

ANNEX 3 COUNTRY REPORTS

Country report: Ethiopia

Field mission to Ethiopia 20.2.-25.2.2011

1. Country context

Ethiopia has a population of approximately 80 million people out of whom 80% live under the poverty line and about 10 million are at risk of starvation. In the DAC classification Ethiopia belongs to the group of the least developed countries. Livelihoods are predominantly based on agriculture, which accounts for 80% of employment, 45% of national income and over 90% of export earnings. Nevertheless, poverty indicators are improving and Ethiopia is on-track to meet some of the Millennium Development Goals by 2015, but none of the health MDG's.

However, in recent years Ethiopia has been one of the fastest growing economies in Africa during 2003 to 2007 which development unfortunately has experienced some setbacks in 2008 and 2009 due to challenges of high inflation (8,5%) and a difficult balance of payments situation. The economy is still the fastest growing economy in Africa, with 10% annual growth rate and the country is anticipated to rise to the level of middle-income countries by 2015. Ethiopia has provided a conducive environment for foreign investment i.e. with customs incentives. Private sector development is a national priority. Industrial sector is growing due to expansion of foreign investments, e.g. Chinese build leather and plastic industries, Turkish and Indian companies invest on textile industry, cement and fertilizer industries are also receiving foreign investments.

Counter effect of the industrial development has been environmental contamination caused by these industries using hazardous chemicals. The government's Environmental Protection Authority has limited capacity to control the environmental threats of the fast growing industrial sector. The capacity to implement the environmental legislation is weak and systematic monitoring and inspection is not yet in place. The environmental crisis is further exacerbated by the dumping of hazardous waste in Ethiopia (and other developing countries) from the western countries.

2. National Authority of the CWC

The National Authority of the CWC is the Ministry of Industry indicating the government's priority as industry being the sector where analytical chemistry capacity is needed. Ethiopia has sent six trainees during the last decade to Finland to attend the

VERIFIN training programme. They all represented the Ministry of Industry institutions and the Quality Standards Authority of Ethiopia. The NA has coordinated the pre-selection process and the trainees (except two whose whereabouts are unknown) work in relevant jobs in regard with the training contents.

3. Interviews of the trainees

Three trainees were interviewed during the field mission. They had also filled in the questionnaire that had been sent to them via e-mail prior the mission. Out of the six participants only one is a female which raises a question concerning the pre-selection criteria of the country.

Educational background of the interviewed trainees was one Bachelor and two Masters level. They had participated in Basic course (2), NACD (1) and workshops (1).

All interviewed reported that they have used the learned skills in their work, two of them the analytical skills in the laboratory. In addition to the Head of the NA, one other trainee was working in the NA in administrative role and she had benefitted from the NACD workshop. Two trainees had trained their colleagues in the laboratories where they had worked. Two trainees had been promoted (one as the Head of the NA, one as the Director of Research Laboratory of Textile Industry). All trainees assessed the training in Finland as high quality and ranked it in the highest grade 5 (1-5 grading scale).

4. Situation analysis of the laboratories visited

4.1 Quality and Standards Authority of Ethiopia (QSAE)

Laboratory's task is to investigate both imported and exported goods. It had many donated analytical instruments of which only some were operating. Testing laboratories for electrical apparatuses were well functioning as well a chemical laboratories for pesticide analyses and wet chemistry (soaps). QSAE has an accreditation for microbiological analyses.

Ethiopia is a significant producer of coffee and for example Japan requires pesticide analyses of coffee. At present QSAE analyses from six to nine coffee samples per day for organochlorine pesticides using GC/ECD (first laboratory in Ethiopia). They are developing methods for other pesticides using GC/NPD. They had a GC/MS for verification of pesticides. GC/MS was a donation from EU and one trainer from VERIFIN helped with the installation of the instrument five years ago (Expert Assistant Visit funded by OPCW). Head of the pesticide laboratory had made his Ph.D thesis at University of Umeå, Sweden.

Laboratory had difficulties with electricity, consumables and maintenance, although they were capable to carry out basic maintenance like cleaning of mass spectrometry's ion source and changing filament. Gases were ordered from Dubai or Germany.

4.2 Leather Institute

Leather Institute functions as vocational training institute and carries out R&D for leather industry. The pilot plant of the institute was comprehensive and it was used as an additional resource for leather industry to help in bottle necks in production. Pilot plant had an operating wastewater treatment plant. Laboratory of leather institute was accredited for some basic environmental analyses in water. Instrumentation of the laboratory was basic (spectrometers, titrations, Kjeldahl), but enough for their requirements. In addition to chemical analyses, laboratory is testing the quality of products using physical testing.

4.3 Textile Institute

Leather industry has been strong in Ethiopia for many years, whereas cotton production and textile industry are the most fast growing sectors at the moment. As mentioned earlier one of the trainees had been selected to establish a laboratory for textile industry. He had acted earlier as director of laboratory in Leather Institute and before that as chemist in QSAE. He had also written some scientific articles on natural products while working in the University of Addis Ababa.

Starting up of the laboratory seemed to be planned well and proceeding without extra delays, although at the moment it only has a building, some equipment and some personnel. Procurement of all chemical instruments has been done with the help of consultants, but these instruments had not yet received. The knowledge of the existing personnel (five textile engineers) seemed to be good. Recruiting of the personnel was ongoing. Laboratory's future tasks will be similar to the laboratory of Leather Institute; these institutes are situated geographically very close. Challenging aim of the laboratory will be to become an authorized laboratory for Ökō-*Tex* standard (an international testing and certification system for textiles, limiting the use of certain chemicals) in the future. Quality system of laboratory was already under preparation, it had started from the management of documents. Director of the laboratory had been trained for quality system and standards (e.g. ISO17025) in South Africa, however, he felt that they would need some support for building a working quality system and get accreditation.

4.3 Environmental Protection Authority (EPA)

EPA was established under the Ministry of Natural Resources Development and Environmental Protection (MNRD&EP), in May 1994. Later, EPA as environmental regulatory and monitoring body has become independent institution and was re-established by proclamation no. 295/2002. It seems that Ethiopia (like many other de-

veloping countries) has already many regulations in place for environmental protection. However, implementation and especially the control is still inadequate.

EPA has regional offices that do not have laboratories with the only exception is the regional office of Addis Ababa. It is able to carry out all the basic environmental water analyses (heavy metals and other elements, anions, cations, BOD, COD). Unfortunately we did not meet the head of the laboratory, thus it remained unclear who is responsible for taking the samples. The sample load was not very high, for example maximum five samples for BOD per day. Many of the instruments were donations and not operating at the moment, for example chromatographs (GC/ECD, GC/FID and HPLC) and infra-red spectroscopy (IR). It seemed that the software for GC was never actually purchased, because the software was reported to be expired. Chemist responsible for elemental analyses had good knowledge also on gas chromatography partly obtained from a 3-days training course organised at the University of Addis Ababa. She would be very eager to use GC/ECD for pesticide analyses. In some cases they have had a one-day-training for a new instrument, but only one person had attended the training and has not been able to start using it. An effective system for substitutes was clearly missing.

4.4. University of Addis Ababa

Ethiopia has an ambitious aim to increase the number of universities in the near future. University of Addis Ababa is expanding its graduate program to train enough teachers for these new universities. However, it is clear that many of the new universities will suffer serious difficulties; lack of teachers and equipment.

Main area of research was natural products. Research laboratories had many donated and/or second-hand instruments that were not operating at the moment. For example GC/MSD was a second-hand instrument from University of Umeå, and its transportations had been funded by OPCW. It had been used to analyse pesticides, but it was now broken. NMR instrument has been operating since 2001. Funds for spare parts and maintenance were difficult to get. They could carry out a large part of the maintenance themselves, but some of the suppliers refuse to send only spare parts.

Both industry and university people mentioned that graduated students do not have enough practical experience of laboratory work. Practical training was not carried out as part of the studies like in Kenya. The University had organised workshops and short courses on analytical chemistry chemists in industry, but this kind of activity had been decreased due to brain drain and lack of operating instruments. University had difficulties with the procurement system; choosing always the cheapest option produces problems, for example chemicals are of very low quality or even totally wrong.

Summary of the laboratory facilities

Laboratory	Description	Instrumentation		Comments
		Operating	Non-operating	
Quality and Standards Authority of Ethiopia (QSAE)	Import and export inspection	GC/ECD GC/MS	HPLC, several detectors GCs, FTIR	Responsible chemist was an Ph.D (Umeå)
Regional Environmental Protection Agency (EPA)	Environmental basic analyses (metals, ions, COD, BOD)	AAS, titrations	GC/ECD, HPLC, FTIR	
Leather Institute	Quality and environmental basic analyses			
Ayka Addis-textile factory's laboratory	Process support	Special instrumentation		No control of water emissions
University of Addis Abeba	Research (Natural products)	NMR	HPLC, GC, GC/MS	

5. Visits to the industrial plants

5.1 East African Pharmaceuticals Pvt. Ltd. Co.

The high cost of branded medicines had fuelled an epidemic of sub-standard counterfeit drugs imported into Ethiopia from Asia. Quality of these cheap drugs is dangerously low, indicating that even 10-50% of these drugs can contain wrong API (Active Pharmaceutical Ingredient), wrong amount of API etc.

EAP currently operates one human and one veterinary drugs production lines. Most of the raw materials are imported from Asia. As a small actor they have a lot of difficulties with purchase (quality, price and delivery times). Suppliers can set the price of raw material (API) higher than corresponding imported drug. This was case especially with human drugs.

They were developing a quality system aiming at a Good Manufacturing Practise (GMP), but a lot of documentation was still missing. In addition, there was lack of trained personnel. At present there were nine chemists and four engineers working at

the plant. It was estimated that it took one and a half year internal training before a person can work independently. Long internal training is costly, especially because sometimes a person leaves the company after training. Education given in Universities does not meet with the need of industry being too theoretical.

Laboratory was small and some essential instruments were missing, for example Karl Fisher titration apparatus for moisture content. However, HPLC, UV/VIV and IR were used for quality control of raw materials. Personnel that we met seemed to be motivated and competent.

5.2 Ayka Addis Group

Ayka Textile is a vertically integrated textile manufacturer, covering spinning, knitting, dyeing and sewing facilities located in Turkey. To be able to stay competitive in the global market they have invested in Ethiopia and built a vertically integrated subsidiary the **Ayka Addis Group**. The factory was opened in 2010 and it is the biggest integrated textile factory in sub-Saharan Africa. The facilities were extremely modern and many occupational safety issues were considered. Management was mostly Turkish. Laboratory was sophisticated, however, it was only carrying out tests for dyeing (quality control of dye formulas). Ayka Textile has an environmental policy stated at their webpages and we visited their wastewater treatment plant. However, the waste water was running into river was clearly red. Factory uses groundwater. Our hosts could not tell any details about the wastewater treatment and the explanations on the analyses of wastewater were not satisfactory. It is noteworthy that basic environmental water analyses (COD, BOD, metals, anions and cations) could be carried out in many laboratories that we visited. Some of these analyses were actually accredited in the Leather Institute, and also regional laboratory of EPA was able to perform those analyses. One problem is the sample taking; authorisation and resources. Ethiopia has adopted the document of Standards for Industrial Pollution Controls that is comprehensive. Transition period ends after two years. At present only the above-mentioned basic water analyses can be carried out.

Field mission to Kenya 26.2.-4.3.2011**1. Country context**

Kenya has a population of approximately 39 million (July 2009) and it belongs to the group of other low income countries (DAC 2009), being in the second lowest category. Kenya is one of the most industrialised countries in East Africa, yet industry represents only 10% of its GDP. The Kenyan economy depends on agriculture which employs 80% of the population and accounts for 50% of all exports and 25% of the GDP. Traditionally tourism, tea and coffee have been the largest foreign exchange earners, but horticultural products and industrial exports such as refined petroleum are also becoming important. The economy has started to grow after the poor performance during the last decade. The GDP has shown a steady growth rate during the last years from 3.0% in 2003 to 6% in 2007. The sectors that drive the growth include tourism, manufacturing, construction, trade, transport and communications.

The main environmental issues affecting Kenya are: (i) natural resource degradation; (2) loss of biodiversity in the country's main ecosystems, including wetlands, forests and marine ecosystems; and (iii) the socio-economic environment: falling socio-economic indicators on health (high prevalence of major diseases, i.e. HIV/AIDS, malaria and TB), access to water and access to education.

Other tran-boundary environmental issues include: (i) persistent organic pollutants (POPS); (ii) trans boundary movements and disposal of hazardous wastes; (iii) reduction of substances that deplete the ozone layer; (iv) trade in endangered species; and (v) wetlands of international importance.

2. National Authority of the CWC and its role in pre- selection of the trainees

The National Authority is the Government Chemist Department under the Ministry of Public Health and Sanitation. It has 17 stakeholder organisations including government ministries and offices (e.g. Office of the President, Ministries of Foreign Affairs, Trade, Industry, Higher Education, Defense, Finance, Environment, Police Department and Revenue Authority) and private sector representatives (e.g. Association of Manufacturers). Nine participants had attended the VERIFIN training programme during the last decade. Six of them had represented the Government Chemist Department, the NA itself, two were from local universities and the organization of one participant who had attended the BACC course in South Africa was unknown.

The NA had played an active role in pre-selecting the candidates for training indicated by the high number of them coming from the organization itself. The NA had also informed the universities on the training possibility in Finland, but it seems that the priority had been the Government Chemist Department.

3. Interviews of the trainees

Six participants were interviewed and one had sent the questionnaire via e-mail, three out of them were females and four males. Data was received from seven former trainees. Educational background of the trainees was adequate (three with bachelor and the masters level degrees). Four reported of having applied independently and three by the information provided by the NA. However, it is likely that all applied on the basis of the information provided by the NA. Courses attended were; 1 Basic, 1 Advanced, 2 NACD and 5 various workshops. Five participants had trained others in the laboratory where they worked and two had been promoted after the training (as Principal Chemist and Chief Chemist).

All seven participants reported as having been able to use the learned skills in their work e.g. analysis methods with the equipment, troubleshooting of the GC, training students to use the instrument in analysis of various samples (e.g. pesticide residues, hydrocarbons) and proper sample preparation and interpretation of the results. All in all the training had been useful for the trainees and their capacity had enhanced.

Main recommendations for improving the capacity building impact were twofold; (1) to regionalize the training either in a regional centre where participants from the neighboring countries (e.g. from the East African Community) would attend; and/or (2) to implement country-specific training courses in relevant laboratories with the trainers moving from one country to another. However, the prerequisite for this modality would be to ensure that the equipment in the labs is maintained and fixed beforehand.

4. Situation analysis of the laboratories visited

4.1 Government Chemist Department (NA)

Five interviewed participants worked at the Government Chemistry Department (NA). Situation in the laboratory was typical for laboratories in Kenya and Ethiopia: well equipped in principal, but the instruments were not in use for various reasons. Laboratory's main task was to carry out forensic investigations, for example they had good possibilities for DNA analyses. Largest number of samples for chemical analyses was for foods and alcohol beverages (totally about 1000 samples per year). Toxic and carcinogenic aflatoxins, which are produced by fungies, are very common in Kenya because of unsatisfactory storage conditions for crops. Methanol poisonings are also common. Thin layer chromatography (TLC) was mostly used for aflatoxins, pes-

ticide and drug analyses. GC/FID has been used for alcohol content and identification of methanol, but it was not now operating. GC/ECD instrument has never used.

In addition to above-mentioned analyses, Government Chemist Laboratory carries out some environmental monitoring (water analyses), however, they had very limited possibilities to carry out sampling. National Environmental Management Authority (NEMA) did not have a laboratory. Government Chemist laboratory has good co-operation with University of Nairobi. Many of the chemists had graduated from there. They have participated in seminars that University of Nairobi has organized, for example ten persons had been trained for pesticide analyses by the University of Nairobi. One trainer at the University was a former VERIFIN trainee. Industrial attachment of three months in laboratories is also part of the University studies. In Ethiopia there was not this kind of arrangement to train chemistry students for practical work. Pesticides analyses with GC/ECD were outsourced to the University of Nairobi. In addition and the University of Jomo Kenyatta had been consulted about GC/MS.

Consumables were not a problem, for example there was a local supplier for helium gas. There was also a local company ESTEC Ltd. that is a supplier of laboratory and testing equipment operating in East Africa offering also services for instruments. However, ESTEC's time of delivery for service could take weeks. However, it remained a bit unclear why so many instruments had been out of order for such a long time. One reason could be that TLC technique was used efficiently and the number of samples was low.

One of the largest problems was clearly the government complicated procurement system that slows down the timely purchase of the needed items causing ineffectiveness in the laboratory functions. For example, installation of the donated GC/MS instrument had been delayed nearly a year, because funds for an air conditioned room, which is needed for a proper function of the instrument, had not been received.

Interviewed persons said that the laboratory had enough staff and they are very competent with the theory, but they need more practical experience. They all could use the skills they have learned in VERIFIN training, even more if the instruments would be fixed. Personnel have participated also in further training organized by University of Nairobi and OPCW (Rhodes University, South-Africa, four days, theory and hands-on).

4.2 University of Nairobi

One VERIFIN trainee (short course) works as a technician teaching gas chromatography and doing her Master degree in Environmental chemistry in Department of Chemistry that is one of the largest departments in the University (staff 43, of which 30 technical staff). Chemistry teaching is divided in the following sections: organic, inorganic, physical, analytical, environmental and industrial chemistry. Currently they have 41 M.Sc students and 11 Ph.D students. Earlier natural products research had been the main area, but nowadays environmental research has increased. NMR instrument, which is essential for natural product research, has been operating since 1998.

Also other universities, even from neighboring countries, use their NMR. They have wide international co-operation, for example the following: University of Illinois (USA), King Saud University (Saudi Arabia), Bill Gates foundation, ISP (Sweden), DAAD (Germany) and WHO. One interesting example was an UNEP project on Nairobi river where staff from the University of Amsterdam had visited and at first helped them to fix their GC/ECD (donation from EU) and then trained the staff to analyse POPs (Persistent Organic Pollutants). Analyses on POPs were on-going on the day we visited, which was one of the rare occasions when the team observed actual analysis undertaken.

As mentioned earlier, the University of Nairobi had organised seminars on analytical chemistry, and they were very willing to continue the training. One drawback was that they did not have a GC/MS instrument, and they had problems with GC/FID. It remained unclear whether it was only consumables that were not ordered on time, or were there also more serious problems with the software of GC/FID.

4.3 University of Jomo Kenyatta of Agriculture and Technology

One VERIFIN trainee (short course) works in the University of Jomo Kenyatta. Unfortunately he was not available for interview (had sent the questionnaire), but as we had learned that he had the only operating GC/MS in Nairobi we decided to visit his laboratory. Analytical chemistry laboratory of Food Science Department was very well equipped and most of the instruments were operating. They carried out analyses also for other universities and the palette of analyses was large. Actually there were two GC/MS instruments that have been donated by UK; the older Trio-1 (Fisons) donated in 2004 (now broken) and the newer Voyager (Thermo Finnigan) in 2008 (operating). Both instruments have been maintained and used mostly by the VERIFIN trainee who had studied post-graduate studies in France and Germany, he had also written several scientific articles. The instrument is used for environmental (pesticides), pharmaceutical and natural products (essential oils) analyses. Delivery time for some spare parts is long (filament for 3 months).

5. Visits to the industrial plants

5.1 Pharmaceuticals company – Universal Corporation Ltd. (UCL)

Established by a Finnish engineer, and two Kenyan partners and the UCL began operating at the turn of the millennium. Its products include off-patent generic drugs for treating AIDS, malaria and tuberculosis. Some 140 different pharmaceutical products are made in its production plant of 10 000 square meters. UCL is one of the largest and most advanced drug producers in sub-Saharan Africa, and is continuing to grow rapidly. Over a year ago FINNFUND granted 10 million US dollars of additional financing to Universal Corporation Ltd., to expand production and develop its operations towards quality certification by the World Health Organisation. The addi-

tional loan will make FINNFUND as the UCL's main source of finance. At the same time, UCL will become FINNFUND'S largest equity investment.

Major purchases have been made from Finland to develop the factory's ventilation and water purification. UCL uses a waste water treatment system supplied by Galvatek of Finland, which minimises emissions. It is intended to serve as an example of environmental concern to other production plants in Kenya. 'Kenya is a better place for doing business than it is reputed to be', says the Finnish owner of the company. 'The biggest problem faced by the pharmaceuticals industry is to find competent employees'.

Laboratory was well equipped and managed. Nearly all equipments were second-hand or donations from Finland (Orion). Laboratory had some non-operating instruments, because there was not need for them at present. Also maintenance was partly carried out from Finland by the old contacts of the Finnish owner.

Laboratory had also similar problems that all laboratories in Kenya (long delivery time for spare parts and consumables), but these problems were tackled efficiently with good management and quality system.

Summary of the laboratory findings

Laboratory	Description	Instrumentation		Comments
		Operating	Non-operating	
Government Chemist Department	Forensic, food, drug and environmental	DNA analyser AAS, titrations, TLC , UV/VIS GC/FID (partly)	HPLC, GC/ECD FTIR GC/MS (2)	Well trained staff Plans to repair the equipments TLC efficiently used
Univ. of Nairobi	Org./ inorg., physical, analytical, environmental, industrial chemistry	NMR, GC/ ECD, IR, AAS, HPLC	GC/FID	NMR efficiently used since 1998 Project on POPs A lot of international co-operation

Univ. Jomo Kenyatta	Food and agriculture	GC/MS HPLC (diode, UV, RI) GC/FID, GC/TCD	GC/MS	Large variety of analyses
Universal corporation Ltd.	Pharmaceuticals	HPLCs, AAS TOC	GCs (not needed at the moment)	The most efficient laboratory seen in Africa

6. Country specific findings/conclusions

It is important to note that these findings are based on interviews with other stakeholder representatives than former trainees only and on observations in the visited institutions/laboratories/industries. Hence, the findings are based on broader basis than just on views of the trainees.

According to the Government Chemist Department the most important national priority for capacity development is forensic analysis where capacity in analytical chemistry methods need to be enhanced. This is perhaps due to the high level of violence in the country. The Government Chemist Laboratory is responsible for forensic, food, water and environmental examinations. However, it was clearly seen that forensic examinations were a priority area, for example instrumentation for DNA analyses was sophisticated and operating compared with instrumentation for chemical analyses.

Environmental hazards are caused by water contamination due to effluence from the industries. The rivers and Lake Victoria are suffering from large scale fish perils because of polluted water. Ignorance of the local fishermen has also caused water pollution because they have sometimes used pesticides in maximizing fishing results. National Environmental Management Authority (NEMA) does not have a laboratory, they use Governmental Chemist Department. However, neither of them have sufficiently resources for efficient sampling.

Even though the chemical warfare agents are not a major issue in Kenya, suspicious chemicals are sent for analysis from the neighbouring countries twice a year due to Kenya's geopolitical location in the middle of the warzone area.

Problematic areas identified in the laboratories were insufficient funds for maintenance, spare parts and consumables preventing, and inefficient management of the laboratory functions. This was observed in the Government Chemist laboratory and in the Department of Chemistry in the University of Nairobi. The government complicated procurement system also slows down the timely purchase of the needed

items causing ineffectiveness in the laboratory functions. On the other hand anticipation of the needs for consumables was not built into the management of the laboratories.

Need of training for laboratory management and quality systems was identified by the team for minimising the trouble caused by the complicated procurement system

Field mission to Malaysia 7.3.-12.3. 2011**1. Country context**

Malaysia's population (2010) is estimated to be approximately 28 million with the growth rate of 2,4% per annum. Malaysia belongs to the Upper Middle Income Countries in the DAC classification of ODA recipients (2009). It is the strongest economy in the region among the developing countries with the GDP growth rate of 7%, inflation below 2% and unemployment rate of approximately 3% (2010). The ambitious aim of the country is to achieve the developed country status by 2020. Two big development initiatives have been launched for this aim; (i) improving state governance system ; and (ii) economy with simultaneous eradicating of corruption. An interesting feature in these efforts has been the selection of Finland as one example of countries that has been able to succeed in competitive global market economy. Finland has also been one of the model countries for Malaysia in development of the education system. Malaysia has compared herself to Finland due to Finland's similar geographical size, dependency on export industry and high educational level.

Economic growth is accounted by manufacturing sector (the largest contributor), tourism and primary commodities such as petroleum, palm oil, natural rubber and timber.

Malaysia is also paying a high price of its fast economic development through environmental degradation. According to UN data Malaysia's deforestation rate is accelerating faster than in any other tropical country in the world. Other environmental hazards are pollution of inland and marine waters, soil and coastal erosion, overfishing and coral reef destruction, along with air pollution, water pollution and the problem of waste disposal.

2. National Authority of the CWC

The National Authority for Chemical Weapons Convention is the Ministry of Foreign Affairs of Malaysia as the lead agency. Fourteen other ministries and agencies are members of the NA (e.g. Ministries of International Trade&Industry, Science, Technology and Innovation, Defense, Home Affairs and Natural Resources and Environment as well as Departments of Chemistry, Occupational Safety and Health, Environment, Customs, Pesticide Board etc). The NA performs all the tasks stipulated in the CWC in systematic and efficient manner. The Government has passed legislation as the backbone of efficient CWC implementation (CWC Act 2005, Customs Order 2000 of Prohibition of Exports and Imports and Strategic Trade Act 2010 for Export

control). Even though Malaysia has passed all the legislation related to CWC and related export control it still has challenges in implementing the legislation.

Training has also been carried out at national level with the support from OPCW for capacity development in analytical skills, assistance and protection, chemical safety management, chemical database, customs, inspection&declaration and through participation in associate programme in Hague. The official target for the NA is to have a designated laboratory in the country. So far Malaysia has not been successful in the proficiency test. In regard with the VERIFIN training the NA coordinates pre-selection of the trainees by sending the invitations to selected institutions and pre-selecting the candidates whose application will be submitted further. The participants will have to submit a report after the training which allows follow-up of the results.

3. Interviews of the trainees

Ten Malaysians have participated in the VERIFIN training during the past decade and eight of them provided information to this evaluation through interviews and/or filling in the e-mail questionnaires. Majority of the respondents were females (6 out of 8). Courses attended were: Basic, 2 ASDC, 2 NACD, internship, 2 CW-LSE II and ACW-REP.

Educational background of the respondents was: 3 Bachelor, 3 Masters, 1 PhD and 1 Diploma in mechanical engineering. Five had sent their application independently to the NA based on the information from the NA and four had been appointed among the NA staff.

Six respondents reported that they had utilized the skills learned their jobs. Areas of skill application are summarized as follows: (i) participating in the proficiency test; (ii) assisting the NA in declarations to OPCW using the databases and identifying institutions using, producing, manufacturing, importing and exporting schedule 1,2&3 chemicals as well as DOCs; (iii) improved analysis and interpretation capacity; and (iv) organizing training workshop annually in the university on GC/MS. Five respondents had trained other staff in their laboratory and three reported to have been promoted, but two of them indicated that it had nothing to do with VERIFIN training.

The priority of performing well in the proficiency test and subsequently obtaining a designated laboratory in the country was clearly articulated in the interviews which also should reflect on the training programme contents in the future. Other recommendations on the training were not expressed by the respondents.

4. Situation analysis of the laboratories visited

4.1 National Poison Centre, Universiti Sains Malaysia

Interviewed participant worked at the National Poison centre, Drug and Poisoning unit. She participated to LC/MS course organized by Verifin, but GC/MS course would have been more suitable for her needs. However she learned the analyses related to chemical weapons. More information or guidelines for proficiency testing is still needed.

The laboratory was well equipped and all equipments were in active use. Laboratory's main task was to provide information on toxicity, risk of poisons, doping control (evidential and forensic testing) and chemical risk assessment. Different modern and demanding analyzing techniques were in use. Centre operates for example over 20 mass spectrometers with different configurations (GC/MS, GC/MS/MS, LC/MS, LC/MS/MS, HR/MS/DFS, LC/TOF/MS, ICP/MS, ICP/TOF). The samples for chemical analyses were food, pharmaceutical (for example medical plants), drugs, sport dope and environmental. The amount of samples were high (over 3000 per year). Laboratory was accredited (ISO/IEC 17025 and WADA).

In addition to chemical analyses, poison education and ICT training were also given by the National Poison Centre. Modern multimedia tools were in use to produce training kits to enhance effective learning. National Poison Centre has know-how, excellent technical resources and also human resources to provide regional education related to demanding chemical analyses.

4.2 Department of Chemistry, Ministry of Science

Interviewed participant worked at the Department of Chemistry. The team was not given permission to visit the laboratory; so it was not possible to evaluate its capacity, technical resources and know-how. The competencies provided by Department of Chemistry were: forensic science services, environmental health services, industry and trade tariff classification analytical services and research and quality assurance. According to the interviewed participant proper training for proficiency testing is needed. This would require more information in the method development for chemical weapons (to **synthesize the compounds**). Laboratory has not yet passed the proficiency test. Their aim is to become a designated laboratory.

4.3 Department of Occupational Safety and health, Ministry of Human Resources

Interviewed participant worked in the Chemical Management Division. The permission was not given to visit the laboratory, so it was not possible to evaluate its capacity, technical resources and know-how. However, the participant assured that the laboratory is well equipped and resourced.

5. Country specific findings/conclusions

The Government of Malaysia is committed to implementing the CWC and its priority is to have a designated laboratory in the country. The technical capacity in the country is at high level in terms of material resources (laboratory equipment etc.) and human capacity to manage these resources. The universities are adequately financed by the government and the staff is competent. Malaysia is capable to respond to the challenges of environmental degradation caused by factors related to fast economic development. It does not need external assistance in improving the capacity in general analytical chemistry. On the contrary, the universities could be used in providing capacity building for the neighboring countries. Malaysia is technically prepared for responding to the environmental challenges caused by the economic growth, but implementation of the environmental legislation still has considerable deficiencies.

Immediate threat of chemical weapons is not a current issue in Malaysia but the government is aware of the possible future threats of increasing terrorism in the region. Hence, the Malaysian government considers it vitally important to establish a Designated Laboratory in the country and in this aspect there is a need for well targeted capacity development from VERIFIN/OPCW. Support from VERIFIN is expected and prioritized to be received through in-country training and expert assistance visits. Assistance is needed to pass the proficiency testing. In fact, Malaysia has requested this from the OPCW and the support will be given.

Field mission to Vietnam 12.3.-18.3.2011

1. Country context

Vietnam's population (2010 estimated) is approximately 89 million and it belongs to the category of Other Low Income Countries in the DAC list (2009) of developing countries. It is also one of the main partners of the Finnish development cooperation.

The economy of Vietnam is developing planned-market economy. The shift from a highly centralized planned economy to a socialist-oriented market economy (using directive and indicative planning) took place in the mid-1980. Since then the economy has grown rapidly. Today Vietnam is integrating into the world economy as part of globalization. The GDP growth rate is estimated at the level of 6,7% in 2010. The main sectors accounting for the GDP (in 2008) are industry (42,7%), services (38,4%) and agriculture (19,0%). Vietnam has been rising as a leading agricultural exporter (biggest in the world in rice exports. Other export products are coffee, shrimps and nuts. Vietnam has also provided a conducive environment for foreign investment in Southeast Asia largely due to cheap labor force. Textile industry is one of main export sectors (footwear, clothes, leather products). China and Taiwan are the main investing partners in manufacturing industries.

Fast growing economy has also taken a toll on environmental degradation and the government's capacity to control the worsening environmental situation is limited. In addition to industrialization urbanization and intensive farming have a negative effect on environment. These factors have led to air pollution, water pollution and noise pollution, particularly in urban and industrial centres like Ho Chi Minh City and Hanoi. Waste treatment is also a serious problem. Land use pressures have led to significant environmental problems, including severe deforestation, soil erosion, sedimentation of rivers, flooding in deltas, declining fish yields and pollution of the coastal and marine environment. Environmental contamination is aggravated by the existence of Agent Orange and other herbicides in the soil that was used by the U.S. military in the Vietnam War (1964-75) and still causing various diseases and birth defects.

2. National Authority of the CWC

Ministry of Trade and Industry is the National Authority of the CWC implementation in Vietnam. Because it does not have its own laboratory it cooperates closely with the Ministry of Defense that has a laboratory and therefore performs the analysis of chemicals for the OPCW in preparing the declarations. OPCW has donated the nec-

essary equipment (GC/MS) for the laboratory. Vietnam's problem in terms of chemical warfare agents is dioxin planted in the soil by the US Military. It is estimated that more than 17 million litres of dioxin is still in Vietnam. There are three different laboratories in Vietnam that are able to analyze polychlorinated dioxins. The US government cooperates with the OPCW in Central Vietnam in solving this problem which deals with not only analysis of the samples but more with cleaning operations.

More investment on the laboratories (staff and equipment) and training is needed in order to be able to analyze all samples. Vietnam's aim is to have designated laboratory in the future.

The National Authority has an active role in selection of participants in the VERIFIN training. It informs about the available courses and calls for applications and then pre-selects the applications to be sent to OPCW/VERIFIN.

3. Interviews of the trainees

Nine participants from Vietnam have attended the VERIFIN training during the last decade. Four of them were interviewed in Hanoi. The five not interviewed were: (i) one former trainee works in OPCW Headquarters in Hague; (ii) one had been transferred to work in Ho Chi Minh City in the same organization; (iii) two are currently studying abroad (UK and USA); and (iv) one was ill at the time of the mission .

All interviewed had Bachelor degree. All Vietnamese participants in training were males. One participant has attended Basic and Advanced courses (+internship and CW-LABEX), two NACD and three in various workshops. Two interviewed had applied through the NA and two had been recommended by the NA among their own staff.

All four (one through the e-mail questionnaire) responded as having been able to use the skills learned in the training in their work. The areas mentioned were: (i) learned to use the instruments (GC-MSEI) in analysis; (ii) sample preparation; (iii) maintenance of the equipment; and (iv) preparing reports and declarations to the OPCW. Three had trained others working in the laboratory. One had been promoted as the deputy manager of his laboratory. Three interviewed worked in the Centre for Environmental treatment Technology which is a part of the laboratory of Ministry of Defense and one worked as Chemical Defense Command.

4. Situation analysis of the laboratories visited

4.1 Centre for Environmental Treatment Technology, Ministry of Defense

Interviewed participants worked at the Centre for Environmental Treatment Technology which is a department within the Laboratory for Ministry of Defense. Only a

small part of the laboratory could be visited (the part where the VERIFIN trainees worked). This part of the laboratory has only one GC/MS and it is used for environmental analyses (polychlorinated dioxins, 200 samples per year). It is used daily. This instrument has been maintained and used by the VERIFIN trainees. This laboratory has also GC/ECD (to analyse other chlorinated organic compounds) and GC/FID. At the moment the equipments were operating well, but in general it is difficult to get spare parts. More equipment and training is needed because the need for environmental analyses (polychlorinated dioxin, DDT, pesticides) is huge. Vietnam has at least 1000 contaminated area. More cooperation with OPCW/VERIFIN is needed.

All participants considered the VERIFIN training very useful for their work. More information is however needed to be able to identify unknown compounds (CW) and to get test agents. Trainees did not know how to get the spectral library owned by OPCW.

4.2 Hanoi University of Science, Department of Chemistry

No VERIFIN trainees were working in the University. Chemistry teaching is divided into following sections: basic chemistry, chemical engineering, pharmaceutical and chemical education. Currently they have over 2000 Bachelor/M.SC students and 100 Ph.D students. Also several international programs are going on with France (organic materials, nanotechnology, medicine), Germany (environmental management), USA and Japan (biofuels).

International partners have donated also several modern equipments but they are only available for research work (for examples TGA, LC/SPD, LC/MS, FT/IR, ICP/MS, HR/GC-MS, HR/LC-MS). The facilities for basic education were simple and somewhat inadequate.

4.3 Centre for Environmental Monitoring, Ministry of Natural resources and Environment

No VERIFIN trainees were working in the Environmental laboratory which is part of Centre for Environmental Monitoring. Laboratory was established in 2009. Its role is to organize and implement the national environmental monitoring and to act as coordinator for the national environmental monitoring network. It is also the national reference laboratory. In addition to ordinary environmental laboratory equipment it has AAS, GC/MS, GC/MSD and LC/MS and is therefore capable in analyzing for examples pesticides, PCP, PCB, PAH and heavy metals.

Dioxin Laboratory funded by The Bill and Melinda Gates Foundation and Atlantic Philanthropies Foundation is situated in the Environmental laboratory. It was established to improve the capacity to analyze polychlorinated dioxins and furans as well other persistent organic pollutants (POPs) in Vietnam. Equipment for dioxin analyses is very good, but the laboratory is still lacking ordinary sample pretreatment equipments (centrifuge, mill, etc.)

More effort should be made to improve the laboratory management. Also more training is needed, for example in pesticide analyses.

5. Country specific findings/conclusions

The priority expressed by the Ministry of Defense representatives was to obtain the designated laboratory for Vietnam. This is understandable as the Defense Ministry's role is related to weapons and CWC. The Centre for Environmental Treatment Technology Laboratory has only one GC/MS donated by the OPCW. It is only used for polychlorinated dioxin analysis. This equipment is not sufficient to analyse all the needed environmental samples. So it is unlikely that the aim is realistic. Broader environmental issues and their importance for the country's sustainable development were brought up in other institutions (e.g. Ministry of Trade and Centre for Environmental Monitoring under the Ministry of Natural Resources and Environment Administration). Environmental protection and capacity enhancement in analyzing the industrial and agricultural pollution are prerequisites for the country's future and are more important for the country than the Chemical Weapons. Currently the capacity of the Centre for Environmental Monitoring is only on water analysis apart from the US donated a dioxin laboratory. It is also worth mentioning that the University of Hanoi Department of Chemistry has received a lot of donor support in high level equipment and various scholarship/research programmes (e.g. France, Germany, Japan). Development of the basic training in analytical chemistry has been neglected.

Field mission to Mexico 25.3.-1.4.2011**1. Country context**

Mexico is one of the two big economies in Latin America (the other one is Brazil) with the population of 111 million. According to the World Bank data Mexico is 13th largest economies in the world in nominal terms and 11th by purchasing power. The economy has fast recovered from the world economic crisis of 2008 and the year 2011 forecast is positive. The Mexican Central Bank has projected 5,5 % annual growth rate. In the DAC list of ODA Recipients (2009) Mexico belongs to the Upper Middle Income Country category.

The economy consists of rapidly developing modern industrial and service sectors. It is estimated that 58% of the workforce is employed by the service sector, 24% by industry and 18% by agriculture. As a percentage of GDP agriculture has been steadily decreasing resembling now that of the developed nations.

Mexico experiences several environmental problems despite of the increasing environmental awareness over the past 30 years. The ecological issues have been presented in the media by a group of intellectuals and civil activist groups. The federal government has also acknowledged the fact that the economic development needs to be environmentally sustainable.

The biggest threats to Mexico's environment are: (i) scarcity of hazardous waste disposal facilities; (ii) rural to urban migration; (iii) natural fresh water resources scarce and polluted or inaccessible; (iv) raw sewage and industrial effluents polluting rivers in urban areas; (v) deforestation; (vi) widespread erosion; (vi) desertification; (vii) deteriorating agricultural lands; (viii) serious air and water pollution in the capital and urban centres.

All in all Mexico's environmental challenges are of similar nature as in other developing countries even with those at lower economic level than Mexico.

2. National Authority of the CWC

The National Authority in Mexico is the Ministry of Interior supported by the National Security Council with seven working groups with the main aim of preparing the declarations on scheduled chemicals to the OPCW. Compliance of the CWC requirements is the main focus of the NA work. The industries are required to register under the NA for licensing and their declarations of chemicals are submitted in accordance with the Non-Proliferation Law (passed in 2009) and CWC requirements.

The NA priority in training was to send their staff members to NACD course in Finland for learning about the declaration procedures in order to be in compliance with the OPCW regulatory framework. Training in analytical chemistry apparently was not their priority area because they did not coordinate let alone actively participate in the student pre-selection for the VERIFIN courses. An indication of this was that the NA had not kept a register of former trainees and was hesitant to arrange meetings with the persons that VERIFIN had provided for the evaluation mission. One reason for that has also been the change of the National Authority from one ministry to another.

3. Interviews of the trainees

Eight persons had attended the VERIFIN training programme during the last decade (five females and two males). Responses were given by seven participants out of whom six were interviewed and one sent the e-mail questionnaire. One had participated in the Basic Course and in ASD workshop , two in NACD and four in workshops.

NA had appointed two of their staff members to the NACD course and the rest had heard about the training possibility informally. NA had not had an active role in pre-selection of the candidates for training. VERIFIN had invited one for the Basic course.

The most prominent training impact was for the NA staff that learned making declarations to the OPCW using internet in finding databases. One of the laboratories (customs) was expected to participate in proficiency test and hence had sent two staff members to VERIFIN training. However, the test result was not successful. Still, the interviewed found useful to learn more about sample preparation and interpretation, even though these skills were not applicable in their everyday work.

Other useful skills were better understanding of the GC analyses, pesticide, sediment samples and environmental checks for one participant, although environmental analyses are not the focus of her laboratory. Five participants had given hands-on training to their colleagues. None had been promoted as a result of VERIFIN training. Situation analysis of the laboratories visited

4.1 Mexican Custom Laboratory (SAT)

As a custom laboratory their task is to investigate both exported and imported good using mostly qualitative analyses, about 5000 samples per month. The laboratory is divided in the following sections: organic and inorganic chemistry, textiles, petroleum and food. Instrumentation in the laboratory was very sophisticated and most of the instruments were operating and in use. As mentioned earlier Mexican NA had asked custom laboratory to participate in proficiency testing to become a designated labora-

tory, although they have no experience on environmental samples. At that time two people were sent to VERIFIN training. After failures in proficiency testing, the laboratory got funds to purchase a modern NMR instrument and some other instruments, although NMR is not necessary for designated laboratories as mentioned by VERIFIN staff.

Interviewed chemists reported that they will always have extreme difficulties to analyse samples of proficiency test, because the samples that they usually analyse contaminate instruments. They are not used to trace analyses and they cannot carry out any organic syntheses for model substances. Naturally the VERIFIN training was useful for the proficiency tests; however, both trainees said that the VERIFIN training was not 'useful for everyday work'.

4.2 Institute of Chemistry / University of Mexico (UNAM)

The National Autonomous University of Mexico (UNAM) is a public university based primarily in Mexico City and is generally considered to have the largest enrollment among universities in the Americas. Institute of Chemistry is a unit that primarily carries out research. Analytical instrumentation was very sophisticated and adequate. Personnel were naturally highly educated and competent. They did not have any special problems with maintenance, consumables or spare parts. One of the trainee mentioned that the VERIFIN training gave her ideas how to teach chromatography, but she recommended that the training should have been more general.

4.3 Research Center for Food and Development A.C. Mazatlan unit (CIAD)

CIAD carries out research, consultancies and services for the agricultural, fisheries, industrial and commercial sectors. CIAD has impacts in three basic areas: 1) the production, preservation, quality and commercialisation of food, 2) health and biological development of the human being; and 3) the socio-economic impact of the processes of economic development and international integration. Mazatlan unit is specialised in aquaculture and environmental management. It has a small chemical laboratory in which they carry out pesticide analyses in tissue samples (fish, birds), water and soil samples using GC/NPD and GC/ECD. Also other units of CIAD have chemical laboratories, for example analysing pesticides in dairy products and foods.

VERIFIN training was very useful for the trainee working in Mazatlan unit, because her educational background was biochemistry and environmental management. Thus, she had no experience on analytical chemistry, but she had attended one commercial gas chromatography course organised by Agilent (supplier of GC instruments) in Mexico City before Verifin training. However, same kinds of analyses were carried out in other units of CIAD so she could have been trained also internally. CIAD is giving training at masters' level and the former VERIFIN trainee teaches gas chromatography in that program. Also she got ideas for her teaching FROM VERI FIN training.

5. Country specific findings/conclusions

The facilities and capacity in the country are sufficient to provide the training in analytical chemistry in the country. The University of Mexico's Faculty of Chemistry has high level human capacity and is well equipped. In short, the government funding is at adequate level. The specific training demand was for the NA staff to attend the NACD course in order to be able to perform the declarations to the OPCW and for the custom laboratory that was participating in OPCW proficiency test twice a few years ago. However, it remained unclear whether Mexico is still aiming to have a designated laboratory and why the custom laboratory was chosen. All other participants who had been sent to Finland for the VERIFIN training in analytical chemistry had applied on the basis of individual interest and attracted by an opportunity for fully funded courses in Finland and/or invited by VERIFIN. Thus, half of the training for Mexican chemists had been supply-based instead of demand-based.

Field mission to Panama 2.4.-8.4.2011**1. Country context**

Panama has population of 3 million inhabitants. It belongs to the group of Upper Middle Income Countries in DAC list (2009) of ODA recipients. The economy is a fully dollarized free market economy with a history of low inflation. It is based mainly on the service industry, heavily weighted towards banking, commerce and tourism. 80% of the GDP is accounted for a well-developed service sector including the Panama Canal, banking, the Colon Free Trade Zone, insurance, container ports, and flag-ship registry, medical and health and other business. 67% of the workforce is employed by the service sector, 15% by agriculture (exporting bananas, shrimp, sugar, coffee) and 18% by industry (mainly production of manufacturing of aircraft spare parts, cements, drink, adhesives and textile). The problem of the country is a shortage of skilled labour and oversupply of unskilled labour. Estimated unemployment rate was 7,1% in 2009.

Expansion of the Panama Canal was initiated in 2007 and is scheduled to be completed by 2014 at a cost of \$5,3 billion accounting for 25% of the current GDP. The government's priority to invest on the Canal development was attributable to the strong economic growth that has been prevailing since 2002 having its peak in 2007 (11,5%). Although it slowed down to 2,4% in 2009 due to global recession, it has been improving since 2010. Poverty was reduced from 37 % in 2001 to 29% in 2007. Panama still has the second-most unequal income distribution in Latin America. Considering the high level of performance of the economy the poverty indicators are at unacceptable level when about a third of the population lives in poverty and 12 % in extreme poverty.

Soil erosion and deforestation are among Panama's most significant environmental concerns. Air pollution is also a problem in urban centres due to emissions from industry and transportation. Only 79% of rural inhabitants have pure drinking water. Pesticides, sewage and pollution from oil industry cause much of the pollution. The nation's fish resources are threatened by water pollution.

2. National Authority of the CWC

The Ministry of Health and its Directorate of Public Health is the National Authority for CWC implementation. Due to the change of the government after the general elections in 2009 the top cadre of civil servants was changed. Information had not been passed on from the previous National Authority to the present director of the

NA. He was not aware of the history of CWC implementation in general let alone of the trainees sent to VERIFIN. His major concerns were related to the need to train industries to avoid dangerous chemicals in the production. Financial constraints of the Ministry of Health were discernible.

3. Interviews of the trainees

One person had attended the VERIFIN training during the last decade. She had participated in Basic and Advanced courses. Her educational background is Bachelor in biochemistry and two Masters (economical chemistry at USA and parasitology at Sweden). As a biochemistry professor in the university she has a teaching job, but the training was not relevant in relation with her work. She told the mission that she was selected to the training by coincidence, because the university had received the call for the application from the NA and she happened to be free to go to Finland and she also had good command of English language. She was also hesitant of accepting the training offer, because she is not an analytical chemist. She ended up continuing her studies in the advanced course even though the training contents were not relevant for the professional background and work. She rated the training in Finland of high quality and she enjoyed the programme and reported of having learned a lot, but unfortunately it's not possible for her to utilize her skills in analytical chemistry.

Also two other persons from the University were interviewed because they had attended other training funded by the OPCW (pilot associate training programme at OPCW in Hague and training in Spitz laboratory in Switzerland). The training in Switzerland had concentrated on training for field testing and sample taking and screening analysis. It seems that the earlier NA had been active during years 2001-03, for example interviewed persons had given training and assistance for industry in co-operation with NA for declarations. However, as the university does not have the laboratory equipment needed for CW analysis, it seems that the VERIFIN training (Basic and Advance course) has not been as appropriate as above-mentioned training in Hague and Spitz.

One person was also interviewed who had attended the Assistance and Protection course in Kuopio. He had worked in the Fire Department for 25 years and was now retired and established a private company. He had also attended the workshop in the Spiez laboratory in Switzerland. He assessed the contents and training methods in Kuopio very useful and of high quality. The two training programmes attended were also complementary to each other. He is using his skills in training the Police Force and the University Chemistry teachers.

4. Situation analysis of the laboratories visited

4.1 University of Panama

Department of Analytical Chemistry is concentrating on teaching; it has about 350 students in chemistry out of which more than half are at M.Sc. level. Department has the basic analytical instruments that are used only for teaching. They had an opportunity to buy instruments with a loan offered by Spain few years ago, however, the procurement department of university did not have the capacity to specify the requirements and as a result they got equipment that they did not need. Research activities in analytical chemistry were quite modest. It seems that government funds other research laboratories on focused areas and some of these are very well equipped.

4.2. INDICASAT AIP

INDICASAT AIP (Institute of Scientific research and Technological Services) is equipped with a diversity of high technology equipment employed in the biomedical and chemical fields. Currently, INDICASAT AIP has a staff of close to 60 people, including scientists, technicians, university and post-graduate students, visiting scientists, and administrative personnel. Eight staff scientists hold a Ph.D. degree in areas of research including immunology, neuroscience, parasitology, biotechnology, pharmacognosy and chemistry of natural products. Ph.D. program is partly funded by government.

INDICASAT AIP collaborates with Glaxo-SmithKline in two clinical trials for the development of vaccines for global infectious diseases. The Institute also undertakes water analysis services for the Autoridad del Canal (Panama Canal Authority), a principal source of income in the area of services.

INDICASAT AIP was a good example on high level research done outside universities partly funded by government.

4.3 Forensic laboratory

At present laboratory is using GC/FID and FTIR for narcotics, however, they have two GC/MS instruments (donations from USA) that they are starting to use. Also arson investigations are at present done using only GC/FID, but a GC/MS instrument has been installed and they have received training by the supplier. Laboratory was clearly operating with modest budgetary appropriation, however, personnel seemed to be competent.

5. Country specific findings/conclusions

The NA has not had an active role of pre-selecting trainees for the VERIFIN training from the relevant institution. Evidence suggests that the change of the political leadership after the election made a gap between the earlier and present NA in passing the information and securing continuity in the CWC implementation. The Science Faculties in the University are not adequately funded by the government indicating low priority of higher education. On the other hand government funds some high-level research on focused areas, for example tropical diseases and parasitology.

It remained unclear how committed the present government is on CWC implementation. The training offered by VERIFIN clearly was not one of their priorities. Only participant had attended VERIFIN courses and reportedly she had not been the right selection.