological variations, measurement error, intra-lab variation;
- **Communication**: organizing research results, presenting research results to peers, modern communication via electronic media, international exchanges, discussing collaborative project results electronically;
- **Geography & Development Issues**: distribution of the world's water resources, regional water and pollution characteristics, general geography, languages and cultures, and the variation in development and environmental concerns in different parts of the world.
- **Health:** drawing connections between water quality and health issues, understanding the impact of toxic contaminants on health, learning about prevention measures to avoid illnesses caused by toxic waters. In mining, agricultural, and industrial areas where the use, emission and unchecked disposal of chemicals increases the likelihood of toxic contamination of waters, these tests are especially relevant to monitor their quality. (For more details see manual appended)

In addition to the material on the tests, the manual brings information on diverse yet related topics, hints and facts about water issues around the world. Prior to the commencement of the project we requested environmental professionals and teachers in the science field to review the contents of the book and to provide us with comments. Their feedback was very positive and their comments were incorporated before the final print. However, we could

only consult with educators in Canada, even though we would have ideally liked to do similar consultations with educators from the South where the book was going to be used. Nonetheless, during the process of translation we had the opportunity to incorporate feedback provided by Centre's staff in Ottawa and from Latin America.

## *THE EXPERIMENTAL KIT*

In keeping with IDRC's spirit to transfer technologies which do not create new needs but rather address existing problems, we commissioned the design of a prototype kit containing the materials necessary for carrying out the tests with minimum cost to students and teachers. The design process involved the selection of appropriate material to be included in the kit, and finding the best way to pack it, considering that it had to be shipped to remote areas of the world. Several proposals were rejected due to economic considerations, and eventually we opted for a plastic container where the material was carefully packed to resist the rough handling during shipment. The list of materials according to the tests and the corresponding illustrations were included in the AQUAtox manual, see copy attached.

Each kit sent to the schools was equipped with sufficient material to perform 20 sets of experiments. We provided **all** the materials necessary to run the lettuce seed and $H_2S$ tests. By making these tests compulsory, we ensured that the waters are analysed for both chemical and bacteriological contamination. The running of the other two tests was contingent on the schools' ability to obtain the required resources. For instance, in the case of the Hydra test, it was necessary for the school to create the conditions for culturing the hydra and/or for them to have an association with a laboratory which could provide them at no cost. For schools in Canada, we gave them the option of requesting the hydra for their tests, as the Centre Saint-Laurent had offered to supply the necessary hydra for the tests in the country. For schools abroad, the WaterTox laboratories fulfilled this role whenever possible.

Onion bulbs, as the ones needed for the tests are only available in countries with cold and moderate climates due to the short planting season. In the South, given the longer growing season, onions are cultivated directly from seeds, and therefore are not readily available in bulb form. It was necessary for the schools to plan ahead in order to have the necessary bulbs. We considered supplying the bulbs from Canada, but we realized that it was an insurmountable task given the large amounts involved and the restrictions imposed to ship live plants across countries.

## *THE WEB-SITE*

The experimental manual and kit were complemented by a medium that would connect all the participants from around the world, the AQUAtox 2000 WEB-SITE. In partnership with

IDRC's UNGANISHA project, we commissioned the design and development of an trilingual interactive web-site for the project. The web-site is an important tool for the AQUAtox 2000 project. The web site acts as a home base where students, teachers, and scientists can access, post, and exchange information about water, health, and the state of the environment worldwide. Participants are also able to share the results of their experiments with other students around the world and discuss how water affects the quality of life.

Our web site address: **http://www.idrc.ca/aquatox**. The home-page gives the visitor the option to proceed in one of three languages: Spanish, English, or French. There are five sections featured on the web-site:

- **The Experimental Manual:** This section includes a copy of the manual with a step-by-step description on how to do the water tests and information that will assist you with the project.

- **The Bulletin Boards:** These enable participants to exchange information with other students, teachers, and scientists involved with AQUAtox 2000 by posting and reading messages. They can share knowledge and experiences about what's happening in the different schools around the world! Teachers have their own BBS, "teachers corner", where they are able to exchange teaching tips and more theoretical materials.

- **The Results Section:** In this section, participants can enter the results of their experiments. They can also access a map of the world that features each participating school and its country or region of the world. By pointing and clicking on the school of interest, one can get information about that particular school and the teachers and students involved. Each school has a profile with the respective results, so anyone can find out how the experiments are coming along in different parts of the world.

- **The Resources Page**: Which includes an interactive quiz and links to other Internet sites that deal with education and the environment, and other sources of related information. There is also a link to the scientific protocols that describe the original versions of the tests.

- **The What's New Page:** This section has several components: space for new announcements, for the submission of the month which features noteworthy student contributions (essays, pictures, drawings, etc), and the archives section which can hold a bank of images (photos) and drawings sent by participating schools.

The web-site and its components have not been utilized to the degree we expected, this is due to several factors. Access has been a factor in the under-utilization of the web-site. In some instances the schools have the computers and have e-mail but their access to windows-based programs as Netscape or MS Explorer is restricted. In other cases, the schools had to rely on third parties to have access to the Internet. This situation has led to

partnerships between the schools and non-educational institutions and/or NGOs.

## OUR PARTNERS AND COLLABORATORS

While international research and development are the Centre's strong points, it has had no experience in the area of school instruction. It is for this reason that the Centre sought to establish a solid partnership with agencies already involved in science teaching, in order to pursue this activity. The project AQUAtox 2000 received the support of many institutions and individuals throughout the various stages of its development and implementation. It was possible to profit from previously established associations and partnerships that the Centre has developed in the course of its institutional life. At the same time, the project provided an occasion to build new partnerships with entities that share the same concerns about water quality issues and health. Partners lent their support on different aspects of the project. For instance in technical and scientific aspects we have the assistance of the following persons:

**Technical Advisors**

- Mr. Barney Dutka, and Rodney McInnis from National Water Research Institute (NWRI), Environment Canada
- Dr. Syed Sattar, Professor, Faculty of Medicine, University of Ottawa
- Dr. Geirid Fiskesjö, Department of Genetics, University of Lund, Sweden
- Mr. Sylvain Trottier, and Dr. Christian Blaise, Centre Saint-Laurent, Environment Canada, Montreal
- The WaterTox team: Dr. Alicia Ronco (Argentina); Dr. Yolanda Pica G (Mexico); Dr. Luisa Castillo (Costa Rica); Dr. Victor Arkhipchuk (Ukraine); Dr. Jeff Ridal and Ms. Tracey Beauregard (Canada); Dr. R.C. Srivastava (India); Dr. Gabriela Castillo (Chile); Dr. Consuelo Díaz (Colombia)

**Web Site**

- Design and programming: Daniel Nash and June Pang;
- Design support: Unganisha Project, IDRC
- Maintenance of Cold-Fusion components: Kevin McCann

**Partnerships**:

In making AQUAtox 2000 a reality, we sought and obtained financial and in kind contributions from different organizations and professionals. Our major partners are listed below:

- **Centre for Research on Environmental Microbiology (CREM)** of the University of Ottawa - donated materials for the H2S kits.

- **National Water Research Institute (NWRI)** of Environment Canada - donated glassware and lab materials for all the kits.
- **Centre Saint-Laurent** of Environment Canada - donated the kits for the Canadian schools.
- **Fisher Scientific Ltd. (Canada)** - donated materials for the development of the prototype kit.
- **Earth Council of Canada** made a significant financial contribution for the training of NGO representatives working with disadvantaged youth in Rio de Janeiro, Brazil.
- **The Department of Foreign Affairs and International Trade for Canada** facilitated the distribution of the experimental kits to schools in participating countries.
- **Admiral Travel Agencies Ltd.** - donated the travel to Ottawa of the Canadian winners of the school draw;
- **Mr. Samuel Carlson** at the **World Bank** also lent a hand to ensure that the schools in Uganda receive their experimental kits and material.
- **Mr. Patrick Beaudin,** Director General, Société pour la promotion de la science et de la technologie (SPST), we thank his support of and collaboration in publicizing this project in science and teaching forums;
- **Dave Blackie, Alice Casselman,** and **Wendy Lalancette** who carefully reviewed and provided suggestions for improving the Teachers' Guide and AQUAtox Activity Book.
- The latest of our partners is the **Canadian Museum of Nature** who have come aboard of the team to lend their support and expertise to organize all the events for when the AQUAtox 2000 schools come to Ottawa in May 2000.
- Also we are in the process of developing a partnership with the **Biosphere of Environment Canada,** in Montreal to explore the possibility of forming a consortium to continue the life of the project beyond its pilot year.

**Failed attempts**

While AQUAtox 2000 has been successful in attracting sympathizers and supporters from many fronts, we have also experienced the disappointment of less successful attempts in search for co-funders. Efforts were directed approaching and negotiating with the National Capital Commission (Ottawa), Fisher-Canada, Rubbermaid - Canada, and the major Canadian airline carriers, the water companies, to name a few.

## IMPLEMENTATION OF THE PROJECT

We had initially planned to start AQUAtox 2000 in the Fall of 1998. However, the process of development proved to be more arduous and time-intensive than anticipated. And thus, after the launching in October 1998, we could only officially begin the project in April 1999 in most schools. The launching took place in the context of the International Conference Class, Laboratory , Industry and Cyberspace Conference organized by the SPST. This was

a forum for science, education, and industry player to meet and exchange views and news.

## *RECRUITMENT OF THE SCHOOLS*

We recognized early on that the success of the project depended heavily on the drive and enthusiasm of the teachers. We therefore decided to reach them first and ask them to obtain the necessary permission to carry out all the activities related to AQUAtox 2000. To recruit schools in Canada, we proceeded to contact Canadian teachers who had participated in the former Summer Institute Program supported by the Centre. This list had a very good regional representation so we could reach across Canada.

For the schools abroad, our first step was to ask the WaterTox participants to identify and invite schools to be part of the project. And in general, we also contacted a limited number of current and past recipients of IDRC grants to make the contact for us. Initially the recruitment moved slowly, but after the launching and due to the media coverage, the project gathered momentum and the requests and applications to be enrolled in it increased dramatically. The result was a very successful campaign that exceeded our target, we had initially planned to have 60 schools in the network, 20 in Canada and 40 abroad. However, given the favourable reception and welcome, we had to review our original plans to accommodate more schools in the network. At the moment, we have over 90 schools registered which represent 26 countries, and four continents. (See list in appendix 2)

While our recruits were targeted and invited to participate in the project, the school had to meet a set of terms and conditions in order to become part of the network. These are described in appendix 3.

## *THE INCENTIVES: A TRIP TO OTTAWA*

In the course of our consultations and communications with teachers and educational professionals we came to realize that for many teachers incorporating new projects meant additional work that many were not prepared to take on. It became really apparent that the success of the project depended heavily on the keen spirit of the teachers and our ability to build in incentives to make the project enticing to students beyond its research value. To that end we devised some incentives in the form of T-shirts which are given to the students when they make a noteworthy contribution, such as essays, poems, drawings or pictures. Also we established a series of draws through which students and teachers could come to Ottawa for a week. In consultation with the Centre's legal team, we established a set of rules which are detailed in appendix 1.

## *POSTING OF RESULTS TO DATE*

The project is mid-way in its implementation time-line, and thus far forty-two out of ninety schools have submitted results of their experiments onto the website. Gathering the material submitted by sixteen countries, our data base contains 208 datasheet records which are linked to 83 H2S, 18 Hydra, 105 Seed and 22 Onion tests .

Using the information that the data base yields, we are in the process of contacting the schools to follow up on their work. Special attention is being paid to those schools that have not posted any results. As a preliminary finding, it appears that complex situation in the Canadian Educational system is negatively affecting the project. For instance, of the thirty schools participating in Canada, ten teachers that initially committed themselves to carry out the project have either retired or moved to another school.

As for the schools abroad, through the visits made by IDRC staff, we gather that one of the problems the schools face is lack of access to the Internet to report their work.

### *THE WINNERS*

To date we have held two draws of a total of five planned for the year. The Lyceum 157 from the Ukraine was the first winner of a trip to Ottawa, Canada and Colegio Morelos from Mexico became a winner in the second draw.

Each winning school will be able to send one teacher and two students to Ottawa with all the expenses paid for by IDRC and the AQUAtox sponsors. In partnership with the Canadian Museum of Nature, the Centre is organizing a week-long series of activities to welcome and host five teachers and 10 students from around the world and Canada in the Spring of 2000.

## AQUAtox 2000 IN THE NEWS

The AQUAtox 2000 project has enjoyed and continues to enjoy good media coverage. Radio, television, printed and electronic media have featured the project at various points in its implementation. The natural consequence of this is that AQUAtox 2000 has gained both presence and popularity beyond the confines of the classroom, as politicians, scientists, environmental agencies have been attracted to it. What follows is a chronological list with the titles of the articles and names of the sources who have covered the progress of the project. Diane Hardy, the head of Media Relations for IDRC has played an important role in bringing the project to the media's eye.

**YEAR 1998**

- Date: October 18, 1998
  Title: LE SYMPOSIUM CLIC : COMMENT INTÉRESSER LES JEUNES À LA SCIENCE ET À LA TECHNOLOGIE
  Source: **Radio Canada - French**
  Author: Pauline Vanasse
  URL: http://radio-canada.ca/lumiere/arch1098.htm

- Date: October 19, 1998
  Title: IDRC LAUNCHES AQUATOX 2000
  Source: **IDRC - MEDIA**
  Author: Diane Hardy
  URL: http://www.crdi.ca/media/Aquatox_e.html

- Date: 6 octobre 1999
  Title: AQUAtox 2000: Quand l'eau donne le goût de la science
  Source: **Interface, septembre-octobre 1999**
  Author: Laurent Fontaine
  URL: http://www.idrc.ca/Media/AquatoxCSM.html

- Date: October 19, 1998
  Title: Interview avec Laurent Lavigne, CBC Radio News
  Source: **CBC - IDRC Media Relations**

- Date: October 19, 1998
  Title: Reportage au Petit Journal de Télé Quatre Saisons
  Source: **IDRC Media Relations Archives**

- Date: October 19, 1998
  Title: Reportage au CFCF-TV Montréal
  Source: **IDRC Media Relations Archives**

- Date: October 22, 1998
  Title: School Children Around the World to Examine State of Planet's Water Supply
  Source: **IDRC REPORTS**
  Author: IDRC
  URL: http://www.idrc.ca/reports/read_article_english.cfm?article_num=287

**YEAR 1999**

- Date: February 05, 1999
  Title: Students tread global waters
  Source: **Capital News at Carleton University**
  Author: Carmen Crinion
  URL: http://www.carleton.ca/Capital_News/05021999/f4.htm

- Date: February 10, 1999
  Title: Editor' Picks
  Source: **ARC Currents: Newsletter of Art, Research and Curriculum Associates,**
  Author: Editor: Jeff Abramson

- Date: March 19, 1999
  Title: **Gilles in a interview for CBAF-Bonjour, IPE**
  Source: Radio Canada - IPE (tape)
  Author: Radio Canada

- Date: Mars 24, 1999
  Title: AQUATOX 2000
  Source: **Radio ONU - Perspectives Internationales**
  Author: Nicole Kékeh and Danny F. Chabot

- Date: March 29, 1999
  Title: Aquatox 2000: a worldwide network to study water pollution
  Source: **Indev: Development News**
  Author: Indev
  URL: http://www.indev.org/news/5march99.html

- Date: Spring 1999
  Title: Testing the waters
  Source: **YES Mag: Canada's Science Magazine for Kids**
  Author: Carmen Crinion

- Date: April 1, 1999
  Title: Le programme Watertox - essais effectuées sur l'eau dans le monde
  Source: **Science et Environnement No. 11 Mars-Avril 1999**
  Author: Science et Environnement

- Date: April 6, 1999
  Title: IDRC in the News; Aquatox 2000

Source: **Radio Canada International**
Author: Radio Canada International
URL: http://www.rcinet.ca/pages/rci_prog.asp

- Date: 11 avril 1999
  Title: AQUATOX 2000 : DE JEUNES SCIENTIFIQUES POUR DE L'EAU PROPRE, PROPRE, PROPRE
  Source: **Radio Canada**
  Author: Joane Arcand
  URL: http://radio-canada.ca/lumiere/arch0499.htm#11/04/99

- Date: April 19, 1999
  Title: Aquatox 2000: Worldwide Schools Network on Water
  Source: **Source Weekly, a journal of the water Supply and sanitation collaborative council. No. 14-15**
  Author: Source
  URL: http://www.wsscc.org/source/weekly/99145.html

- Date: April 29, 1999
  Title: AQUAtox 2000, Programme
  Source: **Eau, qualité, vérification, Nunavut, circonscription, écoles, participation, déc. art. 31, 14478(218:1405**
  Author: Mme Eleni Bakopanos (Ahuntsic, Lib.)
  URL: http://www.parl.gc.ca/36/1/parlbus/chambus/house/debates/indexf/a-36-1_4-f.html

- Date: April 29, 1999
  Title: AQUATOX 2000
  Source: **Eau, qualité, vérification, Nunavut, circonscription, écoles, participation, déc. art. 31, 14478**
  Author: Mrs. Nancy Karetak-Lindell (Nunavut, Lib.)
  URL: http://www.parl.gc.ca/36/1/parlbus/chambus/house/debates/218_1999-04-29/han218_1405-f.htm#LINK14

# CASE STUDIES: ECUADOR, MEXICO and CUBA

In an attempt to document some of the events and activities schools have organized around the AQUAtox 2000 project, we decided to visit three countries: Ecuador, Mexico and Cuba. Each country presents situations and aspects that are particular to their context, but they all have many similarities as it will be shown below. I will present the case studies in the order they were visited.

Funding constraints do not allow us to visit each location where AQUAtox is being implemented. However, the documented case studies serve to illustrate the impact the project can have in some countries.

## *ECUADOR*

Ecuador is located in South America, is bounded by Colombia to the North, Peru to the East and South, and to the West with the Pacific Ocean. It has a population of about 11 million people. As a developing country, Ecuador is afflicted by many problems, including poor water quality and supply. Most cities have chlorine treated water, but their monitoring programs are not sufficient to ensure the quality of the water beyond the conventional treatments. Even though issues of water quality do worry the people in Ecuador, there is very little that they can do about it, given the lack of access to conventional forms and equipment of water monitoring which are costly. In many cases, local authorities give less priority to such issues in the face of a constraining budget. The tests used in the AQUAtox project offer a real alternative in these situations, not only because they can be carried out by students, but also because they offer an inexpensive and reliable way to monitor the local waters.

The two schools are participating in Ecuador are located in the Andes, in the city of Ibarra (100,000 inhabitants). Both schools have organized a series of activities related to the AQUAtox project. In the following pages I will provide a brief description of the context where the schools are conducting their work, including an account of the events organized during my visit.

Both schools were very receptive to the project when I first approached them. Like the rest of schools worldwide, they received their kits from the Canadian Embassy in the country. Each school has a different set up and format to conduct the experiments, since the ages of the students differ.

For instance, the **Colegio Pensionado Mixto "Atahualpa"**, is a secondary school. It has enlisted twenty-five students of the same grade, from two different classes. The average age of the students is 13, and they all live in the city. The highschool caters mostly the middle-class and it is known for providing a very high level of teaching. The group of sutdents

works under the direct supervision and guidance of Ms. Soraya Jaramillo who is the science teacher, but also has the support of other school staff, such as Dr. Grace Vinueza, the school's teaching advisor, Mr. Fernando Coba, school's principal, Mr. Jorge Villaroel, pedagogic advisor to the school, Mr. Ulpiano Rosero, mathematics teacher, Ms. Silvia Arciniegas, language teacher and Mr. Fausto Villena the school's computer technician.

This group of teachers which meets regularly to discuss and organize activities in many areas. They met to plan the activities the school will carry out in the AQUAtox 2000 project. Before proceeding to conduct the experiments, the school discussed what type of water they should focus on, and the area of the city they would sample from. They chose to

sample drinking water as they considered that this water has more direct impact on their health. They decided to concentrate on two peripheral neighbourhoods, as they receive their water from a different water main as the city in general. These are El Ejido, a fast growing neighbourhood located in the South of the city, and San José de Chorlaví, a relatively new barrio located in the West end of the city where an old Hacienda used to be.

Carla Cevallos (student) and Soraya Jaramillo (teacher)

The school is equipped with a computer laboratory. The students and the teacher have fitted a room for the AQUAtox experiments. The parents are very supportive of any initiative that proves to be innovative and interesting, and thus they have provided and continue to provide the students with what they need to conduct the experiments. For instance, they contribute to cover the costs of the field trips for sampling, provide the water needed for the tests. The local University provides them with access to the Internet both to post results and to send and receive messages.

Up to the time of the visit the school had performed two series of tests, including, the lettuce seed, the onion, and the H2S. They have prepared and applied a community survey to gather information from the residents of the site where the samples were taken. With the guidance of their teachers the students ran the tests and documented some information about the conditions of the environment surrounding the communities. Using the information from the tests and the surveys, the school prepared a report to be distributed to the residents from the barrios, the water committees, the School Board, the water authorities for the city and the parents and school at large. (See copy in appendix 4)

*The VISIT: Highlights*

In August 30 and 31 1999, the school organized a series of activities which were captured in pictures for the documenting of the project. These included:

- Interview with the teacher and photographer to set out the agenda of activities
- Visit to their facilities: classrooms, computer lab and the science lab set up for AQUAtox
- Open house and press conference to present the results of their tests to the public
- Field trip to collect samples for demonstration of tests procedures
- meeting with the students and school working team to interview and gather their impressions of the project
- photo sessions with photographer contracted by the Centre

Darío Chico (student) Observing the test he was responsible for

Carla Cevallos, Soraya Jaramillo (teacher), Ximena Larco, Natalie Yépez and Silvia Caicedo - interview

"The students have adopted the tests as if they were their pet or even children, they care for them and are willing to sacrifice their afternoons to come to the school to monitor the experiments," narrated to me Dr. Vinueza, as she gave me her impressions of the project.

The interviews revealed many aspects of their impressions and experience with the experiments and what they had learned. For the students active learning has more lasting consequences, as I gathered from what a student told me.

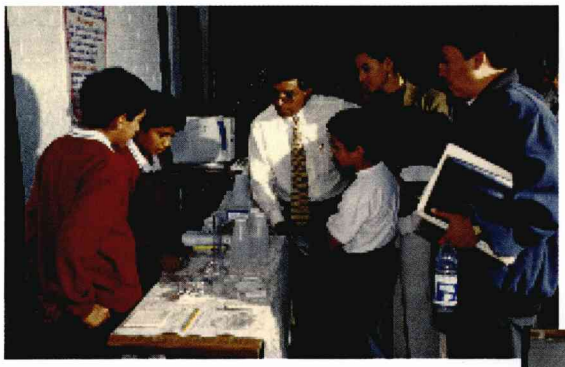
> I did not know that the tap water could have so many pollutants even though it looks very clean. It is an opportunity to talk to the mayor of the city and to tell him that we need to clean the water better. (Carla Cevallos, student).

The students find the project really exciting, and as I mentioned earlier they decided to tests the drinking water of two barrios.

> Kids loved the project because it gives them the chance to do field work and have activities, to leave the classroom. You know, kids do not like being in rooms all the time. Also it gave them something else to do in the afternoons, extra reason to come to school and check the growth of the seeds and onions. The experiments came to be like kids to them, they would nourish and care very much for them. (Dr. G. Vinueza, teaching advisor)

During my visit the school was on official summer holidays, however the Ms. Jaramillo kindly agreed to organize the open house and related activities with the students so we could have the opportunity to document their work. She could only get a hold of a few of the students working in the AQUAtox project: Carla Cevallos, Ximena Larco, Natalie Yépez, Jorge Navas, Juan Manuel Rosero, Dario Chico, Milton Proaño, Alex Almeida, Evelyn Viana, Cristian Guevara, Vanesa Acosta, Mauricio Cervantes, José Luna and Mayra Godoy.

# AQUAtox 2000 in the public eye



Mr. Luis Galeano, (Chorlaví water committee), Mr. Narcizo Tadeo (pump operator)Mr. Ulpiano Rosero (teacher), Mr. Luis Enriquez, and Mr. Ramiro Estevez (representatives of the water utility company) discussing the tests

The people in the barrios were generally very receptive and showed a lot of interest in knowing what information the tests would yield about the water they drink daily.

Cristian Guevara explains how the incubator works to Mr. Galeano (Chorlaví water committee president)

The students also found that people did not know much about the source of their waters and their quality. For instance, a lady from the Barrio El Ejido de Caranqui told me that thanks to the work that the kids are doing she realized and

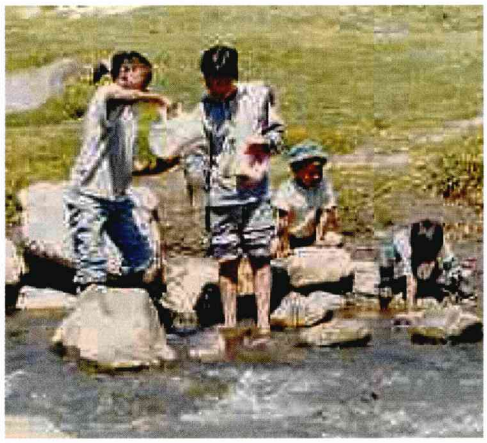
learned that her water was not treated and she could also make the connection between common ailments and the quality of the water. She was really happy to see the kids interested in water issues and she was especially happy because she could use the information given to her by the school to put pressure on the water authorities to improve the water system. The Open House was the opportunity to inform the city water authorities of the tests. There was a lot of enthusiasm to see the experiments and especially the results of the H2S test, as it gives clear results of faecal contamination in the water. The water authorities in attendance expressed a lot of interest in following up the progress of the project. They also enquired about the possibility to do this at city level in much larges scale. I sent the call for proposals made by IDRC to implement WaterTox at municipal level. And in the interim, they agreed to take tests of the reservoir tanks and in some strategic points of the water distribution system.

The results of the school tests showed that one of the two barrios was not receiving really potable water. This was the same barrio which received piped untreated water. We talked to the water authorities about this and they explained that since that section of the city had grown too fast in the last 10 years, they had concentrated in providing water which was done by simply piping a stream as they lacked the budget to provide treated water. Many residents were not aware of this fact, and drank the water without boiling it or treating it in any other way. The authorities publicly recommended residents, not only in the barrio affected but to everyone in the city, to boil the water prior to consumption as they could not guarantee the quality of the water beyond what was considered the urban perimeter.

Both the authorities and the teachers view the project as a great vehicle to raise awareness among kids and through kids to the rest of the community. Kids are seen as social awareness advocates and stewards of the environment.

For the teachers in particular, the project came at a moment in which they were making a transition to a more hands-on and interdisciplinary approach to teaching. Each teacher collaborates according to their discipline. For instance the math teacher uses the opportunity to emphasize or to teach anew the principles of averages, and issues of values, statistical rules, etc. The language teacher also plays a role in facilitating the development of communication and presentation skills. In short, the school has utilized the project in all its potential very much in line with the ideas it was initially conceived. The kids learned about environmental issues, that enable them to witness with their own eyes the reaction of nature and water.

# The Outings to sample the waters of the city



The second participant school in Ecuador is **Escuela AfredoAlbuja Galindo**, an elementary school located in a relatively new neighbourhood. This school is sponsored and administered by the local municipality through a cooperation agreement with the French government. The school caters to students who have a working class background.

Founded only a few years ago, the school has gained recognition for their distinctive approach to teaching. The students that participate in AQUAtox come from different classes, grades five and six, and their age average is 10. Ms. Anita Cartagena and Ms. Dolores Males are the two teachers who lead the group of students in their experiments and related activities. The students are: Yadira Vallejo, Fernando Jácome, Roberth Ortega, José Luis Ortiz, Janina Garzón, Evelyn Ochoa, Katherine Calero, Verónica Males, and Washington Ponce. The school's principal is also involved in the project, but in general the teachers carry out the work with the students in the afternoons. They access the internet at the computers of the local municipality, the authorities view this school as a model they want to replicate.

This school has devoted one room for the project and in it they have set up the tables for working on the tests as they do not have a science laboratory. The classroom walls display a series of card-boards with the instructions and procedures of the tests which have been prepared to facilitate the access and reading. They have run many tests, four series of tests using the lettuce and the H2S. The AQUAtox group has a balanced number of girls and boys, who work side by side to protect the environment. All the students received copies of the manual for their use in the experiments.

Roberth Ortega, Yadira Vallejo, Janina Garzón, Evelyn Ochoa, José Luis Ortiz running the tests

This school focussed their experiments on waters of different rivers, streams and ponds in the city. Ms. Cartagena explained that "these waters are the ones that we eventually drink and are used for irrigation of vegetables we consume every day, and therefore it is important to know the quality of these waters." They are aware of the limited capacity of the water utility company to provide clean and safe water and in this way they can alert the company to pay attention to specific places in the city. Especially as they take samples from places that disadvantaged people still use this water for washing clothes and dishes, and in

some cases to drink.

Much in the same fashion as the other school, we held meetings during my visit to see the school and to meet the teachers in charge of the project. We organized the following activities:

- Interview with the teacher and photographer to set out the agenda of activities
- Visit to their facilities: classrooms, computer lab and the science lab set up for AQUAtox
- Open house and press conference to present the results of their tests to the public
- Meeting with the students and school working team to interview and gather their impressions of the project
- Photo sessions with photographer contracted by the Centre

*Highlights of the visit*

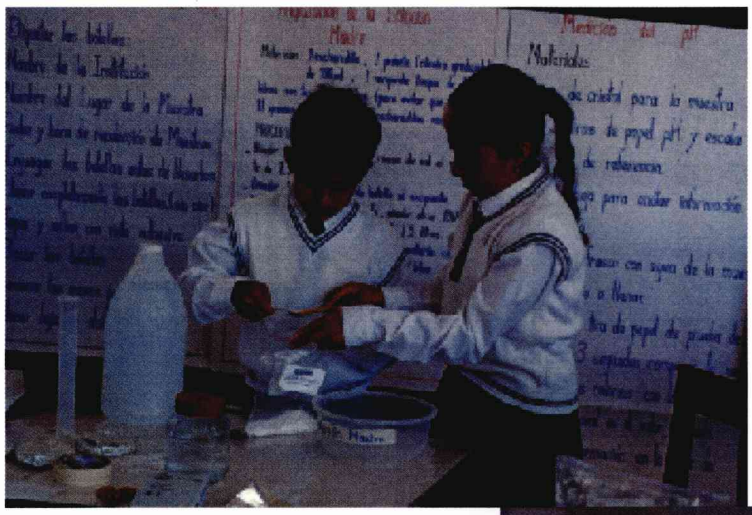
For the teachers, who did not have a science background, it was a challenge to first learn and later teach the students the procedures for the tests. Some parents are also involved and supportive of the project, they have provided the transport to the sampling sites.

Students sampling in the Tahuando river

They have sampled various sites within the city, as it has a very rich watershed. Two rivers run through the city and also there are sources of water with mineral deposits that in the past were used for recreational and healing purposes. Nowadays, most of these places are located at the heart of fast developing neighbourhoods, and very often they have become foci of disease.

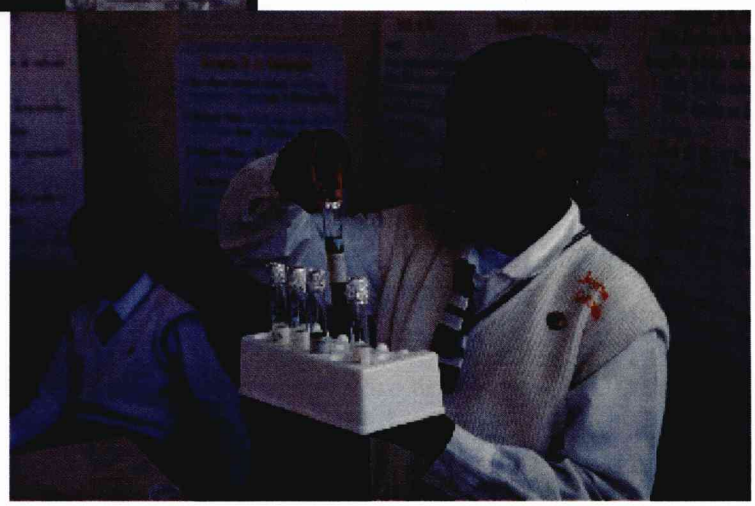
"Sampling and doing field work is a freeing activity for them, they can see nature more closely", says Ms. Males. The students love the project and are very proud of it. They have made various presentations to the public, they participated in a city-wide Open House organized by the municipality. We did not have the opportunity to make a field trip, but they had documented their trip very well, as we can see below.

The students are quite comfortable with public speaking and according to their teachers this has been greatly improved by the opportunity that the project has created. It is the first project of this nature, that combines effectively theory and practice of environmental studies, Ms. Cartagena told me.



Fernando Jacome and Yadira Vallejo (left)

Janina Garzón (below)



The students demonstrated thorough knowledge of the procedures and confidently performed the tests in front of the public attending their Open house and press conference.

The teachers praised the project both for its format, and presentation, especially since for many of them it represented the first opportunity to teach environmental studies and all related issues in a practical manner and yet keeping it both exciting and interesting to the students. Despite their limited access to the internet, they value greatly the opportunity to interact in some degree with schools of other countries which are engaged in the same exercise of monitoring and protection of their waters.

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## *MEXICO*

Mexico is located in North America, has land boundaries with USA to the North, to the South with Belize and Guatemala, the Atlantic Ocean to the East and the Pacific Ocean to the West. It has an estimated population of 100,294,036 (CIA, July 1999 est.). As an middle-income country it has a very good infrastructure, nonetheless it still faces the problems of many countries in the South. The drinking water in Mexico still does not meet the quality standards of WHO, even though it is treated in most cities. As in Ecuador, chlorination is the most common treatment and the existing monitoring programs do not guarantee the quality of the water. Local authorities cannot (or are not willing to) make water quality a priority due to the high prices of conventional monitoring.

Nonetheless, Mexico invests in water research and development of technologies. One leading institution in this area is the Instituto Mexicano de Tecnología del Agua (IMTA). Dr. Yolanda Pica Granados, who works at IMTA is one of the scientists participating in the WaterTox project, and she is also co-ordinating the activities of the AQUAtox 2000 project in Mexico. She identified the schools to participate in AQUAtox, and she is the main link between the schools, IMTA and IDRC.

Three Mexican schools participate in the AQUAtox network, two are located in Cuernavaca, in the state of Morelos and the third one is in the city of Queretaro, in the state of Queretaro. Cuernavaca, known as the city of "eternal spring", has a population of a bout 500,000 inhabitants. It is located in a very rainy part of the country, and it has a watershed system affected by the rapid growth of industry. This is the setting where IMTA and two of the schools work on the AQUAtox project. The two schools are different in their organizational format, institutional life and in their approach to the project. I will first present Colegio Morelos, then I will describe Instituto para las Ciencias, Artes y la Imaginación (ICAI), and the I will move to Queretaro.

The **Colegio Morelos de Cuernavaca** is an institution with 30 years of history in education in Cuernavaca. It offers instruction to students of 1 year of age up to college level. It has a student population of more than 2000. This long institutional life affords the school a well equipped structure, and a ratio teacher-students of 1 to 30. The school has several science and computer laboratories, and access to the internet.

Ms. Cecilia Frias and Ms. Beatriz Villalva, both of them science teachers, Chemistry and Biology respectively, are in charge of the AQUAtox and the related activities. They enlisted ten students from grades seven and eight, whose age averages 13. The students come from various class groups and thus it is their responsibility to make up for missed classes if these coincide with the activities of the project. The research team in composed by Carlos González R., Jans Huesca N., Mirelle Rodel, Fernanda Corrales, Orlando Valle, Daniela Lozano, Rubén Bahena, Guillermo Galicia, Gerardo Villalva, Carla Gálvez.

The group works closely with IMTA staff, they collect their samples from the same places as IMTA scientists. The students often visit the institute's facilities, they received training on the tests procedures there. Their focus is environmental waters in the rivers Cuautla and Ayala that are located close to some factories and a tannery. They are interested in these waters because these are upstream of many farms that use the rivers for irrigation. The farmers are interested in the results of the tests. To date they have done seven series of tests including the hydra, lettuce seed and H2S.

## *Highlights of the Visit*

Dr. Yolanda Pica (IMTA), Mr. David Mawbray, and Carla Gálvez (student)

In September 13, I visited their school to document their work and to give the school the opportunity to ask questions about the project. We had a meeting with the students where they explained why they are part of the project and what they like most about it.
Then, the students did a demonstration of the procedures of the tests, and granted interviews to Mr. David Mawbray, a camera-person hired by the Centre to document the visit. After the photo session and interviews we met with the teachers in charge of AQUAtox, the school Mr Miguel Angel Valle principal and other teachers, also present were Dr. Pica, Gisele Trujillo and Homero Hernández from IMTA.

The students and teachers were very pleased to receive our visit. For them this was an opportunity to express how much they liked the project. There was a sense of ownership in the way the students spoke about the project. For them, this project is special because it is different from the lab project they usually do. "It is great because we get to go to the field to collect samples and also we have to set up the experiment, it is different from the rest of lab exercises where everything is provided, material and reagents." (Carla Gálvez, student)

They remarked that thanks to AQUATox they have become more aware of the bad quality of water in Mexico and the little work done by the authorities. What surprised most of them was the realization that crystal clear water does not mean safe water. I felt that the level of awareness and concern was really high in the students, when they expressed worries for the type of water their grand-children will inherit.

Daniela Lozano (left)

Orlando Valle, Rubén Baehna and Jans Huesca (below)

In the lab they followed the procedures in thorough manner, and answered questions with much confidence which it is only evidence of a real ownership of the project. They feel proud that they handle scientific concepts and the scientific process even if they do not intend to pursue a scientific career. These are skills that can be used in real life all the time.

The teachers love the opportunity to participate in this project as it gives them a chance to connect with others and exchange information about similar or different problems faced by the participants. For Ms. Frias, one of the teachers, the project gave her the chance to go out in field with her students for the first time. As she put it, "I felt really lucky to have the opportunity to participate in this project, it is something completely different from what I have done in my 23 years of teaching". She and her teammate would like to take the project out of the school. During the meeting, ideas emerged to draw an action plan in conjunction with IMTA to approach the water authorities, and the local branch of the Secretaría de Educación Pública (SEP) a government agency/portfolio in charge of

education in the country.

The **Instituto para Ciencias, Artes, y Imaginación (ICAI)** is a special private school with 100 students, that emphasizes individual learning/teaching methods. Ms. Leonor González, Mr. Gerardo Gómez (teachers) and Ms. Ana Isabel León (director) are the guides for the AQUAtox project. The group of students is in the same class, and their age is about 13 on average. The activities related to the AQUAtox project have been inscribed into a larger project the school is carrying out in Anenecuilco, a small farming community located outside Cuernavaca. The school has a small computer lab and has fitted a classroom for the experiments.

The school works with the community in a project to rescue the history and past of the place. The community is the birthplace of Emiliano Zapata, the revolutionary leader who championed the cause for the landless peasants, which gives it historical importance. To date, the school has performed two series of tests with the lettuce in addition to the geographical survey of the region, worked with community groups on parameters for the project, measured water contamination using the AQUAtox test kit, and reported back to the community including intervention suggestions and training on how the locals could use the tests in their homes.

The residents of Anenecuilco are very receptive of the work of the school, especially because the students are sampling the water the farmers use for irrigation. They have focussed on the two rivers Cuautla and Ayala that the locals believe has problems of pollution. As mentioned earlier, the factories and the tannery deposit their effluents onto the rivers. There is a strong bad smell in the water by the tannery which for the locals is the most clear evidence of pollution in the water.

*Highlights of the Visit*

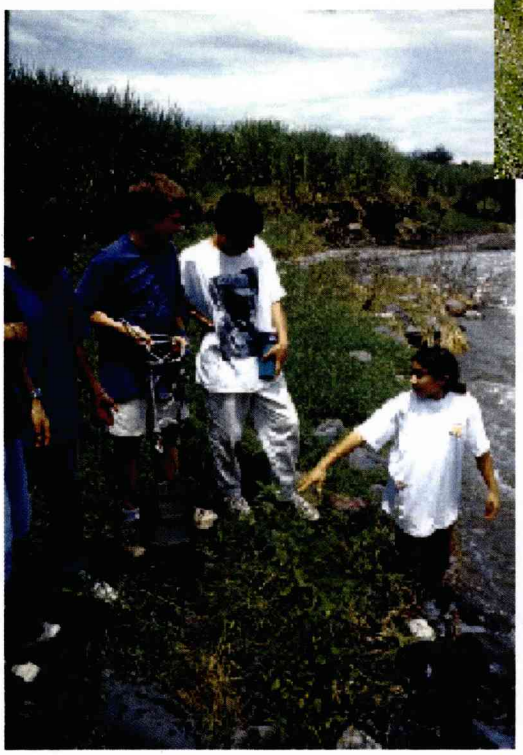
During the visit, the school organized a series of activities including a presentation of their work in a session where we could interview the students and the teachers. They also granted interviews to Mr. Mawbray for IDRC. We made a field trip to visit the community and took water samples. We had the opportunity to meet the community leaders and see the students interact with them. Together they discussed where they would take the samples from, this was done in light of concerns brought forth by the farmers. They needed to know the level of contamination that the waters have this season. It had rained heavily and some of the waters were being re-routed to allow the cleaning of the irrigation canals.

After the meeting and the discussion about the sampling sites, the local leaders guided the whole group to the sites.

# ICAI in Anenecuilco

Homero henández (IMTA), Gerardo Gómez, Ana León Salvador Varo (Comisiado Ejidal Anenecuilco), a student and other leaders

The students, the local leaders and teachers at one of the sampling sites



Photos: Silvia Caicedo

The visit to the community and the field trip provided a great opportunity to interview the community leaders and get their opinions about the project. Mr. Lucino Luna, one of the leaders who is the main link between the community and the school, told me that the project is very important as it allows them to monitor their water. He expressed that he trusted the work that the kids are doing as they act very professionally.

> The problem they are dealing with is big, and one has to have faith in the work they are doing. We do not have the solution, and perhaps the students can help us fight the contamination and recover the paradise we have lost! (Lucino Luna, resident of Anenecuilco)

The children found the project exciting as they can work directly with the community on something that is important to the community. "We do not live here, but we are happy to help the community to monitor the water and to find solutions to the problems of pollution they face." (Marisol Melessio, student). The community and the school hope to continue to work together on the issues and find solutions, like talking to the people in the tannery to treat the water before depositing it in the river.

The watershed they sample is the confluence of two rivers, in one of which two factories and the tannery deposit their untreated waste waters. The schools report that the factory has a water treatment plant which is required by law. Yet, one of the students said that the tannery wastewater outflow is greater than the amount the plant can **really** treat.

Ms. León enquired about alternatives to the use of fertilizers and especially to pesticides as one of the measures to implement to address the issues of pollution in addition to those created by the factories. The farmers on the other hand prefer the use of pesticides or herbicides as it is economically more efficient for them than to hire people. Both groups are discussing alternatives that make sense to them. This group has been working independently from IMTA, and because of that they had moved more slowly. However, this will change as they will try to coordinate their action with those of IMTA and Colegio Morelos in the future.

The **Escuela de Biologia (U niversidad Autónoma Queretaro)** is another coordination centre for AQUAtox in Mexico. This group is based in Queretaro, 2 hours north of Mexico City, and it runs the project through an elementary school **Escuela Anglo-Mexicano**, and with first year university students. Dr. Marco Antonio Sánchez and Dr. Guadalupe Malda (university professors) guide the activities of the project and coordinate their field trips with the school. They have linked their work in AQUAtox to the environmental education program which the university offers to the schools. They have a centre for environmental interpretation. All their activities are inscribed within the program of extension and community service that the university has in the city of Querétaro. Unfortunately, my trip coincided with the celebrations of te national holiday in Mexico and therefore I could not meet with the students in school in Querétaro.

In general, teachers expressed their concern with what they called the "feeling of disempowerment" (sentimiemto de impotencia) that the discovery of problems can have if no actions can be taken to address them. Dr. Pica organized a lunch to give the teachers the opportunity to meet informally. During this meeting their teachers exchanged impressions, ideas and concerns as to "what to do next". Some mentioned the need to device mechanisms and avenues of action to start wider programs of monitoring and actions to address the problems. Dr. Pica suggested to make a plan to harness the technological expertise of the IMTA, and the energy and enthusiasm of the students, the interest of the residents affected by the contamination and create a team of water protection. We mentioned the other possibilities to address problems that exist, like the Modules for Monitoring Water Quality, as well as the Call for proposals to do similar work with Municipalities.

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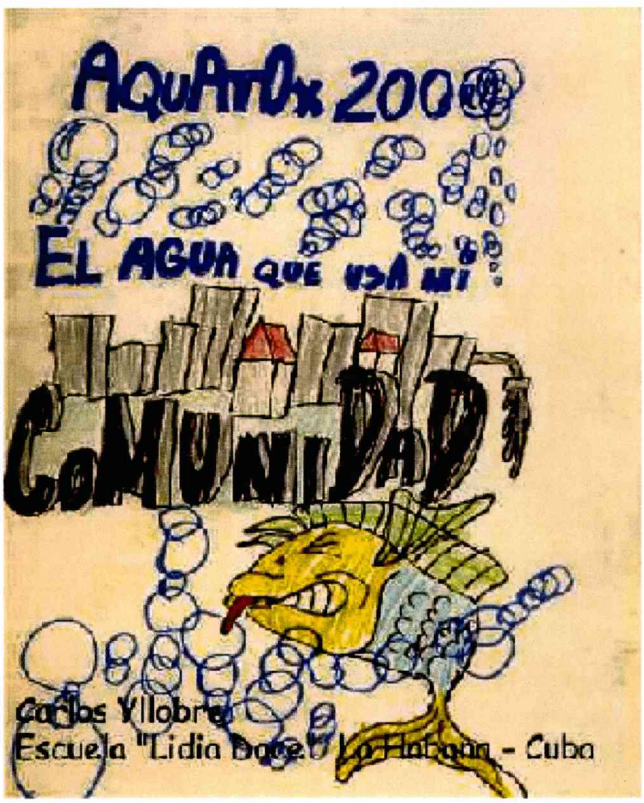
*CUBA*

Cuba, the largest of the Caribbean islands, has a population of about 11 million people. In recent years, Cuba has faced a series of crises which have affected its infrastructure and its ability to provide public health and other services efficiently, safe drinking water included. Most cities and urban centres in Cuba have access to chlorine treated water, but monitoring programs are not sufficient to ensure the quality of the water beyond the minimal conventional treatments. Like in most developing countries, even though issues of water quality do worry the local people, there is very little that they can do about it, given the lack of access to sophisticated and costly conventional forms and equipment of water monitoring. In their efforts to find alternative solutions to problems of water quality, the Cuban government through the Instituto Nacional de Higiene, Epidiemiología y Microbiología (INHEM) is implementing a project with IDRC's support in the city of Santiago de Cuba and in Havana.

INHEM staff have included in their activities the AQUAtox project. They identified the participating schools and have assigned a two-person team to lead and supervise the work of the schools. Ms. Marina Torres and Ms. Caridad Cumbá are the coordinators of the project and the main link between the schools, INHEM and the rest of the AQUAtox participants. INHEM has organized activities with the two schools to stimulate their enthusiasm and interest in the project. For instance, they organized a contest in which the students were asked to write compositions, poems, and drawings. The creativity of the students was manifested and translated into amazing work. The students received copies of sections of the manual and additional material dealing with issues of water produced by INHEM.




In addition to technical guidance, the institute also offers its facilities to assist the school in the most technical aspects of the tests' procedure such as sterilization and preparation of the H2S test tubes, and donate the waters for the control tests.

They have also organized recognizance field trips as well as visits to the water treatment plant in Havana. They are linking the project to the activities organized by UNICEF for El Día

Interamericano del Agua which this year had dedicated to the theme "El Derecho al Agua Potable para todos los Niños" (The Children's Right to Safe Drinking Water). Also, their activities are part of the efforts the city has organized to save and rescue the Armendares river in the "Salvemos el Armendares" project.

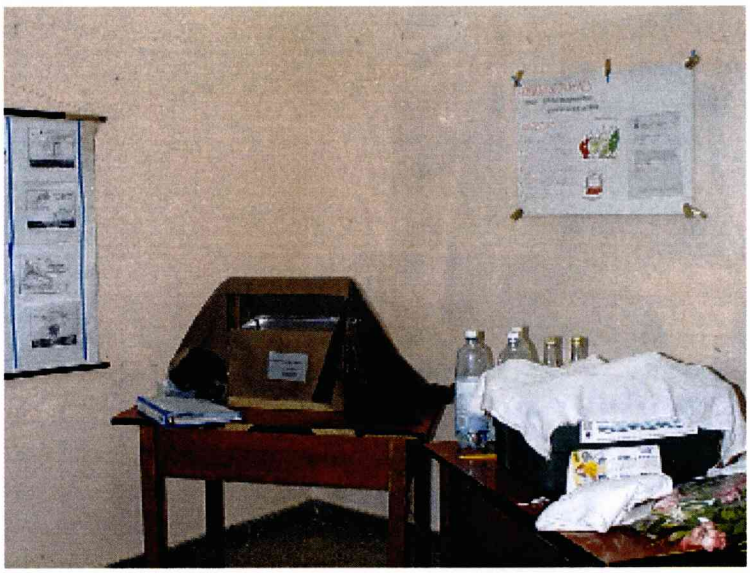
The two schools are located in Havana, one is located in Central Havana, and the second one is located in the Municipio Cerro. The schools have similar set up of the implementation of AQUAtox. They have organized what they call "Círculos de Interés" (Focussed Circles - a sort of club that groups students with similar interests). Both schools have adapted a room and devoted to AQUAtox and the keen spirit of the teachers and INHEM staff has translated their limited resources into great work. The two schools go sampling jointly and they have focussed on waters of the same watersheds and drinking waters. This is an incentive to work hard and to compare results between schools. The schools do not have access to computers, however Ms. Torres (INHEM) enters their results on the web and makes print outs of the messages and happenings on the AQUAtox website for the schools so they can follow up the progress of the project as well as participate in it.

In September, I visited Cuba to document the progress of the project. INHEM staff organized similar activities as for the other countries:

- Meeting with Dr. Pedro Mas, Dr. Conrado del Puerto, Dr. Luis Muñoz and his team, Ms. Torres and Ms. Cumbá to discuss the activities organized
- Visit to the schools' facilities: classrooms and the science lab set up for AQUAtox
- Field trip to collect samples for demonstration of tests procedures with both schools
- meeting with the students and school working team to interview and gather their impressions of the project as present AQUAtox t-shirts to the winners of a local contest

*Highlights of the Visit*

The first school we visited was the **Escuela Secundaria Basica Bartolome Masó** where the group of the students and the teachers were waiting for us. The group composed by Zulay Osasujo, Madeleine Abreu H., Indira Rodríguez, Madeleine García, Daniel Martínez, Pavel Extremera, Yanellis Fernández, Yusnalvis Pompa, Claudia María Alvárez, Sailin Dubois works under the direct guidance of Ms. Hondanares Rodríguez (Chemistry teacher).



Escuela Secundaria Bartolomé Masó's AQUAtox room

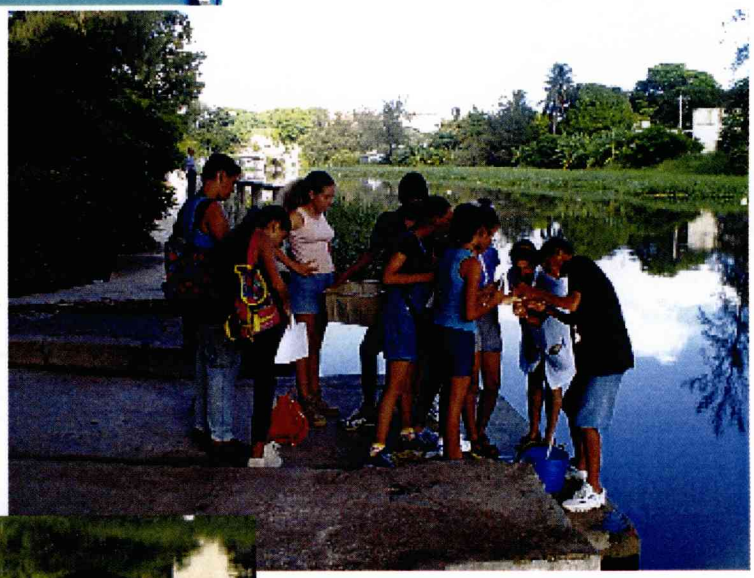
The students had to compete to become part of the club AQUAtox and it implies extra hours of work to conduct the experiments and still have to keep good or excellent marks in the other classes. The classroom they use for AQUAtox was the result of the combined efforts of parents, INHEM staff, the students and the teachers of the school. The room was used by the teachers to meet, and it had to be fixed to be used as a lab, the parents donated the paint and painted the room, INHEM donated the chairs, and Ministry of Education the tables and desks for the students. The efforts I witnessed are a clear indication of the great support the project has gathered even in a place stricken by hardship and financial constraints as Cuba.

The students love the project and they reported to have learned a great deal because of it. They prepared a research paper about Cuba and its waters to complement their own work. They started their work in September and plan to conduct experiments until March 2000, on fortnightly basis. They have focussed on the two compulsory tests, as it is difficult to obtain the onions and the Hydra in Cuba. While I was there, we made two trips to collect samples. The first one was on the context of the UNICEF project for the Inter-American Water Day. We visited the water treatment plant and collected water from the river and from the tap at the plant. We had the chance to enter the plant to see the tanks for the different stages of the chlorination process. Havana's aqueduct is special because it relies entirely on gravity for its functioning and it was built 106 years ago.

Students from both schools and Ing. Eduardo Molina at Havana's Aqueduct

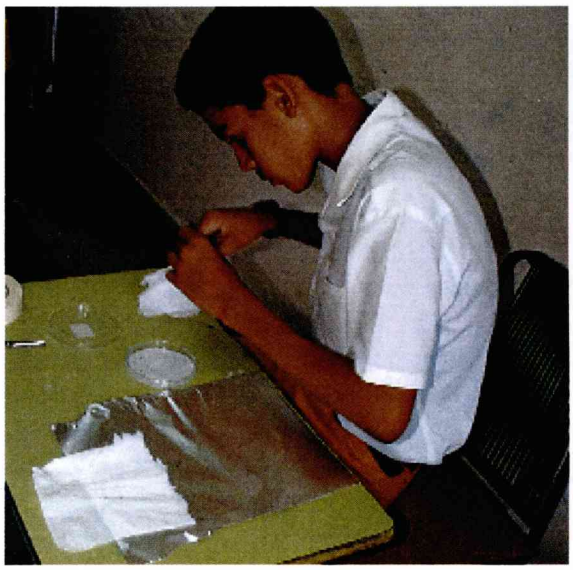
# Outings with the students of Escuela Bartolomé Masó

Students from both schools and Ing. Eduardo Molina at Havana's Water Treatment Plant



B. Masó's students and Ms. Torres (INHEM) at river Armendares in Havana taking samples (photos above and to the left)

I had the opportunity to interview the students and all those involved in the project, and the students made presentations to demonstrate what they have learned. The interviews revealed how happy the students were to be part of the AQUAtox network. They see this as an opportunity to do something in their community and city to monitor the water quality in their environs. The River Armendares is known to be very polluted as the industry deposits their waste in it, also the city dumps many untreated waste waters in it, said the students. And these are the facts that made them choose this river as one of the sampling places. They hope and plan to provide the municipality and some environment activists with the results to join their efforts to save the Armendares river.



They follow the procedures of the tests in a very thorough way. They feel and act very confident of the knowledge acquired through the project, enough to make a presentation to the public. After running 6 months of tests they plan to write a report with the results and present it to the local authorities as well as to industry to create awareness about the problems of pollution and together look for solutions.

During the interviews, the students demonstrated how aware of the history they are. They told me the story of their school, which in the years leading up to the revolution of 1959 it was one of the jails and centres of detention to interrogate many revolutionaries. At the moment it is one of the schools in Central Havana, with a population of 560 students in grades seven, eight and nine.

**Escuela Primaria Lidia Doce Sanchez**' students work jointly with the students of the highschool. Their school is located in the adjacent municipality which enables them to monitor two districts in the city of Havana. Xavier Matos, Carlos D. Yllobre, Ernesto Pino, Reynaldo Mazorra, Heidi Bolaños, Maritza Yusted Maraña, Miguel Rosales, Amanda Robaina, Claudia García, and Adrian Torres are the members of the schools AQUAtox club that works under the guidance of Ms. Mirelis Andino Caballero. The students are in grade 5 and their ages average 12 years.

In their newly set up AQUAtox lab, they carry out the experiments with a lot of enthusiasm. They received us in their lab and Xavier Matos gave us a warm and eloquent welcome.

Ms. Andino (teacher), Danilo, Claudia, Heidi, Ernesto, Maritza and Amanda in their AQUAtox room at school Lidia Doce (above)

The school does not have a science lab per se, and this is why they have fixed this room to run the experiments of the project. The school director and other teachers are very supportive of the project. They contribute to the students snacks for the field trips. Also, parents contribute in kind to the project with access to photocopiers among other things.

The students have learned about their waters, their environment, and science, said Ms. Andino in reference to the project.

"We need to protect our waters and tell the people in factories, and even our friends that we need to stop dumping waste in the water, because that eventually makes us sick". (Claudia García, Lidia Doce school). The students demonstrated a clear notion of how waters act as vehicles for water-borne diseases and the need to make sure that it is safe for humans.

The school started their sampling and tests the week I was visiting and I had the opportunity to go with them to Havana's Aqueduct together with the other school. The other planned outing was cancelled due to an electrical storm. But we opted to sample rain water and tap water at their school instead. They are using the lettuce and H2S tests. And in addition to sampling in the Armendares river, they have chosen to sample a small creek that is located close to a park in their district. During our conversations students expressed great concern for the state of the water in their country and the world, and they are happy

that this project can help them to do something about the issues.

*Highlights of the Visit*

## Images of school Lidia Doce's students


In the contest organized by INHEM staff, the best pieces of prose and drawings came from the school Lidia Doce, and the visit was the opportunity to present the winners with the AQUAtox t-shirts.

Maritza Yusted Maraña receives her AQUAtox t-shirt from Silvia Caicedo (left)

Xavier Matos, Carlos Yllobre and Miguel Rosales (below)

They showed a lot of comfort with the concepts and procedures for the tests, and they believe that the project has opened the doors to science. They wish to become scientists and continue to work on water and environmental issues, as they feel that they can contribute to improving the world.

They feel sad to know that many people do not care about the health of the planet, "man is the most destructive creature in the world, all the pollution that we find in rivers, oceans and the world has been done by man" said Heidi Bolaños.

During the visit to Havana's Aqueduct, the Doce's students took advantage to ask many questions to the officer who gave the presentation about the work of the plant. Mr. Molina explained the water treatment process and answered questions about the origin of the water that is distributed in Havana. There is a high level of consciousness among the students about the impact we humans in the water and the impact that water can have in human health.

Teachers and INHEM staff agreed to continue to work together and try to conduct tests very often as they want to increase their chances to win a trip to Ottawa. To date, I have seen many results being posted by both Cuban schools.

While I was there, I also provided training to Ms. Torres in using the website and entering the results. Due to the limited space and special conditions of the computer room at INHEM is not possible for the students to input their own results. As mentioned earlier, the alternative is to print out the news for the students.

INHEM also organized a meeting with Ms. Dagmar González, the Director of Cooperation with Developed Nations at the Ministry of Foreign Affairs of Cuba. After briefing her on the objectives and the progress of the project it was agreed that I would send her a letter with al the information about the project and its activities. Copies of the letter were also sent to

project it was agreed that I would send her a letter with al the information about the project and its activities. Copies of the letter were also sent to INHEM, to Mr. Arnoldo Rodriguez from the Cuban Embassy in Canada, to Ms. Linda Wishart from the Canadian Embassy in Cuba. We would like to ensure that all the interested parties are aware of the project and its progress.

*Names and contacts in Cuba*

**Escuela Primaria Lidia Doce Sanchez**
Calle Maso 215
Ciudad de La Habana, Cuba
Director: Vivian Ramos
Teacher: Mirelis Andino Caballero / Clara Gutiérrez
Tel: 702850

**Escuela Secundaria Bartolomé Masó**
Calle Balascoain
Ciudad de La Habana, Cuba
Director: Edilberto de Moya
Teacher: Hondanares Rodríguez
Tel: 635969

**Dra Regla Cañas Pérez /Conrado del Puerto**
Vicedirectora Salud Ambiental
Instituto Nacional de Higiene y Epidemiología
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MINVEC in Cuba
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Email:malmierca@mivec.get.cma.net

# LESSONS LEARNED AND REFLECTIONS

The AQUAtox 2000 project by all accounts is a great and successful project, and has attracted a lot of interest. Its success can be measured in many ways, the number of schools presently enlisted in the project, the demand we have received from the schools that want to become part of it, the media coverage and the level of visibility it has reached, among other things. But, the success of this project can be measured especially by watching a nine-year-old child explain the tests' procedures to a community leader with the confidence of an experienced scientist. This project has changed the approaches to teaching and education in many of the schools where it is being implemented.

The success of the project does not come without a number of lessons to be learned. For instance, there was the need to have a more realistic time frame to carry out the activities. Being as it was, the first time that a project of this nature was implemented by the Centre, it is only natural to have encountered the frustration we did when it came to our own deadlines at the different stages of the process.

At the level of school performance, we have observed that there is a difference in the approach and level of enthusiasm between those participants that were targeted and those who approached us out of their own interest. Late-comers show a higher level of commitment and desire to participate in the project's activities.

Also, in the Canadian context the complexity of issues that loom over the educational system has affected the project as many teachers have retired, or transfered, leaving the AQUAtox 2000 project orphan. Abroad, the situation is more complicated. From the visits to the various AQUAtox schools, we gather that for many teachers the project has proved to be both a challenge and an opportunity. For some it is a challenge as the project presumes that the teachers have a vision and an interdisciplinary approach to teaching and learning. This in many cases has meant that they have to introduce changes to their structures and work schedules. Connected to the requirement of vision and interdisciplinary is the need for resources to carry out activities in such a fashion. It was our desire to design a project that would not create news needs for the schools. However, the reality shows us that simple things like clean water for running the control tests, and more sophisticated items as computers are not always part of the regular infrastructure of the schools. Lack of these items prevents many schools from fully participating in the project. Those who carry on, do so because they believe in the objectives of the program and are able to make the extra effort it demands.

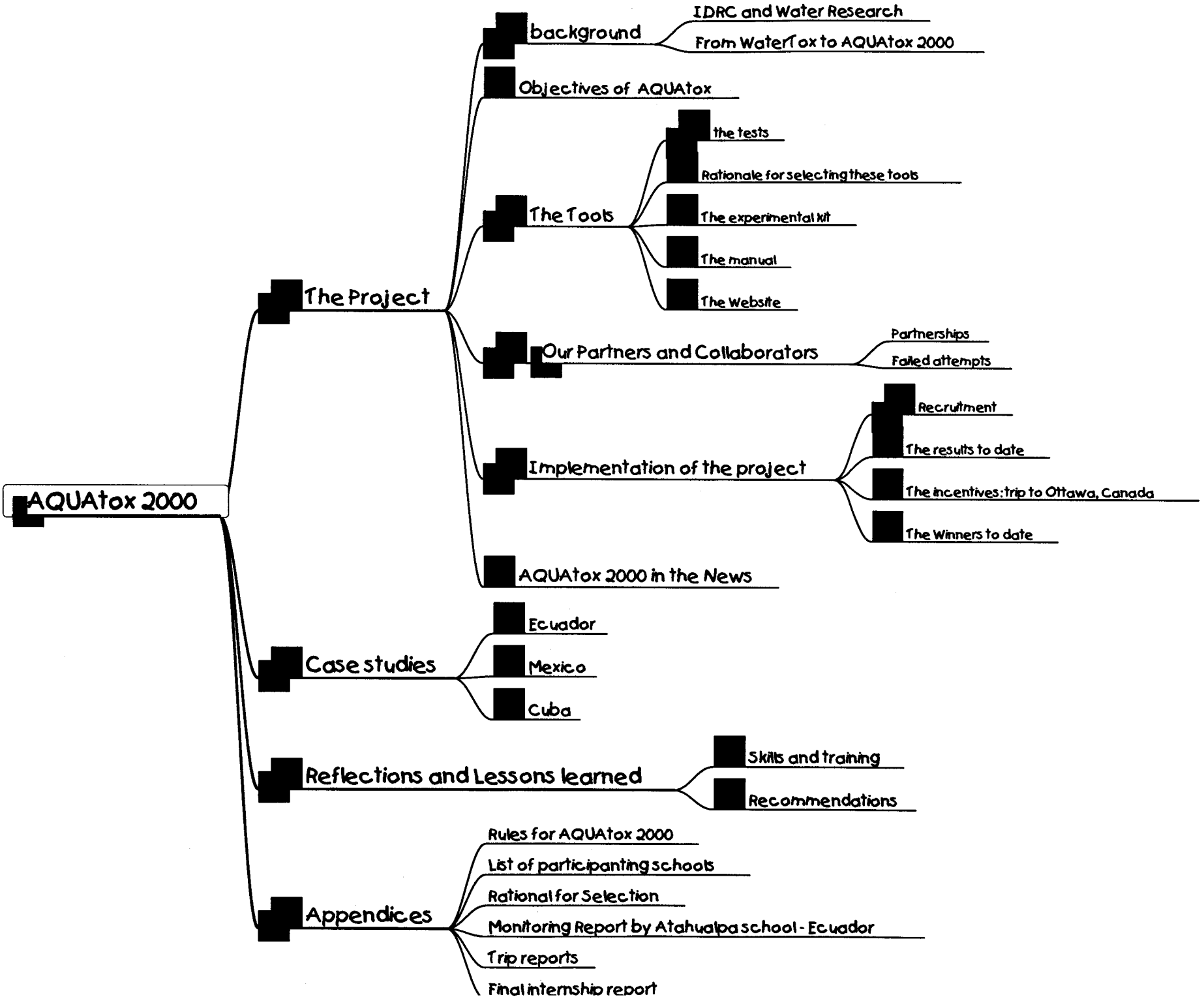
### The WEBSITE

In designing the website, one of the main considerations was to make it accessible to users with unsophisticated browsers and computers. Most people have commended us on both

the design and format of the website. However, the lack of access to computers of many schools compounded with the type of material presented in the Website account for its under-utilization. For instance, Mr. Pedro Pereyra from School St. Thomas Aquinas expressed to us that the material was not attractive to his students in grade ten. It is difficult to present material that is interesting to such a wide range of interests, ages and contexts. Another shortcoming of the website is that it was designed to receive data on-line which proves to be restrictive in countries of the South where the connections are not that reliable and expensive. This could be improved by creating an off-line form in which data can be input and later incorporated into the database via Internet.

While keeping all the limitations in mind, it is necessary to remember the excellent reception and demand that the project has had to date. Students and teachers are willing to work even on weekends to meet the requirements of an added learning task. There is a lot interest at all levels, school authorities, universities, water authorities and scientific institutions to see the project continue in the future. INHEM authorities from Cuba for example, proposed to prepare a document of the experience in their country and Latin America and write a manual for use in the communities in collaboration with the Centre. The Earth Council of Canada in looking and assessing different approaches to environmental monitoring chose AQUAtox for their Canada- Brasil Eco-Exchange Program. All these are testimonies of the quality and success of this project.

Thank you team for giving me the opportunity to coordinate it!


AQUAtox 2000
The Project
background
IDRC and Water Research
From WaterTox to AQUAtox 2000
Objectives of AQUAtox
The Tools
the tests
Rationale for selecting these tools
The experimental kit
The manual
The Website
Our Partners and Collaborators
Partnerships
Failed attempts
Implementation of the project
Recruitment
The results to date
The incentives: trip to Ottawa, Canada
The Winners to date
AQUAtox 2000 in the News
Case studies
Ecuador
Mexico
Cuba
Reflections and Lessons learned
Skills and training
Recommendations
Appendices
Rules for AQUAtox 2000
List of participanting schools
Rational for Selection
Monitoring Report by Atahualpa school - Ecuador
Trip reports
Final internship report

# APPENDIX 1 to AQUAtox 2000 Internship Report

## RULES FOR THE AQUAtox 2000 DRAWS

a. To participate in any of the draws the schools must be registered in the AQUAtox 2000 project.

b. The school will automatically get an "electronic" ticket each time it has posted the results from two (2) sets of experiments with the lettuce seed and hydrogen sulphide tests. Remember that each set of experiments must include two (2) environmental samples as outlined in the Activity Book.

c. Each "electronic ticket" gives they school the chance to enter a draw. Tickets will continue to accumulate as they report your experiments throughout the year. Participation in more than one trimester is encouraged. The more tickets a school collects, the higher the chances of winning!

d. A total of five schools could win a trip to come to Ottawa. The winners will be selected as follows:
   - For all the non-Canadian schools, a draw will be held at the end of each trimester (July 2, October 1, January 10, and April 6). In all draws the winners will be selected randomly, however the chances of winning will be limited to two schools per continent. This means that once two schools in a continent have been drawn, the rest of the schools in that continent are no longer eligible for subsequent draws.

   - a fifth draw will be held especially for Canadian schools. In this case only one school will be selected at random.

e. The two students from each winning school will be chosen by the school authorities from the students who actually participated in the program during the semester that corresponds to the winning ticket.

f. The teacher responsible for the AQUAtox 2000 project in your school will accompany the two lucky students. In the event that there are two or more teachers in your school involved in the AQUAtox 2000 project, the school will select the teacher that will accompany the students.

**Rules for the selection of the winners of the Contest (fine print).**

1. There will be five draws for the trips, one exclusively for Canadian schools, and four (4), one per trimester, for the non-Canadian participating schools. The rationale behind a separate draw for Canada is to ensure that Canadian schools are represented amongst the winners, and also to address the issue that Canada would otherwise have more chances of winning than any other country given that there will around 30 Canadian schools, versus an average of two per country.

2. The prize for each winning school will be a trip from their country or region of origin to Ottawa for one adult (the teacher) and 2 students. The trip expenses will be completely covered by the IDRC, including hotels, perdiems and air fares, and part of this cost would be covered through the donations from some of the project sponsors - for instance Admiral travel will provide the ticket costs for the Canadian winners.

3. The two students from each winning school will be chosen by the school authorities. The only proviso is that these two students must be selected from amongst those participating in the AQUAtox project during the trimester of the draw.

4. To be eligible for this contest, schools must perform and post the results for at least two series of experiments following the instructions in the Activity Book, and according to the contest procedures outlined below.

5. The trip will give the visitors a chance to visit the National Capital Region and especially participate in the "Canada and the Word" activities planned for the Spring of 2000 by the National Capital Commission.

**Contest Procedures:**

i. One (electronic) ticket for the draws will be issued to each school every time it posts results for two sets of experiments for each of the Lettuce Seeds and Hydrogen Sulfide tests (this means a total of 4 environmental samples.

ii. Each electronic ticket will have the name of the school, the country, and the trimester in which it was carried out. In the case that postings for the two sets of experiments are entered in different trimesters, the ticket will be issued for the trimester in which the second posting was entered.

iii. The draws will be executed as follows:

Trimester 1: April- June 99 Draw date: 2 July 1999 Non-Canadian Schools
Trimester 2: July-Sept. 99 Draw date: 1 October 1999 Non-Canadian Schools

Trimester 3: Oct.-Dec. 99 Draw date: 10 January 2000 Non-Canadian Schools

Trimester 4: Jan.- March 99 Draw date: 6 April 2000 Non-Canadian Schools

Draw for Canadian Schools: Draw date: 6 April 2000

iv. Canadian schools will accumulate tickets for the single Canadian draw throughout the course of the calendar year.

# Appendix 2 AQUAtox 2000 - List of participating schools



| School Name | City | Country | Langua | Grade/Age |
|---|---|---|---|---|
| Colegio Nacional Rafael Hernandez | La Plata | Argentina | S | |
| Colegio "La Inmaculada" | Ensenada | Argentina | S | Grade 7 |
| Escuela Graduada Joaquin V. Gonzalez (UNLP) | La Plata | Argentina | S | 10-14 years |
| College d'Enseignement Gén. de Gbegamey - | Cotonou | Benin | F | Grade 6 |
| Associacao Projeto Roda Viva | Rio de Janeiro | Brazil | S | 11-17 years |
| American College of Sofia - Bulgaria | Sofia | Bulgaria | E | Grade 9 |
| Cellule Scientifique du Lycée Ouezzin | Bobo Dioulasso | Burkina Faso | F, E | Grade 3-6 |
| École St. André-Apôtre | Montreal | Canada | F | 10-11 years |
| Thomas Simpson School | Fort Simpson | Canada | E | Grade 8 |
| Takijulauk School | Pond Inlet | Canada | E | |
| Chief Julius School | Fort McPherson | Canada | E | Grades 11-5/6 |
| Netsilik School | Taloyoak | Canada | E | |
| Qiqirtaq Llihavik | Gjoa Haven | Canada | E | Grades 10-12 |
| Chief T'Sehilye School | Fort Good Hope | Canada | E | |
| École Fernand Seguin | Montreal | Canada | F | Grades 5&6 |
| Ulaajuk School | Pond Inlet | Canada | E | Grade 5 |
| Courcelette Public School | Scarborough | Canada | E | Grade 7 |
| Robert Service School | Dawson City | Canada | E | Grade 7 |
| Tantramar Regional High School | Sackville | Canada | E | Grade 9 |
| École Secondaire Sacré-Coeur | Granby | Canada | F | Ages 12-15 |
| St. Thomas Aquinas | Oakville | Canada | E | Grades 10- |
| Northern Secondary School | Toronto | Canada | E | Grades 11- |
| É.s.p. L'Héritage | Cornwall | Canada | F | Grades 9-11 |
| Mackenzie Mountain School | Norman Wells | Canada | E | Grades 10-12 |
| Lakeview Public School | Nepean | Canada | F | Grade 5 |
| Centre Consolidated | Lunenburg County | Canada | E | Grade 9 14-15 |
| École Polyvalente Le Carrefour | Gatineau | Canada | F | Ages 12-13 |
| Tecumseh Senior public school | Scarborough | Canada | E | Grades 7 & 8 |
| Valmont Academy | King's Point | Canada | E | Grades 9-11 |
| Earth Council Institute - Canada | Toronto | Canada | E | Grades 6-11 |
| Porter Creek Secondary School | Whitehorse | Canada | E | Grade 9 |
| Zion Heights Junior High | North York | Canada | E | Grades 7 & 8 |
| École Henry Kelsey School | Saskatoon | Canada | F | Grade 5 |
| Willows School | Victoria | Canada | F | Grade 6-7 |
| École Lakeview School | Saskatoon | Canada | E | Grade 6 |
| Brentwood Elementary School | Calgary | Canada | E | Grade 5 |
| École Secondaire Des Lacs | Ste-Cécile-de- | Canada | F | Ages 14-16 |
| École St-Paul | Plantagenet | Canada | F/E | Grade 7 (13 |
| Nellie McClung Collegiate | Manitou | Canada | E | Grade 7 |
| Madeleine D'Houet School | Calgary | Canada | F | Grade 7&8 |
| Holliston Elementary School | Saskatoon | Canada | E | Grade 6 |
| Escuela Repocura G-387 (C.E.S.) | Temuco | Chile | S | Grades 4-6 |
| Colegio Alcantara La Florida | La Florida | Chile | S | Grades 7-8 |
| Escuela Chapod G-539 | Temuco | Chile | S | Grades 5-8 |
| The Experimental High School of Beijing (N.Univ.) | Beijing | China | E | Grade 8, 10, |

| | | | | |
|---|---|---|---|---|
| No. 8 Middle School | Beijing | China | E | Grade 2 |
| Centro Educativo Distrital Rural Chorillos | Cundinamarca | Colombia | S | Grades 7-8 |
| Instituto Pedagogico Arturo Ramirez Montufar | Santa fe de Bogota | Colombia | S | Ages 14-16 |
| Escuela Bagatzi de Bagaces | Bagaces, | Costa Rica | S | Ages 10-14 |
| Colegio Rodrigo Hernandez Vargas | San Jose | Costa Rica | S | Grade 10 |
| Escuela Alberto Paniagua Chavarria | Getsemani de San | Costa Rica | S | Grade 5 |
| EPP KOKO | Korhogo | Côte d'Ivoire | F | Ages 6-15 |
| EPP KAFIOKAHA II | Korhogo | Côte d'Ivoire | F | Ages 11-15 |
| Escuela Secundaria Basica Bartolome Maso | Ciudad de La | Cuba | S | Grades 7-9 |
| Escuela Primaria Lidia Doce Sanchez | Ciudad de La | Cuba | S | Grade 5 |
| Escuela Municipal Alfredo Albuja Galindo | Ibarra | Ecuador | S | Grades 6-7 |
| Pensionado Escolar Mixto "Atahualpa" | Ibarra | Ecuador | S | Grade 8 |
| École Charlie Chaplin | Redon | France | F | Ages 8- 16 |
| École J. Y. Cousteau | Maure de Bretagne | France | F | Ages 10-12 |
| GHS Zell-Weierbach - | Offenburg | Germany | E | Ages 10-14 |
| Staufenberg-Schule | Durbach | Germany | E | Ages 10-14 |
| Navrongo Secondary School | Navrongo | Ghana | E | Ages 15-20 |
| Bolatanga Girls Secondary School | Bolatanga | Ghana | E | Ages 15-22 |
| Lycée Albert Camus - Ecole française | Conakry | Guinée | F | Age 14 |
| New Shri Saraswati High School (Dr. Sunil Karad) | Pune | India | E | Grades 5-10 |
| St. Xavier's Collegiate School | Calcutta | India | E | Ages 10-14 |
| Kendriya Vidyalaya, Fort William | Calcutta | India | E | Grades 7-9 |
| Kendriya Vidyalaya, I.I.T. Campus | Kanpur | India | E | Grade 9 |
| Escuela de Biologia (UA..Queretaro Campanas) | Queretaro | Mexico | S | Ages 7-12 |
| Colegio Morelos de Cuernavaca | Cuernavaca | Mexico | S | Age 13-15 |
| Instituto para Ciencias, Artes, y Imaginación | Cuernavaca | Mexico | S | Ages 12- 14 |
| School Complex "Future" - Building No. 1 | Ulanbaatar | Mongolia | E | Grade 7 |
| Secondary School No. 11 | Ulaanbaatar | Mongolia | E | Grade 9 |
| Chandra Giri Vidyashram High School | Kathmandu | Nepal | E | Grade 9-10 |
| Paropakar Adarsha High School | Kathmandu | Nepal | E | Grade 9-10 |
| Miag-ao Central Elementary School | Iloilo | Philippines | E | Grade 5 (11 |
| Cours Sainte Marie de Hann | Dakar | Senegal | F | Ages 10-14 |
| Kilbasila Secondary School | Dar Es Salaam | Tanzania | E | Ages 14-18 |
| Thai-Chinese International School | Samut Praktarn | Thailand | E | Grades 1-8 |
| Lubiri Secondary School | Mengo | Uganda | E | Ages 12-19 |
| Mount Saint Mary's College Namagunga | Lugazi | Uganda | E | Ages 13-20 |
| Lyceum No. 157 | Kyiv | Ukraine | E | Grade 8 |
| Lyceum No. 145 | Kyiv-33 | Ukraine | E | Grade 8 |
| Escuela Ténica Arroyo Seco | Montevideo | Uruguay | S | Age 14 |
| Liceo No. 49 | Montevideo | Uruguay | S | Age 14 |
| Liceo No. 31 | Montevideo | Uruguay | S | Age 14 |
| Liceo No. 55 | Montevideo | Uruguay | S | Age 14 |
| Durfee School | El Monte | USA | E | Grade 8 |
| U.E. Hugo Montiel Moreno | Mara | Venezuela | S | Grades 7-9 |
| Unidad Educativa "Dr. Jesus Semprum" | Cabimas | Venezuela | S | Grades 7-9 |

# APPENDIX 3 to the AQUAtox 2000 Internship Repor

## *SELECTION OF THE SCHOOLS FOR AQUAtox 2000*

As mentioned earlier, the schools had to meet the following terms and conditions in order to participate in the network :

### Terms and Conditions

1. Each participating school will receive one experimental kit, free of charge. The kit contains instructions, an activity book, and the necessary reagents and supplies to carry out twenty sets of experiments with each of the four bioassays. What follows is a list of the bioassays and the materials that each school will need to have on hand to perform the tests.
   - **Hydrogen Sulphide ($H_2S$):** school to provide one small bottle (500 ml) of non-carbonated water or freshly boiled and cooled water for each set of experiments.
   - **Germination of lettuce seeds**: school to provide one bottle (1 litre) of non-carbonated water for the preparation of positive and negative controls for each set of experiments.
   - **Onion bulb germination**: school to provide 36 onion bulbs, and one bottle (1 litre) of non-carbonated water for the preparation of positive and negative controls for each set of experiments.
   - **Toxic effect on fresh-water hydra:** the fresh-water hydra will be provided to the school only after the responsible teacher agrees, in writing, to grow and maintain the hydra for the purpose of the school experiments. This will require a bit of additional effort from the teacher and a some additional equipment. An application form to receive the hydra and instructions on how to grow and maintain them will be provided with the experimental kit. The school will also need to provide one bottle (1 litre) of non-carbonated water for the preparation of positive and negative controls for each set of experiments.

2. All participants in the project must perform the Lettuce Seed and Hydrogen Sulphide tests and post their results on the Internet. While these two tests are compulsory, the Onion and Hydra tests will be optional.

3. The project is set to begin in January 1999 and will continue until January 2000. All experiments are designed to be run in 3-month time blocks. Schools can carry out the experiments and post their results in any one of four trimesters. We hope that the flexibility in the choice and timing of experiments will allow schools and teachers to

tailor the project to local environmental conditions and budgetary constraints. Participation in more than one trimester is welcomed.

In the application for we also asked if the school had access to the Internet as one the pre-requirements to be part of and effectively participate in the network. Most of the schools in the network met the requirements laid out for participation, however we made some exceptions with some school which did not have access to Internet as their teacher demonstrated great enthusiasm for the project.

Once the schools were selected, they received a letter of acceptance to participate in the network, which was followed by the experimental kit and materials. Every experimental kit was sent via diplomatic pouch to the Canadian embassies and/or diplomatic representations in each participating countries thanks to the kind assistance of the Department of Foreign Affairs and International Trade.