[1]DEVELOPING A STRATEGY FOR IMPROVING THE QUALITY AND RELIABILITY OF ANALYSES PERFORMED IN ENVIRONMENTAL AND OCCUPATIONAL HEALTH LABORATORIES IN THE LATIN AMERICA AND CARIBBEAN REGION

Report of a consultation held at PAHO Headquarters, Washington, 17-18 October 2005.

Participants

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Summary

The Area of Sustainable Development and Environmental Health (SDE) held a consultation on 17-18 October 2005 to formulate a strategy for improving the quality and reliability of analytical data produced by environmental health laboratories in the Latin America and Caribbean region. To assist the consultation SDE hired a consultant (Dr Peter Toft) to prepare a background paper which is attached to this report as Annex 1. The background paper was circulated to participants one week before the meeting.

Dr L. Galvão welcomed participants and outlined the purpose of the meeting; he then asked Dr Toft to chair the consultation and lead the discussion. Presentations were made by Peter Toft, Alain LeBlanc and Jean-Marc Gabastou.

PAHO recognizes that Governments, when implementing health protection programs, need to have good and reliable data on which to make decisions. In the case of environmental health, Governments need reliable analytical measurements of the components of the environment (including the workplace environment) which can adversely affect human health, for example on the concentrations of pollutants in drinking water, in food, and in air, and where possible in humans. Reliable data permit meaningful judgments to be made about the magnitude of the health risks posed by the presence of pollutants in the environment. And this information, then allows Governments and other decision makers to decide about the allocation of resources in order to reduce environmental risks to health. Clearly, in the absence of good data, scarce resources may be misdirected or wasted.

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The participants agreed that the consensus standard for analytical laboratories developed by the International Standards Organization (ISO) is widely used in developed countries (see Annex 1).

PAHO has a project to strengthen laboratory capacity and capability in public health and clinical laboratories. Activities include implementation of a regional network of reference laboratories, improving the safety of personnel, promoting the use of quality management systems and accreditation through national standards based ISO laboratory standards, and training and education. In the case of food testing, laboratories in the LAC region are using the complete ISO/IEC standard 17025. For clinical and public health laboratories ISO standard 15189 is used. In Argentina, the accrediting authority is using a gradual approach towards achieving accreditation. It has developed a series of standards based on ISO 15189 but not incorporating all of the requirements of the ISO standard. There are 4 levels, each level incorporating more of the ISO standard than the previous one, until the laboratory is ready to apply for a full ISO accreditation.

The Centre de Toxicologie du Québec (CTQ) is an accredited laboratory (according to ISO/IEC 17025) and has expertise in the areas of clinical, industrial and environmental toxicology. It operates external quality assessment schemes (interlaboratory comparison programs) for heavy metals and persistent organic pollutants (POPs) in biological fluids and provides reference materials to toxicology laboratories worldwide. CTQ/INSPQ is a WHO Collaborating Center.

There is a need for more providers of proficiency testing samples in the LAC region for environmental health laboratories.

In addition to providing a means of judging the competence of a laboratory, accreditation always incorporates an element of training and gradual improvement. One of the objectives of an accreditation review is to provide feedback to the laboratory staff on shortcomings or gaps in the laboratory's operating procedures, and to discuss how these can be remedied. A laboratory is always given an opportunity to modify its procedures before a decision on accreditation is given.

Conclusions

The consultation agreed that the best way to improve the competence of laboratories is to make use of the process of laboratory accreditation developed by the International Standards Organization (ISO) together with use of proficiency testing which is a mandatory component of accreditation. The participants agreed to the following strategy for SDE (PAHO).

OBJECTIVE: To promote, coordinate and catalyze activities to improve the analytical laboratory quality and capabilities of countries in Latin America and the Caribbean related to environmental and occupational health.

STRATEGY:
Encourage and support the development of proficiency testing (PT) programs and accreditation programs, at the national or regional level as appropriate, for environmental and occupational health laboratories, by:

i. encouraging countries either (a) to establish or expand national institutions to become accrediting bodies for environmental health laboratories according to ISO/IEC 17011 or (b) to make formal arrangements with an international partner organization to offer accreditation in the country for environmental and occupational health laboratories. (In some countries the number of environmental analytical labs may too small to permit a national authority to offer an accreditation program cost effectively. In such cases the government can consider encouraging an external accrediting body to undertake accreditation activities on its behalf.) and

ii. Making use of ISO standards, consistent with PAHO policy; (e.g. ISO/IEC standards 17025, 17011 and guides 32, 33, 34 and 43)[1]; and

iii. supporting the development of external (third party) Proficiency Testing programs, at the country and regional level where appropriate; and

iv. providing and facilitating training related to the establishment of accreditation and PT programs; and

v. working in accreditation activities in partnership with Collaborating Centers and other partners, and with international accreditation cooperation bodies such as the International Laboratory Accreditation Cooperation (ILAC), the Asia Pacific Laboratory Accreditation Cooperation (APLAC), and the InterAmerican Accreditation Cooperation (IAAC), and with providers of certified reference materials; and

vi. promoting and facilitating direct cooperation between countries, e.g. for training, preparation of PT samples, reference standards etc; and

vii. promoting the use of accredited laboratories by countries in their official monitoring programs. (As an example SDE, in conducting or supporting research activities, will implement a policy of giving preference to working with accredited laboratories.); and

viii. continuing to develop and support networks of laboratories, e.g. for the purpose of exchanging information on analytical and sampling methodologies.

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[1] ISO/IEC standard 17025: *General requirements for the competence of testing and calibration laboratories.*
ISO/IEC standard 17011: *General requirements for accreditation bodies accrediting conformity assessment bodies.*
ISO/IEC guide 43: *Proficiency testing by interlaboratory comparisons, Parts 1 & 2, 1997*
ISO guide 32: *Calibration in analytical chemistry and use of certified reference materials, 1997*
ISO guide 33: *Uses of certified reference materials, 2000*
ISO guide 34: *General requirements for the competence of reference material producers, 2000*

ANNEX 1

ACHIEVING IMPROVEMENT OF THE CAPABILITY AND RELIABILITY OF ANALYTICAL LABORATORIES RELATED TO ENVIRONMENTAL HEALTH IN THE AMERICAS REGION THROUGH LABORATORY ACCREDITATION

Objective: To promote, coordinate and catalyze activities to improve the analytical laboratory quality and capabilities of countries in Latin America and the Caribbean related to environmental health.

INTRODUCTION

1. The Pan American Health Organization is concerned with supporting governments in their efforts to protect and enhance environmental and public health, and implements programs in the Region with this end in mind. One aspect of programs designed to improve environmental health is a requirement for good and reliable analytical measurements of those components of the environment which can impact on human health, such as the quality and safety of food, air and water. Reliable analytical data permit judgements to be made about the health risks posed by the presence of contaminants in the human environment. This, in turn, provides the information base which allows decisions to be made about appropriate allocation of resources in order to reduce environmental health risks.

2. The need for good quality environmental data, particularly from developing countries, was recognized at the first meeting of the Intergovernmental Forum on Chemical Safety in Stockholm in 1994, and reiterated at subsequent meetings.

3. A more specific need for good quality environmental data was indicated in Initiative 47 of the Summit of the Americas held in Santa Cruz de la Sierra in 1996, in which countries were requested to implement programs to ensure that drinking water is safe. PAHO had previously developed a Regional Plan on Drinking Water, and, in response to the Summit of the Americas, PAHO, in collaboration with its Partner Organizations, further elaborated a Plan of Action, to improve the safety of drinking water. One of the principal components, *inter alia*, identified in the Plan of Action is a proposal to improve drinking water quality surveillance and control. In order to achieve this objective the Plan recognizes the need for increased and improved laboratory capacity in the Region to monitor the quality of drinking water, including **a mechanism for assurance of data quality.** However, only limited progress has been made.

4. The reality is that only a relatively small number of environmental analytical laboratories in the Latin America and Caribbean Region, particularly in the smaller countries, are considered to be capable of producing data with the necessary degree of quality assurance required by governments in developed countries.

5. In countries, analytical data of value to government decision makers are generated by a variety of laboratories, ranging from government's own regulatory laboratories to institutional laboratories, e.g in hospitals, to university facilities, to process control laboratories in industries

and to private laboratories offering analytical services on a contractual basis. The quality of data generated by such a wide range of laboratories is likely to vary substantially even though most laboratories have some sort of internal quality assurance procedures. Decision makers, therefore, need a method of judging the reliability of analytical data and hence also a way of selecting competent laboratories appropriate for their future needs. A national analytical laboratory accreditation program based on international standards can provide confidence in analytical data generated in participating laboratories. Laboratory accreditation has become widely accepted in developed countries as a means of ensuring the quality of analytical data.

LABORATORY ACCREDITATION

6. *What is Laboratory Accreditation?*

Laboratory accreditation may be defined as:

> *A formal recognition that a laboratory is competent to perform specified tests or measurements.*

The primary purpose of accreditation is to provide confidence to the end user of the competence of a particular laboratory. When a laboratory is accredited, the accrediting body defines its capability in a schedule of specific tests which the laboratory is capable of performing. Accrediting bodies perform their work independently. Accreditation is granted only when the accrediting body has been satisfied that the laboratory can carry out these tests correctly and that it is managed in such a manner that it can likely continue to carry out the tests consistently. In practice a detailed assessment is conducted to determine if the necessary equipment, reagents and trained staff are available, that suitable procedures are being followed and that the laboratory can correctly analyze test samples.

7. ***International Standards.*** The International Standards Organization (ISO) and the International Electrotechnical Commission (IEC) together form the international specialized body for worldwide standardization. ISO/IEC has produced a document: *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025).* The first edition of this document was published in 1999 by an international committee and a revision carrying the date 2004 is now in preparation. It covers all areas of laboratory operations, including organization, staff, quality management system, document control, supplies, dealing with complaints, technical records, internal audits, as well as technical requirements, such as personnel, environmental conditions, test and method validation, estimation of uncertainty, equipment and calibration, quality assurance, sampling and reports.

An accreditation body which wishes to obtain international recognition of its own competence, as well as the competence of its accredited laboratories, also needs to follow the rules and procedures of another document, ISO/IEC Guide 58. This latter document provides guidance on the operation of accrediting bodies. It will be replaced in December 2005 by a revised and more stringent standard, published in 2004 under the title: *Conformity Assessment – General Requirements for accreditation bodies accrediting conformity assessment bodies (ISO/IEC 17011).* Many accrediting bodies have already been operating according to the new standard for some time.

8. ***ISO 9000.*** It is important to recognize the difference between accreditation to standard ISO/IEC 17025 and registration to the ISO 9000 family of standards. The ISO 9000 series is concerned with quality management and may be applied to any organization. In contrast ISO/IEC 17025 is concerned with the competence and quality management of laboratories only. ISO/IEC 17025 incorporates all of the relevant quality management aspects of ISO 9001, and, in addition, addresses other technical matters, such as the competence of staff, test method validation, measurement uncertainty and use of reference standards which are specific to laboratories.

9. Limits of Accreditation (What it can and cannot do).

Accreditation is the recognition of specific competence whose scope is normally highly specific. It evaluates people, skills and knowledge. Assessors are used who are recognized specialists in their fields of expertise. Accreditation also evaluates the supporting management systems for a specific activity. It requires practical tests as appropriate, e.g. satisfactory performance in proficiency tests.

Accreditation identifies that a particular laboratory has demonstrated to an independent body that it meets the requirements of an international standard and has satisfied a committee of its peers that it is technically competent in its specified fields.

Accreditation does ***not*** guarantee all analytical results. It simply enhances confidence that the user of the laboratory services is entitled to have in the ability of a particular laboratory to supply reliable analytical results.

10. ***Proficiency testing (PT)*** is a requirement of any internationally recognized accreditation process. It is the term applied to comparing actual test data from different laboratories. ISO/IEC Guide 43 provides the detailed requirements for the development and operation of PT schemes and their use by accrediting bodies. The underlying premise is that participation in a properly designed and coordinated PT program is an essential part of the quality assurance of an analytical laboratory.

PT is used to complement the on-site peer assessment process and to provide objective data about the performance of individual laboratories. It involves the concurrent analysis of test samples by groups of laboratories. All laboratories are required to participate in regular PT programs relevant to their scope of accreditation. The International Laboratory Accreditation Cooperation (ILAC) has published a guideline document for use by the providers of PT services. Samples are generally shipped to laboratories twice per year. They must be analyzed within a specified time period, and laboratories are evaluated on each parameter.

11. Laboratory Assessment

An assessment is conducted by an accrediting body in order to ascertain whether a laboratory is competent to undertake certain specific tests and if it has management policies and practices in place which are likely to result in reliable test data each time a given analysis is performed. As mentioned above, the basic document which defines the assessment requirements is ISO/IEC 17025. An accrediting body may also impose its own additional requirements.

Assessments generally follow a set format, consisting of (i) preparatory work prior to a site visit, (ii) a visit by an assessment team to the laboratory, (iii) consideration of proficiency test data,

(iv) resolution of any problems identified by the assessment team, and (v) decision to accredit or not.

(i) Preparatory work will normally involve submission of basic documentation, such as the laboratory's quality manual, for review by the assessment team. Inadequate documentation can result in postponement of the site visit.

(ii) An independent assessment team consisting of experts in the scope of analyses to be assessed visits the laboratory. The assessors will assess the organization and management of the facility, the competence of the relevant technical staff, the adequacy of the equipment, including its calibration and maintenance, the operation of the facility, as well as the analytical methods and their documentation.

(iii) Satisfactory performance in a suitable proficiency testing program is usually a prerequisite for consideration for accreditation.

(iv) Any problems or concerns identified during the site visit are recorded and reported to the laboratory, which is usually given a specific time period in which to respond. If these are resolved to the satisfaction of the assessment team and the accrediting body, then the laboratory is recommended for accreditation.

(v) Accrediting bodies must use an independent review process such that its decision-making is independent of the assessment team. Often its Board of Directors assumes the role of granting accreditations. Its decision making process must be transparent, and the laboratory must have an avenue of appeal.

12. Proof of Performance

(i) Proficiency Testing (PT) Programs

Although one would intuitively expect accredited laboratories, which are required to follow rigorous quality control procedures, to perform better than non-accredited laboratories, little comprehensive data exist on this topic. Fortunately, however, the Canadian Association for Environmental Analytical Laboratories (CAEAL) has a continuous data set beginning in 1994 which allows such comparisons to be made.

Middlebrook and Morris (2004) have published: *The Effect of Proficiency Testing Participation on Laboratory Performance.* Their study spans 10 years' worth of data from 1994, there being 2 PT rounds per year. It focused on laboratories which first entered the PT program after October 1994 and participated in at least 10 consecutive PT rounds. The data set comprised 84 parameters, including inorganics and organics in water and soil and on filters. The results demonstrated that, on average, the performance of analytical laboratories improved over the first 5 or 6 participating events, and was then followed by a plateau. Similar results have been observed in clinical laboratories by Taylor and Fulford (1981) and Hassemer (1996).

(ii) Accredited vs Non-Accredited Laboratories

The CAEAL data set also allows a comparison to be made between laboratories which participate only in their PT program and those which also participate in the more comprehensive accreditation program, since both types laboratories analyze the same PT samples. Morris and Macey (2003) compared the performance of these two groups in their analyses of 5 PT parameters: BOD, total suspended solids, chloride, dissolved iron and fecal coliforms. Laboratories were selected which had been in the program for at least 3 years, hence participating in at last 6 PT rounds, in order to avoid the *learning curve* influence of labs which

had just joined (see paragraph (i) above). Pairs of labs were randomly selected from the groups for each parameter. The results showed that accredited labs performed better than non-accredited labs in all areas. The former had a higher mean scores (92% vs 87% for the entire data set), a greater number of perfect scores (46% vs 36%) and fewer unsatisfactory scores (3% vs 17%).

These results demonstrate that participation in a PT program alone improves the performance of analytical laboratories, and that continuing on to full accreditation adds a further level of improvement.

13. International Cooperation and Recognition

Although laboratory standards are developed and published through the International Standards Organization (ISO), the principal international forum for operational accreditation matters is the International Laboratory Accreditation Cooperation (ILAC). ILAC first met in 1977 as an informal meeting of national accreditation bodies. Their main concern was mutual recognition of accreditations as a means of eliminating technical barriers to trade. Mutual recognition would minimize the need for additional analytical testing in importing countries of products already tested in an exporting country. (In this context, the analysis of exported food products may be of indirect interest to PAHO because of its economic importance to some countries in the region). ILAC decided to encourage the creation of a matrix of national laboratory accreditation bodies all operating to the same standards, using harmonized practices, and linked through mutual recognition agreements. The focus was primarily on international trade and therefore on testing laboratories relevant to this area, although the same international standard (ISO/IEC 17025) applies to all types of laboratories, including environmental analytical laboratories. Worldwide there are 71 countries with membership in ILAC, of which 11 are in the Americas. These are Argentina, Brazil, Canada, Chile, Cuba, Ecuador, El Salvador, Guatemala, Mexico, Trinidad and Tobago and the United States. Mexico chairs a committee dealing with the needs of developing countries.

In addition to ILAC there are regional cooperation bodies in the Americas, Asia Pacific, European and Southern African areas to address particular regional needs, e.g. the European cooperation for Accreditation (EA) is closely tied to the needs of the European Union. The Asia Pacific Laboratory Accreditation Cooperation (APLAC), created in 1992, comprises countries bordering the Pacific Ocean. Membership includes Australia, Brunei, Canada, China, India, Indonesia, Japan, Korea, Malaysia, Mexico, Mongolia, New Zealand, Philippines, Singapore, Pakistan, Taiwan, Thailand, United States and Vietnam. The Inter-American Accreditation Cooperation (IAAC) was created in 1996 in Uruguay and incorporated in 2001 under Mexican law. Membership comprises: Argentina, Brazil, Canada, Chile, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, United States, Uruguay, and Venezuela.

ILAC has established a mutual recognition arrangement (the ILAC Arrangement) with the purpose of promoting confidence and acceptance of data from accredited laboratories around the world. To date only the European cooperation for Accreditation (EA) and the Asia Pacific Laboratory Accreditation Cooperation (APLAC) are signatories to this Arrangement. IAAC is still developing its MRA evaluation process before requesting recognition.

It is also important to note that, while laboratories are subject to regular assessment by their accrediting body, the accrediting bodies themselves are regularly assessed by their peers, usually from within their regional cooperation body, to ensure international conformity.

14. ***The United Nations Industrial Development Organization (UNIDO)*** published a document in 2003 entitled *Laboratory Accreditation in Developing Economies (Tested Once – Accepted Everywhere) Working Paper No. 2.* This document recognizes the importance of acceptance by importing countries of analytical data generated in exporting countries related to products, e.g. the safety of foodstuffs and the quality of minerals. In the absence of internationally recognized accredited test facilities in the exporting country, tests would have to be repeated in an accredited facility in the importing country. This could result, for example, in the rejection of an entire shipment of food. This purpose of the UNIDO publication is to address the issue of accreditation for testing and calibration laboratories with special emphasis on developing economies.

15. The Canadian experience

Canadian interest in laboratory accreditation in the environmental and public health areas began in the decade of the 1980s. It was probably stimulated by a government interest in transferring a large percentage of its environmental analytical work from its own laboratories to laboratories in the private sector through the use of service contracts. In this context a method was needed to judge the competence of private laboratories. Firstly proficiency testing programs were developed by a voluntary not-for-profit organization – the Canadian Association of Environmental Analytical Laboratories (CAEAL). Then in the 1990s laboratories were encouraged to become accredited using ISO/IEC Guide 25 (the precursor of ISO/IEC 17025) through a partnership arrangement between CAEAL and the Standards Council of Canada (SCC). Accredited laboratories were favoured by government when issuing service contracts for environmental analyses. By the turn of the century most large and medium private environmental laboratories and many of their counterparts in government were either accredited or had applied for accreditation. There was, however, much less interest shown by the large number of smaller laboratories. This picture, however, changed rapidly following the Walkerton tragedy and the two-part report produced in January and May 2002 following the inquiry by Judge Dennis O' Connor.

16. The Walkerton Tragedy

On May 12, 2000, one of the five wells serving as a source of drinking water for Walkerton, Ontario, a town of about 10,000 people, became contaminated with *E. Coli 0157:H7* and *Campylobacter jejuni*, whose source was later found to be manure spread on a nearby farm. Seven people died and more than 2,300 became ill.

Judge O'Connor was appointed by the Government of Ontario to investigate the incident and to make recommendations for corrective action. His final report was released in May 2002. Among his findings was that the disease outbreak could have been prevented by the use of continuous chlorine residual and turbidity monitors at the affected well. In addition, for years, the operators of the drinking water system engaged in a host of improper operating practices, including failing to use adequate doses of chlorine, failing to monitor chlorine residuals daily, making false entries about residuals in daily operating records, and misstating the locations at

which microbiological samples were taken. The operators knew that these practices were unacceptable and contrary to government guidelines and directives.

In his final report Judge O'Connor made several recommendations relating to monitoring, including the following:

> *Recommendation 41: The provincial government should phase in the mandatory accreditation of laboratories for all testing parameters, and all drinking water testing should be performed only by accredited facilities.*
>
> *Recommendation 42: The Ministry of Environment should license and periodically inspect, as required, environmental laboratories that offer drinking water testing; as with water treatment operations, continuing accreditation should be a condition of licence.*

It is interesting to note that lack of monitoring was identified as one of the contributing factors which, had it been present, could have prevented the disaster in Walkerton. Judge O' Connor did not identify the absence of *accurate* analysis as a cause of the problem. However, he did not confine himself to investigating the situation in Walkerton only. Instead he conducted a detailed evaluation of the whole system of drinking water supply in the Province of Ontario and he concluded that, in order to ensure the continuing safety of the water supply, all water testing in the province should be performed by accredited laboratories.

The Government of Ontario moved rapidly to respond to the recommendations from the inquiry. As a result Ontario now requires that all drinking water testing in Ontario is now conducted in laboratories accredited according to ISO/IEC 17025. Other provinces in Canada have also either followed this practice or have initiated similar programs.

In addition, the partnership between CAEAL and SCC was dissolved in 2004 by a vote of the CAEAL membership, and CEAL decided to become an independent accrediting body in the area of environmental analysis. CAEAL is now in the process of being so accredited in the Asia Pacific Laboratory Accreditation Cooperation (APLAC). SCC continues to offer accreditations of environmental analytical laboratories independently. The impending mandatory implementation of ISO/IEC 17011, which would have caused difficulties for the operation of the partnership, was one of the principal factors resulting in the break up. Canada now, therefore, has two bodies at the national level accrediting environmental analytical laboratories, while a third body operates only in Quebec.

17. PAHO's partnership with CAEAL and SCC

PAHO signed an agreement with CAEAL and SCC in April 2001 to offer a joint program of accreditation of environmental analytical laboratories in Latin America and the Caribbean. The partnership focused initially on accrediting laboratories in the LAC region responsible for drinking water testing, and would invite the local appropriate accrediting body where one existed to participate. There was no intention to compete with other accrediting bodies by offering the program in countries which already had an existing program. In the long term it was intended to broaden the scope of the program to other areas of environmental health, e.g. occupational hygiene and air quality. Essentially the SCC acted as the accrediting body and the PT program and laboratory assessment component was administered by CAEAL and PAHO through CEPIS, its facility in Peru. This program was discontinued in 2004 when CAEAL and SCC decided to terminate their partnership. During the limited period of this tripartite arrangement four laboratories in the region entered the accreditation stream and training programs were conducted

in Bolivia, Colombia and Panama with a view to assisting those countries to develop their own accreditation programs. In addition staff in drinking water laboratories in El Salvador and Nicaragua were trained with funding from USEPA with the aim of those laboratories also entering the accreditation stream. PAHO, through its center (CEPIS) in Lima, Peru, also continues to provide direct support to countries in the region on accreditation issues. This will go some way towards ensuring that the improvements in laboratories would be maintained.

18. Current Situation

With the termination of the agreement with CAEAL and SCC, PAHO is no longer actively involved in work on the accreditation of environmental or public health analytical laboratories. The larger countries in the LAC Region, e.g. Brazil and Mexico, have laboratory accreditation programs. The main focus of these programs, however, is primarily aimed at facilitating trade, the environmental component often being relatively minor. The smaller countries, in general, do not have accreditations programs for environmental analytical labs. One of the difficulties arises from the lack of availability of proficiency testing samples in the developing countries in the region.

The PAHO area for Sustainable Development and Environment (SDE) is fortunate to have a relatively large number of Collaborating Centers. Some of them have laboratories and may be able to participate in partnerships with SDE in carrying out activities related to improving the capability of laboratories in the LAC region. CEPIS, PAHO's center for sanitary engineering and environmental sciences also maintains a network of water quality laboratories (RELAC) in the LAC region.

A PROPOSED STRATEGY FOR PAHO

19. Objective: To have some laboratories in all countries or sub-regions of Latin America and the Caribbean which are capable of analyzing samples (related to environmental and occupational exposure, including biological samples) competently, reliably and accurately by:

(i) making use of internationally recognized standards and criteria such as those developed for laboratories by ISO/IEC (Standards 17025 and 17011, and Guide 43);
(ii) providing training in appropriate methodology where necessary;
(iii) continuing to develop and support networks of laboratories, e.g. for the purpose of exchanging information on analytical and sampling methodologies;
(iv) ensuring/facilitating, through partnerships with collaborating centers or other appropriate institutions, the preparation and distribution to environmental analytical laboratories of proficiency testing (PT) samples, which have been prepared according to international standards (e.g. ISO/IEC Guide 43);
(v) encouraging and facilitating, through partnerships with collaborating centers or other appropriate institutions and national bodies, the accreditation of environmental analytical laboratories to the international standard ISO/IEC 17025;
(vi) encouraging countries either (a) to establish or expand national institutions to become accrediting bodies for environmental laboratories according to ISO/IEC 17011 or (b) to make formal arrangements with an international partner organization to offer accreditation in the country for environmental analytical laboratories. (In some countries the number of environmental analytical labs may too small to permit a national authority to offer an accreditation program cost effectively. This is especially

the case in establishing a proficiency testing (PT) component. In such cases the government can consider encouraging a foreign accrediting body to undertake accreditation activities on its behalf. It some cases the country may consider setting up a formal contract for this purpose. PAHO may assist in this process.)